NATIONAL HEALTH LABORATORY SERVICE

National Health Laboratory Service

2017/18

ACADEMIC AFFAIRS, RESEARCH AND QUALITY ASSURANCE ANNUAL ACADEMIC REVIEW REPORT

2017/18

The NHLS is a proud recipient of the
2015 European Quality Award

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Foreword

Prof Koleka Mlisana

The National Health Laboratory Service (NHLS) Teaching, Training and Research (TTR) mandate is achieved through existing formal partnerships and constant interactions with our academic partners in medical universities across South Africa. The drive to provide support and encourage translation of research to policy and service enhancements in order to improve the health of South Africans remains a priority. The NHLS is currently finalising a 5-year Research Strategic Plan, whilst also introducing measures to ehance academic pathology and the service platforms. These measures include reviewing of strategies to: improve registrar pass rates and pathologists retention efforts, increasing intern medical scientists intake and strengthening the internship programme. The NHLS remains the only organisation to provide vocational training for pathology registrars and intern medical scientists in the following disciplines: Anatomical Pathology, Chemical Pathology, Haematology, Human Genetics, Immunology, Medical Microbiology, and Medical Virology.

The NHLS vision of "Efficient Patient Centred Services and Global Centre of Excellence for Innovative Laboratory Medicine" is driven in full support and coordination with our academic partners. Quarterly the National Academic and Pathology Committee (NAPC) meetings are held, to address key isues and strategies that will improve efficiency and service effectiveness.

In the past 5 years, the NHLS has published more than 2500 publications in peer reviewed journals and have contributed substantially to national and international health policies, including those of the World health Organistation (WHO). Our research outputs have significantly contributed to national policy change and treatment guidelines whilst being published in highly rated journals with high impact factor such as the New England Journal of Medicine (NEJM), The Lancet, Nature, British Medical Journal (BMJ), etc. We also have the National Research Foundation (NRF) A-rated researchers and substantial number of rated researchers across the academic institutions.

The Umbrella Agreement which formalises the relationship with the partner institution was signed with the 10 medical universities mentioned below:

- The University of Cape Town
- The University of the Free State
- The University of KwaZulu-Natal
- The University of Limpopo
- The University of Pretoria
- Stellenbosch University
- The University of the Witwatersrand
- Sefako Makgatho Health Sciences University
- Walter Sisulu University
- The University of the Western Cape

The NHLS mission "to provide quality, affordable and sustainable health laboratory services through an integrated network of laboratories, the provision of training for health science education and the execution of innovative and relevant research with focus on patient care" has seen the AARQA department initiating strategies and process to drive innovation.

This Annual Report showcases work performed by our researchers at academic platforms in collaboration with various national and international researchers. There is remarkable talent and effort put by our departments while also continuously thriving to deliver best and efficient laboratory services. The dual responsibility does not go unnoticed and the hardwork put by our staff is greately acknowledged and appreciated. Special regards to our Heads of Schools and Heads of Departments Representatives who are continuously driving the academic platforms to perform at their optimal best. We further acknowledge the Heads of Departments for keeping the departments functional despite all challenges and all NHLS staff who put their efforts to ensure the NHLS mandate is realised.

Prof Koleka Mlisana
MBChB, MMedMicro, PhD
Executive Manager: Academic Affairs Research and Quality Assurance

Abbreviations

AACC	American Association of Clinical Chemistry
AARN	African Ameloblastoma Research Network
AAVC	Annual African Vaccinology Course
ACLI	African Cancer Leaders Institute
ACSR	AIDS and Cancer Specimen Resource
ADA	American Dietetic Association
AfSHG	African Society of Human Genetics
AGEI	African Genome Education Institute
AMC	AIDS Malignancy Consortium
AMS	Automated Management System
ANOVA	Adolence Analysis of Variance
APEC	Anatomical Pathology Expert Committee
ASM	American Society for Microbiology
ASSAf	Academy of Science of South Africa
AV	Anti-vaccination
BARNARDS	Burden of Antibiotic Resistance in Neonates from Developing Societies
BC	Breast Cancer
BDG	β-d-Glucan
BDISH	Bright-field Dual in Situ Hybridization
BDQ	Bedaquiline
BLM	Bloom Syndrome
BLRT	Bootstrap Likelihood Ratio Test
BMI	Body Mass Index
BOCA	Brown Oculocutaneous Albinism
BP	Blood Pressure
BREATHe	Breathing REtraining for Asthma
BSc	Bachelor of Science
BSL	Biological Safety Level
BV	Bacterial Vaginosis
CANSA	Cancer Association of South Africa
CAP	College of American Pathologists
CAPD	Continuous Ambulatory Peritoneal Dialysis
CAPRISA	Centre for the AIDS Programme of Research in South Africa
cART	Combination Anti-retroviral Therapy
CAVD	Collaboration for AIDS Vaccine

CA-VIMC	Comprehensive Antibody Vaccine Immune Monitoring Consortium
CBHAH	Chris Hani Baragwanath Hospital
CBTBR	Centre of Excellence for Biomedical TB Research
CCHF	Crimean-Congo Hemorrhagic Fever
CCMT	Comprehensive Care Management and Treatment
CDC	Centers for Disease Control
CEQAS	Cytogenomics External Quality Assessment Services
CFAR	Centers for AIDS Research
CGH	Comparative Genomic Hybridization
CHAVI_ID	Centre for HIV/AIDS Vaccine Immunology - Immunogen Design
CHPC	Centre for High Performance Computing
CHRU	Clinical HIV Research Unit
CIHR	Canadian Institutes for Health Research
CLF	Claude Leon Foundation
CLL	Chronic Lymphocytic Leukemia
CLM	Chronic Myeloid Leukemia
CLSI	Clinical and Laboratory Standards Institute/ Capillary-Like Space Involvement
CMGSA	Council of the College of Medical Genetics of South Africa
CMJAH	Charlotte Maxeke Johannesburg Academic Hospital
CMSA	College of Medicine of South Africa
CMV	Cytomegalovirus
CNE	Centre for Neuro-Endocrinology
CNS	Central Nervous System
COBES	Community Based Education and Service
C PATH	College of Pathologists of South Africa
CPD	Continued Professional Development
CrAg	Cryptococcal Antigen
CRC	Colorectal Cancer
CRE	Carbapenem-resistant Enterobacteriaceae
CREDE	Clinical Research Education and Development
CRG	Centre for Genomic Regulation

CRISPR	Clustered Regularly Interspaced Short Palindromic Repeats
CROI	Conference on Retroviruses and Opportunistic Infections
CSF	Cerebrospinal Fluid
CT	Chlamydia Trachomatis
CTAC	Chemistry Technical Advisory Committee
CUT	Central University of Technology
CVD	Cardiovascular Disease
CVM	Cervical Vaginal Microbiome
DAFF	Department of Agriculture, Forestry and Fisheries
DCS	Department of Correctional Services
DCS	Dried Culture Spot
DCTB	Differentially Culturable Tubercle Bacteria
DDD-Africa	Deciphering Developmental Disorders in Africa
DFG	Deutsche Forschungsgemeinschaft
DFID	Department for International Development
DGM	Dr George Mukhari Academic Hospital
DGMC	Donald Gordon Medical Centre
DHET	Department of Higher Education and Training
DIC	Disseminated Intravascular Coagulation
DL	Delamanid
DMPA	Depot Medroxyprogesterone Acetate
DNA	Deoxyribonucleic Acid
DOAC	Direct Oral Anticoagulant
DoH	Department of Health
DPRHU	Developmental Pathways to Health Research Unit
DPRU	Diarrhoeal Pathogens Research Unit
dRVVT	Dilute Russell Viper Venom Time
DST	Department of Science & Technology
DTHF	Desmond Tutu HIV Foundation
DUT	Durban University of Technology
eAG	Estimated Average Glucose
EBV	Epstein-Barr Virus
ECCMID	European Congress of Clinical Microbiology and Infectious Diseases
ECHO	Evidence for Contraceptive Options and HIV Outcomes
ECOWAS	Economic Community of West African States
ECTMIH	Tropical Medicine and International Health
EDCTP	European & Developing Countries Clinical Trials Partnership
EFI	European Federation of Immunogenetics
EID	Early Infant Diagnosis
EM	Expectation-Maximization
EMQN	European Molecular Genetics Quality Network
EQA	External Quality Assurance
ESBL	Extended-spectrum Beta-lactamases
ESPGHAN	The European Society for Paediatric Gastroenterology Hepatology and Nutrition
EU	European Union
FA	Fanconi Anaemia
FEMS	Federation of European Microbiological Societies
FFPE	Formalin-Fixed, Paraffin-Embedded
FIDSSA	Federation of Infectious Diseases of Southern Africa
FIML	Full Information Maximum Likelihood
FISH	Fluorescent in situ Hybridization
FNA	Fine-Needle Aspiration
FPSA	Fractionated Plasma Separation and Adsorption
GA	Gastric Aspirates
GAP	Global Alliance for Progress
GCMS	Gas Chromatograph Mass Spectrometer
GEMP	Graduate Entry Medical Programme
GIFT	Genital Inflammation Test
GLOBVAC	Global Health- and Vaccination Research
GMO	Genetically Modified Organism
GPDSN	Global Paediatric Diarrhoeal Surveillance Network
GSH	Groote Schuur Hospital
H3Africa	Human Heredity and Health: Africa
HARP	HPV in Africa Research Partnership
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus

HCW	Healthcare Workers
HD	Huntington Disease
HGDDRL	Human Genomic Diversity and Disease Research Laboratory
HHT	Haemorrhagic Telangiectasia
HIV	Human Immunodeficiency Virus
HLA	Human Leukocyte Antigen
HMB	Human Milk Bank
HMS	Harvard Medical School
HNSCC	Head and Neck Squamous Cell Carcinoma
HOD	Head of Department
Hons	Honours
HPCSA	Health Professions Council of South Africa
HPLC	High-performance Liquid Chromatography
HPTLC	High-performance Thin Layer Chromatography
HPTN	HIV Prevention Trials Network
HPV	Human Papillomavirus
HRMA	High Resolution Melt Analysis
HVTN	HIV Vaccine Trials Network
HWSETA	Health and Welfare Sector Education and Training Authority
IALCH	Inkosi Albert Luthuli Central Hospital
IAMSE	International Association of Medical Science Educators
IAP	International Academy of Pathology
IARC	International Agengy for Research on Cancer
IAS	International AIDS Society
IAVI	International AIDS Vaccine Initiative
ICCR	International Collaboration on Cancer Reporting
ICGEB	International Centre for Genetic Engineering and Biotechnology
ICID	International Congress on Infectious Diseases
ICMM	Institute for Cellular and Molecular Medicine
ICPLM	International Congress of Paediatric Laboratory Medicine

ID	Infectious Diseases
IDCM	Idiopathic Dilated Cardiomyopathy
IDM	Institute of Infectious Disease and Molecular Medicine
IFCC	International Federation of Clinical Chemistry
I-HAB	Institute of Human Virology Nigeria H3Africa Biorepository
IHC	Immunohistochemistry
INR	International Normalized Ratio
IOFT	International Obesity Task Force
IPC	Infection Prevention and Control
IPVC	International Papillomavirus Conference
IQC	Incoming Quality Control
ISH	In Situ Hybridization
ISI	International Scientific Indexing
ISTH	International. Society on Thrombosis and Haemostasis
IUD	Intrauterine Device
JCVI	J Craig Venter Institute
KEH	King Edward VIII Hospital
KRISP	KwaZulu-Natal Research Innovation and Sequencing Platform
LA	Lupus Anticoagulant
LBC	Liquid Based Cytology
LCGA	Latent Class Growth Analysis
LCGMM	Latent Class Growth Mixture Model
LDL	Low-Density Lipoprotein
LIS	Laboratory Information System
LPA	Line Probe Assay
LpX	Lipoprotein X
LSDV	Lumpy Skin Disease Virus
LSHTM	London School of Hygiene & Tropical Medicine
MALDI-TOF MS	Time-of-flight Mass Spectrometry
MAOA	Monoamine Oxidase A

MAP	Mean Arterial Pressure
MAR	Missing at Random
MBChB	Bachelor of Medicine and Bachelor of Surgery
MCC	Medicines Control Council
MeCRU	Medunsa Clinical Research Unit
MEEI	Mass Eye and Ear Infirmary
MEPI	Medical Education Partnership Initiative
MFREF	Medical Faculty Research Endowment Fund
MIBE	Measles Inclusion Body Encephalitis
MIC	Minimal Inhibitory Concentration
MIST	Mucosal Injury and Sexual Trauma
ML	Minimum Likelihood
MLPA	Multiplex Ligation-dependent Probe-analysis
MLST	Multi-locus Sequence Typing
MMed	Masters in Medicine
MMRU	Molecular Mycobacteriology Research Unit
MoA	Memorandum of agreement
MRC	Medical Research Council
MSc	Masters in Science
MSM	Men Who Have Sex With Men
MSMD	Mendelian Susceptibility to Mycobacterial Disease
MTB	Mycobacterium Tuberculosis
mtDNA	Mitochondrial DNA
NaF	Sodium Fluoride
NCD	Non-communicable Diseases
NGO	Non-Governmental Organisation
NGS	Next-generation Sequencing
NHBPEP	National High Blood Pressure Education Programme
NHLS	National Health Laboratory Service
NHLSRT	National Health Laboratory Service Research Trust
NIAID	National Institute of Allergy and Infectious Diseases

NICD	National Institute of Communicable Disease
NIH	National Institutes of Health
NIMH	National Institute of Mental Health
NPP	National Priority Programmes
NRF	National Research Foundation
NSCLC	Non-small Cell Lung Cancer
NTT	National Task Team
NYHA	New York Heart Association
OVC	Ovarian Cancer
OWSD	Organisation for Women in Science in the Developing World
PathReD	Pathology Research and Development
PBL	Plasmablastic Lymphomas
PCN	Plasma Cell Neoplasm
PCOS	Polycystic Ovary Syndrome
PCR	Polymerase Chain Reaction
PD	Pharmacodynamics
PEG	Polyethylene Glycol
PHASA	Public Health Association of South Africa
PHRI	Population Health Research Institute, Canada
PK	Pharmacokinetic
PLG	PanLeucogate
PMMH	Prince Mshiyeni Memorial Hospital
PMLL	Pretoria Medico-Legal Laboratory
POC	Point-of-care
POCT	Point-of-care Test
PRF	Pathology Research Facility
PRL	Prolactin
PSOAR	Permanent State of Audit Readiness
PTB	Pulmonary TB

QF-PCR	Quantitative Fluorescent Polymerase Chain Reaction
QMS	Quality Management System
QIT	Quality Improvement Tool
qPCR	Quantitative Polymerase Chain Reaction
RCCH	Red Cross War Memorial Children's Hospital
RCIPS	Research Contracts and Intellectual Property Services
RDC	Research Development Committee
RIC	Research and Innovation Committee
RIQS	Randox International Quality Assessment Scheme
RNA	Ribonucleic Acid
SACHaS	South African Clinical Haematology Society
SADC	Southern African Development Communities
SAHF	South African Haemophilia Foundation
SAHF MASAC	South African Haemophilia Foundation Medical and Scientific Advisory Council
SAIS	South African Immunological Society
SAMJ	South African Medical Journal
SAMRC	South African Medical Research Council
SANAS	South African National Accreditation System
SANBI	South African National Bioinformatics Institute
SAPS	South African Police Service
SARChI	South African Research Chairs Initiative
SASCeTS	South Afrivcan Stem Transplant Society
SASHG	South African Society of Human Geneticists
SASM	South African Society of Microbiologists
SASTH	Southern African Society of Thrombosis and Haemostasis
SAVIC	South African Vaccination and Immunisation Centre
SBAH	Steve Biko Academic Hospital
SBP	Systolic Blood Pressure
SHIP	Strategic Health Innovation Partnerships
SI	Superinfection
siRNA	Small Interfering RNA
SMLTSA	Society of Medical Laboratory Technologists of South Africa
SMU	Sefako Makgatho Health Sciences University
SOP	Standard Operating Procedure
SSA RBR	Sub-Saharan Africa Regional Biospecimen Repository
SSIEM	Society for the Study of Inborn Errors of Metabolism
SSM	Special Study Module
SSPE	Sub-acute Sclerosing Pan Encephalitis
STAMP	Screening for Tuberculosis to Reduce AIDS-Related Mortality in Hospitalized Patients in Africa
STEAM	Science, Technology, Engineering, Arts and Maths
STI	Sexually transmitted infection
SUDI	Sudden Unexpected Death of Infant Case
TAC	TaqMan Array Card
TAD	Tshwane Academic Division
TAH	Tygerberg Academic Hospital
TAT	Turnaround Time
TB	Tubercolosis
TBP	Teaching Biology Project
TBSRTC	The Bethesda System for Reporting Thyroid Cytopathology
TDH	Tshwane District Hospital
TIA	Technology Innovaiton Agency
TSP	Teaching Sciences Programme
uCHOOSE	Choices for Adolescent Prevention Methods for South Africa
UCT	University of Cape Town
UFS	University of the Free State
UKZN	University of KwaZulu-Natal
UL	University of Limpopo
UP	University of Pretoria

USCAP	United States and Canadian Academy of Pathology
UV	Ultraviolet
UWC	University of the Western Cape
VD	Vitamin D
VIN	Vulvar Intraepithelial Neoplasia
VIP	Vaginal Insertion Practice
VLIR	Vlaamse Interuniversitaire Raad
VNTR	Variable Number of Tandem Repeats
VSCC	Vulvar Squamous Cell Carcinoma
VTE	Venous Thromboembolism
VUT	Vaal University of Technology
WGS	Whole-genome Sequencing
WHO	World Health Organization
WHO-AFRO	World Health Organization Regional Office for Africa
Wits	University of the Witwatersrand
WRC	Water Research Commission
WSU	Walter Sisulu University

UNIVERSITY OF CAPE TOWN

Foreword

Prof Raj S. Ramesar

Head of Department:

The University of Cape Town (UCT) hosts the oldest medical teaching facility in the country, which was established on 6 June 1912, with pathology being one of the first formal disciplines. More recently, the revamping of academic structures saw a cognate Department of Pathology established comprising of the disciplines of Anatomical Pathology, Chemical Pathology, Forensic Pathology, Haematology, Human Genetics Immunology, Medical Microbiology and Medical Virology. The department is home to 120 academic staff (UCT and the National Health Laboratory Service (NHLS)/UCT joint staff), 105 professional- and support staff, and over 260 postgraduate students. This document covers the range of academic activities within seven of the eight divisions which fall under the joint management of the NHLS and the university. The Division of Forensic Pathology, although academically located within the department, is jointly managed by UCT and the Provincial Government of the Western Cape.

What we do

The department provides a comprehensive, SANAS-accredited, diagnostic service to the Western Cape Province, together with national coverage for specialised diagnostic tests. Several members of staff play a leadership role on NHLS national committees: Dr Heleen Vrede serves as the Chair of the Chemical Pathology Expert Committee and Associate Prof Di Hardie serves as Chair of the Virology Expert Committee.

In terms of education and training, which is the primary role of the academic institution, the department is a major contributor to the Bachelor of Medicince and Bachelor of Surgery (MBChB) undergraduate training, convening year three of the six-year programme. At a postgraduate level, the department hosts over 200 postgraduate students including 22 honours (Hons), 23 Master of Medicine (MMed), 55 Master of Science (MSc) and 102 Doctor of Philosophy (PhD) students. The department's dynamic registrar and medical scientist training programmes have the objective of training clinicians and researchers to focus their attention on the local and regional burden of disease.

Although the department is officially housed in the Falmouth Building on the Health Sciences campus, it's dynamic research programme led to many staff, including several of the Heads of Divisions (HODs), being members of and located in the prestigious Institute for Infectious Diseases and Molecular Medicine. In the reporting period, members of the department produced approximately 200 papers in peer reviewed journals and as book chapters. The research programme is aligned with the priorities of the national Department of Health (DoH), covering a breadth of topics, from genetics and cancers, to the quadruple burden of disease in South Africa related to maternal and infant mortality, infectious diseases such as HIV/AIDS and TB, and emerging chronic diseases related to unhealthy lifestyles. These deep investigations into both host and pathogen biology are targeted to developing and implementing improved diagnostic tests through the NHLS pathology laboratories. The department is host to two National Research Foundation (NRF) South African Research Chairs Initiative (SARChI) members, namely Profs Anna-Lise Williamson in Medical Virology and Frank Brombacher in Immunology. The HOD, Prof Raj Ramesar, has just been awarded an extramural Medical Research Council (MRC) Research Unit for Genomic and Precision Medicine. He was also nominated as Chair of the National Human Genetics Working Group which is mandated by the national DoH to develop a road map for a national genetic services plan.

HIGHLIGHTS 2017/2018

Highlights are included under the respective divisions and can be read in the relevant sections.

Anatomical Pathology

Head of Division:
Prof Dhirendra Govender

1. About the division

The Division of Anatomical Pathology provides comprehensive diagnostic histopathological, cytopathological and autopsy services to Groote Schuur Hospital (GSH), Red Cross War Memorial Children's Hospital (RCCH), and Somerset and Victoria Hospitals, which form part of the academic hospital complex of the University of Cape Town (UCT). The division also provides diagnostic services to approximately half of the Western Cape public health service, including 2 Military Hospital in Wynberg. There are separate South African National Accreditation Services (SANAS)-accredited laboratories at GSH (histopathology and cytopathology) and RCCH. In addition, diagnostic services are offered to the UCT Private Academic Hospital and consultative and referral services to the NHLS and private laboratories in East London, Port Elizabeth, Cape Town, Durban and Pietermaritzburg.

2. Diagnostic services

The GSH histopathology laboratory received 35 840 surgical pathology cases (including many cases with multiple specimens) and the cytopathology laboratory processed 72 404 cases, of which 63 434 were cervical smears and 8 970 were non-gynaecological cases. The histopathology laboratory also provided diagnostic services for the NHLS East London laboratory and intermittent support to the NHLS Kimberley laboratory, as part of its national coverage commitment. The Fine Needle Aspiration (FNA) Clinic performed 257 FNA procedures. The electron microscopy unit at GSH processed 566 specimens and the immunohistochemical laboratory performed 29 323 tests. New molecular diagnostic tests were introduced in 2017 and included B & T cell receptor gene rearrangements and mycobacterial polymerase chain reaction (PCR). The total number of molecular tests conducted during the reporting period was 82. Sixty-one adult autopsies were performed. The foetal and perinatal service at GSH examined 47 foetuses and 707 placentas.

The histopathology service at RCCH included paediatric patient referrals from Western Cape and Eastern Cape. This laboratory received a total of 2 929 specimens which include paediatric cases and muscle biopsies. A consultative service for muscle biopsies is also based at RCCH and during the reporting period, 197 muscle biopsies were processed. The Electron Microscopy Unit at RCCH, processed 398 specimens. A total of 34 paediatric autopsies were conducted. The laboratory processed 245 non-gynaecological cytology samples and 60 intra-operative frozen sections.

Pathologists and registrars participated in an excess of 50 clinicopathological meetings per month, which was mostly conducted at GSH and RCCH.

Table UCT 1: Total number of staff per profession and highest qualification

	Doctoral	MMed	FCPath	Honours	Diploma	All	South Africans
Pathologists*		7	2			9	9
Medical Scientists	2					2	2
Technologists					25	25	25
Other					1	1	1
South Africans	2	7	2	0	26	37	37
All	2	7	2	0	26	37	37

- Excluding Head of Division

3. Teaching, training and professional development

3.1 Undergraduate level

The consultant staff are responsible for delivering undergraduate teaching in Anatomical Pathology to MBChB students during semesters three to five, in an integrated, problem-orientated (case-based) course, with computer-based tutorials and small-group teaching (i.e. museum and mortuary demonstrations). Newly structured tutorials make use of the recently upgraded Pathology Learning Centre in the

Faculty of Health Sciences. A limited number of MBChB students gain access to a special study module (SSM) in Anatomical Pathology in semester four; currently this exposure (of approximately one month) is the best and earliest opportunity of attracting future Anatomical Pathologists into the discipline.

Third-year Bachelor of Science (BSc) in Occupational Therapy and BSc in Physiotherapy students are taught by Anatomical Pathology consultants as an integral part of the clinical sciences course for the Allied Health Sciences.

3.2 Postgraduate level

There are twelve registrar posts and three supernumerary registrar posts in Anatomical Pathology. Three registrars were successful in the FCPath (Anat) Part 1 examination in 2017. There were sixteen MMed students during the reporting period. Three registrars passed their MMed dissertations with distinction.

3.3 Other

Prof. D Govender, A/Prof. K Pillay and A/Prof. R Naidoo continued their lecture and tutorial contribution in the BSc (Hons) cancer module.

Table UCT 2: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern Medical Scientist	Honours	All	South Africans
Total Number of Trainees	2	2	15		1	20	14
Final Year Trainees	1	2	5 *		1	8	4
Successful Completion	0	1	0		1	2	1

*** None attempted the examination**

3.4 Awards and special achievements

Dr Hue-Tsi (Tony) Wu received the Basil Bloch Shield from the Department of Obstetrics and Gynaecology for his contribution to oncology.

Drs Michael Otto, Louis de Jager and Garret Skead passed their respective MMed dissertations with distinction.

4. Research activities

The division was involved in a range of research activities, using a variety of techniques and continues to broaden its research base. The main research focus is in the field of molecular pathology pertaining to diseases that are common in South Africa and the Western Cape. These include various cancers, and in particular those affecting disadvantaged population groups. The major research focus since the establishment of the divisional research laboratory has been breast cancer, gastrointestinal cancer and lymphoma. Cancer research includes studies related to the use of matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS), to identify proteins and peptides in formalin-fixed paraffin-embedded (FFPE) cancer tissue. In addition, we are also investigating the use of MALDI imaging mass spectrometry to identify proteomic patterns and their distribution directly in tissue. Other research areas include tuberculosis, cardiomyopathy and foetal-alcohol syndrome.

4.1 Research projects

Project title: TBX3 as an oncogene in cervical cancer
Principal investigators: Khan S (UCT) and Ramburan A (UCT, NHLS)
Co-researchers: Prince S (UCT); Wu H-T (UCT, NHLS) and Govender D (UCT, NHLS)
Short description: Cervical cancer is the second most common female cancer in South Africa and it is necessary to identify new targets for treatment and to better understand this disease. The aims of this project were to identify TBX3 protein expression levels in different stages of cervical carcinoma progression (CIN 2/3 to invasive squamous cell carcinoma) by immunohistochemistry (IHC) and to determine the oncogenic potential (cell

proliferation and migration) of TBX3 in-vitro, using cervical cancer cell lines. The IHC results showed that TBX3 cytoplasmic protein expression increased significantly between the premalignant and malignant stages when compared to the adjacent normal epithelium, while the cell culture assays showed that TBX3 has an anti-proliferation and a pro-migratory role. The study is ongoing to determine the significance of these findings.

Project start date: May 2017
Project end date: July 2018

Project title: An investigation of Epstein-Barr Virus (EBV) latency type and MYC gene aberrations in plasmablastic lymphoma diagnosed at Groote Schuur Hospital, Cape Town, South Africa
Principal investigators: Ramburan A (UCT, NHLS) and Kriel R (UCT)
Co-researcher: Govender D (UCT, NHLS)
Short description: HIV-infection has been associated with increased risk in the development of aggressive B-cell Non-Hodgkin lymphomas such as plasmablastic lymphomas (PBL). The pathogenesis of PBL is incompletely understood, however MYC gene rearrangements and the association with Epstein-Barr Virus (EBV) infection has been identified as important pathogenic mechanisms. We aim to determine the pattern of EBV latent infection and MYC gene aberration status in our cohort of PBLs diagnosed at Groote Schuur Hospital. Immunohistochemistry will be employed to determine expression of EBV latent proteins (LMP1, EBNA1 and EBNA2) and MYC gene aberrations will be observed by fluorescence in situ hybridisation.
Project start date: July 2017
Project end date: December 2019

Project title: Histological classification of serrated polyps: in search of biomarkers for routine use in a clinical diagnostic setting
Principal investigators: Ramburan A (UCT, NHLS) and Govender D (UCT, NHLS)
Short description: The distinction between different polyps is based on morphology and in most cases the pathologists can classify these accordingly. However, misclassification is possible when biopsy specimens are small and impossible to orientate. Correct classification is important as some polyps have the potential to become cancer. Therefore, there is a need for sensitive and specific markers to independently and reproducibly identify polyps with risk for progression. The first aim is to determine by immunohistochemistry if one or a combination of these antibodies (MUC6, Annexin A10, Hes1 and BRAF VE1) will be valuable in a clinical diagnostic setting. The second aim is to identify novel biomarkers in signal transduction pathways that show differential gene expression between different polyps.

Project start date: September 2017
Project end date: December 2018

4.2 Grant funding

- SAMRC;
- NHLS Research Trust; and
- UCT.

5. Research output

5.1 Journal publications

Kajawo S, Botha FCJ, Okpechi IG. Clinico-pathological features of repeat renal biopsies in patients with lupus nephritis at Groote Schuur Hospital, Cape Town. Lupus. 2017; 26: 1339–1346

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Chaya S, Zampoli M, Gray D, Booth J, Riordan G, Ndondo A, Fieggen K, Rusch J, van der Watt G, Pillay K, van der Westhuizen F, Menezes M, Wilmshurst J. The First Case of riboflavin transporter deficiency in sub-Saharan Africa. Semin Pediatr Neurol, 2017; [Epub ahead of print]

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Rautenbach RM, Pillay K, Murray ADN, Heckmann JM. Extraocular muscle findings in myasthenia gravis associated treatment-resistant ophthalmoplegia: A Case Report. J Neuro-Ophthal. 2017;4: 414–417

Cassim F, Sinha S, Lazarus J, Locketz M. An atypical cause of retroperitoneal fibrosis: Case report and literature review. Afr J Urol. 2017;23, 62–65

Scrivena JE, Botha FCJ, Schutz C, Lalloob DG, Wainwright H, Meintjes G. Paradoxical respiratory failure due to cryptococcal pneumonia after amphotericin B treatment for HIV-associated cryptococcal meningitis. Medical Mycology Case Reports. 2018; 19: 38–40

Nel M, Buys JM, Botha FCJ, Wearne N, Prince S, Heckmann JM. The functionality of African-specific variants in the TGFB1 regulatory region and their potential role in HIVAN. Clin and Exp Nephrol. (pub online)

Crombie K, Spengane Z, Locketz M, Dlamini S, Lehloenya R, Wasserman S, Maphanga TG, Govender NP, Kenyon C, Schwartz IS. Paradoxical worsening of Emergomyces africanus infection in an HIV-infected male on itraconazole and antiretroviral therapy. PLoS Neglected Tropical Diseases. 2018, March

Viljoen C, Dladla K, Francis I, Wainwright H, Meintjes G. A Diffuse fine papular and pustular rash in a man with advanced Human Immunodeficiency virus and diabetes. Clinical infectious diseases. 2018;66:477-8

5.2 Conference presentations

5.2.1 Oral presentations

International congresses

Levin L, Goddard E, Pillay K, De Lacy R. Biliary Atresia Review: The Clinical Course and Outcome of Patients at Red Cross War Memorial Children's Hospital, 10 – 13 May 2017, 50th Annual Meeting of the European Society for Paediatric Gastroenterology Hepatology and Nutrition (ESPGHAN), Prague.

National congresses

Rikhotso T, Interdigitating dendritic cell sarcoma. 22–24 June 2017, Pathology Research and Development (PathReD) Congress 2017, Emperors Palace, Johannesburg.

Masenya A, CNS EBV-associated smooth muscle tumour. 22–24 June 2017, PathReD Congress 2017, Emperors Palace, Johannesburg.

Williams G, Mbutho X, Buys H, Eley B, Pillay K, Use of the combined Sandiford - Alcian blue stain to demonstrate Klebsiella biofilms in autopsy cases. 22–24 June 2017, PathReD Congress 2017, Johannesburg. (Gavin received an honourable mention for this presentation – certificate).

Pillay K, The role of histological diagnosis in diffuse lung disease. 22-25 August 2017, South African Thoracic Society Congress, Century City Cape Town.

Local congresses (university academic days)

Pillay K, Neuropathology focus in tribute to Richard Hewlett understanding low grade gliomas. Paediatric brain tumour workshop programme, 25-26 November 2017, Wolfson Pavilion, UCT Faculty of Health Sciences, Anzio Road, Observatory, Cape Town.

Aldera A, RELA-positive anaplastic ependymoma. Paediatric brain tumour workshop programme, 25-26 November 2017, Wolfson Pavilion, UCT Faculty of Health Sciences, Anzio Road, Observatory, Cape Town.

Tu S, Seizure associated neuronal-glial neoplasms. Paediatric brain tumour workshop programme, 25-26 November 2017, Wolfson Pavilion, UCT Faculty of Health Sciences, Anzio Road, Observatory, Cape Town.

Masenya S, An unusual CNS embryonal tumour. Paediatric brain tumour workshop programme, 25-26 November 2017, Wolfson Pavilion, UCT Faculty of Health Sciences, Anzio Road, Observatory, Cape Town.

Chemical Pathology

Head of Division:
Prof David Marais

1. About the division

Chemical Pathology integrates a diagnostic service with training and research on a platform comprising laboratories in GSH, the RCCH, and the Falmouth Building at the UCT.Clinical pathology training of registrars was coordinated from this division until September 2017 when it was transferred to Dr Jessica Opie in the Division of Haematology. The clinical pathology registrars rotate through Chemical Pathology as an important component of their broad discipline. The NHLS at C17 in GSH comprises chemical pathology, haematology, immunology, allergology, virology and microbiology. It provides routine diagnostic services, as well as a clinical trials service, to the local teaching hospital, other Western Cape provincial healthcare facilities, and the UCT Private Academic Hospital.

The consultant staff at GSH includes Dr F Omar, Dr M Ndlovu and Dr H Vreede whose involvement in other activities is relieved by the part-time appointment of Dr C Hudson. Dr H Vreede chaired the Chemical Expert Committee of the NHLS. A/Prof. G van der Watt is based at the RCCH laboratory. The scientists are Dr J King and Mrs S Meldau. Ms J Pillay is the lecturer in the division, as part of the new generation academic programme. Dr J McCarthy who contributed to cell culture as a scientist in the employ of the Western Cape Government retired, and the post was closed.

The GSH C17 laboratory is a highly automated laboratory that is accredited by SANAS. Altogether 1 641 965 laboratory assays were done in chemical pathology over this interval. Analyses are undertaken on automated instruments using the Cobas 6000 system. Specialised tests include protein and lipoprotein electrophoresis (semi-automated Sebia Minicap and Hydrasys systems), various manual assays, and immunoassays. The radioimmunoassays include active renin, aldosterone, 17-hydroxyprogesterone, acetylcholine receptor autoantibody, and 11-deoxycortisol. The molecular laboratory genetic testing repertoire includes metabolic diseases, pharmacogenetics, androgen receptors and some mitochondrial genes. Inherited metabolic disease assays are performed at the RCCH laboratory by gas chromatography with mass spectrometry detection. Additional investigation of a more specialised nature and on a smaller scale, is done in the Falmouth Building. This includes the establishment of primary fibroblast lines, especially in lipidology. The repertoire of diagnostic tests in metabolic disorders including lipidology, should develop and will hopefully be expanded as the need arises for patient care and research.

Table UCT 3: Total number of staff per profession and highest qualification. The total number of posts is as reflected but there are 2 vacancies in the consultant category and another in the technologist category.

	Pathologists	PhD Scientist	MSc Scientist	Technologists	South African	All
Total	5	1	1	17	22	22

2. Diagnostic services

The laboratories perform a wide range of investigations, and may opt for consultation and additional investigation on ad ad hoc basis, to solve clinical problems as seamlessly as possible, with the limited means to its avail. Constraints on staff as well as finances limit the capacity but fibroblast cultures, spectrophotometric, fluorometric and chromatographic studies can still be executed. Special investigations include: 7-dehydrocholesterol, blood cyanide and Niemann Pick C disease by filipin staining of fibroblasts. Thin layer chromatography was used in the absence of more sophisticated techniques to investigate amino acid, organic acid and sterol disorders. Genetic work-up included sterol biosynthetic errors (mevalonate kinase deficiency, Smith-Lemli-Opitz syndrome). Dyslipoproteinaemias are worked up by electrophoresis and ultracentrifugation for dysbetalipoproteinaemia and lipoprotein X (LpX). Genetic investigations included the low-density lipoprotein (LDL) receptor, apolipoprotein B100 for binding defects and PCSK9 for the familial hypercholesterolaemia phenotype. These services to the lipid clinic unfortunately ceased with the departure of Mrs G Solomon who was funded informally at the university.

3. Teaching, training and professional development

Staff members perform both undergraduate and postgraduate teaching. The undergraduate teaching involves regular lectures and tutorials, as well as a SSM and the molecular medicine course. Postgraduate teaching of registrars involves rotations amongst the different sections within the laboratories at the GSH and RCCH laboratories to obtain broader skills and experience. They receive weekly tutorials

on basic biochemistry, methodology, management, metabolic disorders, lipidology, and molecular medicine. Journal discussions in chemical pathology are supplemented with endocrinology seminars, ward attendances, and post-clinic meetings in lipidology.

The erstwhile chemical pathology registrar, Dr M Ndlovu, commenced work as a retention time pathologist to replace the services of Dr P Fortgens. The remaining registrar team, Drs J Cole and J Rusch, was joined by Dr B Vermooten in January 2017 who then resigned to change direction of specialisation to internal medicine. The intern scientist training post was cancelled for the year. Dr F Omar was the course convenor for clinical pathology which involved Drs M Bosman, N Erasmus, H Swanepoel and C Swart. Drs Erasmus, Swanepoel and Swart qualified.

Table UCT 4: Total number of trainees per qualification category and rates of successful completion/pass rates

	Total nr trainees	Final year trainees	Successful completion	% successful
All	4	0	0	NA

3.1 Other training information

The course in deoxyribonucleic acid (DNA) analysis is offered annually in the Falmouth Laboratory and proves to be popular. A full-day course in lipidology is in preparation for Dutch physicians who are on a grant from the Netherlands and will, with support, be available to medical practitioners in South Africa as well.

4. Research activities

The diagnostic work provides information on various disorders in the region and serves as the point of departure for research to best serve the country. This should be an important mode of training and gaining experience for registrars, but these activities require enhanced support and facilities.

There is a high demand from practising clinicians to introduce the progress made in diagnostic investigations, especially in metabolic disorders, to this country. Of particular interest, is inherited metabolic disease, including mitochondrial disorders. Importantly, a recessive disorder of a nuclear gene for MPV17 was discovered to have a high prevalence in black infants. Local experience differs from experience abroad, due to the different composition of our population. Lipidology expertise and research spans electrophoresis, thin layer chromatography and genetics of familial hypercholesterolaemia and dysbetalipoproteinaemia. These interests attracted collaborations from the Universities of Amsterdam and Utrecht, respectively. We are currently collaborating with the University of Western Australia on hypobetalipoproteinaemia.

4.1 Research units or study groups linked to the department

The NHLS Trust award for developing direct analysis in real time with MALDI-TOF MS is still awaited. This will significantly enhance research and contribute to the establishment of additional diagnostic and training repertoires. The expectation was that Ms J Pillay would use this investigation to complement investigations at RCCH.

4.2 Research projects

Project title: The N-acetyl transferase 2 gene haplotype and single nucleotide prevalences in the local mixed ancestry population

Researchers: Dr C Swart, Dr F Omar, Ms S Meldau, and Prof. D Marais

Project start date: October 2013

Project end date: October 2017. (Successfully submitted for MMed degree).

Project title: Using urinary biomarkers (MCP-1 and TWEAK) in risk prediction models to

enhance the assessment of disease activity (therefore influencing choice of therapy and patient outcome) in patients with lupus nephritis in Cape Town: A sub-study of the ALUGEN Registry

Researchers: Dr J Rusch, Assoc. Prof I Okpechi, Dr F Omar and Dr J King
Project start date: 2017
Project end date: 2019

Project title: Evaluation Protocol of the Humor BRAHMS CgA II KRYPTOR: HTP16-02
Researchers: Dr JA Rusch, Mrs C Seaton, Assoc. and Prof G van der Watt
Project start date: 2016
Project end date: 2017

Project title: Development and Validation of a High-Efficiency Galactose-1-Phosphate Uridyltransferase Activity Assay Galactose-1-Phosphate Uridyltransferase Activity
Researchers: Dr J Cole, Ms R Brown and Ms S Kear
Project start date: February 2017
Project end date: March 2017

Project title: Audit of laboratory-based pre-analytical errors using absence of provided clinical information as a proxy, and measurement of effects of time investment in staff education over a 6-month period.
Researcher: Dr J Cole
Project start date: 2018
Project end date: 2018

Project title: Loss of function mutations in endothelial lipase conferring hyperalphalipoproteinaemia.
Researchers: Dr J Cole, Dr D Blackhurst and Prof D Marais
Project start date: 2018
Project end date: 2019

Project title: Investigation of the genetic defects underlying Leigh syndrome in South African paediatric patients
Researchers: Surita Meldau, Gillian Riordan and Karen Fieggen
Duration: 2017- expected completion 2019/2020.

Project title: Determination of the population frequency of the GALNT3:c.484C>T(p.Arg162Ter) pathogenic variant detected in two unrelated black South African patients with hyperphosphatemic familial tumoral calcinosis
Researchers: Surita Meldau and Kashief Khan
Project start date: 2018
Project end date: 2019

Project title: Diagnostic audit of the UCT Chemical pathology mitochondrial disease database with investigations into diagnostic rate, efficiency of current and historic testing strategies and referral patterns
Researchers: Surita Meldau, Gillian Riordan and Kashief Khan
Project start date: 2018
Project end date: 2019

Project title: Potential cardioprotective effect of chronic moderate consumption of regular and reduced-alcohol wine in a rat model of pulmonary arterial hypertension. MSc thesis
Researchers: P Diaba-Nuhoho, D Blackhurst, S Lecour and AD Marais
Project start date: 2016
Project end date: 2018

Project title: Dried spot cards to analyse biologic fluids for diagnostic investigation of patients. MSc Thesis
Researchers: AM Rapulana, DM Blackhurst and AD Marais
Project start date: 2015
Project end date: 2018

Project title:	Pathogenicity of novel mutations in proprotein convertase subtilisin/kexin type 9 in familial hypercholesterolaemia patients at the Groote Schuur Hospital Lipid Clinic
Researchers:	Dr R Huijgen, Ms G Solomon, Ms B Ratanjee, Ms R Jooste, Dr D Blackhurst, Prof AD Marais and the Lipid Clinic staff, including Prof D Blom, Dr K Wolmarans, Dr B Brice, sister J Barron and Ms Z Behardien
Project start date:	November 2016
Project end date:	July 2017

Project title:	Control of LDL cholesterol in familial hypercholesterolaemia at Groote Schuur Hospital.
Researchers:	Mr X van Delden, Dr R Huijgen and Lipid Clinic staff, including Prof. D Blom, Dr K Wolmarans, Dr B Brice, Sister J Barron, Ms Z Behardien and chemical pathology staff, including Ms G Solomon and Prof. D Marais
Project start date:	December 2016
Project end date:	July 2017

Project title:	STAP1 mutations as a cause of familial hypercholesterolaemia in Cape Town.
Researchers:	Dr M Hartgers and Lipid Clinic staff, including Prof D Blom, Dr K Wolmarans, Dr B Brice, Sister J Barron, Ms Z Behardien and chemical pathology staff, including Ms G Solomon and Prof D Marais
Project start date:	February 2018
Project end date:	April 2018

4.3. Grant funding

Funding for the above projects has been received from:

- The Chemistry Technical Advisory Committee (CTAC);
- NHLS Research Trust;
- Sanofi-Regeneron; and
- The NRF.

5. Research output

5.1 Journal publications

Koopal C, Marais AD, Westerink J, Visseren F; Autosomal dominant familial dysbetalipoproteinemia: A pathophysiological framework and practical approach to diagnosis and therapy. Journal of Clinical Lipidology. 2017;11:12–23

Koopal C, Marais AD, Westerink J, van der Graaf Y, Visseren Effect of adding bezafibrate to standard lipid-lowering therapy on post-fat load lipid levels in patients with familial dysbetalipoproteinemia. A randomized, placebo-controlled, crossover trial. Journal of Lipid Research. 2017; 58:2180-2187

Maarman G, Andrew B, Blackhurst D, Ojuka E;Melatonin protects against uric acid-induced mitochondrial dysfunction, oxidative stress, and triglyceride accumulation in C2C12 myotubes. The American Physiological Society J Appl Physiol. 2017; 122: 1003–1010

Opie J, Omar F, Huang H, Sandler L, Ross I; Primary hyperparathyroidism manifesting with pancytopenia; Pathology. 2017;49:326-329. doi: 10.1016/j.pathol.2016.11.011. Epub. 2017 Mar 6

Levin ME, Blackhurst D, Kirstein F, van der Watt G, Kok D, Marais AD; Residual allergenicity of amino acid and extensively hydrolysed cow's milk formulae. South African Medical Journal. 2017;107:763-767

Thompson G, Blom D, Marais AD, Seed M, Pilcher G, and Raal F; Survival in homozygous familial hypercholesterolaemia is determined by the on-treatment level of serum cholesterol. European Heart Journal. 2018;39:1162-1168 doi:10.1093/eurheartj/ehx317

Raal F, Meldau S, Jones E, Ensor J, Weimers-Willard C, Rayner B; Liddle's syndrome in an African male due to a novel frameshift mutation in the beta-subunit of the epithelial sodium channel gene. Cardiovasc J Afr. 2017;28: e4-e6. doi: 10.5830/CVJA-2017-012

Shiau Ng Y, Lax N, Maddison P, Alston C, Blakely E, Hepplewhite P, Riordan G, Meldau S, Chinnery P, Pierre G, Chronopoulou E, Du A, Hughes I, Morris A, Kamakari S, Chrousos G, Rodenburg R, Saris C, Feeney C, Hardy S,Sakakibara T, Sudo A, Okazaki Y, Murayama K, Mundy H, Hanna M, Ohtake A, Schaefer A, Champion M, Turnbull D, Taylor R, Pitceathly R, McFarland R, Gorman G; MT-ND5 Mutation Exhibits Highly Variable Neurological Manifestations at Low Mutant Load. EBioMedicine, 2018;30:86-93

Rusch J, Dave J, The Gut Microbiota and Metabolic Disease. South African Journal of Diabetes. 2018 March

Rusch J A, Hudson C L, Marais A D, Laboratory investigations in lipidology. S Afr Med J. 2018;108(4):266-270. DOI:10.7196/SAMJ. 2018. v108i4.13233

5.2 Book chapters

None.

5.3 Conference presentations

Rusch JA, Chaya S, Riordan G, Wilmshurst J, Van der Watt G; Evaluating Riboflavin Deficiency in the First Case of Riboflavin Transporter Deficiency in Sub-Saharan Africa. International Congress of Paediatric Laboratory Medicine. October 2017, Durban, South Africa.

Rusch J, Snyman T, De Lacy R, Van der Watt G; Transient Hyperphosphatasaemia in a Child with a History of Liver Transplantation. International Congress of Paediatric Laboratory Medicine. October 2017, Durban, South Africa.
Meldau S, De Lacy R, Riordan G, Pillay K, Fieggen K, Van der Watt G; MPV17 Mitochondrial neurohepatopathy in South Africa: High incidence, detailed clinical description and proposed disease mechanism. International Congress of Paediatric Laboratory Medicine. October 2017, Durban, South Africa.

Huijgen R, Blom DJ, Ratanjee BD, Brice BC, Wolmarans KH, Solomon GAE, Marais AD. Proprotein convertase subtilisin/kexin type 9 mutations. A significant contributor to familial hypercholesterolaemia in the Western Cape region of South Africa. American Heart Association. November 11-15. Anaheim, California.

6. Additional information

The constraints on staff and funding during the review period limited research and coverage programmes, especially since there is a delay in filling vacant posts for consultants and technologists. As a result, some specialised tests could not be executed.

Consultation on metabolic diseases and lipid disorders is provided at a national level. It is clear that the repertoire of tertiary level investigations is not meeting demands for diagnosis. There is a need to establish special clinics together with laboratory expertise and to develop experience. There should be at least one national centre for superspecialised work which can be efficiently channelled in a large network of laboratories to render service across the country. Ideally these centres should be strategically located across the country, to enhance teaching and research at each teaching institution. Enhancing investigations on metabolic disease with additional chromatography, cell culture, enzymology and other investigations that are relevant to these disorders, would improve patient care, and enhance relevant research and training. Upgrading endocrine diagnostics to gas chromatography mass spectrometry will also be worthwhile.

There is great opportunity for expansion of the repertoire of tests with innovations that can reduce costs, while contributing to accurate diagnosis. The laboratory developed a card system that can process several samples for a range of analytes that includes urea, protein, salicylate and cyanide. This system can be used for DNA investigation as well. The diagnosis of Smith Lemli Opitz syndrome was excluded by amniotic fluid analysis for the second pregnancy of the mother whose first-born was proved to have this syndrome. An alternative demonstration of methaemalbumin was devised to prove methaemalbuminaemia.

Haematology

Head: Prof Nicolas Novitzky (retired December 2017)
Acting Head: Dr Jessica Opie (January 2018 – April 2018)

1. About the division

The Division of Haematology provides a comprehensive routine haematology laboratory diagnostic service to GSH and RCCH and offers specialised tests for the diagnosis and monitoring of haematological malignancies to the Division of Haematology and Department of Radiation Oncology at GSH. It also receives samples and provides a diagnostic service from many external NHLS laboratory locations.

In line with international standards, the laboratory continues to maintain its accreditation with SANAS. Pathologists and registrars participate in lectures, practical teaching and conducting of examinations for undergraduate medical students at UCT. Haematopathology, Clinical Pathology and Clinical Haematology registrars undergo experiential training under the supervision of consultant pathologists, and complete examinations following the requirements of the College of Medicine of South Africa (CMSA).

The UCT Leukaemia Unit remains an accredited research group that provides an academic home for science students and pathology registrars undertaking research projects in blood diseases. Scientists are also involved in teaching registrars, medical technologists and postgraduate students at the Health Sciences Faculty (Medical School).

Staff included in this division include members of UCT, UCT/NHLS joint staff, NHLS staff and Provincial Administration of the Western Cape (PAWC) staff members. This report highlights the contributions of the NHLS-associated staff.

Table UCT 5: Total number of NHLS-staff per profession and highest qualification

Pathologists	PhD Scientist	Technologists	South African	All	
Total	5	1	20	26	26

2. Diagnostic services

The haematology section of the laboratory has been SANAS-accredited for more than ten years. It was most recently inspected in March 2018 and continues to maintain this accreditation to a high standard.

The GSH laboratory receives samples from about 300 local and more peripheral locations, including those in terms of memoranda of agreement (MoAs), as well as private laboratories and clinics. More than 100 clinics and hospitals refer samples for ante-natal or antiretroviral (ARV) testing, including tertiary centres such as RCCH, Tygerberg Hospital (TBH) as well as from regional laboratories e.g. Worcester, Vredenburg, Paarl, the Garden Route and the Eastern Cape (Knysna, Port Elizabeth and East London). In addition, this laboratory regularly receives referral material for flow cytometry from the Eastern Cape, hospitals in Namibia and the private sector. The molecular service receives samples from state health facilities from the Western Cape, Eastern Cape and KwaZulu-Natal, as well as the private sector. In 2017, 40% of all the molecular samples analysed were received from private facilities, due to the specialised testing offered by the service.

2.1 New tests developed and introduced into diagnostics

The automated cerebrospinal fluid (CSF) cell count test was validated by Dr Jessica Opie and Mrs Delmaine Rousseau and introduced into routine diagnostics. This test provides an accurate and rapid CSF white cell count (with proportion of neutrophil and lymphocytes) as well as total red cell count. This replaced the previous manual test which was both labour- and time intensive. The test was also accredited by SANAS.

3. Teaching, training and professional development

The division participates in the teaching for both undergraduate and postgraduate students at the UCT Health Sciences Faculty. Registrars and consultants partake in undergraduate training by facilitating and delivering class lectures and practical lectures that focus on blood disorders, in various modules of the UCT MBChB programme.

At a postgraduate level, training is provided to Hons, Masters and PhD science students in cell and molecular biology, through research projects. The division also offers a module in the UCT Medical Biochemistry Hons Degree, entitled "Biology of Blood", which had 11 Hons student participants in 2017. In addition, the division has six posts for medical graduates to pursue specialist training in Haematopathology, that is accredited by the Health Professions Council of South Africa (HPCSA). Clinical Haematology registrars spend at least 12 months of training in the laboratory as part of their certification. In addition, within the UCT Department of Pathology, the division participates in the training for Clinical Pathology trainees. Regular experiential teaching and microscope tutorials are offered to registrars in Haematopathology and others rotating through the laboratory. Regular journal clubs, seminars and group teaching are conducted in the division for Haematopathology, Clinical Haematology and General Medical registrars. Interdepartmental haematology pathology meetings are held quarterly with academic staff from TBH and RCCH.

Dr Karen Shires, the medical scientist in the division, leads a molecular haematology lecture series annually. Additional molecular tutorials provide ongoing training and teaching to registrars, private clinicians, technologists and other interested scientists. Dr Karen Shires, who continues to serve as a national examiner for both the Haematology and Molecular Biology national intern medical scientists training programmes for the HPCSA, is also a member of the HPCSA medical scientist task team (UCT/GSH-NHLS representative), as well as an external examiner for national Hons, MMed, MSc and PhD theses.

Table UCT 6: Total number of trainees per qualification category and rates of successful completions/pass rates

Student qualification	Total number of enrolled students 2017	Final year trainees	Successful completion	Percentage of successful completions
Haematology pathology trainees*	6	0	0	0%
Intern medical scientist	1	0	0	0%
Honours medical science	2	2	2	100%
MMed	5	3	3	100%
MSc Medical science	1	0	0	0%
PhD medical science	1	0	0	0%

- *Dr Sumaiya Cassim passed FCPath (Haem) Part I in February 2018

4. Research activities

The research laboratory is located on the Faculty of Health Sciences (Medical School) campus and is well equipped to support undergraduate and postgraduate pathology and science students. Dr Shaheen Mowla (UCT) and Dr Karen Shires (UCT/NHLS) continued to expand the molecular and cellular research in haematological malignancies, normal and malignant haematopoiesis, detection of minimal residual disease in patients with leukaemia, cellular therapies and haematopoietic stem cell transplantation. There is a solid collaboration with the clinical service which resulted in several combined projects in the field of myeloproliferative and lymphoproliferative disorders (with a focus on the role of HIV) and acute leukaemias.

4.1 Research projects 2017-2018:

MMed project title: The utility of bone marrow sampling in the diagnosis and staging of lymphoma in South Africa
Principal investigator: Dr L Phillips
Supervisor: Dr J Opie (NHLS)
Graduated with distinction December 2017

MMed project title: HIV-associated Hodgkin lymphoma at GSH, Western Cape
Principal investigator: Dr L Swart
Supervisor: Dr J Opie (NHLS) | Co-supervisor: Prof N Novitzky (UCT/NHLS)
Graduated in December 2017

MMed project title: Burkitt lymphoma/leukaemia at GSH, Western Cape
Principal investigator: Dr A Koller
Supervisor: Dr J Opie (NHLS)
Completed in December 2017; passed (with corrections) in April 2018

MMed project title:	Establishing locally derived reference intervals for full blood count parameters and white cell differential countinthe Western Cape region of South Africa
Principal investigator:	Dr A De Koker
Supervisor:	Dr J Opie (NHLS) | Co-supervisor: Dr A Bird (WPBTS)
	Ongoing
Project title:	Immune reconstitution following allogeneic stem cell transplantation
Researchers:	N Novitzky, G Davison and R Mohamed
	The aim of this project is to study the early immune recovery after allogeneic T-cell depleted and haplo-identical non T-cell depleted transplants. 15 T-cell depleted and 20 haplo-identical cases have been analysed. The envisaged end date is December 2018
MMed project title:	Diagnostic molecular markers in South African Ph chromosome negative Myeloproliferative Neoplasms
Student:	Dr R Gopie
Supervisor:	Dr K Shires (NHLS)
	Ongoing
MSc project title:	The use of MAGE C1 to expression in the monitoring and treatment of autologous transplant patients with Multiple Myeloma
Student:	A Rust
Supervisor:	Dr K Shires (NHLS)
	Ongoing
PhD project title:	The use of MAGE C1 to expression in the monitoring and treatment of autologous transplant patients with Multiple Myeloma
Student:	A Muisyo
Supervisor:	Dr K Shires (NHLS)
	The project was terminated in December 2017
Hons project title:	Minimal residual disease and disease progression monitoring using Cancer Testis Antigen expression in patients with Multiple Myeloma
Student:	T van Wyk
Supervisor:	Dr K Shires (NHLS)
	Graduated in December 2017

4.2 Research grants, abstracts and article reviews

Dr K Shires reviewed articles which were submitted for the following journals:

- Journal of Blood Medicine;
- Austin Journal of Forensic Science and Criminology;
- OncoTargets and Therapy;
- Cancer Management and Research; and
- Gene Reports.

5. Research output

5.1 Journal publications

Pule GD, Mnika K, Joubert M, Mowla S, Novitzky N, Wonkam A. Burden, genotype and phenotype profiles of adult patients with sickle cell disease in Cape Town, South Africa. SAMJ. February 2017, 107(2): 149-155

Van Eyssen A, Novitzky N, De Witt P, Schlaphoff T, Thomas V, Pillay D, Hendricks M, Davidson A. Single-centre experience of allogeneic haemapoietic stem cell transplant in paediatric patients in Cape Town, South Africa. SAMJ. March 2017, 107(3): 232—238

Guzha B, Adams T, Rogers L, Mbatani N, H-T Wu H-T, Fakie N, Opie J, Denny L. Grade 3 endometroid endometrial cancer with bone marrow metastases: a management dilemma. Southern African Journal of Gynaecological Oncology. 2017; 9(2): 22-24

Phillips L, Opie J. The utility of bone marrow sampling in the diagnosis and staging of lymphoma in South Africa. International Journal of Laboratory Hematology, 2018; Feb 10: 1-8. 10.1111/ijlh.12782 [Epub ahead of print]

5.2 Conference presentations

5.2.1 Oral presentations

Opie J: Challenges in Haematology; Perspectives from Cape Town. Roche Hematology Academy, Amsterdam Medical Centre, April 2018, The Netherlands.

Phillips LA: The Utility of Bone Marrow Sampling in Lymphoma at Groote Schuur Hospital. Haematology Oncology Symposium, South African Clinical Haematology Society (SACHaS); May 2017, Newlands, Cape Town.

Opie J: Hodgkin Lymphoma; Experience from The Southern Tip of Africa.
Haematology Oncology Symposium, SACHaS; May 2017, Newlands, Cape Town.

Opie J: Haematology for the FCP part I examination. Annual UCT Physicians Refresher Course, May 2017, GSH.

Novitzky N: Unmet needs in transplantation for sickle cell anaemia. Workshop: Innovations for diagnosis and treatment. Pathology Research and Development at PathReD Congress, June 2017, Emperor's Place, Johannesburg.

Shires K: Molecular diagnostic methodologies: The bread and butter at PathReD Congress, June 2017, Emperor's Place, Johannesburg.

Phillips LA: Bone marrow staging of lymphoma - morphology & phenotyping (a South African perspective). Indian Ocean Rim Laboratory Haematology Congress, June 2017, Singapore. Invited speaker.

Opie J: Hodgkin Lymphoma; Experience from The Southern Tip of Africa. Indian Ocean Rim Laboratory Haematology Congress, June 2017, Singapore.

Van Wyk T, Shires K: Minimal residual disease and disease progression monitoring using Cancer Testis Antigen expression in patients with Multiple Myeloma. NHLS Pathology Day, November 2017.

Novitzky N: Stem Cell Transplantation for Haemoglobinopathies. The South Afrivcan Stem Transplant Society (SASCeTS) Conference, November 2017, Protea Balalaika Hotel, Sandton, Johannesburg.

Novitzky N: Immune recovery after haplo- identical stem cell transplantation. SASCeTS Conferfence, November 2017, Protea Balalaika Hotel, Sandton, Johannesburg.

5.2.2 Poster presentations

None.

5.2.3 Conferences, workshops and research day organisation

Indian Ocean Rim Laboratory Haematology Congress, Singapore, June 2017: Dr J Opie was on the Scientific Organising Committee (content planning and abstract review).

PathReD Congress, June 2017: Dr K Shires was on the Scientific Organising Committee (content planning and abstract review), as well as the coordinator and assessor for Haematology best poster and best oral.

UCT/NHLS Pathology Research Day, Nov 2017: Translating research into case reports-
Celebrating Medical Science in Action. Dr K Shires organised and coordinated this event.

6. Academic and research recognition awards

None.

7. Additional Information

Table UCT 7: Numbers of tests performed in the GSH NHLS diagnostic haematology laboratory from April 2017 – March 2018

Test name/type	Number of tests
FBC, diff and fluids	232 318
CD4	59 380
Routine coagulation	59 871
Blood grouping	43 557
ESR	9 665
Flow cytometry	1 131
Malaria	510
Molecular tests	1963

Human Genetics

Head of department: Prof Raj Ramesar

1. About the division

The Division of Human Genetics has a strong clinical presence in most of the major departments (notably Medicine, Paediatrics, Neurology, Obstetrics/Gynaecology, Oncology, Surgery and Psychiatry). This led to research projects based on the burdens of disease in each of these disciplines, which usually have the objective of identifying the biological basis of the disease. The research findings are translated into the molecular and cytogenetic tests which are offered through the NHLS molecular and cytogenetic diagnostic laboratories, located in the business unit at GSH. These tests are useful for accuracy of diagnosis (i.e. molecular for heterogeneous conditions), as well as for predictive testing, where this may be indicated e.g. the extensive colorectal cancer project, with the Department of Surgery.

The division's strong research programme is underpinned by training of BSc (Med) (Hons), MSc and PhD students. At any given time there are about 40 postgraduates in the division. We also strive to be at the cutting edge of research, which currently involves microarray-based genome-wide association studies, as well as next-generation sequencing (NGS) for some of the common chronic disorders which form the greater burden of disease in South Africa. Recognising the promise of genetics and genomics in medicine, the division furthermore hosts a Masters level training programme in Genetic Counselling [MSc(Genetic Counselling)].

Table UCT 8: Division of Human Genetics total number of staff per profession and highest qualification

	PhD Scientists	MSc Scientists	Support	South African	All
Total	10	3	3	11	16

2. Diagnostic service

The Human Genetics diagnostic laboratories are based in the NHLS Business Unit at GSH, and serve as a national referral centre for a range of molecular and cytogenetic diagnostic tests, with the main focus for 2017/2018 being on clients. Several systems were improved within the laboratory, to streamline processes and increase the quality of results. Some of these included appointing supervisors to the different benches, who are responsible for turnaround time (TAT), changes in processes, updating of standard operating procedures (SOPs) and training. A steady increase in workload is a continuing trend since 2012, as depicted in the figure below.

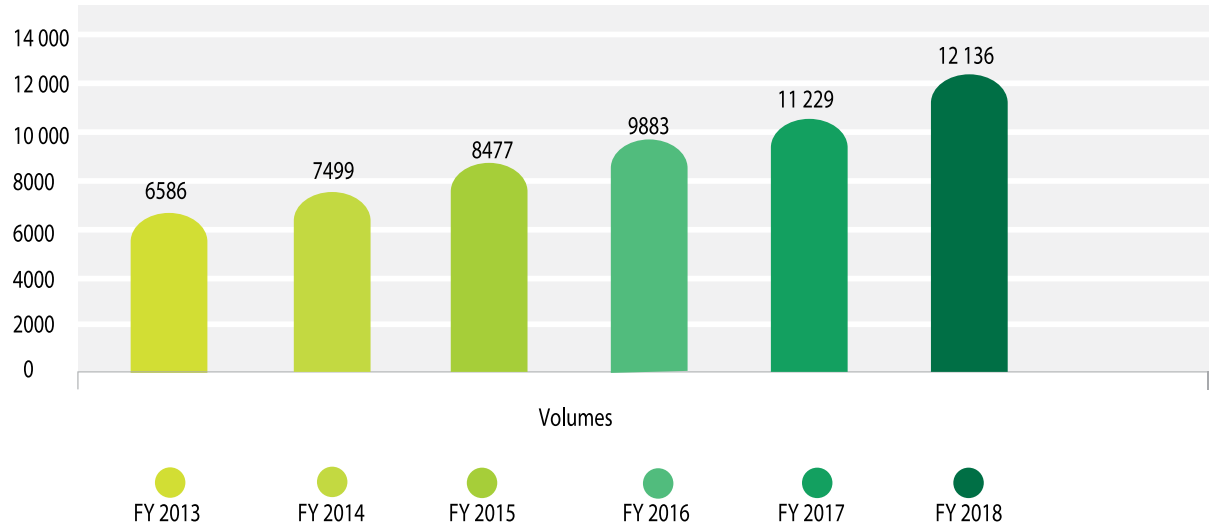

Figure 1: Depiction of increase in volumes in the diagnostic NHLS Human Genetics laboratory

Despite severe understaffing related to the economic challenges faced by the NHLS throughout 2017, SANAS accreditation was renewed following an audit with only two non-conformances (extended TAT). The division continues to perform well in its external quality control (EQA) programmes, which cover all types of samples and testing procedures. The laboratories achieved 92% for all chromosome analysis and fluorescent in situ hybridisation (FISH) challenges, and over 98% for the molecular EQA schemes. Excellent performance over the years was recently acknowledged by the European Molecular Quality Network (EMQN) who extended an invitation to our scientist (A. Esterhuizen) to join EMQN as a scheme assessor. Staff continue to be involved in the training of Hons students, intern medical technologists, experiential students, registrars, intern scientists, scientists, and medical students. We were successful in securing two-year NHLS internships for two medical biological scientists, who will be encouraged to participate in the diagnostic and translational research activities of the continually growing diagnostic service.

The 2016/2017 goal of implementing chromosomal microarray technology as a diagnostic service for copy number variant detection in childhood disorders of developmental delay and intellectual disability, was achieved with great success. A total of 144 samples was processed, with a copy number variant detection rate of 34%, which is in line with international detection rates.

Table UCT 9: Current NHLS staff complement

	Pathologist	PhD Scientist	MSc Scientist	Hons Scientists	Technologists	Intern Scientists	South African	All
Total	0	0	1	2	8	2	13	13

3. Teaching, training and professional development

The division is the headquarters of the African Society of Human Genetics (AfSHG), which was pivotal to the emergence of the Human Heredity and Health: Africa (H3Africa) research programme (www.H3Africa.org), which is funded by the National Institutes of Health (NIH, USA) and the Wellcome Trust (UK). Apart from developing an impressive network of well-supported genomics and human health projects on the continent, this programme has the objective of large-scale education and training, pertaining to genomics and bioinformatics. Prof Raj Ramesar is involved with three working groups in H3Africa, as follows:

i. Co-principal Investigator on the Genetics of Schizophrenia in the Xhosa people;
ii. Co-investigator on the Genetics of Rheumatic Heart Disease; and
iii. The Burden, Spectrum and Aetiology of Type 2 Diabetes in sub-Saharan Africa.

Prof Ambroise Wonkam is the principal investigator on the project: Exploring Perspectives on Genomics and Sickle Cell Public Health Interventions. Ms Alina Esterhuizen, jointly appointed by UCT and NHLS, is the programme coordinator for the HPCSA Internship

Programme for medical biological scientists and is also currently busy with her PhD investigating the 'Genomics of Epilepsy in the South African Paediatric population' In addition, she is spending three months in the lab of one of our past PhD students, Dr Gemma Carvill, at the University of Washington in Seattle, USA, where she is using next generation sequencing (NGS) technologies in our research laboratory at UCT to identify disease-causing mutations.

The division houses the African Genome Education Institute (AGEI), which is a non-governmental organisation (NGO) tasked with making science accessible to the public. In this regard, the AGEI raises funds and supports two major activities:

i. The Darwin Seminars, which are quarterly evening seminars for the public in the areas of genomics, anthropology and evolution, and which attract a full house of 200–250 attendees; and
ii. The Teaching Biology Project [(TBP) http://www.teachingbiologyproject.org.za], which is a programme aimed at teachers from previously disadvantaged high schools.

The latter hosts about 80 teachers every quarter, in a week-long residential programme at Bishops High School (Rondebosch), during school recess. The programme includes lectures and workshops that cover material in and related to their Grade 10, 11 and 12 curricula in great depth. This is going to expand to a Teaching Sciences Programme (TSP) and Teaching Mathematics Programme (TMP) in the near future.

4. Research activities

The division contributed significantly to the understanding of the molecular genetic basis of a wide range of hereditary disorders in South Africa. This research, which is usually done in the UCT laboratories and is funded by e.g. the resident MRC Human Genetics Research Unit, or the lay support group, Retina South Africa, provided the basis for sustainable diagnostic services in the NHLS laboratory at GSH.

The research niches which were explored because of a high level of clinical expertise and interest, include neurodegenerative conditions (this includes Huntington disease and cerebellar ataxias); genetics of inherited forms of blindness and deafness, genetics of colorectal cancers; pharmacogenomics; genetics of bipolar disorder and schizophrenia, and more recently, the genetics of Sickle Cell Disease, and the genetics of early-onset epilepsy.

The niche that is currently being explored, is the analysis of African genomes using state-of-the-art genome-wide analysis to understand the predisposition to common chronic disorders such as diabetes and neuropsychiatric conditions; and notably, bipolar disorder and schizophrenia. Each of the projects is designed at Masters, and notably at PhD level. While aimed at understanding the basis of diseases, the objective is also to produce diagnostic testing of relevance to the clinic.

A major area of current exploration, is the genetic dissection of severe adverse drug reactions for common conditions. Two of the notable diseases/drugs include:

i. Cancer and cisplatin (with hearing impairment as the adverse event); and
ii. Cancer and anthracycline (where the adverse drug reaction is cardiotoxicity).

A range of pharmacogenetics projects pertinent to antiretrovirals is being conducted by Prof Collet Dandara. The division continues to attract clinical specialists to complete their PhDs in genetics. The most recent enjoiners are:

i. An Oncologist, Dr Ramadhani Chambuso (from Tanzania) on the subject of "Host Genetics of Cervical Cancer";
ii. A gastroenterologist Dr Leo Katsidzira (from Zimbabwe):" Genetics of Colorectal Cancer in Zimbabwe";
iii. A Public Health Specialist, Dr Tahira Kootboodien (Public Health, UCT and Institute of Occupational Health, NHLS, Johannesburg) on "Investigation of Environmental and Genetic Factors Contributing to Suicide Attempts";
iv. A Nephrologist: Dr Jashira Naidoo (Division of Nephrology and Hypertension – GSH) – on "The Genetics of Renal Disease linked to hypertension"; and
v. An Obstetrician/Gyanecologist, Dr Tracey Adams (Department of Ob/Gyn, GSH) on "The Genetics of Ovarian Cancer".

4.1 Research units and study groups linked to the department

Research unit: MRC Research Unit for Genomic and Precision Medicine
Director: Prof Raj Ramesar
Short description: The goal of the unit is to undertake research into the genetic basis of diseases important in South Africa, while at the same time focusing on creating genomics-research capacity for the country.

4.2 Research projects

Project title: Genetics of Inherited Retinal Degenerative Disorders
Principal investigator: Prof Raj Ramesar
Co-investigator: Dr Lisa Roberts
Funding: Retina South Africa and NRF
Project start date : 1994
Project end date: Not available

Project title: Genetics of Neurodegenerative Disorders and Stem Cells
Principal investigator: Prof Jacquie Greenberg
Funding: NRF
Project start date: 2000
Project end date: Not available

Project title: Genetics of Bipolar Disorder and Suicidal Behaviour
Principal investigator: Prof Raj Ramesar
Funding: MRC Human Genetics Research Unit
Project start date: 2005
Project end date: Not available

Project Title: Genetics of Schizophrenia in the Xhosa People
Co-principal investigator: Prof Raj Ramesar
Principal investigator: Prof Dan Stein, UCT: Psychiatry
Funding: National Institute of Mental Health (NIMH), NIH USA
Project start date: April 2013
Project end date: Not available

Project title: Pharmacogenomics – Antiretrovirals
Principal investigator: Prof C Dandara
Funding: NRF
Project start date: 2010
Project end date: Not available

Project title: Exploring Perspectives of Genomics of Sickle Cell Public Health Interventions
Principal investigator: Prof Ambroise Wonkam
Funding: NIH
Project start date: Jan 2014
Project end date: Not available

Project title: Genetics of Colorectal Cancer
Principal investigator: Prof Raj Ramesar
Collaborator: Prof Paul Goldberg, Surgery, UCT/GSH
Funding: The Cancer Association of South Africa (CANSA) and the MRC Human Genetics Research Unit
Project start date: 2000
Project end date: Not available

Project title:	Genetics of Epilepsy in the Paediatric Population
Principal investigator:	Prof Raj Ramesar
Co-principal investigator:	Ass. Prof Gemma Carvill (Northwestern University, Chicago, USA) Clinical co-investigator Prof Jo Wilmshurst, UCT/RXH Student co-investigator: Ms Alina Esterhuizen
Funding:	MRC, NHLS Trust, NIH (USA)
Start date:	2016
Project end date:	Not available

4.3 Grant funding

- SMRC, SA
- NIMH, NIH, USA
- NIH USA
- NRF;
- NHLS Research Trust; and
- Retina South Africa.

5. Research output

5.1 Journal publications

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5.2 Conferences and presentations

A Esterhuizen: Delineation of the Genetic Causes of Epileptic Encephalopathies in South African Paediatric Patients. Given as oral presentations at:

- South African Society of Human Geneticists (SASHG) Congress 2017;
- NHLS/UCT Pathology Research Day 2017;
- UCT Dept. of Paeds & Child Health Research Days 2017; and
- Poster: Delineation of the Genetic Causes of Epileptic Encephalopathies in South African Paediatric Patients, 32nd Epilepsy Conference, Barcelona, 2017.

5.3 Research translated to diagnostic technology, policy or service

Genetics of colorectal cancers, neurodegenerative disorders and muscular dystrophies are currently implemented into the NHLS diagnostic laboratories at the GSH Business Unit. Most recently translated, was chromosomal microarray analysis for developmental delay and intellectual disability, which is offered as a national service. This stemmed from a Masters project completed by Mrs Theresa Ruppelt (NHLS Laboratory Manager for Human Genetics) in 2016.

Immunology

Head of department: Professor Clive M. Gray

1. About the division

The Division of Immunology at the UCT/GSH, NHLS coastal branch is involved with a range of activities from histocompatibility and clinical immunology diagnostic testing, to identification of the basic mechanisms of infectious disease immunity and translational clinical research on HIV and tuberculosis (TB). The Laboratory for Tissue Immunology (LTI) is responsible for human leukocyte antigen (HLA) class I and class II typing for solid organ and bone marrow/stem cell matching. This is the only laboratory in South Africa, and in Africa, to have European Federation of Immunogenetics (EFI) accreditation to perform HLA typing, cross-matching and anti-HLA antibody identification.

The Clinical Immunology and Allergy section of the laboratory performs routine diagnostic testing for autoimmune diseases and identification of allergens causing adverse reactions, ranging from minor symptoms, to life threatening anaphylaxis. Basic research in the allergy section focused on the T-cell cytokine responses to allergens, as well as the application of novel assays to identify sensitivity profiles, which complements the diagnostic laboratory. Basic mechanisms of TB disease are being investigated in the academic laboratories, especially exploring novel therapeutic interventions. HIV immunology research is focused on mucosal immunity in neonates and in adolescent males, to understand aspects of host susceptibility to infection.

There is an active and dynamic teaching component in the medical undergraduate syllabus that provides structured immunology lectures from years 1–3 in the MBChB undergraduate syllabus. Online learning is offered through Immunopaedia (www.immunopaedia.org.za) and the e-reader, which both supply adjunct material for undergraduates and postgraduate students. Postgraduate immunology through the BSc Hon in Infectious Disease and Immunology and the Advanced Research Immunology Programme, caters for more advanced basic and clinical immunology.

Table UCT 10: Total number of NHLS staff per profession and highest qualification

	PhD Scientists	BSc Honours	Technologists	South African	All
Total	3		7	9	9

2. Diagnostic service

2.1 Laboratory for Tissue Immunology

The Laboratory for Tissue Immunology, a division of Immunology, is the only EFI-accredited facility in Africa and participates in EQA programmes and maintains a vigorous ongoing accreditation programme. This enables the laboratory to confirm and report HLA matching between donors and unrelated recipients who are awaiting bone marrow transplants, at class I and II loci at high resolution. The laboratory works with the South African Bone Marrow Registry and The Sunflower Fund. The laboratory offers histocompatibility testing and performs HLA class I and II antibody identification, along with single antigen antibody assays for both living-related and cadaveric donor solid organ transplantation; molecular HLA typing at low and high resolution (class II only) for bone marrow and solid organ transplants for disease associations. Over the past year, over 10,000 histocompatibility tests have been performed.

2.2 Histocompatibility statistics

Table UCT 11: Histocompatibility statistics

The following shows the number of histocompatibility tests performed over the past year:

Histocompatibilty test	Numbers
Renal Recipients HLA Typed	470
Renal Donors HLA Typed	312
Cardiac, Liver, Lung, Soft Tissue HLA typed	33
Deceased Donors	36
Bone Marrow Patients	300

Histocompatibilty test	Numbers
Bone Marrow Donors	550
Unrelated Bone Marrow Donors	180
DNA Low Resolution (2-digit)	4850
DNA High Resolution (4-digit)	1480
HLA-B*27	200
HLA-B15*	1
Class I ID Screen + Single Antibody Assay	1575
Class II ID Screen + Single Antibody Assay	1350
Total tests performed	**11337**

2.3 Clinical Immunology and Allergy

Table UCT 12: The number of tests performed in the 2017/2018 reporting year:

Autoimmunity tests	20749
Allergy tests	7549
Total tests	**28298**

There was a 22% increase in autoimmunity tests and a 34% increase in allergy tests, over the past year.

3. Teaching, training and professional development

Table UCT 13: Total number of scientist trainees per qualification category and rates of successful completions and pass rates

	Total number of trainees	Final year trainees	Successful completion	Percentage of successful completions
All	31	10	6	60%

4. Research activities

4.1 Research units and study groups linked to the department

The following are collaborators who are linked to the Division of Immunology:

- Thomas Hope, Northwestern University, United States. Understanding HIV acquisition in males;
- Gordon Brown, Aberdeen University, Scotland. The role of C-type Rectin receptor ClecF8/Clec4D in host immunity against M. tuberculosis;
- Gerald Chege, Virology, UCT. A Novel Dual Animal Pre-clinical Platform: Accelerating HIV Vaccine Product Development in South Africa;
- Anwar Jardine, Department Chemistry, UCT. Evaluating the toxicity and anti-mycobacterial efficacy of 10H-phenothiazine N-propylsulphonate derivatives, C3 and C4 in a small animal model of tuberculosis;
- Dirk Lang, Department Human Biology, UCT. Neuron T cell interaction during CNS-TB; HIV immune target cells in the foreskin;
- Dale Greiner and Michael Brehm, University of Massachusetts, USA. A Novel Dual Animal Pre-clinical Platform: Accelerating HIV Vaccine Product Development in South Africa;
- Stefan Magez, Vrye University, Belgium. Assessment for vaccine efficacy for malaria and tuberculosis in a co-infection setting relevant for disease endemic sub- Saharan African regions;
- Valerie Quesniaux and Bernhard Ryffel, CNRS, France. Understanding TNF/TNFR and IL-1/IL-1R associated mechanisms of host pathogen relationships and innate and adaptive immune responses to tuberculosis;
- Maria Gulumian, University of Pretoria (UP); Prof Rodney Erlich, UCT. The role of silica exposure in tuberculosis;
- Anna-Lise Williamson, Virology, UCT/NHLS. Novel HIV Vaccine Candidates for South Africa;
- Bill Cameron, Ottawa Hospital Research Institute. Co-PI on Innate, Adaptive and Mucosal Immune Responses in HIV-1 Exposed Uninfected Infants: A Human Model to Understand Correlates of Immune Protection;

- Ken Rosenthal, McMaster University. Co-PI on Innate, Adaptive and Mucosal Immune Responses in HIV-1 Exposed Uninfected Infants: A Human Model to Understand Correlates of Immune Protection;
- Alashle Abimiku, Institute of Virology, Nigeria. Co-PI on Innate, Adaptive and Mucosal Immune Responses in HIV-1 Exposed Uninfected Infants: A Human Model to Understand Correlates of Immune Protection;
- Jo-Ann Passmore, UCT/NHLS. Investigator on Factors affecting HIV susceptibility in the adolescent genital tract; and
- Heather Jaspan, UCT/Seattle Children's Research Institute. Co-PI on Mechanisms of altered immune responses in HIV-exposed infants.

4.2. Research Projects

There are various research groupings in the division, spanning infectious disease, allergy, TB and HIV immunology.

Project title: Targeting proteins of the arachidonic acid pathway for host directed therapies against Tuberculosis

Principal investigator: Marakalala Group

Funding: NRF Thuthuka Grant

Project title: Characterization of FtsEX, a protein complex required by Mycobacterium tuberculosis to survive the host immune (MRC Self Initiated Research Grant)

Funding: MRC Self Initiated Research Grant

Project title: Combination biomarkers for early diagnosis of Tuberculosis

Funding: MRC Capacity Building Grant

Project title: Human TB granulomas as targets for host-directed therapies and prediction of disease progression

Principal investigator: Horsnell Group

Funding: Wellcome Trust UK Intermediate Fellowship

Project title: Host immunity to primary, secondary and maternal exposure to the model parasitic helminth Nippostrongylus brasiliiensis

Project title: How helminth infections alter immunity to viral infection of mucosal tissue

Project title: Influence of helminth infection on the onset of mycobacterial infection and disease in mice and humans

Project title: Helminth exposure and risk of allergy in humans in Northern Europe and Southern Africa

Project title: Role of Surfactant Proteins A and D in immunity to parasitic and viral infections

Project title: Generating novel transgenic mouse models to define the significance of immune cell production and responsiveness to acetylcholine

Principal Investigator: Brombacher Group

Project title: Tuberculosis and Tumor Necrosis Factor

Project title: Humanised mouse model for HIV/TB research

Project title:	Genome-wide CAGE transcriptomics for macrophage activation and M. tuberculosis perturbation
Project title:	The role of macrophages in tuberculosis
Project title:	Gene identification for host protection and immune evasion
Project title:	Host-directed drug therapy
Project title:	Pathogen-directed drug therapy
Project title:	The role of immunological cells in the regulation of inflammation
Project title:	The role of cytokines in host protective responses or disease
Project title:	The role of lymphocytes in allergic diseases (Ovalbumin and house dust mites, dermatitis)
Project title:	The role of genes and cytokines in dermatitis
Principal Investigator:	Smith Group
Project title:	Impact of hookworm on cervical cancer progression and HPV uptake
Project title:	Impact of helminths on colorectal cancer progression
Project title:	Impact of helminths on the inflammation associated with colorectal cancer
Project title:	Focus on microbial dysbiosis in helminth exacerbation of disease
Principal Investigator:	Guler Group
Project title:	Epigenetics of macrophages during Mycobacterium tuberculosis infection
Project title:	Development of statins as topical ointment formulation for cutaneous leishmaniasis in humans
Project title:	Remodelling of mycobacterial peptidoglycan during cell division and in tuberculosis disease
Principal Investigator:	Komguep Group
Project title:	Does IL-4 receptor mediated signaling regulate tissue pathology during Human schistosomiasis?
Project title:	Targeting IL-4 receptor using antisense oligonucleotides in a non-human primate model of experimental schistosomiasis to treat liver fibrosis
Project title:	The role of Interleukin-4 receptor mediated signaling in thymopoiesis and thymic involution
Project title:	Host regulators of liver fibrosis during schistosomiasis
Project title:	The role of IL-4 responsive Foxp3+ Tregs at homeostasis and during Helminth Infections
Project title:	The role of host factors and the commensal gut microbial community in host resistance to schistosomiasis
Principal Investigator:	Jacobs Group
Project title:	The role of C-type Rectin receptor ClecF8/Clec4D in host immunity against M. tuberculosis

Project title:	A Novel Dual Animal Pre-clinical Platform: Accelerating HIV Vaccine Product Development in South Africa
Project title:	Evaluating the toxicity and anti-mycobacterial efficacy of 10H-phenothiazine N propylsulphonate derivatives, C3 and C4 in a small animal model of tuberculosis.
Project title:	A Novel Dual Animal Pre-clinical Platform: Accelerating HIV Vaccine Product Development in South Africa
Project title:	Assessment for vaccine efficacy for malaria and tuberculosis in a co-infection setting relevant for disease endemic sub- Saharan African regions
Principal Investigator:	Gray Group
Project title:	Breast Milk Microbiota Influence on Infant Immunity and Growth: the role of HLA on antibody vaccine responses
Project title:	Impact of HIV exposure, feeding status, and microbiome on immune ontogeny and vaccine responses in infants
Project title:	Barrier Integrity, microbiome and HIV target cell interactions in the human male genital tract pre and post circumcision
Project title:	Mechanisms of altered immune responses in HIV-exposed infants
Project title:	ART and risk of preterm delivery in a rural high HIV prevalence area
Principal Investigator:	Jaspan Group
Project title:	Mucosal injury from sexual practices: Behaviour and biology of South African adolescents
Project title:	Effects of hormonal contraceptives on genital immunity and HIV susceptibility
Project title:	Vaginal virome of South African adolescents at high risk for HIV
Project title: **Project end date:**	Mucosal microbiome and vaccine responses in HIV-exposed African infants
Project title:	Hormone induced mucosal susceptibility and HIV risk in South African adolescents

4.3 Grant funding

- NRF;
- SAMRC;
- UCT;
- Research Contracts and Intellectual Property Services (RCIPS) Concept Fund;
- NHLS;
- Canadian Institutes of Health Research;
- NIH;
- European & Developing Countries Clinical Trials Partnership (EDCTP);
- National Institutes of Health (R21, R01, UO1); and
- The Wellcome Trust, UK.

5. Research output

5.1 Journal publications

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Medical Microbiology

Head of department: Prof Mark Nicol

1. About the division

The Division of Medical Microbiology (www.medmicro.uct.ac.za) encompasses a tertiary diagnostic microbiology service, provided by GSH, a research programme based at the hospital, as well as at the Health Sciences Campus and a postgraduate training programme.

The aim is to conduct research that is relevant to the infectious disease burden in South Africa, particularly tuberculosis, pneumonia and drug-resistant pathogens, including a specific focus on identifying cost-effective and appropriate diagnostic solutions for important infectious diseases in South Africa and on the human microbiome.

The division participates in the teaching of undergraduate medical students and has been spearheading an initiative to develop e-learning tools for pathology. The division supports training for registrars in medical microbiology, clinical pathology and infectious diseases, and has an MSc and PhD postgraduate programme. The division also contributes to the training of medical technologists and has an intern medical scientist training programme registered with the HPCSA.

Table UCT 14: Total number of staff per profession and highest qualification

	Pathologists	PhD Scientists	Technologists	Support	South African	All
Total	4	2	19	5	29	30

2. Diagnostic service

The NHLS GSH Microbiology Laboratory continues to provide high quality diagnostic services to eight hospitals, as well as to surrounding clinics, processing an average of 38 000 tests a month. This includes a full range of diagnostic services for tuberculosis, including Xpert MTB/RIF, culture, genotypic and phenotypic drug susceptibility testing, as well as molecular testing for resolution of discrepant rifampicin susceptibility results. The laboratory acts as a referral centre for George, providing both diagnostic testing for challenging isolates, as well as consultative support and advice.

Clinical liaison services are provided to clinicians from the Western and Eastern Cape and intensive care unit and antibiotic stewardship ward rounds, are attended on a weekly basis, in various hospitals. Hospital and provincial management are assisted with infection control matters and advice on the appropriate use of laboratory services.

3. Teaching, training and professional development

The division is actively involved in teaching undergraduate medical students, as well as in ongoing curriculum design and review. A particular focus has been the development of an e-learning approach to support and strengthen undergraduate teaching. Teaching activities include lectures, tutorials and practical. Members contribute to the intercalated molecular medicine course, offered to 3rd-year medical students, to prepare them for BSc (Hons) and a future research career. The division has an active postgraduate programme, including training at Masters and doctoral level. The division contributes microbiology modules to the Hons programme, as well as to the MSc in Forensic Science.

Table UCT 15: Total number of trainees per qualification category and rates of successful completions and pass rates

	Total number of trainees	Final year trainees	Successful completion	Percentage of successful completions
MSc	9	4	1 completed, 2 upgraded	100
PhD	18	4	4	100

MMed	7	1	0	n/a
All	33	9	7	n/a

4. Research activities

Research within the department is focused on infectious diseases in South Africa, particularly on the epidemiology, pathogenesis and microbiological diagnosis of such diseases. Research niches include childhood pneumonia; the origin and evolution of the human microbiome in early childhood; the impact of the microbiome on child health; novel diagnostics for meningitis and leptospirosis; the development and assessment of novel diagnostics for tuberculosis, including point-of-care (POC) tests; and drug discovery for Mycobacterium tuberculosis.

4.1 Research units and study groups linked to the department

MRC/NHLS/UCT Molecular Mycobacteriology Research Unit

Director: Prof V Mizrahi
Deputy Director: A/Prof DF Warner

The Molecular Mycobacterioloy Researh Unit (MMRU), positioned itself in the early preclinical phases of new TB drug discovery and development, with a focus on investigating those aspects of M. tuberculosis physiology of greatest relevance to TB drug discovery, namely metabolic vulnerability, drug permeation, resistance, persistence and tolerance. In close collaboration with local and international partners, a platform was established for routine compound screening against M. tuberculosis under a variety of growth conditions, in vitro. In addition, the unit is part of a major project investigating M. tuberculosis aerobiology and TB transmission. The MMRU comprises senior scientists, postdoctoral fellows, and postgraduate students, and participates in several major TB drug discovery consortia. Since 2011, the MMRU has been based within the Division of Medical Microbiology and the Institute of Infectious Disease and Molecular Medicine (IDM) where it constitutes the UCT node of the Department of Science and Technology (DST)/NRF Centre of Excellence for Biomedical TB Research.

4.2 Research rojects

Project title: Occurrence of a novel plasmid-mediated, colistin resistance mechanism (mcr-1), in South African Enterobacteriaceae with colistin resistance
Principal investigators: Dr C Moodley (NHLS/UCT), Dr C Bamford (NHLS/UCT), Mr R Moonieya and Prof M Nicol (NHLS/UCT)
Funding: The Federation of Infectious Diseases of Southern Africa (FIDSSA) and the NHLS Research Trust
Short description: This study aims to provide novel insight into the occurrence of the plasmid-mediated colistin resistance gene, mcr-1, in selected South African bacterial isolates displaying phenotypic resistance to colistin.
Project start date: January 2016
Project end date: December 2018

Project title: The accuracy of extended spectrum beta-lactamase detection in South African laboratories using the Vitek 2 Gram-negative susceptibility card AST-N255
Principal investigators: Dr C Moodley (NHLS/UCT), Dr C Bamford (NHLS/UCT), Ms AL Young and Prof M Nicol (NHLS/UCT)
Funding: FIDSSA and the NHLS Research Trust
Short description: This study aims to provide novel insight into the occurrence of the plasmid-mediated colistin resistance gene, mcr-1, in selected South African bacterial isolates displaying phenotypic resistance to colistin.
Project start date: January 2016
Project end date: June 2018

Project title: Population genetics of pneumococcal carriage in an intensively sampled birth cohort and impact of vaccination on carriage dynamics in the first two years of life: A South African birth cohort study

Principal investigators: Prof. M Nicol (NHLS/UCT), Dr F S Dube (UCT), Prof H Zar (UCT) and Prof S Bentley (Wellcome Trust Genome Centre)
Funding: Bill and Melinda Gates Foundation, UCT, NRF and Wellcome Trust, Pfizer
Short description: The overall goal of this study in to describe the population structure of S. pneumoniae colonizing the nasopharynx of children enrolled in an intensively sampled, PCV-13 vaccinated birth cohort of 1000 infants with a high incidence of LRTI, by linking whole pneumococcal genome sequences to detailed phenotype metadata.
Project start date: January 2017
Project end date: December 2021

Project title: Detection of Mycobacterium tuberculosis and other potential respiratory tract pathogens in Sudden Unexpected Death in Infants (SUDI) and the broader implications to improving public health and response
Principal investigators: Prof L Martin (NHLS/UCT), Laura Heathfield (UCT) and Andrea Young (UCT)
Funding: UCT and NRF
Short description: This project aims to contribute to the development and optimization of Mycobacterium tuberculosis detection in Sudden Unexpected Death of Infant Cases (SUDI), where cause of death is respiratory tract infection.
Project start date: January 2017
Project end date: December 2018

Project title: Haemophilus influenzae colonisation patterns in young children from Drakenstein sub district, South Africa
Principal investigators: Dr L Ah Tow (UCT), Prof M Nicol (NHLS/UCT), Ms F Patel (UCT) and Prof H Zar (UCT)
Funding: Bill and Melinda Gates Foundation and NIH
Short description: This study aims to:

i. Longitudinally describe colonisation patterns of Haemophilus influenzae in the nasopharynx of children within the first two years of life;
ii. Determine whether nasopharyngeal colonisation of HI is associated with the subsequent development of pneumonia;
iii. Determine the proportion of infants and mothers who have beta-lactam resistant HI, and the type of resistance present, BLPAR, BLNAR, gBLNAR and, or BLPACR'
iv. Longitudinally analyse the association and relationship between nasopharangeal colonisation of HI, S. aureus, S. pneumoniae and M. catarrhalis; and
v. Determine the risk factors associated with HI colonisation in children.

Project start date: May 2017
Project end date: October 2017

Project title: The Microbiome and Metabolome of Human Breast Milk and the occurrence of pneumonia and recurrent wheeze in the first five years of life
Principal investigators: Prof M Nicol (NHLS/UCT), Mrs A Ojo (UCT) and Dr E du Toit (UCT)
Funding: Bill and Melinda Gates Foundation and NRF
Short description: The aim of this study is to:

i. Profile the microbiome composition and metabolome in HBM samples from two population groups (TC Newman and Mbekweni communities) among South African mothers at seven weeks postpartum'
ii. Study the role of possible determinants of the composition of the HBM microbiome and metabolome in South African mothers such as socio-economic status (maternal education, employment), demographic factors (maternal age, maternal (BMI), maternal smoking, maternal and infant antibiotic therapy, mode of delivery, gestational age, infant gender), HIV infection, malnutrition, vaccination and seasonal variation;
iii. Investigate the association between the composition (microbiome and metabolome) of HBM and the development of pneumonia and/or recurrent wheezing illness among SA children;
iv. Predict the metagenome function of the HBM commensal microbiota using PICRUSt by showing their functional role in infant health; and
v. Contribute to existing knowledge of dietary replacement strategies and therapies (based on microbial

replacement and modulation) enabling new applications in the field of personalized nutrition and medicine.

Project start date: February 2016
Project end date: December 2018

Project title: The microbial profile of breast milk from HIV-infected women
Principal investigators: Prof M Nicol (NHLS/UCT), Mr G Petersen (UCT) and Dr E du Toit (UCT)
Funding: Bill and Melinda Gates Foundation and NRF
Short description: We hypothesize that the BM microbiota differs in composition and function between HIV-infected mothers on combination anti-retroviral therapy (cARTs) and HIV-uninfected mothers. The aim of this study is to:

i. Profile the BM microbiome composition and function from 128 African mothers (64 HIV-infected mothers on ART and 64 HIV-uninfected location matched controls) at 7-10 weeks post-partum; and
ii. Construct a metabolic network of the microbiome and compare the abundance of pathways across the sample set to identify metabolic differences associated with HIV.
iii. The Illumina MiSeq data, along with the PICRUSt data, will aid in creating a more in-depth picture of what effect HIV has on the BM and the BM microbiome.

Project start date: February 2016
Project end date: March 2018

Project title: The Pneumococcus Urinary Antigen Test Kit: Use in the laboratory for the presumptive diagnosis of pneumococcal bacteraemia
Principal investigators: Dr C Bamford (UCT/Pathcare), Dr H Tootla (NHLS/UCT) and Dr C Moodley (NHLS/UCT)
Funding: NHLS Research Trust
Short description: This study is investigating the utility of a urinary antigen kit, for the presumptive detection of pneumococci directly from enriched peripheral blood culture specimens, in a routine diagnostic laboratory.
Project start date: January 2017
Project end date: December 2018

Project title: Validation of a Pan-fungal PCR assay for the detection and identification of medically important fungi isolated in a diagnostic laboratory.
Principal investigators: Dr C Moodley (NHLS/UCT), Dr S V Ntuli (NHLS/UCT) and Dr C Bamford (UCT/Pathcare)
Funding: NHLS Research Trust
Short description: This study focussed on assessing the efficacy of a panfungal PCR for the identification of medically relevant fungi from cultured isolates.
Project start date: January 2014
Project end date: June 2018

Project title: Diagnostic PCR for the identification of Legionella pneumophila and Legionella longbeachae from clinical respiratory specimens
Principal investigators: Dr C Moodley (NHLS/UCT) and Dr A Khumalo (NHLS/UCT)
Funding: NHLS Research Trust
Short description: This study will develop a new multiplex real time PCR assay to diagnose Legionnaires disease or Pontiac fever, by detecting the presence of Legionella pneumophila and/or L. longbeachae nucleic acid in clinical samples from infected individuals.
Project start date: October 2017
Project end date: December 2019

Project title: Utility of GeneXpert® MTB/RIF Ultra as a diagnostic assay for the detection of Mycobacterium tuberculosis in Bone Marrow Biopsy aspirates
Principal investigators: Dr C Moodley (NHLS/UCT), Ms N Bhenxa (UCT) and Dr C Swart (NHLS/UCT)
Funding: UCT Departmental Funding
Short description: This study will assess the utility of the GeneXpert® MTB/RIF Ultra Assay to detect MTB complex and rifampin resistance in bone marrow biopsy aspirates from patients with pyrexia and cytopenias of unknown origin.

Project start date:	January 2018
Project end date:	December 2019
Project title:	The nasopharyngeal resistome in children colonized with Streptococcus pneumoniae
Principal investigators:	Prof M Nicol (NHLS/UCT), Dr C Moodley (NHLS/UCT), Dr F Dube (UCT), Mr R Manenzhe (UCT) and Prof H Zar (UCT)
Funding:	Bill and Melinda Gates Foundation, UCT, Organisation for Women in Science in the Developing World (OWSD), NRF and NIH
Short description:	This study is nested within the Drakenstein Child Lung Health Study. The aim of the study is to investigate the composition and dynamics of the nasopharyngeal resistome, as well as the prevalence of carriage of antibiotic-resistant pneumococci in healthy children during the first year of life.
Project start date:	January 2015
Project end date:	December 2019
Project title:	The Breathing REtraining for Asthma (BREATHe) study
Principal investigators:	Prof M Nicol (NHLS/UCT), Prof R Ferrand [London School of Hygiene & Tropical Medicine (LSHTM)], Prof J Oyvind (University Medical School in Tromsø) and Prof L Corbett (LSHTM)
Funding:	Global Health- and Vaccination Research (GLOBVAC)
Short description:	To conduct a randomised controlled trial of azithromycin for HIV-infected adolescents with chronic lung disease.
Project start date:	October 2013
Project end date:	September 2020
Project title:	The epidemiology and genetic characteristics of extended-spectrum beta-lactamase and carbapenemase-producing bacteria in apparently healthy children, South Africa
Principal investigators:	Prof M Nicol (NHLS/UCT), Dr M Kaba (UCT), Dr C Moodley, Mr R Manenzhe (UCT) and Prof H Zar (UCT)
Funding:	Bill and Melinda Gates Foundation, UCT, Carnegie Foundation and Wellcome Trust
Short description:	This study is nested within the Drakenstein Child Health Study and the aim is to study the epidemiology and genetic characteristics of extended-spectrum beta-lactamases (ESBL) and carbapenemase-producing bacteria in the stool of apparently healthy South African children.
Project start date:	January 2013
Project end date:	December 2018
Project title:	The stool bacteria and its relationship to wheezing
Principal investigators:	Dr M Kaba (UCT, South Africa), Prof M Nicol (NHLS/UCT, South Africa), Prof H Zar (UCT, South Africa), Ms S Kanyemba (UCT, South Africa), Ms M Ngwarai (UCT, South Africa) and Dr L Ah Tow (UCT, South Africa)
Funding:	Bill and Melinda Gates Foundation (USA) and Wellcome Trust (UK)
Short description:	The aim of this study is to determine the stool bacterial profile associated with the development of wheezing illness among infants in the Drakenstein Child Health Study.
Project start date:	February 2017
Project end date:	June 2019
Project title:	Nasopharyngeal fungal microbiota in children with and without lower respiratory diseases
Principal investigators:	Dr M Kaba (UCT, South Africa), Prof Mark Nicol (NHLS/UCT, South Africa), Prof H Zar (UCT, South Africa) and Prof L Thabane (McMaster University, Canada)
Funding:	Bill and Melinda Gates Foundation (USA), Canadian Institutes for Health Research (CIHR) HIV Trials Network and Carnegie Corporation of New York (USA)
Short description:	We aim to study the contribution of the nasopharyngeal fungal microbiota (mycobiota) in the development of lower respiratory tract infection in infants within the Drakenstein Child Health Study.
Project start date:	August 2013
Project end date:	July 2017
Project title:	Fecal bacterial markers for prediction of insulin sensitivity following an exercise intervention in a cohort of obese black South African women.

Principal investigators: Dr M Kaba (UCT, South Africa), Ms F Lutomia (UCT, South Africa), Assoc Prof J Goedecke (SAMRC/UCT, South Africa), Dr A Mendham (SAMRC/UCT, South Africa) and Dr L Ah Tow (UCT, South Africa)
Funding: MasterCard Foundation (USA)
Short description: This study investigates the association between gastrointestinal bacteriome and the changes observed in insulin sensitivity after an exercise training intervention in obese women.
Project start date: February 2017
Project end date: March 2019

Project title: Moraxella catarrhalis in the nasopharynx of young children from Drakenstein sub-district, South Africa
Principal investigators: Dr V Allen (UCT), Prof. M Nicol (NHLS/UCT), Dr L Ah Tow (UCT), Prof. H Zar (UCT)
Funding: Bill and Melinda Gates Foundation, NIH
Short description: This study aims to:

i. Longitudinally describe the colonisation pattern of M. catarrhalis in the intensive (two-weekly sampled) birth cohort;
ii. Investigate the strain diversity of M. catarrhalis in the intensive cohort using the whole genome sequencing approach;
iii. Identify risk factors (such as smoking, siblings, breastfeeding and day-care attendance) associated with M. catarrhalis colonization;
iv. Identify the gene responsible for beta-lactamase production (BRO-1 and BRO-2) and to quantify the percentage of each isotype in the population;
v. Longitudinally describe the interaction of M. catarrhalis with other common colonizers of the nasopharynx (Streptococcus pneumoniae, Haemophilus influenzae, Staphylococcus aureus);
vi. dentify whether M. catarrhalis is associated with pneumonia; and
vii. Investigate whether the M. catarrhalis strain obtained from an induced sputum specimen during a pneumonia event is identical to the strain obtained from the nasopharynx.

Project start date: February 2015
Project end date: To date

Project title: Rapid Urine-Based Screening for Tuberculosis to Reduce AIDS-Related Mortality in Hospitalized Patients in Africa (STAMP) Project
Principal investigators: Dr V Allen (UCT), Prof. M Nicol (NHLS/UCT) and Dr L Ah Tow (UCT)
Funding: MRC, the UK Department for International Development (DFID) and the Wellcome Trust
Short description: The aim of this project is to find an alternative way to concentrate M. tuberculosis from urine other than centrifugation. This method is to be used at POC, where there is limited/no electricity or infrastructure to perform elaborate diagnostic tests.
Project start date: March 2015
Project end date: June 2018

Project Title: Characterisation of Mycobacterium tuberculosis complex isolates with discordant rifampicin susceptibility test results detected in a routine TB laboratory in Cape Town
Principal investigator: Natalie Beylis (NHLS/UCT)
Other Investigators: Y Ghebrekristos (NHLS), V Allen (UCT), Dr JM Wojno (NHLS/UCT) and Prof M Nicol (NHLS/UCT)
Funding: NHLS Research Trust
Short description: This study aims to characterise the discrepant rifampicin results for Mycobacterium tuberculosis by rpoB sequencing and rifampicin MIC testing.
Project start date: April 2014
Project end date: October 2017

Project title TB-CHILD: Tuberculosis Collaborating Centre for Child Health
Principal investigators: Prof M Nicol (NHLS/UCT) and Prof H Zar (UCT)
Funding: MRC
Short description: This consortium aims to evaluate a range of novel molecular and immunological tests for their performance in the diagnosis of tuberculosis in children

Project start date: April 2015
Project end date: Jan 2018

Project title: REPORT-TB: Evaluation of the accuracy of Xpert Ultra for the diagnosis of tuberculosis in children.
Principal investigators: Prof M Nicol (NHLS/UCT), Prof H Zar University of KwaZulu-Natal (UCT) and Prof J. Starke (Baylor College of Medicine)
Funding: NIH (USA)
Short description This study aims to evaluate the accuracy of Xpert Ultra for the diagnosis of tuberculosis in children.

Project title: Optimising health systems to improve delivery of decentralised care for patients with drug resistant tuberculosis
Principal investigators: Prof M Nicol (NHLS/UCT), A/Prof H Cox (UCT), Prof M Moshabela (Africa Centre), Dr K Kielman (Queen Margaret), Prof K Mlisana [University of KwaZulu-Natal (UKZN)] and Prof. A Grant (LSHTM)
Funding: UK MRC/Wellcome Trust
Short description: This study looks at health system factors associated with successful implementation of decentralised care for patients with MDR-TB.
Project start date: Janaury 2016
Project end date: January 2020

Project title: Evolution and epidemiology of rifampicin-resistant tuberculosis in Khayelitsha, Cape Town: implications for biology and disease control
Principal investigators: A/Prof H Cox (UCT), Prof S Gagneux (Swiss TPH), Prof M Nicol (NHLS/UCT), Prof R Warren, University of Stellenbosch (SUN)) and Dr L Streicher (SUN)
Funding: Wellcome Trust/ Swiss South Africa Joint Research Programme
Short description: This study aims to use next-generation whole genome sequencing to study the evolution and epidemiology of drug-resistant TB in Khayelitsha, a high HIV, TB and DR-TB burden setting in South Africa.
Project start date: June 2016
Project end date: June 2020

Project title: The stool microbiota and its relationship to allergy and wheezing
Principal investigators: Prof M Nicol (NHLS/UCT), Dr M Kaba (UCT), Mrs S Claassen-Weitz (UCT), Prof H Zar (UCT) and Ms M Ngwarai (UCT)
Funding: Bill and Melinda Gates Foundation, Carnegie Foundation and the Wellcome Trust
Short description: The aim is to identify the diversity and main components of the stool microbiota of infants and mothers over a two-year period at one-month intervals. This information will be related to the development of wheezing illness. Stool samples are being collected from infants and mothers at birth and monthly thereafter until two years of age. DNA is extracted and the diversity is measured using a NGS approach.
Project start date: February 2015
Project end date: December 2018

Project title: Nasopharyngeal microbiome and pneumonia in young children from Drakenstein sub-district, South Africa
Principal investigators: Prof M Nicol (NHLS/UCT), Prof H Zar (UCT), Mrs S Claassen-Weitz (UCT) and Dr E du Toit (UCT)
Funding: Bill and Melinda Gates Foundation, Carnegie Foundation and NIH
Short description: The aim of this study is to:

i. Investigate longitudinally the nasopharyngeal microbiome of a birth cohort of 500 infants (sampled two-weekly over a two-year period);
ii. Determine the nasopharyngeal pathogens associated with near-term progression to pneumonia in childhood during the first two years of life; and
iii. Study the microbial diversity in infants sampled using metagenomic approaches.

Project start date: July 2015
Project end date: February 2019

Project title: Development of a real-time assay for the diagnosis of meningitis in children

Principal investigators:	Dr C Bamford (UCT/NHLS), Dr E du Toit (UCT), Mr J Khumalo (UCT), Dr R Muloiwa (UCT), Dr B Eley (UCT) and Dr D Hardie (UCT)
Funding:	NHLS Research Trust
Short description:	This is a study of the use of molecular diagnostic methods to improve the detection of the common bacterial and viral causes of community-acquired meningitis in children in South Africa. Being independent of culture, molecular methods may be of particular value in patients who have received prior antibiotic therapy. Use of molecular methods may significantly reduce unnecessary antibiotic treatment and hospitalisation.
Project start date:	June 2015
Project end date:	June 2017

Project title:	Validation of a real-time PCR assay for detection of leptospirosis
Principal investigators:	Dr L Paul, Dr PR Naicker (NHLS/UCT) and Prof M Nicol (NHLS/UCT)
Funding:	NHLS
Short description:	This study aims to validate and assess the clinical utility of a real-time PCR assay for the diagnosis of acute leptospirosis, using blood and urine samples from patients presenting to Groote Schuur Hospital and local referring hospitals in Cape Town, South Africa.
Project start date:	May 2017
Project end date:	December 2018

Project title:	Characterisation of anaerobic bacteria isolated from clinical specimens submitted to GSH
Principal investigators:	Dr L Paul (NHLS/UCT), Dr C Moodley (NHLS/UCT) and Dr N Beylis (NHLS/UCT)
Funding:	NHLS Research Trust
Short description:	The study aims to characterise anaerobic bacteria identified from deep tissue infections of patients at GSH. Cultured isolates are being identified, using different phenotypic and genotypic methods. Antimicrobial drug sensitivities of cultured isolates, against antibiotics used to treat anaerobic bacteria, are determined. Lastly, a real-time molecular assay will be developed, to enable detection of DNA from anaerobic bacteria in clinical samples.
Project start date:	January 2018
Project end date:	December 2018

Project title:	Development and validation of an in-house method, real-time PCR method to detect Bartonella from peripheral blood of patients with culture-negative endocarditis
Principal investigators:	Dr L Paul (NHLS/UCT), Dr C Moodley (NHLS/UCT) and Dr N Beylis (NHLS/UCT)
Funding:	NHLS Reearch Trust
Short description:	This study aims to evaluate the Bartonella-specific nuoG gene as a target to identify the bacterium's DNA in patients with culture-negative, suspected endocarditis. A real-time PCR assay will be developed and optimised using plasmid constructs containing the nuoG DNA target, followed by evaluation of the assay using mock samples consisting of human DNA (from peripheral blood) spiked with the plasmid target. Relevant evaluations include determination of assay specificity and specificity. Results from this study could be valuable to develop a faster diagnostic assay, using DNA extracted from peripheral blood, instead of from infected heart tissues.
Project start date:	January 2018
Project end date:	December 2018

Project title:	Development of a real-time PCR assay for detection of shiga toxin-producing Escherichia coli in stool specimens received for community acquired diarrhoea investigation
Principal investigators:	Dr L Robberts (NHLS/UCT), B Kalule (UCT), Prof. M Nicol (NHLS/UCT)|Funding: NHLS Research Trust
Short description:	The study aims to develop a real-time PCR targeting shiga toxin genes from stool specimens received at NHLS GSH Microbiology Laboratory for community acquired diarrhoea investigations.
Project start date:	June 2014
Project end date:	December 2017

Projects – MRC/NHLS/UCT Molecular Mycobacteriology Research Unit

Project title: Target identification and validation in new TB drug discovery
Principal investigators: Prof V Mizrahi (UCT/NHLS) and Associate Prof DF Warner (UCT)
Funding: NRF (South Africa), MRC (South Africa), MRC Strategic Health Innovation Partnerships (SHIP) (South Africa), Bill and Melinda Gates Foundation (USA) and the Foundation for the NIH (USA)
Short description: In collaboration with local and international research groups, the antimycobacterial activity of novel small-molecules derived from chemical screens and other compound sources are being evaluated, as well as using hits as probes in target identification and validation analyses.
Project start date: April 2017
Project end date: To date

Project title: The development of new tools for TB drug discovery
Principal investigators: Prof V Mizrahi (UCT/NHLS), Associate Prof DF Warner (UCT)
Funding: NRF (South Africa), MRC Strategic Health Innovation Partnerships (SHIP) (South Africa), Bill and Melinda Gates Foundation (USA) and the European Union (EU) FP7
Short description: In these studies, genetic methods are being used to develop new tools and bioreporters for application in TB drug discovery and development programmes.
Project start date: April 2017
Project end date: To date

Project title: Understanding drug permeation in M. tuberculosis
Principal investigators: Prof V Mizrahi (UCT/NHLS) and Associate Prof DF Warner (UCT)
Funding: NRF (South Africa), SAMRC (South Africa), Howard Hughes Medical Institute (USA) and the NIH (USA)
Short description: A combination of molecular genetics and 'omics' methods is being applied to determine the factors that influence drug permeation in M. tuberculosis and which might be exploited in TB drug discovery and development programmes.
Project start date: April 2017
Project end date: To date

Project title: Targeting drug resistance in M. tuberculosis
Principal investigators: Associate Prof DF Warner (UCT) and Prof V Mizrahi (UCT/NHLS)
Funding: SAMRC (South Africa) – Newton Foundation (UK) and the Research Council of Norway
Short description: Novel strategies are being investigated to identify new antibiotic targets for drug-resistant M. tuberculosis and/or prevent the emergence of resistance.
Project start date: April 2017
Project end date: To date

Project title: Mechanisms of DNA repair, replication and mutagenesis in mycobacteria
Principal investigators: Associate Prof DF Warner (UCT) and Prof V Mizrahi (UCT/NHLS)
Funding: NRF (South Africa), MRC (South Africa), Howard Hughes Medical Institute (USA), and the NIH (USA)
Short description: An integrated genetic, biochemical and physiological approach was applied to investigate the molecular mechanisms underlying DNA metabolism in M. tuberculosis. The rationale underlying the work is that these processes are intricately associated with some of the defining features of mycobacterial pathogenesis, such as the slow growth rate of the bacillus and its ability to acquire multi-drug resistance by chromosomal mutagenesis.
Project start date: April 2017
Project end date: To date

Project title: The role of vitamin B12 in mycobacterial metabolism
Principal investigators: Associate Prof DF Warner (UCT) and Prof. V Mizrahi (UCT/NHLS)
Funding: NRF (South Africa), MRC (South Africa) and the Howard Hughes Medical Institute (USA)
Short description: The biosynthesis and transport of vitamin B12 in M. tuberculosis, and the role of vitamin B12-dependent enzymes and metabolic regulation in mycobacterial metabolism and pathogenesis are being investigated.
Project start date: April 2017
Project end date: To date

Project title:	Mechanisms of stress adaptation and antibiotic tolerance in mycobacteria
Principal investigators:	Associate Prof DF Warner (UCT) and Prof V Mizrahi (UCT/NHLS)
Funding:	NRF (South Africa) and the MRC (South Africa)
Short description:	This project aims to investigate mechanisms of stress adaptation and antibiotic tolerance in M. tuberculosis by focusing on candidate genes that have been implicated in these processes.
Project start date:	April 2017
Project end date:	To date

Project title:	The impact of drug resistance-associated mutations on mycobacterial physiology
Principal investigators:	Associate Prof DF Warner (UCT) and Prof V Mizrahi (UCT/NHLS)
Funding:	NRF (South Africa) and the MRC (South Africa)
Short description:	It is expected that mutations implicated in resistance to frontline anti-TB drugs might impact key physiological processes in M. tuberculosis. This project aims to investigate the impact of drug resistance on mycobacterial metabolism and, in turn, the host-pathogen interaction.
Project start date:	April 2017
Project end date:	To date

Project title:	Replisome dynamics in M tuberculosis: linking persistence to genetic resistance
Principal investigators:	Associate Prof. DF Warner (UCT), Prof. V Mizrahi (UCT/NHLS), Dr Roger Woodgate (NICHD, USA)
Funding:	NIH (USA), MRC (South Africa)
Short description:	The predicted role of a major M. tuberculosis stress response pathway, the so-called 'SOS response', is being investigated with respect to providing the functional link between the formation of antibiotic-tolerant "persister" cells and the subsequent emergence of genetically drug-resistant mutants during extended antibiotic treatment.
Project start date:	April 2017
Project end date:	To date

Project title:	Tuberculosis transmission: host, bacterium and environment
Principal investigators:	Prof R Wood (UCT/DTHC), Associate Prof DF Warner (UCT) and Prof V Mizrahi (UCT/NHLS)
Funding:	Bill and Melinda Gates Foundation (USA) and the MRC Strategic Health Innovation Partnerships (SHIP) (South Africa)
Short description:	This consortium, led by Prof. R Wood (UCT/DTHC), aims to elucidate the bacterial, host and environmental factors contributing to TB transmission in a high-burdened target community.
Project start date:	April 2017
Project end date:	To date

Project title:	Genomic investigations of transmission and microdiversity in a high TB-HIV burden setting
Principal investigators:	Associate Prof DF Warner (UCT) and Dr K Middelkoop (UCT)
Funding:	Bill and Melinda Gates Foundation (USA)
Short description:	This study utilises whole-genome sequencing to determine the degree of genotypic heterogeneity in aerosolised Mycobacterium tuberculosis (MTB) populations isolated under clinical conditions.
Project start date:	April 2017
Project end date:	to date

5. Research output

5.1 Journal publications

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5.2 Books and chapters

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5.3 International and national invited, plenary and keynote addresses

Mizrahi V. Harnessing biological insight to accelerate TB drug discovery. Keynote Lecture presented at the Gordon Research Conference on Tuberculosis Drug Discovery & Development, Lucca, Italy, 25-30 June 2017.

Mizrahi V. Harnessing biological insight to accelerate TB drug discovery. Keynote Lecture presented at the South African Immunological Society (SAIS) Conference, Gordon's Bay, 3 September 2017.

Mizrahi V. Metabolic vulnerabilities in M. tuberculosis: lessons from guanine nucleotide metabolism. Plenary lecture presented at the Keystone Symposia: New Developments in our Basic Understanding of Tuberculosis, Vancouver, 14-19 January 2017.

Reiche M, Martin Z, Lang D, Aaron J, Chew T, Dhar N, Müller R, McKinney JD, Mizrahi V, Warner DF. SOS-dependent mutasome recruitment and griselimycin-mediated inhibition of mutagenesis in live mycobacterial cells. Invited short talk presented at the American Society for Microbiology (ASM) Conference on Tuberculosis: Past, Present and Future, New York, 1-4 April 2017.

Warner DF. Phenotypic and genomic approaches to M. tuberculosis transmission. Plenary lecture presented at the National Institute of Allergy and Infectious Diseases (NIAID)/SAMRC/BMGF Workshop on Halting TB Transmission in HIV-Endemic Settings, Cape Town, 1-2 June 2017.

Warner DF. A moving target: evolution of drug resistance in Mycobacterium tuberculosis. Invited talk presented at Turning the tide of antimicrobial resistance (TTA), Oslo, Norway, 27-28 April 2017.
Warner DF. Whole-genome sequencing of M. tuberculosis for TB transmission. The Bill & Melinda Gates Foundation Aerobiology Symposium, Seattle, USA, 7-8 March 2017.

Warner DF. Drug permeation and activity in Mycobacterium tuberculosis infected macrophages. Invited talk at Scientific Research Workshop of the US-SA Program for Collaborative Biomedical Research, Durban, 12 June 2017.

Warner DF. Mutasome targeting to limit TB drug-resistance. Invited talk at the International Centre for Genetic Engineering and Biotechnology (ICGEB) Workshop on Host-directed therapies in infectious disease, Cape Town, 18-21 September 2017.

Kipkorir T, Mashabela G, Krishnamoorthy G, Mizrahi V and Warner DF. Riboswitch regulation of methionine metabolism and vitamin B12 uptake in mycobacteria: a role in pathogenesis? Invited poster talk presented at the Federation of European Microbiological Societies (FEMS) 2017, 7th Congress of European Microbiologists, Valencia, Spain, 10-17 July 2017.

Reiche M, Martin Z, Lang D, Aaron J., Chew TL., Dhar, N, Müller, R, McKinney, J, Mizrahi V, and Warner DF. Invited talk presented at Mycobact '17: 10th International Conference on the Pathogenesis of Mycobacterial Infection, Stockholm, Sweden, 23-26 August 2017.

de Wet TJ, Mhlanga M, Warner DF. Knocked down and out: A Comprehensive CRISPRi library targeting M. smegmatis genes with M. tuberculosis homologues. Invited talk presented at the Genomics Discovery Initiative Annual Meeting, Philadelphia, USA, 12 October 2017.

Nicol MP. Rapid microbiological diagnostics as an aid to antimicrobial stewardship. H3D Symposium on drug-resistant infections, Cape Town, 1 February 2018.

Nicol MP. Microbiome analysis in the routine microbiology laboratory: now, or never? Federation of Infectious Diseases Societies of South Africa Congress, Cape Town, 10 November 2017.

Nicol MP. Recent Advances in Diagnostics for Active TB. Federation of Infectious Diseases Societies of South Africa Congress, Cape Town, 11 November 2017.

Nicol MP, Zar HJ. Tuberculosis Collaborating Centre for Child Health, Paediatric Diagnostic Studies Update. RePORT Consortium Meeting, Rio de Janiero, 12 September 2017.

Nicol MP. Drug-resistant tuberculosis: Molecular tools: opportunities and challenges. Wellcome Trust Advanced Course: Molecular Approaches to Clinical Microbiology in Africa, Cape Town, 3 September 2017.

5.4 National and Oral Contributions

Warner DF. A moving target: evolution of drug resistance in Mycobacterium tuberculosis. Invited talk presented at Meeting the challenge of drug resistant tuberculosis, Cape Town, 24-26 March 2017.

Warner DF A moving target: evolution of drug resistance in Mycobacterium tuberculosis. Invited talk presented IDM/ICGEB Seminar Series, UCT, 19 April 2017.

Warner DF. A moving target: evolution of drug resistance in Mycobacterium tuberculosis. Invited talk presented in the School of Public Health, UCT, 24-26 March 2017.

de Wet TJ, Mhlanga M, Warner DF. Knocked down and out: A Comprehensive CRISPRi library targeting M. smegmatis genes with M. tuberculosis homologues. Talk presented at the HUB/IBMS/PAT Postgraduate Research Day, Faculty of Health Sciences, UCT, 27 September 2017.

Kipkorir T, Mashabela G., Krishnamoorthy G., Mizrahi V. and Warner DF. Riboswitch regulation of methionine metabolism and vitamin B12 uptake in mycobacteria: a role in pathogenesis? Talk presented at the Western Cape Acid Fast Club meeting, Stellenbosch University, 22, August 2017.

5.5 Posters

Taylor C, Mizrahi V, Warner DF and Egan T. Visualising whole-cell translational activity to investigate metabolic quiescence in mycobacteria. Poster presented at the Microscopy Society of Southern Africa 2017 Annual Conference, Bela Bela, 4-7 December 2017.

Tanner L, Mashabela G, de Wet T, Parkinson C, Warner D, Haynes R, and Wiesner L. An in vitro model of drug accumulation at the target site of pulmonary tuberculosis. South African Society for Basic and Clinical Pharmacology Conference 2017, 1-4 October, Bloemfontein.

Gobe I, Mizrahi V, and Warner DF. Disabling the intrinsic resistome of Mycobacterium tuberculosis: elucidating hierarchies of DNA repair and mutagenesis that undermine current antibiotic efficacy. HUB/IBMS/PATH Postgraduate Research Day, Faculty of Health Sciences, UCT, 27 September 2017.

Mbau RD, Mukherjee R, Mizrahi V and Warner DF. Whole-genome transposon mutagenesis to elucidate the genetic requirements for vitamin B12 biosynthesis and assimilation in mycobacteria. HUB/IBMS/PATH Postgraduate Research Day, Faculty of Health Sciences, UCT, 27 September 2017.

Masuku B, Young E, Mizrahi V, Wilkinson RJ, Mkhwanai N, Koch A and Warner DF. Beyond the lab and behind the lens: An anthropological exploration of a youth-based TB community engagement project in Khayelitsha, Cape Town. HUB/ IBMS Research Day, Faculty of Health Sciences, 27 September 2017.

Bamford C, Tootla H, Moodley C. Utility of a novel urine antigen test for the rapid presumptive identification of S. pneumoniae bacteraemia. Federation of Infectious Diseases Societies of Southern Africa Conference. Cape Town, South Africa, 2017.

Manenzhe I, Moodley C, Dube FS, Nicol MP. Characterizing antibiotic-resistant pneumococci in the nasopharynx of healthy South African infants using shotgun sequencing and conventional typing. European Society for Paediatric Infectious Diseases, Madrid, Spain, 2017.

Du Toit E. Oral presentation: The microbiota and human milk oligosaccharides in breast milk from HIV-infected mothers. 8th Child Health Priorities Conference. UP, 2017.

Du Toit E. Oral presentation: The difference in microbiota and human milk oligosaccharides in breast milk from HIV-infected mothers and their uninfected controls.7th FIDSSA Congress. Cape Town, 2017.

Du Toit E. Oral presentation: The microbiome of the gut and breastmilk, UCT Winter School, Cape Town, South Africa, 2017.

Kipkorir T, Mashabela G, Mizrahi V, Warner DF. Riboswitch regulation of methionine metabolism and vitamin B12 uptake in mycobacteria. Poster presented at the ASM Conference on Tuberculosis: Past, Present and Future, New York, 1-4 April 2017.

Singh V, Loerger T, Mizrahi V, Teague S, Warner DF. Identification of AspC as primary target of a novel bactericidal compound. Poster presented at the Gordon Research Conference on Tuberculosis Drug Discovery & Development, Lucca, Italy, 25-30 June 2017.

Mabhula A, Mashabela G, Njoroge M, Tanner L, Wiesner L, Warner DF, and Chibale K. Investigating permeation of anti-mycobacterial agents in macrophages as an in vitro model for early stage TB drug discovery. Poster presented at the Gordon Research Conference on Tuberculosis Drug Discovery & Development, Lucca, Italy, 25-30 June 2017.

Agarwal P, Mizrahi V. Development of an assay for growth, persistence and drug susceptibility of Mycobacterium tuberculosis in foamy macrophages. Poster presented at the Gordon Research Conference on Tuberculosis Drug Discovery & Development, Lucca, Italy, 25-20 June 2017.

Mashabela G, Moosa A, Frigui W, Krishnamoorthy G, Mizrahi V, Brosch R, Warner DF. The evolution of Mycobacterium tuberculosis as obligate pathogen: loss of cobF results in vitamin B12 auxotrophy in M. canettii. Poster presented at Mycobact '17: 10th International Conference on the Pathogenesis of Mycobacterial Infection, Stockholm, Sweden, 23-26 August 2017.
Tanner L, Mashabela G, de Wet T, Parkinson C, Warner D, Haynes R, Wiesner L. An in vitro model of drug accumulation at the target site of pulmonary tuberculosis. 10th International Conference on the Pathogenesis of Mycobacterial Infections, Stockholm, Sweden, 23-26 August 2017.

Koch A, Brites B, Stucki D, Evans JC, Seldon R, Nicol M, Oni T, Mizrahi V, Warner DF, Parkhill J, Gagneux S, Martin DP, Wilkinson RJ. The evolution of Mycobacterium tuberculosis in HIV co-infected individuals in an HIV/TB endemic setting. 22nd International Bioinformatics Workshop on Virus Evolution and Molecular Epidemiology (VEME), Lisbon, Portugal 27 August – 1 September 2017.

Koch A Brites B, Stucki D, Evans JC, Seldon R, Nicol M, Oni T, Mizrahi V, Warner DF, Parkhill J, Gagneux S, Martin DP, Wilkinson RJ. The evolution of Mycobacterium tuberculosis in HIV co-infected individuals in an HIV/TB endemic setting. 2nd ASM Conference on Rapid Applied Microbial Next-Generation Sequencing and Bioinformatic Pipelines, Washington D.C., USA, 8 – 11 October 2017.

Medical Virology

Head of department: Professor Carolyn Williamson

1. About the division

The Division of Medical Virology contributes to the diagnosis, treatment, prevention and eradication of viral diseases in South Africa through a diagnostic laboratory service together with a dynamic research and teaching programme. The NHLS Virology Diagnostic Laboratory, located at GSH, is a SANAS-accredited facility which provides a comprehensive service to both GSH and RCCH. It also serves as a regional reference centre providing a clinical and diagnostic service to local teaching hospitals and surrounding public health clinics.

In addition, the division contributes to undergraduate teaching and plays a major role in postgraduate training. The division currently hosts three MMed students, and 30 postgraduate students (registered for, BSc(Med) Hons, MSc and PhD).

Research within the division focuses on:

- HIV-1 vaccine design and development;
- Human papillomavirus (HPV);
- Factors affecting risk of HIV-1 infection;
- Neurovirulence of measles virus;
- Surveillance of non-polio enterovirus infections associated with viral meningitis and respiratory illness; and
- Strengthening health diagnostic services in the Western Cape, including early infant diagnosis (EID).

Research is performed within the Institute of Infectious Diseases and Molecular Medicine and in the Groote Schuur NHLS diagnostic laboratory.

Research highlights from 2017/2018 include:

- The evaluation of EID in Cape Town;
- The integration of post-partum health care services for HIV-infected women and their infants (Durrning et al., Plos One, Myers et al. and PLoS Med);
- The elucidation of contamination as a source of false HIV-1 positives on automated platforms (Hardie et al., Plos One); and
- The identification of hepatitis B virus (HBV) on blood contaminated hair-clippers which could pose a transmission risk (Spenganeet al., SAMJ).

In HIV transmission, we contributed to research that established the following:

- Certain vaginal bacteria can modify HIV tenofovir microcode efficacy (Klatt et al., Science);
- Inflammation undermines the effect of tenofovir gel (McKinnon et al., Nature Medicine); and;
- One mechanism could be through the ability of less infectious HIV variants to cross the mucosal barrier in the presence of inflammation (Selhorst et al., Clin Infect Disease).

Furthermore, as part of a larger African collaboration, we demonstrated that Integrin α(4)β(7) expression on peripheral blood CD4(+) T cells predicts HIV acquisition and disease progression outcomes (Sivro et al., Sci Trans Medicine). In viral discovery, Hardie and Smuts identified pegivirus-1 in CSF of patients with HIV-associated neurocognitive disorder (HAND) (J Clin Virol) and published the first complete genome of hepatitis B virus (HBV) genotype G from Africa (Smuts et al., J Emerg Dis Virol).

In HPV research, the division informed vaccine strategies through:

- Elucidation of HPV prevalence in adolescents (Mbulawa et al., PLoS one);
- HPV clustering patterns among HIV-infected and uninfected adolescent females (Dylla et al., J AIDS HIV Res);
- Identification of high diversity of HPV in men (Meiring et al., Papilloma Res); and
- Lately, novel DNA and MVA vaccines have been evaluated in small animal models and non-human primates (Chege et al., Vaccine; Chapman et al., Plos One).

Table UCT 16: Total number of NHLS/UCT staff per profession and highest qualification

	Pathologists	PhD Scientists*	South African*	All
Black	-	-	-	-
Coloured	-	-	-	-
Chinese	1	-	1	1
White	2	4	6	6
Other	-	-	-	-
South African*	3	4	7	6
Total	3	4	7	7

***One SARChI chair**

2. Diagnostic services

2.1 Medical Virology Diagnostic Laboratory

Head of department: A/Prof Diana Hardie

The SANAS-accredited Medical Virology Diagnostic Laboratory at GSH, provides a wide range of virology diagnostic assays for the public sector health facilities in the Western Cape. The laboratory serves as the referral laboratory for primary and secondary facilities in the province to provide critical serology and molecular diagnostic tests, including HIV viral load and EID for the priority programme. In addition, the laboratory also serves the requirements of tertiary academic hospitals such as GSH and RCCH, in highly specialised assays for complex academic settings.

It is one of the leading laboratories in the country in terms of the range of molecular diagnostic tests offered. In 2017, the laboratory added quantitative BK virus PCR and hepatitis D PCR to its extensive repertoire of molecular assays. The assay development philosophy of the division is to offer new diagnostic tests, based on local disease burden and clinical expertise.

The laboratory also actively participates in optimisation of public health programmes. The diagnostic laboratory collaborates closely with the Department of Public Health at UCT, the National Institute of Communicable Disease (NICD), and the NHLS National Priority Programme (NPP) on several surveillance and operational quality improvement. The staff furthermore work closely with the provincial DoH, and the World Health Organization (WHO).

Dr Stephen Korsman leads the national coverage programme for Virology at UCT which supports the laboratories in the Eastern Cape and parts of Western Cape. Telephonic and electronic support were provided. In-person outreach was limited in the past year due to the financial constraints of the NHLS. The George NHLS lab was visited by a pathologist on one occasion. Due to financial limitations, visits to the Eastern Cape did not occur, but substantial support was provided telephonically and by e-mail.

3. Teaching, training and professional development

The division is responsible for semester 3-5 undergraduate teaching in the discipline of medical virology which includes problem-based learning facilitation, lectures and computer-based tutorials. The division adopted a lead role in developing a Virology e-Reader for MBChB students, which is an interactive, integrated learning tool. The division is also a major contributor to the Molecular Medicine BSc/MBChB/PhD intercalated programme. In terms of postgraduate training, staff in the division participates in the teaching and training of registrars, intern technologists, technicians, and intern medical scientists in the discipline of molecular biology and virology. In addition, there is a major teaching programme for BSc honours, MSc and PhD students.

Table UCT 17: Total number of trainees per qualification category and rates of successful completions /pass rates

	Total number of trainees	Final year trainees	Successful completion	Percentage of successful om-pletions
BSc Med Hons	3	3	3	100
MSc	10	2	2	100
Registrars	3	2	2	100
PhD	17	5	3	60
All	33	12	10	83
South African	25	9	8	89

4. Research activities

4.1. Research projects

Project title: Novel HIV Vaccine Candidates for South Africa
Investigators: Prof AL Williamson, Dr R Chapman, Dr N Douglass, Dr G Chege, E. Margolin, M van Diepen, P Ximba and S. Galant
Collaborators: Prof E Rybicki (UCT) and Prof L Morris (NICD)
Funding: MRC-SHIP
Short description: Novel Env vaccines based on modified and chimeric proteins as well as expression using plant-based production and poxvirus systems are being produced and tested. These vaccines have been shown to induce high titre antibodies in rabbits and the concepts are now being tested in non-human primates.

Project title: Sequence analysis of human papillomaviruses
Investigators: Prof AL Williamson, Dr T Meiring, Prof E Rybicki, Dr Z Mbulawa and A Murahwa
Funding: The Pathology Research Facility (PRF), NRF and the NHLS Trust
Short description: NGS technologies opened up the opportunity to directly examine viral diversity in clinical specimens. Nine novel HPV types were identified using this technology and were cloned and characterised.

Project title: An investigation of the interaction of the genital microbiome with HPV
Investigators: Prof AL Williamson, Dr T Meiring and H Onywera
Funding: CANSA and the NRF
Short description: While our studies at UCT linked HPV, HIV and the immune milieu, no studies were conducted on the impact of the total genital microbiota on HPV. The bacterial microbiota of the female genital tract is known to protect the vagina from pathogens. The cervical vaginal microbiome (CVM) was studied and compo nents found to be related to HPV infection. The microbiome of the penis was also investigated.

Project title: Development of novel lumpy skin disease virus (LSDV) as a vaccine vector
Investigators: Prof AL Williamson, Dr N Douglass, H Munyanduki and R Omar
Funding: Technology Innovation Agency (TIA)
Short description: Development of LSDV as a vaccine vector for bovine ephemeral fever virus for cattle.

Project title: A study of the feasibility of the introduction of a Swedish HPV test for the management and prevention of cervical disease in the Eastern Cape
Investigators: Prof AL Williamson, Dr Z Mbulawa, Prof L Denny, Prof J Moodley and Dr T Meiring
Collaborators: Dr C Businge and Prof M Garcia-Jardon (Walter Sisulu University); Prof U Gyllensten and Dr I Gustavsson (Uppsala, Sweden)
Short description: The project investigates the hypothesis that the Swedish hpVIR test for the detection of HR-HPV types is an appropriate test for the detection of HPV in a primary test using self-sampling and to manage patients with low grade cervical lesions.

Investigator: Prof C Williamson, C Rademeyer, G Nthambeleni, D Sheward and D Mielke
Collaborators: Dr D Montefiori (Duke University, USA) and Prof L Morris (NICD)
Funding: Bill and Melinda Gates Foundation
Short description: HIV-1 functional env genes and infectious molecular clones from South Africa were cloned and charac terised, in preparation for the next phase 2b/3 HIV vaccine trials. The clones were evaluated for genetic and antigenic diversity of HIV-1 strains currently circulating in this region, and to determine how well the strains are represented by current vaccine immunogens and reference reagents.

Project title: Vaccine-mediated effects on immunological, viral and clinical factors in HIV breakthrough infections Inves-
tigators: Prof C Williamson, N Ndabambi, D Matten, C Anthony and Prof L Morris (NICD)
Collaborator: J McElrath (UW, Seattle)
Funding: SHIP and MRC

Short description: Vaccine-mediated effects on neutralizing responses and viral sequences are being investigated through the evaluation of breakthrough infections from vaccine trials in South Africa. This study is likely to provide critical insights into understanding the mechanism of action of vaccines, and optimization of future HIV vaccine candidates, as well as contribute substantially towards understanding the effect of vaccination on the natural history of HIV infection.

Project title: Broad neutralizing HIV antibodies, adjuvants and immunogens
Investigators: Prof P Moore (NICD), Prof C Williamson, Dr C Anthony, D Sheward, D Matten and A/Prof W Burgers
Collaborators: Prof L Morris (NICD); Dr N Garrett [Centre for the AIDS Programme of Research in South Africa (CAPRISA)] and Prof S Abdool Karim (CAPRISA)
Funding: SHIP and the MRC
Short description: An effective HIV vaccine needs to elicit broadly cross-neutralizing antibodies (bNAbs), that are able to neutralize diverse HIV strains from across the world. These kinds of antibodies develop in ~20% of infected people, though normally only after two to three years of infection. We aim to learn lessons from infected people who naturally produced broadly cross-neutralizing antibodies (bNAbs) and translate these into immunogens. To achieve this, we are performing viral deep sequencing of defined epitopes, to identify viral variants that contribute to the development of breadth.

Project title: Risk assessment of HIV infected to HIV infected transplantation in SA
Investigators: Prof E Muller (UCT) (PI); T Quinn (John Hopkins) (co-PI), Prof C Williamson; Dr P Selhorst and C Combrink
Funding: MRC-NIH: U01 NIAID
Short description: This project examines clinical and virological factors in HIV infected kidney transplants from deceased donors into HIV infected recipients namely: determining the incidence, extent, and nature of donor-to-re cipient HIV-superfinfection (SI) in HIV-infected-to-HIV-infected renal transplants; quantifying recipient's virus infiltration into the graft kidney and investigating virus compartmentalization in kidney epithelium.

Project title: Timing of establishment of the HIV latent reservoir in subtype C infected women
Principal investigator: Prof C Williamson; Dr N Garrett (CAPRISA); Prof R Swanstrom (UNC, USA); Dr MR Abrahams and L Tyre
Funding: MRC-NIH: R01 NIAID
Short description: This project aims to characterise the genetic diversity of the latent reservoir of HIV subtype C infected individuals as a function of time, to determine when the latent viral reservoir is established, and to determine how immune activation influences the viral composition of the reservoir.
Project title: Identifying the sources of HIV infection in adolescent girls in rural South Africa

Investigators: Dr A Kharsany (CAPRISA); Prof C Williamson, R Thebus and MR Abrahams
Funding: MRC-NIH: R01 NIAID
Short description: The purpose of the study is to understand the HIV transmission dynamics and sexual networks that ado lescents might belong to, potentially increasing their risk for HIV. Our group is utilising stored dried blood spots to generate HIV-1 Pol gene sequences from approximately 1,500 adolescent girls who are in school.

Project title: HIV-1 superinfection as a model for vaccine studies
Investigators: Prof C Williamson, M Logan and D Sheward
Funding: Poliomyelitis Research Foundation.
Short description: We are comparing individuals with single infection and SI, to investigate correlates of protection from SI, and the role of SI in boosting HIV neutralizing antibody responses.

Project title: Analysis of breakthrough infections in the HIV Vaccine Trials Network (HVTN)/HIV Prevention Trials Network (HPTN)081 phase 2B study which evaluates the safety and efficacy of the VRC01, broadly neutralizing monoclonal antibody in reducing HIV-1 infection
Investigators: Prof C Williamson, A Gwashu-Nyangiwe, T York, Dr C Anthony, D Matten and D Sheward
Funding: HVTN; NIAID and the NIH

Short description: We are generating envelope sequences for evaluation of their sensitivity to VRC01, to inform efficacy measurements.
Role: UCT lead

Project title: Investigation into the sources of sample contamination leading to false positive HIV serology in the clinical pathology environment.
Investigators: A/Prof D Hardie, Dr S Korsman and Dr N Hsiao
Funding: None
Short description: False positive HIV serology is a common occurrence when serology testing is performed in the clinical pathology environment. A study to investigate the source identified that sample contamination by other sero-positive samples during the pre-analytical and analytical process on the auto-analyser was responsible. Auto-analysers of two different manufacturers were implicated. Ongoing investigations are underway (with the cooperation of Roche), to identify the processes where contamination is most likely to occur.

Project title: Molecular characterisation of measles viruses from brains of patients with measles inclusion body encephalitis (MIBE) and sub-acute sclerosing pan encephalitis (SSPE)
Investigators: A/Prof D Hardie and Dr H Smuts
Funding: Poliomyelitis Research Foundation
Collaborators: M Porotto (University of Columbia, New York)
Short description: As part of an ongoing investigation into the mechanism underlying neurovirulence of measles virus, the function of the fusion machinery (F and H proteins) was tested in vitro. Both MIBE and SSPE recombinant viruses bearing mutated F and H proteins were able to enter cells without the need to engage regular measles virus receptors. This confirms that hyperfusogenic F protein is a key feature responsible for neurovirulence in measles virus.

Project title: Molecular surveillance of non-poliovirus enterovirus infections in patients with viral meningitis and respira tory illness
Investigators: Dr H Smuts, A/Prof D Hardie and Dr S Korsman
Funding: Poliomyelitis Research Foundation

Short description: There is minimal recent data on the changing prevalence and seasonality of enterovirus species and sero types in the Cape Town community. Screening of enterovirus-positive respiratory and CSF samples from hospitalized patients for the four different enterovirus species/serotypes, A, B, C and D will be undertaken over a three-year period, to identify these changes as well as disease associations. An investigation into one of the largest outbreaks of enterovirus-associated meningitis (n=42) in South Africa in the Mossel Bay area during December 2015 to February 2016, demonstrated the importance of serotyping in understanding the epidemiology and dynamics of an outbreak.

Project title: Seroprevalence of hepatitis B virus in women attending antenatal clinics in Cape Town
Investigators: Dr A Ibrahim and Dr N Hsiao
Funding: Not yet funded
Short description: South Africa introduced the HBV vaccine as part of the expanded programme of immunisation more than 20 years ago. Currently there is a strong consideration in adding a birth dose of HBV vaccine to further reduce the mother-to-child transmission of the virus. However, the cost effectiveness of this is heavily dependent on the HBV seroprevalence in women of childbearing age in this country. This study will screen mothers who are attending antenatal clinics for their syphilis screening, to determine the seroprevalence of HBV surface antibody in Cape Town.

Project title: Determinants of low level viraemia in Western Cape: a population level HIV viral load data analysis
Investigators: Dr N Hsiao, Dr M Lesosky, Dr J Maritz, Prof W Preiser and P Landon Myer
Funding: None

Short description: In this retrospective HIV viral load review study, we analysed 1.1 million routinely collected viral load relat ed data from the Western Cape between 2008 and 2015 to describe the trends, proportions and determinants of low level viraemia in the province with the hope that the insight could be used to strengthen the HIV treatment programme in South Africa and around the world.

Project title: Rational use of HIV PCR in the new EID with birth testing in the Western Cape
Investigators: J Maritz, Dr N Hsiao, Dr W Preiser and Dr L Myer
Funding: None
Short description: The requests and results of HIV PCR for EID in the Western Cape were reviewed through analysis of labo ratory information system data. In our previous analysis, we found that the uptake of routine EID testing following in the birth testing, was suboptimal as <50% of infant with negative birth PCR returned for routine EID testing. We aim to use the existing laboratory EID data in the Western Cape to determine the optimal testing window in this complex landscape of sophisticated prevention of mother-to-child transmission regimens an d poor maternal postnatal antiretroviral therapy (ART) adherence.

Project Title: A GIFT (Genital Inflammation Test) for HIV prevention
Investigators: A/Professor JA Passmore and Dr L Masson
Collaborators/co-investigators: Dr S Barnabas (UCT), Prof LG Bekker [Desmond Tutu HIV Foundation (DTHF)]., Prof D Lewis (Western Sydney Health Institute), Prof K Mlisana, (UKZN), Dr L Johnson (UCT) , Prof D Coetzee (UCT) and Dr E Sananovic (UCT)
Funding: MRC and SHIP
Short description: Sexually transmitted infections (STIs) and bacterial vaginosis (BV) cause inflammation in the female genital tract that is associated with increased risk of HIV infection. There is an urgent need for novel, accurate and inexpensive POC tests to identify women with asymptomatic STIs/BV who have subclinical inflamma tion and are therefore at increased risk of HIV infection. We are investigating the feasibility of using a combination of three cytokine biomarkers as predictors of the presence of an STI or BV when measured in genital secretions, to develop a POC test device to identify women who have asymptomatic infections. A prototype lateral flow test device is currently being developed. In parallel, the markers were validated in three different cohorts of women from South Africa (Cape Town and Durban) and Kenya.

Project title: Hormone-induced mucosal susceptibility and HIV risk in South African adolescents
Investigators: A/Prof JA Passmore and Dr H Jaspan (Seattle Children's Hospital, USA; UCT)
Funding: MRC-NIH R01
Short description: This study seeks to identify factors, in particular hormones and microbiome, which render SA adoles cents at extremely high risk of HIV infection, with a view to future interventions or policy changes to address these factors. We enrolled participants from an NIH-funded study Choices for Adolescent Prevention Methods for South Africa (uCHOOSE): an open-label,

randomised crossover study to evaluate the acceptability and feasibility of, and adherence to, contraceptive choices (R01AI094586: 150 healthy, HIV-negative 16- and 17-year old, sexually active females who are visiting the Masiphumelele Youth Centre). We sequenced the double stranded DNA virome from adolescent females enrolled in this study and identified >15000 unique viral species, of which ~3% were bacterio This finding is important as it relates to the study we are conducting on the role of bacteriophages in driving BV in women.

Project title: Mucosal injury and sexual trauma (MIST): an observational study of vaginal insertion practices in South African women
Investigators: A/Prof JA Passmore and Dr H Jaspan
Collaborators/ co-investigators: Dr P Gumbi (UKZN) and Dr L Masson (UCT)
Funding: NIH R01
Short description: Vaginal insertion practices (VIPs) are common in women in sub-Saharan Africa. These VIPs [including intravaginal use of cloth or paper, insertion of products to dry/tighten the vagina and intra vaginal cleansing with soap] were associated with increased risk for HIV infection. This study aims to evaluate the hypothesis that in adolescent women, sexual immaturity, use of vaginal products and gender-based violence, increase genital inflammation, damage the mucosa and alter the vaginal flora, which influences genital HIV target cell availability and risk of HIV-1 infection.

Project title: Effects of Hormonal Contraceptives on Genital Immunity and HIV Susceptibility

Investigators: Dr H Jaspan, Dr R Heffron and A/Prof JA Passmore
Funding: NIH R01
Short description: Injectable depot medroxyprogesterone acetate (DMPA) has been associated with as much as a two-fold increase in HIV risk in some observational studies. We hypothesized that the initiation of hormonal contraceptives elicits one or more of the following: vaginal phylotypes associated with HIV risk prefer entially increase, genital inflammation increases, HIV target cells are recruited and activated, and genital mucosal barrier integrity is disrupted. We are collecting genital samples from South African and Kenyan women participating in the Evidence for Contraceptive Options and HIV Outcomes (ECHO) study, to examine immediate and long-term changes to vaginal microbiota, markers of inflammation and genital immunity induced by contraceptives. We will conduct a nested case-control study with HIV seroconverters to determine the effect of these changes on HIV acquisition risk at the end of follow-up.

Project title: How immunity in the female genital tract health is influenced by parasitic nematode infections
Investigators: A/Prof W Horsnell (SA), Dr L Layland (Bonn), Dr G Katawa (Togo); Dr L Masson and A/Prof JA Passmore
Funding: Deutsche Forschungsgemeinschaft (DFG): German-Africa Cooperation Project in Infectology
Short description: Human helminth infections have been shown to influence vaccine responses to unrelated infections such as Salmonella and Tuberculosis, and ourselves and others have demonstrated that helminth exposure is also associated with increased risk of HPV infection. The mechanism underlying increased risk for STI infection, is thought to be gastro-intestinal helminth infections that influence female reproductive tract inflammation through the common mucosal immune system, although little direct evidence for this is currently available. This study aims to investigate the influence of gastro-intestinal parasitic worm infections on female genital immunity/inflammation, to translate signatures observed in the murine models; and to evaluate whether these nematode infections are associated with increased risk of STI acquisition.

Project title: Chlamydia trachomatis genotype influences genital inflammation in young women at risk for HIV infection
Investigator: A/Prof JA Passmore
Collaborators/ co-investigators: Dr S Barnabas, Prof D Lewis and Prof S Bruestein (Amsterdam)
Funding: MRC Self-Initiated Research Funding
Short description: Chlamydia trachomatis (CT) is highly prevalent in young people, and causes reproductive complications and increased HIV risk in young women. In the WISH cohort study (2013-2015), we found strikingly high CT prevalence in young women (42% in Cape Town and 17% in Johannesburg) with >90% of infections being asymptomatic. CT infections were associated with potent genital inflammation. We used multi-locus se quence typing (MLST) of both conserved housekeeping genes and variable genes in CT, isolated from women in Cape Town, to show that certain sequence types of CT induced higher levels of genital inflammation than others. We will use whole-genome sequencing (WGS) of archived genital samples from infected women to investigate potential genetic factors associated with genital inflammation and virulence.

Project title: Role of vaginal bacteriophages in emergence of BV and modulating the microbiome: controllable viral strategies to decrease risk for HIV infection in women
Principal investigator: A/Professor JA Passmore
Collaborators/ co-investigators: Dr H Jaspan, Dr R Froissart and Dr A Varsani
Funding: Poliomyelitis Research Foundation
Short description: BV is characterized by a disruption of the female vaginal bacterial microbiome that is typified by a re placement of commensal and protective bacteria belonging to Lactobacillus spp. with other less protective pathogenic commensal bacteria. This condition increases susceptibility to sexually transmitted viral infections, including HSV-2 and HIV. Critically, the cause of the shift between a healthy the shift between a healthy genital microbiome to a pathogenic vaginal microbiome that is symptomatic of BV, is unknown. The aim of this study was to evaluate the role of bacteriophages in the depletion of Lactobacillus spp. that occurs during the development of BV.
We hypothesized that fluctuation of healthy vaginal bacterial composition to an unhealthy one is

associated with the presence of bacteriophages targeting commensal vaginal Lactobacilli spp.

Project title:	Randomized single-blinded trial, testing the topical probiotic Vagiforte Plus® for treatment of BV in South African women
Principal investigator:	Dr S Barnabas
Collaborator/ co-investigator:	Assoc. Prof. JA Passmore and A Happel
Funding:	NRF CAPRISA Centres of Excellence
Short description:	Lactobacilli-containing biotherapeutics for treating BV in women was evaluated internationally, with varying success. We are currently conducting the first randomized, clinical trial that is approved by the SA Medicine Control Council (MCC) (second quarter 2017), to test the efficacy of the over-the-counter probi otic formulation – Vagiforte Plus® - in 50 adult women from Cape Town with confirmed BV (Nugent 7-10), at the UCT Clinical Research Centre, Cape Town. Vagiforte Plus® is one of only four products marketed explicitly for vaginal health in South Africa. This first MCC-approved trial of a probiotic product licensed in South Africa, will provide important guidelines for conducting good quality clinical trials of probiotics for treating BV.

Project title:	Evaluation of clinical Lactobacilli isolates for vaginal probiotic product development
Principal investigators:	A/Prof JA Passmore and Prof S Harrison (Chemical Engineering, UCT)
Collaborators/ co-investigators:	Dr S Barnabas, A Happel and Dr M Fagan-Endres (Chem Engineering)
Funding:	UCT Research and Innovation Pre-Seed Funding
Short description:	Since the products for vaginal health in South Africa do not contain organisms commonly found in the vagina, and very few candidates are available internationally, we partnered with the Department of Chemical Engineering to screen and select vaginal Lactobacilli isolates with the preferred product profile for development of a topical or oral probiotic for treating BV. To date, we have screened >80 Lactobacilli species from young South African women (partici pating in the WISH and uCHOOSE studies), for their ability to adhere to epithelial cells without caus ing in flammatory changes, grow at neutral and low pHs, lower culture pH, produce lactic acid and H2O2 and exhibit resistance to commonly administered antibiotics. We identified the top ten candi dates to take forward to scale up. These isolates will be sequenced and conditions required for large bio-fermenter batches will be defined.

Project title:	Mechanism of HPV-associated genital wart persistence and recurrence in HIV-infected women in South Africa
Investigators:	A/Prof JA Passmore
Collaborator/ co-investigator:	Prof AL Williamson (UCT)
Funding:	Poliomyelitis Research Foundation
Short description:	Women with persistent HPV infections are at the highest risk of cervical disease progression and cancer. Identifying co-factors associated with HPV persistence is therefore important in our fight to prevent HPV-associated disease progression. One of the most significant co-factors for HPV persistence and accelerated disease progression is infection with HIV. The aim of this study was to compare the prevalence and persistence of HPV types associated with genital warts in HIV-in fected and uninfected women; and to compare NK and T cell functional and phenotypic properties from HPV-associated genital warts from HIV-infected and HIV-uninfected women.

Project title:	HPV prevalence during HIV infection in women using intrauterine devices (IUDs)
Principal investigator:	A/Prof JA Passmore
Collaborator/ co-investigator:	Prof AL Williamson (UCT)
Funding:	Poliomyelitis Research Foundation
Short description:	IUDs are greatly underutilised in South Africa with less than 1% of women currently using this con

traceptive method. Although the Copper T and the levonorgestrel-releasing IUD (LNG-IUD) are available to South African women, the LNG-IUD is mostly employed in the private sector. IUDs have been shown to consistently decrease the risk of endometrial cancer in women. However, very little is known about how IUD affects the progression of HPV infections and cervical cancer. The aim of this study was to determine whether copper IUD or the LNG-IUD use by HIV-infected women leads to more prevalent or persistent HPV infections, and the role that genital inflammation plays in this setting in a double-blinded randomized control trial.

Project title: Impact of vitamin D deficiency on HPV prevalence in South African women
Principal investigator: A/Prof JA Passmore
Collaborator/ co-investigator: Prof AL Williamson (UCT) and Dr Anna Coussens
Funding: UCT-MRC Gynaecological Cancer Research Centre
Short description: Vitamin D deficiency in Africa is linked to susceptibility to a number of mucosal infections, including tuberculosis. Vitamin D is a steroid that plays a key role in mucosal defence against pathogens, as a major regulator of inflammation and antimicrobial peptides production. We hypothesized that immunity at the genital mucosa would also be compromised by vitamin D deficiency, which may influence genital inflammation, and susceptibility to STIs, including HIV and HPV in women. We investigated the relationship between plasma vitamin D concentrations, HPV prevalence and genital cytokine levels in adolescent women from South Africa

Project title: WISHing for Wellness (International Public Engagement Award)
Principal investigator: A/Professor J-A Passmore
Collaborators/ Co-investigator: Dr S Barnabas, Dr Z Mbulawa, Professor L Bekker, F Hartley, B Fitchen and L Rabinowitz
Funding: Wellcome Trust Social Engagement Award
Short description: Using an integrated arts approach, WISHing for Wellness created a platform through which adoles cent girls can engage with biomedical research and the sociocultural norms associated with sexual and reproductive health. Recently completed, this 18-month project (com menced in September 2016) enrolled twenty 15-18-year old women from Masiphumele, Cape Town. The engagement addresses the landscape of silence associated with sex and STIs and introduces biomedical research. Through WISHing for

Wellness, the young women:

a) Engaged in a series of biomedical research workshops;
b) Produced a series of body maps;
c) Engaged in drama activities and performances; and
d) Developed visual digital material documenting their journey.

In the last quarter of 2017, this creative engagement was exhibited as an interactive installation as follows:

(1) In the IDM, UCT Wolfson Pavillion exhibition space (10-20 October 2017); and
(2) In the Fish Hoek Library Foyer, Cape Town (1 November 2017 to 15 February 2018).

This enabled UCT staff, students, invited school groups and patrons of the Fish Hoek library to view the exhibition on sexual health and engage with sexual health biomedical research approaches. This engagement will continue during 2018.

Project title: WISHing for Wellness: Functional Food Club (Engagement)
Principal investigator: A/Prof JA Passmore

Collaborators/ co-investigator: Dr S Barnabas, Prof L Bekker, Prof M Senekel (Human Nutrition, UCT), F Hartley and T Martin
Funding: None (application submitted)

Short description: Live biotherapeutics (probiotics) are being successfully used in treatment of various inflammatory conditions, like inflammatory bowel disease, Crohn's Disease and ulcerative colitis, which involve microbial dysbiosis in the gastrointestinal tract. Since BV is a common vaginal dysbiosis, Lactobacilli containing biotherapeutics for treating this condition in women is being evaluated by others and us. We have recently evaluated fermented and cultured foods containing Lactobacilli as a cheaper alternative to over-the-counter oral probiotic products, although these functional foods make up only a small proportion of nutritional intake in young women living in low-socioeconomic settings in South Africa. Using anintegrated nutrition-biomedical approach, in collaboration with the Division of Human Nutrition, UCT, we initiated the "WISHing for Wellness Functional Food Club at the Desmond Tutu HIV Foundation Youth Centre in Masiphumelele, to create a platform to introduce the concept of functional foods to adolescents (male and females; n=30 enrolled first quarter 2018). In addition to addressing the concept of functional food in healthy living, this engagement is a powerful vehicle to introduce biomedical concepts around hygiene, microbes in food production and to expose youth to biomedical research.

5. Research output

5.1 Journal publications

Abdool Karim SS, Passmore JS, Baxter C, The microbiome and HIV prevention strategies in women. Curr Opin HIV AIDS. 2018. Jan; 13(1):81-87

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5.2 Chapters in books

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5.3 Conference presentations

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Passmore JA. Invited plenary. HIV risk in young women: A cohort perspective. Nature Medicine HIV Immunity and Eradication Herrenhausen Symposium. November 2017. Hannover, Germany.

Williamson C. Invited speaker. The role of vaccines in HIV cure. International AIDS Society (IAS) HIV Cure Global Research Academy. Wits Rural Academy. Mpumalanga, 29-31 May 2017.

Williamson C. Invited speaker. Early evolution in acute infection. 9th IAS Conference on HIV Science. July 2017, Paris.

Williamson C. Invited speaker: Both neutralizing antibody and ADCC responses drive viral evolution following HIV-1 infection. Cent Gardes Conference on HIV Vaccines. Veyrier du Lac, France, 6-8 October 2017.

5.4 Poster presentation

Hsiao NY, E Mukonda, M Lesosky, J Maritz, W Preiser, L Myer. Impact of testing delay on low-level viraemia in South Africa: A programme-wide view. Conference of Retroviruses and Opportunistic Infections, March 2018, Boston, USA.

6. Academic and research/recognition awards

Dr Nokwazi Nkosi received the Coulter Medal 2017 from the College of Medicine of South Africa based on the results of the Fellowship examination of the College of Pathologists.

A/Prof Jo-Ann Passmore was invited to serve on the SA Department of Agriculture, Forestry and Fisheries (DAFF) Genetically Modified Organisms (GMO) Committee.

A/Prof Jo-Anne Passmore was invited to serve on the International AIDS Vaccine Initiative (IAVI) Clinical Trials Sub-committee.

Prof Anna-Lise Williamson was awarded SARChI Chair in Vaccinology (renewal).

Prof Anna-Lise Williamson was elected to Executive Board, International Society for Vaccines.

Professor Anna-Lise Williamson was nominated a member, SA HPV Advisory Board (2010- ongoing). This is a board of South African experts that meets to discuss issues to do with HPV vaccination and diagnostic tests.

Professor Carolyn Williamson was awarded the SAMRC's Gold Medal for Scientific Achievement 2017, which is awarded to established senior scientists who have made seminal scientific contributions that have impacted on the health of people, especially those living in developing countries.

Professor Carolyn Williamson was invited to be a member of Scientific Advisory Board of Centre for HIV/AIDS Vaccine Immunology - Immunogen Design (CHAVI_ID), Duke University, USA (2016-2018).

Professor Carolyn Williamson was invited to be a member of the Scientific Advisory Board of Uganda Vaccine Research Institute – MRC, Uganda (2018).

University of the Free State

Foreword

Head of Department: School of Pathology: Dr Jocelyn Naicker

Who we are

In 2017 the University of the Free State (UFS), created a new structure for the Faculty of Health Sciences whereby the previous School of Medicine was subdivided into the following three schools: School of Biomedical Sciences, School of Pathology and School of Clinical Medicine. Dr Jocelyn Naicker was appointed part-time Head of the School of Pathology.

The creation of the School of Pathology resulted in a more focused approach to the specific needs of the individual pathology departments/divisions. By the end of 2017, all vacant permanent Academic Head positions were filled and the presence of this additional leadership will support growth in all academic functions of the specific disciplines.

What we do

The Division of Medical Virology became a standalone unit separate from the Department of Medical Microbiology and the School of Pathology now has six departments /divisions: Anatomical Pathology, Medical Microbiology, Medical Virology, Human Genetics, Haematology and Cell Biology and Chemical Pathology.

Besides providing SANAS-accredited routine laboratory services and conducting research, the pathology departments are also HPC-SA-accredited to train medical undergraduates, discipline-specific pathology registrars and medical scientists.

Highlights

The South African Research Chair (DST/NRF- SARChI) in Vector-borne and Zoonotic Pathogens was awarded to Prof Felicity Burt (Division of Virology) for the period 2016-2020. The objectives of this chair are to:

- Increase awareness of arthropod borne and zoonotic pathogens;
- Investigate the presence of known and novel pathogens with propensity to cause outbreaks;
- Improve tools for diagnosis and surveillance (including rapid accessible tests); and
- Define disease associations for improvement of current knowledge.

In 2017, seven postgraduate students received bursaries linked to the Chair.

Despite the ongoing challenges of continued academic staff shortage, the school's researchers managed to publish 15 articles in peer-reviewed accredited journals with the Department of Haematology of which eight were international papers (with six first authors from the Department), and four were South African papers (with three first authors from the Department) in 2017 (see additional text for achievements in other departments).

In addition, our NRF researchers have the following ratings: Dr Dominique Goedhals was awarded an NRF Y2 rating in 2017 and Prof Felicity Burt uprated to NRF B3 in Jan 2018, whilst both Prof Muriel Meiring and Prof Chris Viljoen retained their C3 NRF ratings.

Anatomical Pathology

Head: Prof. J Goedhals

1. About the department

The Department of Anatomical Pathology at the UFS provided histopathology and autopsy pathology services to state hospitals in the Free State province and a cytology service to state hospitals and clinics in the Free State and Northern Cape provinces.

The department remains SANAS-accredited and is involved in both undergraduate- and post graduate training.

2. Diagnostic services

The department evaluated 15 754 histology cases during the year, including neuropathology, renal pathology and bone pathology. A total of 76 325 cytology cases were evaluated and 58 post mortems were conducted.

A frozen section service was available at Universitas Academic Hospital and 57 frozen sections were performed. Technologists were available to assist with on-site adequacy evaluation and diagnoses on fine needle aspirates performed in Theatre and at Radiology at Universitas Academic Hospital. Technologists also attended theatre at both academic and private hospitals in Bloemfontein to confirm adequacy of renal biopsy specimens.

The immunohistochemistry laboratory performed 15 144 stains. In addition to the departmental work, the immunohistochemistry laboratory also performed stains for private laboratories in Bloemfontein. Five hundred and thirty five immunofluorescence stains were performed on kidney and skin biopsies.

Table UFS 1: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	0	4.5				4.5	4.5
Medical Scientists	0	0	0	0		0	0
Technologists	0	0	0	2	12	14	14
Other*	0	0	0	0	0	0	0
South Africans	0	4.5	0	2	12	14	32.5
All	0	4.5	0	2	12	14	32.5

3. Teaching, training and professional development

3.1 Undergraduate level

Pathologists presented a module in general pathology to second-year medical students which included lectures and tutorials. Seventeen sessions on systemic pathology, which were integrated into system modules, were given to second- and third-year medical students. The lectures were conducted in both English and Afrikaans, although this will change from 2018 with the new language policy of the UFS. Registrars from the department presented a short course on general pathology to third-year occupational therapy and physiotherapy students.

3.2 Postgraduate level

The department currently has six 6 registrars of which two passed the part II FC Path (Anat) exam and one passed the part I exam. Registrars from Dermatology, Oncology and Forensic Medicine also rotate through the department. The training programme includes weekly surgical pathology and cytology slide discussions, tutorials, journal discussions and monthly practical and theory tests. Dr Dan Zaharie, a neuropathologist from the University of Stellenbosch and NHLS visited the department on18 and 19 April 2017 to give the registrars a short course on Neuropathology.

3.3 Other

The Department of Anatomical Pathology currently has two intern medical technologists and three student technicians. Unfortunately the department does not have a medical scientist and has a shortage of qualified pathologists. It is therefore not possible to train intern medical scientists at present.

Table UFS 2: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern Medical Scientist	Honours	All	South Africans
Total number of trainees	1	0	6	0	0	7	7
Final year trainees	0	0	2	0	0	2	2
Successful completion	0	0	2	0	0	2	2

4. Awards

Dr L du Toit won the Real Short Registrar Research Results Presentations held by the Faculty of Health Sciences, UFS on 15 November 2017.

5. Research activities

5.1 Research projects

Project title: The incidence of c-myc translocations in plasmablastic lymphoma
Principal investigators: Co-researcher: Theron M
Funded by: NHLS Research Trust
Total funding for the entire project: R89 000
Project start date:
Project end date: 2017. Manuscript in preparation for publication.

Project title: The profile of genetic mutations in pheochromocytomas and paragangliomas in South African patients
Principal investigators: Maree L, Goedhals J and Pearce NE
Co-researchers: Kaplan N, Bester PA and Goedhals D
Funded by: Department of Surgery, UFS
Total funding for the entire project: R400 000
Project start date: 2017
Project end date: 2019

Project title: NUT midline carcinoma in the state sector of the Free State Province, South Africa
Principal investigators: Roets A and Goedhals J
Co-researchers: van der Westhuizen G and Joubert G
Project start date: 2017
Project end date: 2019

Project title: Determining the mutation frequency and prognostic import of POLE proofreading domain mutations in uterine carcinosarcomas

Principal investigators: Goedhals J (local PI), Bosse T (Leids Universitair Medisch Centrum, The Netherlands) and Working Group

Funded by: Dutch Cancer Society
Project start date: 2016
Project end date: 2019

6. Research output

6.1 Journal articles

Goedhals J, Haupt L and Jafta D. Chronic lymphocytic leukaemia with concomitant plasmablastic lymphoma. South African Journal of Oncology. 2017;1. doi: 10.4102/sajo.v1i0.8

6.2 Conference presentations

6.2.1 Oral presentations

National congresses

Dr L Maree. Primary pulmonary lymphoepithelioma-like carcinoma. Registrar's slide seminar, International Academy of Pathology (IAP) Congress, Wits, Johannesburg, 23 June 2017..

Chemical Pathology

Head of department: Dr. Jocelyn Naicker

1. About the department

The Department of Chemical Pathology and the core laboratory are situated within the Francois Retief Building, Faculty of Health Sciences, UFS, Bloemfontein. Functions of the department include:

- A 24-hour chemical pathology diagnostic laboratory service;
- Teaching of undergraduate UFS medical students and chemical and clinical pathology medical technology student interns;
- Postgraduate training of chemical pathology and other clinical disciplines' registrars.

Clinico-pathological consultation and laboratory service support is offered as part of national coverage of the Free State, Northern Cape and North West provincial hospitals and laboratories.

Research activities, which were dormant due to lack of academic staff, are now picking up since the permanent appointment of a Head of Department in 2017, and newly appointed registrars in 2018.

2. Diagnostic services

The Universitas automated core laboratory is SANAS-accredited and provides a 24-hour diagnostic service to the Universitas, nNational, Free State Psychiatric, and 3 Military Hospitals as well as private laboratories in Bloemfontein, Free State. In addition, it is the referral laboratory for other Free State, Northern Cape and North-West province regional laboratories, It processes approximately 100 000 tests per month, yielding an average monthly revenue of R5 427 916.

The current NHLS analyser supplier and reagent contract has expired and the Roche Cobas 6000 automated chemistry, endocrine and immuno-serological platforms are awaiting replacement via the NHLS procurement tender process.

In addition, the laboratory offers several manual tests including:

- Serum and urine protein electrophoresis and immunofixation;
- Bence Jones protein;
- CSF isoelectric focusing electrophoresis;
- Blood brain permeability testing;
- Urine pH;
- Serum and urine osmolality;
- Kidney stone analysis; and
- Gout and other fluid crystal identification.

This is conducted through the use of:

- Polarising microscopy;
- Porphobilinogen and porphyrin testing;
- Urine myoglobin;
- Urine reducing substances; and
- Thin layer chromatography for:

— Identification of urine sugars;
— Detection of cryoglobulins, blood gases N& co-oximetry;
— Whole blood pyruvate measurement;
— Stool steatocrit; and
— Stool occult blood testing.

Table UFS 3: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	1	1				2	2
Medical Scientists	1	0	0	0		1	1
Technologists	0	0	0	0	13	13	13
Other*	0	0	2	0	0	2	2
South Africans	2	1	2	0	13	18	18
All	2	1	2	0	13	18	18

***Chemical Pathology Registrars**

3. Teaching, training and professional development

3.1 Undergraduate level

The Universitas Chemical Pathology Department provides undergraduate teaching and assessment services to medical students of the UFS, Faculty of Health Sciences (Phase II modules: MMol 2618, MMol 1620, MNER3714 and MURI 2724) and is currently increasing its footprint in the medical undergraduate programme. There are plans for further expansion of teaching activities in proportion to the increase in departmental academic staff.

In addition, the Department participates in the in-service training of medical technology students from the Central University of Technology (CUT) and Vaal University of Technology (VUT) as well as technicians. The pass rate was 100% in 2017 (seven medical technologists and two technicians).

3.2 Postgraduate level

The department is an HPCSA-accredited postgraduate training site for chemical pathology registrars, medical science students (BSc Hons, MSc and PhD) and intern medical scientists. MMed teaching and assessment services are also provided to other clinical departments (Internal medicine, Anaesthesiology and the Surgical disciplines). Consultants are module leaders and examiners for the MCHP7900 and MCHI7900 MMed Chemical Pathology modules for the Surgery and Anaesthesiology departments' registrar training programmes.

There is an organised, intensive four-part Chemical Pathology Registrar Training Programme in place. Weekly academic activities include: seminars, case presentations, journal club, Internal Medicine clinical grand rounds, Endocrine and Disorders of Sexual Differentiation Clinic attendance, Endocrine ward rounds, wet and computer-based laboratory practicals, clinical case tutorials, lectures, hands-on laboratory based training activities and laboratory mathematics and statistics tutorials.

In addition, registrars attend a 17- week Molecular Biology course (including applied molecular techniques and practicals) and UFS Faculty of Health Sciences training workshops and lectures on topics such as research ethics, how to lecture, how to conduct research, research referencing software, online searches, plagiarism, etc.. Their rotations include the Department of Pharmacology's mass spectrometry-based analytical laboratory.

Consultants and registrars are actively involved in national coverage for the Free State, Northern Cape and North West provinces. These services are conducted via telephonic and email communications, as well as on-site meetings to enhance quality assurance, assist in the procurement of appropriate analytical equipment, laboratory trouble-shooting and clinico-pathological consultation to clinicians in these areas.

3.3. Other

Intern medical scientists and other scientist trainees will be trained as soon as the Department has filled its vacant senior medical scientist post. Both consultants, Prof Johan Kuyl and Dr Naicker, contribute to the NHLS nationally as members of the Chemistry Expert Committee (15 years' service). Dr Naicker also serves as the Chair of the NHLS CTAC, and forms part of the advisory team for the NHLS

Proficiency Scheme. Both also contribute to the UFS Faculty of Health Sciences Management as members of the UFS Senate and Dr Naicker as the part-time Head of the School of Pathology. Both contribute to the pathology discipline training nationally as MMed (internal and external) and College of Pathology (Chemical and Clinical Pathology) examiners. In addition, Dr Naicker serves as a College of Pathologists Council member, representing Chemical Pathology for the triennium 2017-2020.

Table UFS 4: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern Medical Scientist	Honours	All	South Africans
Total number of trainees	0	0	2	0	0	2	2
Final year trainees	0	0	0	0	0	0	0
Successful completion	0	0	0	0	0	0	0

4. Awards

A Society for the Study of Inborn Errors of Metabolism (SSIEM) travel scholarship was received by Dr J Naicker to attend the XIV International Congress of Paediatric Laboratory Medicine in Durban from 20-22 October 2017.

Morrison EM and Naicker TJ received an honourable mention for their poster on Patient Mix-up at the NHLS PathReD Congress at Emperor's Palace Conference Centre, in Johannesburg, from 23-24 June 2017.

5. Research activities

5.1 Research projects

Project title: Determination of the calcaemic status of Oncology Patients at the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) using unadjusted serum total calcium
Principal investigators: Khan SB and Naicker TJ
Co-researcher: Pillay T
Funding: None
Project end date: In write-up stage. Expected completion date: late 2018

Project title: Detection of the presence of Lipoprotein-X using a direct homogenous LDL-Cholesterol assay
Principal investigators: Khan SB and Naicker TJ

Project end date: October 2017

Project title: Precision Study for Kidney Stone Analysis using the Nicolet IS10 Fourier Transform Infrared Spectrometer
Principal investigators: Dhlamini B and Naicker TJ
Project end date: Oct 2017

Project title: Patient Mix-up due to Pre-labelling of Specimen Tubes Prior to Sample Collection
Principal investigators: Morrison EM and Naicker TJ
Co-researcher: Potgieter HD
Funding: None
Project end date: August 2017

Project title: Evaluation of small sample Analysis (Micro Mode) on the Radiometer ABl90 Flex Plus Analyser
Principal investigators: Naicker TJ, Shagane N and Jacobs A
Funding: Radiometer HTA project
Project end date: May 2018

6. Research output

6.1 Journal publications

No publications submitted.

6.2 Complete books

None.

6.3 Book chapters

None.

6.4 Conference presentations (oral, posters)

6.4.1 Oral presentations

International congresses

None.

National congresses

NHLS-FSASP PathReD Congress, Emperor's Palace Conference Centre, Johannesburg, 23-24 June 2017. Preanalytical Errors in Whole Blood Ionised Calcium Testing: Dr J Naicker. Invited speaker.

Case presentation entitled "More than one….": by Dr J Naicker at a workshop at the NHLS-FSASP PathReD Congress on 24 June 2017 at Emperor's Palace Conference Centre, Johannesburg.

Registrar Examination Workshop Co-facilitator on behalf of the College of Pathologists (CMSA) on 24 June 2017 at Emperor's Palace Conference Centre, Johannesburg.

Scientific abstract reviewer, oral and poster adjudication by Dr J Naicker at the NHLS PathReD Congress at Emperors Palace, Johannesburg from 23-24 June 2017.

Scientific abstract review by Dr J Naicker at the International Federation of Clinical Chemistry (IFCC) and Laboratory Medicine (IFCC)-Worldlab 2017 Conference in Durban, from 22-25 October 2017.

Local congresses

The Society of Medical Laboratory Technologists of South Africa (SMLTSA) Free State Branch Academic Morning, 11 April 2017, Kine 4, UFS: Dr J Naicker invited speaker: Preanalytical Issues in Whole Blood Ionised Calcium Testing.

SMLTSA Free State Branch Academic Morning, 3 March 2018, Kine 4, UFS: Dr TJ Naicker invited speaker: An Update on Diabetes Mellitus.

6.4.2 Poster presentations

International congresses

XVI International Congress of Paediatric Laboratory Medicine (ICPLM), 20-22 October 2017, Durban.Clinical review of classic galactosaemia paediatric patients seen at a metabolic clinic in South Africa. NL Bhengu and TJ Naicker.

IFCC-Worldlab Conference, Durban, 22-24 October 2017. Detection of the presence of Lipoprotein-X using a direct homogenous LDL-Cholesterol assay. SB Khan and TJ Naicker.

National congresses

NHLS-FSASP PathReD Congress, Emperor's Palace Conference Centre, 23-24 June 2017. Patient Mix-Up due to Pre-Labelling of Specimen Tubes prior to sample collection. Morrison EM, Potgieter HD and Naicker TJ.

Local congresses (university academic days)

UFS, Faculty of Health Sciences, Bloemfontein: Research Forum 24-25 August 2017. Patient Mix-Up due to Pre-Labelling of Specimen Tubes prior to sample collection. Morrison EM, Potgieter HD and Naicker TJ.

6.7 Patents

None.

6.8 Research translations

None.

Haematology and Cell Biology

Head of department: : Prof Marius J Coetzee

1. About the department

The Department published six papers in international journals and four in South African journals. Members of the department were first authors in all of the six international papers, and three of the four South African papers. Prof Meiring and Prof Viljoen retained their NRF rating, while several research grants were awarded to members of the department.

We now have two supernumerary registrars from the Southern African Development Communities (SADC) countries. The department also hosted a successful self-infusion workshop for persons with haemophilia on World Haemophilia Day on 17 April 2017 and Dr Leriska Haupt was invited to the first international Von Willebrand Disease Congress in Prague, the Czech Republic. Several posters were presented at international congresses. The service level agreements (SLAs) between the NHLS and the Chronic Myeloid Leukemia (CML) Diagnostic and the Special Haemostasis Laboratories (which are both UFS entities), are working well. Members of the department won a number of prizes at the Faculty Research Forum and elsewhere. We are slowly regaining a critical mass of academic professionals.

The department is benefitting from the creation of the School of Pathology at the Faculty of Health Sciences, UFS. We look forward to continue promoting scholarship, service and research in the new financial year.

Caption: Dr Leriska Haupt teaching a patient with haemophilia and his mother to inject him with clotting factor. (Permission to reproduce the photograph was given by the UFS Brand Management)

2. Diagnostic services

Over 100 000 tests were conduced. The paternity testing volumes are increasing dramatically. We continue to do fortnightly outreach haematology clinics in Kimberley. More than 10 000 patients were seen at the clinics we are involved in. We implemented a rapid method of screening for the inversion of intron 22, the most common genetic aberration in severe haemophilia A.

Table UFS 5: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	BTech	Diploma	All	South Africans
Pathologists	0	3					3	3
Medical scientists	2			1			3	3
Technologists			1	1	4	8	14	14
Other*	0	0	0	0		1	1	1
South Africans	2	3	1	2	4	9	21	21
All	2	3	1	2	4	9	21	21

***Footnote: One professional nurse works at the INR Clinic**

3. Teaching, training and professional development

3.1 Undergraduate level

The department is actively involved in undergraduate training of scientists, doctors and allied health professionals. We award the prize for the best student in the Immunology and Haematology modules.

3.2 Postgraduate level

We now have two supernumerary registrars from SADC countries. We also have four interns that are employed by the NHLS. Five BMedSc(Hons) (Human Molecular Biology) students and one MMedSc (Human Molecular Biology) student qualified and one PhD student graduated.

3.3 Other

Table UFS 6: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern Medical Scientist	Honours	All	South Africans
Total number of trainees	2	3	6	4	5	20	18
Final year trainees	1	1	0	0	5	7	7
Successful completion	1	1	0	0	5	7	7

4. Awards

Professor Chris Viljoen was appointed as part-time Head of the School of Biomedical Sciences, at the Faculty of Health Sciences from 1 October 2017. He was also awarded NRF Incentive Programme Funds. Prof Muriel Meiring maintained her NRF C3 status and received NRF funding.

Dr Jaco Joubert received a Reach-The-World travel grant from the International. Society on Thrombosis and Haemostasis (ISTH), to attend their congress in Berlin, in July 2017. Dr Leriska Haupt was awarded R20 000 from the Faculty Research Committee to complete her project of a new two-stage factor VIII assay.

Several prizes were won at the 2017 Faculty Research Forum.

5. Research activities

5.1 Research projects

Current projects

Project title: Two-stage factor VIII assay
Researchers: Dr L Haupt (PI), Dr WJ Janse van Rensburg and Dr J Joubert
Short description: The two-stage factor VIII assay is more accurate than the commonly used one-stage, but the reagents are not being produced anymore. The team is attempting to modify the method so that it uses reagents that can be obtained easily. The project is underway.
Funding: Faculty of Health Sciences UFS and the NHLS Research Trust

Project title: Update and expansion of the Free State and Northern Cape component of the South African Haemophilia Registry with special reference to bleeding and treatment during the period July 2016 to June 2017
Researchers: Dr MS Roux (PI), Prof MJ Coetzee and Dr J Joubert
Short description: This is an MMed registrar project which aimed to obtain a current overview of haemophilia patients and the treatment in central South Africa. It also evaluates the effect of low-dose prophylaxis. It is about to be submitted for examination.
Funding: None

Project title: Bleeding disorders in women with heavy menstrual bleeding
Researchers: Dr Motshidisi Duiker (PI), Dr Haupt and Prof Coetzee
Short description: This is an MMed project for a registrar in Obstetrics and Gynaecology. Data collection is underway. It will help to determine to what extent inherited bleeding disorders contribute to heavy menstrual bleeding in the Free State.
Funding: Department of Haematology and Cell Biology and the Special Haemostasis Laboratory UFS

Project title: An audit of diffuse intravascular coagulopathy (DIC) request forms
Researchers: Dr Haupt and Prof Coetzee
Short description: This is a research project for medical students where we are retrospectively looking at what the indications are for requests of tests for DIC are, and in which cases the fibrinogen and concentration, thrombin time contributed to the diagnosis of DIC. We also want to confirm that platelet counts were requested concomitantly, as these form part of the scoring system for DIC.
Funding: None required, as laboratory records are being reviewed.

Project title: Validation of the Cerebrospinal Fluid (CSF) Module of the Siemens ADVIA® 2120i for Automated Cell Counts of Cerebrospinal Fluid
Researchers: Dr E Kalambi-Matengu (PI) and Dr L Haupt
Short description: Automated cell counts are more accurate and reproducible. CSF cell counting is a newish application of an existing haematology analyser. The method is being verified before it can be implemented. This is a registrar MMed project. Data is being collected.
Funding: Reagents being supplied by Siemens as part of an HTA evaluation

Project title: Prevalence of comorbid psychiatric illness and quality of life in adults with bleeding disorders at the Bloemfontein Haemophilia Treatment Centre, South Africa. (MMed project)
Researchers: Dr H Koekemoer (Psychiatry) (PI), Dr J Joubert, Prof MJ Coetzee and Prof R Nichol (Psychiatry)
Short description: This is an MMed research project examining comorbid psychiatric illness and quality of life among patients with inherited bleeding disorders. A previous project documented that the patients struggle with such problems. This project is evaluating the situation in a properly structured manner.
Funding: None needed

Project title: Audit on pre-analytical influences on lupus anticoagulant testing at an Academic Laboratory
Researchers: Mrs C Conradie (PI), Dr J Joubert, and Prof SM Meiring

Short description: This is a BTech project where preanalytical influences like age of the specimen, its temperature, volume, etc. will be analysed to see if these had an influence on the results of lupus anticoagulant (LA). LA is an important test in the work-up of thrombophilia.
Funding: Special Haemostasis Laboratory, UFS

Project title: Haematological characterisation of the chacma baboon (Papio ursinus) fibrinolytic system, Von Willebrand factor and ADAMTS13. (PhD project)
Researchers: Dr J Joubert (PI), Dr WJ Janse van Rensburg and Prof SM Meiring
Short description: This project is investigating animal models of haemostasis.
Funding: Department of Haematology, Special Haemostasis Laboratory, UFS.

Project title: Seeding of vessel conduits with endothelial progenitor cells
Researchers: Prof SM Meiring and Ms C Blaauw
Short description: This project is studying the recellularisation of decellularised blood vessel transplants.
Funding: The NRF and Special Haemostasis Laboratory, UFS

Completed projects

Project title: Hereditary haemorrhagic telangiectasia in the Free State and Northern Cape (MSc obtained)
Researchers: Prof Coetzee, Dr G Marx and Ms Kimberly Peta (PI)
Short description: Several genetic variants in the endoglin gene were detected, but more individuals need to be analysed before they can be regarded as pathogenic in this population.
Funding: NHLS Research Trust Grant 004-94482

Project title: Development of a Von Willebrand factor propeptide assay. MMedSc obtained.
Researchers: R Maleka (PI), Prof Meiring, and R Bragg

Short description: Type 1 von Willebrand disease is either caused by decreased synthesis and secretion or increased clearance of von Willebrand factor from plasma. It is essential to diagnose individuals with an increased clearance rate of von Willebrand factor, as the treatment of these patients with 1-deamino-8-D-arginine vasopressin is not effective. A rapid enzyme-linked immunosorbent assay, using commercial antibodies was developed and validated. This rapid assay has equal sensitivity, accuracy and precision as the commer cial method and can be used to diagnose patients with increased von Willebrand factor clearance.

Project title: Development and implementation of a real-time reverse transcriptase polymerase chain reaction assay to detect the intron 22 inversion in severe haemophilia A patients. (MMedSc obtained)
Researchers: Mr JF Kloppers (PI), Dr Janse van Rensburg and Dr GM Marx

Short description: A rapid, cost-effective and accurate gel-based PCR method for the detection of the intron 22 inversion in haemophilia A was developed. This simplified the detection of this common causative mutation in haemophilia A.
Funding: Department of Haematology

6. Research output

6.1 Journal publications

Coetzee MJ, Blumberg LH, Paweska JT, Leman P, Swanepoel R, de Kock A; Crimean-Congo haemorrhagic fever presenting with undiagnosed chronic myeloid leukaemia. Southern African Journal of Infectious Diseases. 2017;32:142-4. DOI: 10.1080/23120053.2017.1345493)

Coetzee MJ, Joubert G, Swart M, Streicher A, Kruger M, Koekemoer H; An audit of the completion of bone marrow specimen request forms at an academic laboratory. Medical Technology SA. 2017;31(1):1-6

Goedhals J, Haupt L, Jafta D; Chronic lymphocytic leukaemia with concomitant plasmablastic lymphoma. SA Journal of Oncology. 2017;1(0), a8. https://doi.org/10.4102/sajo. v1i0.8

Joubert J, van Zyl MC, Raubenheimer J; Performance evaluation of the microINR® point-of-care INR-testing system. International Journal of Laboratory Hematology. 2017;00:1–8. DOI 10.1111/ijlh.12749 (URL http://onlinelibrary.wiley.com/doi/10.1111/ijlh.12749/abstract;jsessionid=A68A622838F30A0D7D2D054CDC689210.f04t02)

Kloppers JF, Janse van Rensburg WJ; Rapid identification of the intron 22 inversion in haemophilia A. Haemophilia. 2017;23:e55-e7. doi:10.1111/hae.13142

Meiring M, Khemisi M, Laker L, Dohmen PM, Smit FE; Tissue Engineered Small Vessel Conduits – The Anti-Thrombotic Effect of Re-Endothelialization of Decellularized Baboon Arteries: A Preliminary Experimental Study. Medical Science Monitor Basic Research. 2017;23:344-51. DOI 10.12659/MSMBR.905978

Meiring M, Haupt L, Conradie C, Joubert J; Challenges in the laboratory diagnosis and management of von Willebrand disease in South Africa. Annals of Blood. 2017; 2. DOI 10.21037/aob.2017.11.01

Meiring M, Myneni S; Evaluation of a cost-effective ADAMTS 13 antigen assay. Medical Technology SA. 2017;31:1-4

Schöchl H, van Griensven M, Heitmeier S, Laux V, Kipman U, Roodt J, et al; Dual inhibition of thrombin and activated factor X attenuates disseminated intravascular coagulation and protects organ function in a baboon model of severe Gram-negative sepsis. Critical Care. 2017; 21: 51. DOI 10.1186/s13054-017-1636-y

Tersteeg C, Roodt J, Van Rensburg WJ, et al; N-acetylcysteine in preclinical mouse and baboon models of thrombotic thrombocytopenic purpura. Blood. 2017;129:1030-8. DOI: 10.1182/blood-2016-09-738856

6.2 Complete books

None.

6.3 Book chapters

None.

6.4 Conference presentations

6.4.1 Oral presentations

International congresses

None.

National congresses

Kloppers J, Janse van Rensburg WJ. Molecular diagnostics in severe Haemophilia A – The central South African experience. The South African Haemophilia Foundation Medical and Scientific Advisory Council (SAHF MASAC) meeting and educational symposium, 2-3 November 2017, Protea Hotel, OR Tambo, Kempton Park.

Meiring SM. Laboratory diagnosis of Von Willebrand disease: the pitfalls, PathReD Congress, 22-24 June 2017, Johannesburg.

Local congresses (university academic days)

D de Necker, H Labuschagne, L Louw, P Schall, A van der Westhuizen, MJ Coetzee. The appropriateness of serological test requests for systemic lupus erythematosus sent to the Universitas Laboratory of the NHLS in Bloemfontein. UFS Health Sciences Student Research Forum, 22 August 2017, Faculty of Health Sciences, Bloemfontein.

Joubert J, Janse van Rensburg WJ, Meiring SM, Blaauw C, Tersteeg C, Vanhoorelbeke K. The in vitro and in vivo effects of streptokinase in a Papio Ursinus baboon model of acquired thrombotic thrombocytopenic purpura (TTP) – a pilot study. UFS Health Sciences Research Forum, 24-25 August 2017, Faculty of Health Sciences, Bloemfontein.

Kloppers JF, Janse van Rensburg WJ, Marx GM. Screening of haemophilia A patients and carriers for the intron 22 inversion mutation in central South Africa with a newly developed method. UFS Health Sciences Research Forum, 24-25 August 2017, Faculty of Health Sciences, Bloemfontein.

Meiring SM, Conradie C. Pitfalls in the laboratory diagnosis of Von Willebrand disease. UFS Health Sciences Research Forum, 24-25 August 2017, Faculty of Health Sciences, Bloemfontein.

Sreenivasan Tantuan S, Fonternel H, Stemmet M, Viljoen CD. Quantification of BCR-ABL1 on the Genexpert: from diagnostics to research. UFS Health Sciences Research Forum, 24-25 August 2017, Faculty of Health Sciences, Bloemfontein.

6.4.2 Poster Presentations

International congresses

Janse van Rensburg W, Kloppers J. Rapid and cost-effective FVIII intron inversion 22 screening of the Central South African haemophilia A population.

Joubert J, Janse van Rensburg WJ, Meiring SM, Tersteeg C, Vanhoorelbeke K. The in vitro and in vivo effects of streptokinase in a Papio Ursinus baboon model of acquired thrombotic thrombocytopenic purpura (TTP) - a pilot study. ISTH Congress, 8-13 July 2017, Berlin, Germany.

Joubert J, Van Zyl MC, Raubenheimer J. Performance evaluation of the CoagSense ® point-of-care INR-testing system. ISTH Congress, 8-13 July 2017, Berlin, Germany.

Joubert J, Van Zyl MC, Raubenheimer J. Performance evaluation of the microINR® point-of-care INR testing system. ISTH Congress, 8-13 July 2017, Berlin, Germany.

Meiring M, Khemisi M, Laker L, Smit F. Tissue Engineered Small Vessel Conduits - The Antithrombotic Effect of Re-endothelialisation of Decellularised Baboon Arteries. ISTH Congress, 8-13 July 2017, Berlin, Germany.

National congresses

Joubert J, Van Zyl MC, Raubenheimer J. Performance evaluation of the CoagSense ® point-of-care international normalized ratio (INR) testing system. NHLS PathReD congress, 22-24 June 2017, Johannesburg.

Van Marle A. Comparison of ADAMTS13 and Von Willebrand factor antigen levels and activities, and plasminogen levels, in the currently

available plasma products for the treatment of thrombotic thrombocytopenic purpura in South Africa. NHLS PathReD congress, 22-24 June 2017, Johannesburg.

Haupt L. Determination of functional iron deficiency status in haemodialysis patients in central South Africa. NHLS PathReD congress, 22-24 June 2017, Johannesburg.

Roux MS. May be May-Hegglin: a case report on a MYH9-related disorder. NHLS PathReD congress, 22-24 June 2017, Johannesburg.

Local congresses (university academic days)

Peta KT, Marx GM, Coetzee MJ. Mutation detection in the endoglin gene in a family affected with hereditary haemorrhagic telangiectasia (HHT). UFS Health Sciences Research Forum, 24-25 August 2017, Faculty of Health Sciences, Bloemfontein.

6.5 Patents

None.

6.6 Research translations

None.

6.6.1 Research translated to policy

None.

6.6.2 Research translated to service

Kloppers JF, Janse van Rensburg WJ. Rapid identification of the intron 22 inversion in haemophilia A. (Haemophilia 2017) was translated into a routine diagnostic service in the Tissue Typing Laboratory at Universitas. (The reverse transcriptase PCR for the detection of the intron 22 inversion in severe haemophilia A patients Q-Pulse SOP UNIH011).

Human Genetics

Head of department: : Prof Magda Theron

1. About the department

The Division of Human Genetics consists of three specialised laboratories: Molecular Genetics, Molecular-Cytogenetics and Cytogenetics. We provide a routine diagnostic service to both the public and private sector for about 49 laboratories nationwide. The focus of the division is the diagnosis of constitutional or birth defects, but we are also offering services to other disciplines like Haematology for acquired malignancies and various FISH analyses to Anatomical Pathology. Genetics is a multi-disciplinary discipline and we assist with research projects for postgraduate students in Medical Science and Medicine.

2. Diagnostic services

The division introduced the most innovative molecular technology, namely NGS, and provide a diagnostic service in the screening of the two breast cancer genes, BRCA 1 and 2. This cost-effective, high-throughput and sensitive test method provides a TAT of about two weeks. Using the best bioinformatics software available on the market, this method can provide a sensitive and high specivicity test result in half the time of most test methods. This is a semi-automated pipeline and provide optimal results.

The introduction of Quantitative Fluorescent PCR (QF-PCR) for aneuploidy recently replaced the golden oldie, FISH aneuploidy. Through the use of similar technology, we introduced a 50 mutation Cystic Fibrosis kit which can differentiate between heterozygote and homozygote alleles with complete test results, in a few hours. The Multiplex Ligation-dependent Probe-Analysis (MLPA) technology was expanded to not only identify microdeletions/duplications in the breast cancer genes, but also in patients with dysmorphic features and developmental delay. This was supplemented by two additional kits to detect abnormalities in the sub-telomeric regions. Real-time PCR is being used to detect variants in genotype analysis in a very short time with high sensitivity and cost efficiency.

The division is the referral laboratory for BRCA full screening, as well as Fanconi Anemia testing with DEB-sensitivity.

Table UFS 7: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists						0	
Medical scientists	2	0	1	2		5	5
Technologists					1	1	1
Other*					1	1	1
South Africans	2	0	1	2	2	7	7
All	2	0	1	2	2	7	7

3. Teaching, training and professional development

The division is an HPCSA- accredited training facility for intern medical scientists and medical technologists. We provide practical session to registrars in other disciplines. We also offer a MMedSc and PhD programme to postgraduate students.

3.1 Undergraduate level

No involvement.

3.2 Postgraduate level

We provide a postgraduate programme in MMedSc and PhD and qualified 10 Masters students over the past 10 years.

3.3 Other

Table UFS 8: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern medical scientists	Honours	All	South Africans
Total number of trainees	0	2	0	3	0	5	5
Final year trainees	0	2	0	0	0	2	2
Successful completion	0	2	0	0	0		

4. Awards

None.

5. Research activities

5.1 Research projects

Project title: Determining the contribution of larger genomic rearrangements in the BRCA1/2 genes to familial breast cancer in South Africa.

Researchers: Van der Merwe NC (Div of Human Genetics, NHLS, University of the Free State, Bloemfontein), Oosthuizen J (Div of Human Genetics, NHLS, North West Free State, Bloemfontein), Chabilal, N (Div of Human Genetics, Inkosi Albert Luthuli General Hospital, Durban, South Africa), Schoeman M (Department of Human Genetics, Faculty of Medicine, Tygerberg Hospital, Cape Town), Chong G (Lady Davis Institute and Segal Cancer Centre, Jewish Hospital, Montréal, QC, Canada) and Foulkes WDD (Program in Cancer Genetics, Departments of Oncology and Human Genetics, McGill University, Montréal, QC, Canada)

Short description: The Division of Human Genetics has been involved in familial breast cancer research for more than a decade. The increase in demand resulted in more comprehensive screens being performed on patients representing all of the SA population groups. More than 500 familial breast cancer patients were screened for both the smaller and larger rearrangements that might be present. A total of four different larger genomic rearrangements were detected. The aim of the project is to determine the break points of these rearrangements in each of thesepatients and to determine whether these mutations segregate within these families.

Project start date: 2010

Project end date: 2018

Project title: Molecular screening of Coloured South African breast cancer patients for the presence of BRCA mutations, using high resolution melting analysis

Principal investigators: Oosthuizen J (Faculty of Medicine, UFS, Bloemfontein) and Van der Merwe NC (Faculty of Medicine, UFS, Bloemfontein)

Co-researcher: Foulkes, WDD (Program in Cancer Genetics, Departments of Oncology and Human Genetics, McGill University, Montréal, QC, Canada)

Funding: MRC

Short description: The aim of the study involved targeting the familial breast cancer genes BRCA1 and BRCA2 for comprehensive mutation analysis in the South African Coloured population. The screen was performed using a variety of more conventional mutation screening techniques. A total of 229 Coloured breast cancer patients were included, based on specific selection criteria. Twelve

different pathogenic or Class 5 mutations were detected for a total of 33 patients. These mutations included all three the Afrikaner founder mutations, together with the Xhosa/Coloured mutation detected for the Xhosa and Coloured population residing in the Western Cape. An additional 50 variants were identi fied, ranging from single base changes to 12-base pairs deletion occurring within the coding region of BRCA2. The clinical significance of these variants were classified using computer based analysis. The majority of the variants was Class 1 polymorphisms, exhibiting normal variation. Nu merous new pathogenic mutations were identified, ranging from likely pathogenic (Class 4) to Class 5. Many of these mutations proved to be restricted to the southern tip of SA. Based on these results, recommendations were made regarding the composition of targeted mutation panels for the diagnostic testing of South African Coloured breast cancer patients and their families.

Project start date: 2013
Project end date: 2017
Project title: The prevalence of disease-causing mutations for BLM (Bloom syndrome) within the diverse South African population
Principal investigators: Adams J (Faculty of Medicine, UFS, Bloemfontein) and Van der Merwe NC (Faculty of Medicine, UFS, Bloem fontein)
Co-researcher: Schneider SR, Department of Genetics, UFS, Bloemfontein
Funding: NRF
Short description: Genome-wide association studies and linkage analyses identified many genes involved in complexes with BRCA1/2, of which the majority is involved in rectifying aberrant DNA sequences caused by biological and environmental stressors. These genes such as BLM were postulated to harbour putative roles in the incidence of breast cancer, especially in BRCA-negative patients. A recurrent mutation BLM c.1642C>T, p.Q548X, associated with an increased breast cancer in Slavic countries, was screened for in 241 BRCA1/2 negative breast cancer patients who presented with early-onset disease. An additional 68 breast cancer patients who had an extensive family history of the disease (44 Indian and 24 Afrikaner/ White patients) were comprehensively screened using High-Resolution Melt Analysis (HRMA) and DNA Sanger sequencing. The clinical significance of each variant was assessed, using various predictive algorithms.

The breast cancer modifying Russian-Slavic founder mutation was not detected within any of the SA high-risk breast cancer cases. Comprehensive screening resulted in the identification of 26 variants, indicating the highly conserved evolutionary nature of the BLM gene. The variants detected, ranged from global to rare, and included several novel mutations. Some of the variants were considered to have an impact on the various SA families presented. However, its clinical significance needs to be proven, using segregation analysis within these families to further establish whether or not these variants have putative pathogenicity. Future large case-control studies or more advance screening techniques such as NGS, ought to include the BLM gene for SA-hereditary cancer patients.

Project start date: 2015
Project end date: 2017

Project title: Assessing the role of PALB2 as a familial breast cancer gene in the South African population
Principal investigators: Makhetha MF, (Faculty of Medicine, UFS, Bloemfontein) and Van der Merwe NC (Faculty of Medicine, UFS, Bloemfontein)
Co-researcher: Dajee BK (Division of Human Genetics, Wits, Johannesburg)
Funding: NHLS Research Trust

Short description: PALB2 (Partner and Localizer of BRCA2) plays a key role in the repair of damaged DNA by localizing BRCA2 and initiating the repair process. The gene was recognized as a third breast cancer predisposition gene, together with BRCA1 and BRCA2. A total of 81 breast- and/or ovarian cancer (OVC) patients were selected for PALB2 screening. The complete coding sequence together with the intron-exon boundaries were screened, using qPCR-based HRMA and DNA Sanger sequencing. A total of 20 variants

was identified, of which two represented loss-of-function mutations. These mutations were detected for the SA Indian (single patient), Coloured (two patients) and Afrikaner (single patient) populations. The two patients carrying these Class 5 pathogenic mutations had an extensive family history of breast cancer and other ca types. A total of 18 missense variants other ca types. A total of 18 missense variants were detected with two classified as putative Class 4 variants.

The majority of PALB2 variants was observed among the Coloured and SA Indian populations, whereas it was limited in the other three groups. This observation could have been due to the unique admixture of these population groups present in SA, as SA has a multi-faceted colonization history based on the country's location with respect to major historical trade routes. Although 17.4% of the cohort represented Black patients, the number of variants observed for this group was very low. This indicated that the prevalence of PALB2 mutations/variants might be different for each of the SA population groups, depending on the genetic heritage of these patients. For this reason, the cohort needs to be increased to determine the mutation spectrum.

Project start date: 2015
Project end date: 2018

6. Research output

6.1 Journal articles

None.

6.2 Conference presentations (oral, poster)

spectrum Van der Merwe NC, Makhetha MF, Dajee BK, Buccamazza I (2017). Screening of high-risk BRCA1/2 mutation negative women for mutations in PALB2. 17th Biennial congress of the SASHG. Durban, South Africa (oral).

Van der merwe NC, Adams J, Schneider SR, Buccamazza I, Imyanitov E (2017). Mutations in Bloom's syndrome: do they contribute to familial breast cancer risk in South Africans? 17th Biennial congress of the SASHG. Durban, South Africa (poster).

Local congresses (university academic days)
Van der Merwe NC and Oosthuizen J (2017a). Introduction of next-generation sequencing for familial breast cancer diagnostics. 49th Faculty Research Forum of the Faculty of Health Sciences, Bloemfontein, South Africa (oral).

Adams J, Scneider SR, Imyanitov E, Van der Merwe NC (2017b). The effect of heterozygous BLM mutations on breast cancer risk in South Africa. 49th Faculty Research Forum of the Faculty of Health Sciences, Bloemfontein, South Africa (oral).

Makhetha MF, Van der Merwe NC, Dajee BK, Buccamazza I (2017c). Screening of PALB2 in high-risk BRCA1/2 negative SA breast cancer patients. 49th Faculty Research Forum of the Faculty of Health Sciences, Bloemfontein, South Africa (oral).

6.2.1 Oral presentations

International congresses

Van der Merwe NC, Oosthuizen J, Makhetha MF, Adams J, Dajee BK, Schneider SR (2017). Contribution of PALB2 and BLM mutations to familial breast cancer risk in BRCA1/2 negative South African breast cancer patients detected using high resolution melting analysis. 19th International Conference on Human Gendetic Disorders and Diseases, Cape Town, South Africa. 2-3 November 2017 – oral presentation.

Oosthuizen J, Van der merwe NC (2017). South African breast cancer mutation spectrum: Pitfalls to copy number variation detection using internationally designed multiple ligation-dependent probe amplification and next-generation sequencing panels. 19th International Conference on Human Genetic Disorders and Diseases, Cape Town, South Africa. 2-3 November 2017 – oral presentation.

National congresses

Van der Merwe NC, Makhetha MF, Dajee BK, Buccamazza I (2017). Screening of high-risk BRCA1/2 mutation negative women for mutations in PALB2. 17th Biennial congress of the SASHG. Durban, South Africa (oral).

Van der Merwe NC, Adams J, Schneider SR, Buccamazza I, Imyanitov E (2017). Mutations in Bloom's syndrome: do they contribute to familial breast cancer risk in South Africans? 17th Biennial congress of the SASHG. Durban, South Africa (poster).

6.2.2 Poster presentations

International congresses

None.

National congresse*s*

Van der Merwe NC, Adams J, Schneider SR, Buccamazza I, Imyanitov E (2017). Mutations in Bloom's syndrome: do they contribute to familial breast cancer risk in South Africans? 17th Biennial congress of the SASHG. Durban, South Africa (poster).

Local congresses (university academic days)

Patents
None.

6.3 Research translations

6.3.1 Research translated to policy

None.

6.3.2 Research translated to service

Full screening of breast cancer genes BRCA 1 and 2 with NGS.

Medical Microbiology and Virology

Head: Dr MB Maloba/Dr D Goedhals

1. About the department

The department comprise academic and diagnostic units for both Microbiology and Virology. In September 2017, the UFS Council confirmed the establishment of an independent Virology Division within the School of Pathology. Dr D Goedhals was appointed as Head of Division in November 2017 and Dr MB Maloba joined the Department of Medical Microbiology as Head of Department in December 2017. The SANAS-accredited diagnostic laboratories provide services to Universitas, National and 3 Military Hospitals in Bloemfontein, while the Virology laboratory is also the referral laboratory for all NPP HIV testing in the Free State and Northern Cape provinces.

Undergraduate and postgraduate training is provided for medical specialists (MMed), medical science students (BSc Honours, MSc and PhD), scientist interns, technicians, technologists, undergraduate physiotherapy, occupational health, optometry, and medical students.

Research in the department focuses on vector-borne and zoonotic diseases, HPV, HIV, and tuberculosis. Prof F Burt holds a South African Research Chair position in "Vector-borne and zoonotic diseases research" that is hosted by the UFS, funded by the DST and administered by the NRF.

2. Diagnostic services

In addition to the 24-hour telephonic consultation services for clinical support, ward rounds are conducted with clinicians at Universitas Academic, Pelonomi and Kimberley Hospitals. National coverage activities now also include a number of laboratories in the Free State and Northern Cape provinces.

The Microbiology laboratory processed 193 318 specimens in 2017, including 78 085 bacteriology specimens, 92 989 TB culture and molecular specimens, 11 712 GeneXpert specimens, and 9 532 serology specimens. The Virology laboratory processed 414 873 specimens in 2017, including 19 126 serology specimens, 352 233 HIV viral load specimens, and 43 514 HIV PCR specimens (EID). The HIV drug resistance testing laboratory which was introduced in 2016, obtained SANAS accreditation in 2017. Automation of the majority of Microbiology and Virology serology assays was implemented in 2017 in a consolidated serology laboratory.

Table UFS 9: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	1	5				6	6
Medical scientists	2		2			4	4
Technologists					18		
Other*			1	1		2	2
South Africans	3	5	3	1		12	12
All	3	5	3	1		12	12

**Intern medical scientists*

3. Teaching, training and professional development

3.1 Undergraduate level

The department presented the annual module on infections to second-year medical students which included lectures, case discussions, group presentations and laboratory demonstrations over 22 contact sessions. Additional sessions on systemic pathology were integrated into system modules for second- and third-year medical students. Lectures were given in both English and Afrikaans. The department also presented short courses to students in the allied health professions, including optometry, physiotherapy and occupational therapy.

3.2 Postgraduate level

Postgraduate training is provided for medical science students (BMedSc Honours, MMedSc and PhD); medical specialists (MMed in Medical Microbiology, MMed in Medical Virology, and Infectious Disease fellows); scientist interns (Microbiology and Virology); technicians (Microbiology, Virology, TB and Clinical Pathology); and technologists (Microbiology, Virology and Clinical Pathology).

3.3 Other

Table UFS 10: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern medical scientists	Honours	All	South Africans
Total number of trainees	8	7	5	7	4	31	26
Final year trainees	0	2	2	2	4	10	9
Successful completion	0	2	1	2	4	9	8

4. Awards

In addition to achieving a B3 rating from the NRF, Prof FJ Burt was promoted to full professor with an inaugural lecture entitled "Catching a virus". Postgraduate students in the department participated in the UFS 3-Minute Thesis Competition with Y Munsamy and achieved second place and winner of the People's Choice Award in the PhD division, while AE Ogunbayo won the People's Choice Award in the Masters division. Other presentation awards during the year included A Bulane who was the winner of the Dr Lehlohonolo Mathengtheng Trophy at the Faculty of Health Sciences Research Forum and AE Ogunbayo who won the best poster presentation award at the 3rd Annual Free State Department of Health Provincial Research Day.

5. Research activities

5.1 Research projects

Project title: Neonatal Candidaemia at Universitas Academic Hospital, Bloemfontein, South Africa
Principal investigator: LS Mnqokoyi (Medical Microbiology, NHLS/UFS)
Co-researcher: M Moncho (Medical Microbiology, NHLS/UFS)
Funding: None
Short description: The aim of the project was to evaluate the distribution and antifungal susceptibility of Candida species causing neonatal blood stream infections at Universitas Hospital and compare the reported susceptibility to fluconazole, caspofungin and amphotericin B to those generated at the refer ence laboratory. The methods for identification were colony morphology on Sabouraud dextrose and the germ tube test, using Vitek 2 (bioM´erieux Inc, Marcy l'Etoile, France) and API32C Aux Yeast bioM´erieux Inc, Marcy l'Etoile, France). Susceptibility was tested through Vitek 2 (bioM´erieux Inc, Marcy l'Etoile, France) and YeastOne microbroth dilution panels containing Alamar Blue (Thermo Fisher Scientific, Cleveland, Ohio, USA). It was found that Candida parapsilosis is the major cause of neonatal candidemia in Universitas hospital. Amphotericin B is the recommended empirical drug of choice.
Project start date: January 2016
Project end date: 2018

Project title: The prevalence and bacterial distribution of peritonitis among adult patients undergoing continuous ambulatory peritoneal dialysis at Universitas academic hospital, Bloemfontein

Principal investigator: Musoke J (Medical Microbiology, NHLS/UFS)
Co-researchers: Parlato AB, Moola IM, Moola YM, Natverlal A, Kajee U, Bailey A and Arendse JE (UFS)
Collaborator: Bisiwe BF (UFS)
Funding: None
Short description: The study aimed to determine the prevalence of peritonitis in peritoneal dialysis (PD) patients in Academic Hospital. The inclusion criteria was adult patients who were on PD treatment and were diagnosed with continuous ambulatory peritoneal dialysis (CAPD)-associated peritonitis. The exclusion criteria entailed patients with no bacterial growth observed after five days with a dialysis white cell count of zero. Positive cultures with no clinical picture of peritonitis was also excluded. Total patients included were 72 patients with 159 episodes. From the 159 episodes, 38 episodes had a cell below 100 with bacterial growth and 27 had no cell count with a positive bacterial growth. Healthcare services should revisit preventative measures such as educating patients on better hygiene and proper procedure when using the dialysis.
Project start date: September 2016
Project end date: October 2018

Project title: Characterization of antigen (MPT64) negative Mycobacterium tuberculosis
Principal investigator: Musoke J (Medical Microbiology, NHLS/UFS)
Co-researcher: Mzimkulu HM (UFS)
Collaborator: Nyaga M (UFS)

Funding: NRF Thuthuka

Short description: The objective of the study is to characterize the antigen (MPT64) negative Mycobacterium tuberculo sis isolates in the NHLS TB reference lab, Universitas. Isolates selected were acid fast bacilli, in cords (ZN staining and MPT64 antigen negative. Over the past 18 months antigen negative ZN cords positive isolates had a prevalence of (7/7144) 0.09798% which showed low impact on TB diagnostics. Genotypic characterisation was performed using spoligotyping. Thus far, the majority of isolates belong to Indo-Oceanic lineage, members of family 33 and mainly Manu 2 strains. Possible MPT64 gene mutations are being investigated in selected TB isolates using NGS.
Project start date: Jan 2017
Project end date: Dec 2019

Project title: The epidemiology of bovine tuberculosis at the wildlife/livestock/human interface in northern KwaZu lu-Natal province, South Africa
Principal investigators: Sichewo P (UP), Michel P (UP) and Etter E (UP)
Collaborators: Musoke J (Medical Microbiology, NHLS/UFS)
Funding: Institute of Tropical Medicine Antwerp and NRF Thuthuka Grant

Short description: This study aims to investigate the epidemiological significance of zoonotic TB at the wildlife-livestock-hu man interface (WLH) in uMkhanyakude district. In addition, the transmission modes of M. bovis from cattle to humans and the risk of transmission will be assessed. This is achieved through collection of samples from cattle that include tracheal swabs, blood and tissues. Sampling from humans, i.e. collection of sputum, blood and fine needle effluents from lymph node is ongoing. Questionnaire interviewz will be conducted to determine the risk factors. Genetic characterization and comparison of M. tuber culosis complex organisms isolated will be compared using spoligotyping MIRU-VNTR.

Project start date: April 2016
Project end date: December 2020

Project title: An investigation of Tuberculosis amongst the adolescent population in the Free State: Prevalence, drug susceptibility and characterisation of strains.
Principal investigators: Butcher CA (Hons student: 2013081969, UFS) and Van der Spoel van Dijk A, (Medical Microbiology, NHLS/ UFS).

Co-researchers: J Musoke (Medical Microbiology, NHLS/UFS) and Coovadia Y (Medical Microbiology, NHLS/UFS)
Funding: NRF Thuthuka
Short description: This study aimed to document the prevalence, tuberculosis (TB) strains circulating among adolescents and association with drug resistance in the Free State, South Africa. Data analysis and spoligotyping was used to achieve the aim. In the adolescent population, TB is higher amongst females compared to higher incidence in male in the rest of the population. Drug-resistant associated TB increase significantly with age in the 15-19-year old group, namely 4 to 10 per 100 00 population (p-value = 0.001; $p<0.05$). No significant association with resistance is present in the 10-14-year old age group. Beijing strain types predominated, indicating high transmission in this group, but no specific association of strain types with resistance. Specific management of TB in adolescents between 15 and 19 years of age are needed.
Project start date: February 2017
Project end date: November 2017

Project title: Comparison of methods and samples used in the diagnosis of childhood pulmonary TB (PTB) and charac terization of Mycobacterium Tuberculosis Isolates.
Principal investigator: Mr Ayodeji Emmanuel Ogunbayo (MMed.Sc. in Medical Microbiology)
Co-researchers: Van der Spoel van Dijk A, (Medical Microbiology, NHLS/UFS), Musoke J (Medical Microbiology, NHLS/UFS) and Coovadia Y (Medical Microbiology, NHLS/UFS)
Collaborator: Bulane, A (UFS)
Funding: NHLSRT; UFS

Short description: This study compared various sample types (nasopharyngeal aspirate, nasopharyngeal swabs, gastric aspirates (GA), urine and stool) and methods (microscopy, culture, GeneXpert® MTB/RIF and Gen otype® MTBDRplus) for diagnosis and susceptibility testing of childhood tuberculosis (TB). Cul tured strains were characterised with spoligotyping and 24 loci Mycobacterial Interspersed Re petitive Units-Variable Number of Tandem Repeats typing. TB was bacteriologically confirmed in 4/126 children. Alternative specimens were valuable and urine-enabled confirmation of TB in 3/4 children compared to GA (2/4). Culture remained the most sensitive detection method. All strains were susceptible and genotyping identified two Beijing strains, one X3 and T1 strains each. The two out of four Beijing strains raises concern, as Beijing strains were not predominant in the Free State before. Results of the examination are awaited.
Project start date: 2017
Project end date: 2019

Project title: To investigate the dynamics of tuberculosis (TB) as a changing disease amongst adolescents (10-19) in comparison to that of adults >20 years
Principal investigator: Mrs A van der Spoel van Dijk (Medical Microbiology, NHLS/UFS)
Co-researcher: Musoke J (Medical Microbiology, NHLS/UFS)
Funding: NRF Thuthuka

Short description: The aim of the project was to investigate the dynamics of TB as a changing disease amongst adolescents (10-19 years of age) in comparison to that of adults >20 years, using data analysis to determine the prev alence, susceptibility versus drug resistance determined with Genotype MTBDR fl and sl (2011-2016) and strains variation within these populations, using spoligotyping and 24 MIRU-VNTR typing. To determine the mutations involved in resistance and lineages, WGS) and the TB profiler were used. It seems like the adolescents and young adult population might be transmitting drug resistance and harbour more Beijing strains. The potential of WGS for solving complicated cases show potential.
Project start date: 2015
Project end date: 2018

Project title: The molecular epidemiology of tuberculosis and the impact of advanced diagnostics on the early detec tion and appropriate management of tuberculosis in the Free State
Principal investigator: Mrs A van der Spoel van Dijk (Medical Microbiology, NHLS/UFS)
Co-researchers: Musoke J (Medical Microbiology, NHLS/UFS) and Coovadia Y (Medical Microbiology, NHLS/UFS)
Funding: NRF Thutuka

Short description: The study plans to determine the molecular epidemiology and the impact of advanced diagnostics "Re flex" on early detection, timely and appropriate patient management of tuberculosis in the Free State (2016 – 2019). The prevalence/incidence and variation of tuberculosis isolates circulating in different age groups of the Free State, and especially Bei jing Typical and Atypical TB strains will be investigated, using spoligotyping and advanced PCR techniques. The management of complex MDR/XDR-TB cases will be assisted using WGS and resistance determinants and phenotypic profiles of the recently employed and r e-purposed TB drugs bedaquiline (BDQ), delamanid (DL), clofazimine (CFZ) and linezolid (LIN) in treatment naïve patients and patients after six months on treatment will be documented. The study proposal is being developed.

Project start date: 2017

Project end date: 2020

Project title: Diagnostic tools and therapeutic monoclonal antibodies against Crimean-Congo haemorrhagic fever: epitope mapping

Principal investigators: Burt FJ (Virology NHLS/UFS) and Mirazimi A (Karolinski Institute)

Collaborator: Blixt O (University of Copenhagen)

Funding: NRF SA/Sweden collaboration

Short description: In this study, we have screened the glycoprotein of Crimean-Congo hemorrhagic fever (CCHF) for novel linear B-cell epitopic regions, using a microarray approach. The peptide library consisted of 168 synthesized 20mer peptides with 10 amino acid overlap, covering the entire glycoprotein. Com mon epitopes were identified using both pooled and individual human sera from survivors of CCHF disease in Turkey and South Africa.

Project start date: 1 Jan 2016

Project end date: 31 December 2018

Project title: Vector-borne and zoonotic pathogens research: identification of arboviruses circulating in mosquito pop ulations in the Bloemfontein area

Principal investigators: Burt FJ (Virology NHLS/UFS) and Terblanche G (UFS postgraduate student)

Collaborator: Kemp A, (NICD, NHLS)

Funding: DST/NRF SARChI in vector-borne and zoonotic pathogens research

Short description: The aim of the study is to identify arboviruses currently circulating in mosquito populations in the Bloemfontein area, Free State province, South Africa. The identity of wild mosquito species caught in the area will be determined using both conventional morphological characteristics and molecular based methods. Molecular assays to screen for arboviruses are being optimised.

Project start date: 1 Jan 2016

Project end date: 31 December 2018

Project title: Vector-borne and zoonotic pathogens research: development of a rapid assay and detection of Sindbis virus infections

Principal investigator: Burt FJ (Virology NHLS/UFS) and Kennedy N (UFS postgraduate student)

Funding: DST/NRF SARChI in vector-borne and zoonotic pathogens research

Short description: The aim of the study is to investigate Sindbis virus prevalence and develop a rapid test for detection of Sindbis virus infection. An in-house assay was optimised and used to screen samples from patients consid ered at possible risk of infection and from patients attending arthritis clinics. The in-house assay will be compared with a commercial assay and confirmed using neutralisation assays.

Project start date: 1 Jan 2016

Project end date: 31 December 2018

Project title: Development and evaluation of novel vaccines for medically significant arboviral diseases: Immunogenicity of alphavirus based replicon for CCHF Virus
Principal investigators: Burt FJ (Virology NHLS/UFS) and Tipih T(UFS postgraduate student)
Collaborator: Heise M (University North Carolina)
Funding: NHLS Research Trust

Short description: To understand the mechanisms for increasing immunogenicity of DNA launched CCHF Virus replicons in vitro based, on ability of the alphavirus replicons to induce apoptosis and an antiviral immune response. Briefly, constructs were prepared expressing the glycoproteins and nucleproteins of reassortant and non reassortant strains of CCHF Virus. The expression of proteins was characterised in vitro, using transfected cells. Currently, the immunogenicity induced in immunized mice is being investigated.
Project start date: 1 Oct 2015
Project end date: 31 December 2018

Project title: Characterisation of the human papillomavirus genome and p53mutations in head and neck squamous cell carcinomas
Principal investigators: Burt FJ (Virology NHLS/UFS) and Munsamy Y(UFS postgraduate student)
Collaborator: Seedat R (UFS)
Funding : NRF
Short description: The overall aim of this study is to characterise HPV in head and neck squamous cell carcinomas (HNSCCs), based on complete genome sequence of HPV isolates from patients with HPV-associated head and neck squamous cell carcinomas, and contribution of p53 mutations. Briefly, the complete genome sequence of HPV isolates from patients with HNSCC in the Free State, SA, were determined and the sequence data used to determine the presence of mutations that could influence transcription. Finally the presence of p53 mutations in HPV associated HNSCC will be investigated.
Project start date: 1 Feb 2015
Project end date: 31 December 2018

Project title: Detection of human papilliomavirus associated with head and neck squamous cell carcinoma in archived tissues and novel biomarkers
Principal investigators: Burt FJ (Virology NHLS/UFS) and Bulane A (UFS postgraduate student)
Collaborators: Goedhals D (Virology NHLS/UFS), Seedat R (UFS) and Goedhals J (NHLS/UFS)
Funding: NRF
Short description: The aim is to determine the prevalence of HPV types in head and neck cancer in patients in the Free State and to identify new biomarkers that can be used as an indicator of head and neck cancer. Briefly, archived tissues from confirmed HNSCC were tested for HPV DNA, using multiplex PCR, targeting the E6 region of selected high and low risk.To identify novel biomarkers, expression of long non-coding RNA and HomeoboxD10 as biomarkers of disease using quantitative real-time PCR, is currently being performed.
Project start date: 1 Feb 2015
Project end date: 31 December 2018

Project title: Seroepidemiologic survey of Crimean-Congo haemorrhagic fever virus in select risk groups in endemic regions of South Africa

Principal investigator: Vawda S (Virology NHLS/UFS)

Co-researchers: Goedhals D, Bester PA and Burt FJ (Virology NHLS/UFS)
Funding: The Postgraduate Committee, Faculty of Health Sciences, UFS and the South African Research Chairs Initiative (Vector Borne and Zoonotic Pathogens Research) of the DST and NRF
Short description: CCHFV seroprevalence differs geographically between and within endemic regions, with some studies documenting asymptomatic or mild disease. CCHFV is endemic in South Africa, but it is unclear

	if mild undiagnosed cases occur. The aim of this study was to determine the current seroprev alence amongst healthy individuals in selected high risk groups within endemic provinces of SA. A total of 374 blood samples were collected between April 2016 and February 2017 from volunteers in high risk groups in the Free State and Northern Cape provinces. An additional 13 stored serum samples,from large animal veterinarians were included. A commercial indirect IFA (Euroimmun, Lubeck, Germany) was used to detect spe cific CCHFV IgG antibodies. A total of 2/387 adults considered at risk had evidence of previous infection. The seroprevalence remains low within the groups investigated.
Project start date:	February 2016
Project end date:	October 2017

Project title:	Characterization of T cell responses to the nonstructural proteins of the M segment in survivors of Crime an-Congo haemorrhagic fever virus (CCHFV) infection
Principal investigators:	Goedhals D (Virology NHLS/UFS) and Maotoana M (UFS postgraduate student)
Collaborators:	Burt FJ (NHLS/UFS) and Paweska JT (NICD)
Funding:	PRF
Short description:	The objectives were to identify the presence of T cell responses to the M segment non-structural proteins in survivors of CCHF infection, to confirm functional cytotoxic activity against the epitopes and to evaluate sequence conservation of epitopes among global isolates of CCHFV. A total of 13 patients were identified with a confirmed history of CCHFV infection within the last 10 years. Peripheral blood mononuclear cells were extracted and ELISpot assays were performed, using a set of overlapping peptides covering the mu cin-like variable domain, the NSm and GP38. A number of responses were identified in the participants during screening of the peptide pools and were subsequently confirmed using individual peptides. Optimisation of the flow cytometry assay CD107a assay is underway.
Project start date:	February 2015
Project end date:	June 2018

6. Research output

6.1 Journal publications

Le Roux MC, Hoosen AA. Quantitative Real-Time Polymerase Chain Reaction for the Diagnosis of Mycoplasma genitalium infection in South African men with and without symptoms of Urethritis. Sexually transmitted Diseases. 2017:44(1):18-21

Hardie DR, Korsman SN, Hsiao N-Y, Morobadi MD, Vawda S, Goedhals D. Contamination with HIV antibody may be responsible for false positive results in specimens tested on automated platforms running HIV 4th generation assays in a region of high HIV prevalence. PloS One. 2017; 12(7):e0182167

Steegen K, Bronze M, Papathanasopoulos MA, van Zyl G, Goedhals D, Variavo E, MacLeod W, Sanne I, Stevens WS, Carmona S. HIV-1 antiretroviral drug resistance patterns in patients failing NNRTI-based treatment: results from a national survey in South Africa. J. Antimicrob. Chemother. 2017; 72:210-219

Burt FJ, Chen W, Miner JJ, Lenschow DJ, Merits A, Schnettler E, Kohl A, Rudd PA, Taylor A, Herrero LJ, Zaid A, Ng LFP. Chikungunya virus: an update on the biology and pathogenesis of this emerging pathogen. Lancet Infect Dis. 2017; 17(4):e107-e117

Rhee SY, Varghese V, Holmes SP, Van Zyl GU, Steegen K, Boys MA, Cooper DA, Nsanzimana S, Saravanan S, Charpentier C, de Oliveira T, Etiebet MAA, Garcia F, Goedhals D, Gomes P, Günthard HF, Hamers RL, Hoffmann CJ, Hunt G, Jiamsakul A, Kaleebu P, Kanki P, Kantor R,

Kerschberger B, Marconi VC, Ndahimana JD, Ndembi N, Ngo-Giang-Huong N, Rokx C, Santoro MM, Schapiro JM, Schmidt D, Seu L, Sigaloff KCE, Sirivichayakul S, Skkosana L, Sunpath H, Tang M, Yang C, Carmona S, Gupta RK, Shafer RW. Mutational Correlates of Virological Failure in individuals receiving a WHO-Recommended Tenofovir-cantaining first-line regimen: An international collaboration. EBioMedicine. 2017; 18:225-235

Goedhals D, Paweska JT, Burt FJ. Long-lived CD8+ T cell responses following Crimean-Congo haemorrhagic fever virus infection. PloS Negl Trop Dis. 2017; 11(12):e0006149

6.2 Complete books

None.

6.3 Book chapters

None.

6.4 Conference presentations (oral, poster)

6.4.1 Oral presentations

International congresses

Burt FJ. Chairperson at discussion/session (clinical diagnostics) at the 2nd International Conference on Crimean-Congo Haemorrhagic Fever that was held from 10-12 September 2017, in the Makedonia Palace Hotel, Thessaloniki, Greece.

National congresses

None.

Local congresses (university academic days)

Bulane A, Goedhals D, Seedat R, Goedhals J, Burt F. Detection of HPV types in head and neck squamous cell carcinoma. Faculty of Health Sciences Research Forum, UFS, Bloemfontein, 24 August 2017. Ms Bulane won the Dr. Lehlohonolo Mathengtheng floating trophy for the best PhD presentation.

Ogunbayo AE, Bulane A, Van der Spoel van Dijk A. Challenges in diagnosing pulmonary tuberculosis in children: A comparative analysis of multiple samples and methods. Faculty of Health Sciences Research Forum, UFS, Bloemfontein, 24 August 2017.

6.4.2 Poster presentations

International congresses

Van der Spoel van Dijk A, Hallbauer U, Nyaga M, Baba K. Role of next generation sequencing in tuberculosis diagnostics: resolving the clinical dilemma of discrepancies in laboratory findings. 48th Union World Conference on Lung Health, Guadalajara, Mexico, 11 to 14 October 2017.

Heunis JC, Chikobvu P, Kigozi NG, Van der Spoel-van Dijk A, Van Rensburg HCJ, Janse van Rensburg AP, Engelbrecht MC. Research towards improved tuberculosis control in the Free State, South Africa – a narrative review. 10th European Congress on Tropical Medicine and International Health (ECTMIH) 2017, Antwerp, Belgium, 16 to 20 October 2017.

Bulane A, Goedhals D, Goedhals J, Seedat R, Burt FJ. Detection of HPV types in head and neck squamous cell carcinoma. 31stInternational Papillomavirus Conference – HPV 2017, Cape Town, South Africa, 28 February to 4 March 2017.

Munsamy Y, Seedat RY, Bester PA, Burt FJ. Characterisation of the complete genome of an HPV31 isolate associated with head and neck cancer. 31stInternational Papillomavirus Conference – HPV 2017, Cape Town, South Africa, 28 February to 4 March 2017.

Sekee TR, Goedhals D, Seedat RY, Burt FJ. Molecular assays for the detection of human papillomavirus in head and neck tumours. 31stInternational Papillomavirus Conference – HPV 2017, Cape Town, South Africa, 28 February to 4 March 2017.

National congresses
Van der Spoel van Dijk A, Uebel K, Arendse T, Ntshingila N, Baba K. Sequence analysis of bedaquiline drug resistance determinants atpE and RV0678 in Mycobacterium tuberculosis isolates. PathReD Congress, Johannesburg, South Africa, 22 to 24 June 2017.

Ogunbayo AE, Bulane A, Van der Spoel van Dijk A. Evaluating the utility of various samples and methods for the diagnosis of childhood pulmonary tuberculosis. FIDSSA Congress 2017,Century City Conference Centre, Cape Town, South Africa, 9 to 11 November 2017.

Local congresses (university academic days)
Ogunbayo AE, Bulane A., Van der Spoel van Dijk A. Challenges in diagnosing pulmonary tuberculosis in children: A comparative analysis of multiple samples and methods. 3rd Free State Research Day, Bloemfontein, 2 to 3 November 2017. Awarded best poster presentation.

6.5 Patents

None.

6.6 Research translations

6.6 1 Research translated to policy

None.

6.6.2 Research translated to service

None.

University of KwaZulu-Natal

Foreword

Dr Verena Gounden
Head of School

The Pathology Disciplines form part of the School of Laboratory Medicine and Medical Sciences at the University of KwaZulu-Natal, with Prof. Musa Mabandla as Dean of the school.

The five pathology disciplines are led by the following Heads of Department:

- Prof. Pratista Ramdial: Head of Anatomical Pathology
- Dr Verena Gounden: Head of Chemical Pathology
- Dr Nadine Rapiti: Head of Haematology
- Dr Elizabeth Samuel: Acting Head of Medical Microbiology (June – December 2018)
- Dr Pravi Moodley: Head of Medical Virology

What we do

The enhanced relationship with the Area Manager in KwaZulu-Natal continues to improve service delivery of laboratory medicine to the province. All discipline heads are members of the provincial Management Committee (Manco), chaired by the Area Manager, which ensures that all service related matters are jointly addressed. This has also resulted in KwaZulu-Natal taking the lead in ensuring provincial coverage for pathology services as well as increasing the number of SANAS accredited laboratories in the region . The HoD meetings (PMC) are held regularly and these ensure that teaching (undergraduate and postgraduate) and research activities are also monitored efficiently.

HIGHLIGHTS

Dr Nadine Rapiti was appointed as Head of Department of Haematology. Sadly we had to say goodbye to Prof Koleka Mlisana as pathology representative and Head of Microbiology as she was appointed NHLS Executive Academic Affairs and Research. We congratulate Prof Mlisana and wish her all the best.

Anatomical Pathology

Head of department: : Prof Pratista Ramdial

1. About the Department

The Department of Anatomical Pathology, based in the Laboratory Building of the Inkosi Albert Luthuli Central Hospital, serves the diagnostic needs of 75% of KZN, the teaching and training needs of undergraduate and postgraduate students and scholars registered at the Nelson R Mandela School of Medicine, University of Durban Westville and the Durban University of Technology (DUT).

2. Diagnostic services

The department reported on 38 637 surgical pathology specimens and 65 autopsies from January - December 2017. A total of 128 311 cytopathology specimens were processed (these included 113 817 gynaecological cases, 14 494 non-gynaecological specimens and fine needle aspirates).

3. Teaching and training

3.1 Undergraduate teaching

175 hours of lectures and practicals were delivered to undergraduate MBChB students. There were five themes in the second year and three themes in the third year in undergraduate teaching. This included a total of 73 lectures and 18 practicals to second-year and third-year medical students at the Nelson R Mandela School of Medicine. It also included setting of assessments, ETT, EME, and marking of scripts. In addition, the department was involved in lecturing to the Clinical Science students at the University of Durban Westville. This included nine lectures and setting of the assessments.

3.2 Postgraduate teaching and training

One registrar (supernumerary) wrote the FCPath Part I examination in March 2017 and was successful. Two registrars wrote and passed the FCPath Part II examination.

During the year, 35 clinicopathological meetings were undertaken with the clinical and surgical disciplines that allowed interaction with clinical colleagues and contributed to improved understanding of disease processes in general, and helped with management of individual patients in particular. The postgraduate training programme facilitated learning and intradepartmental interaction at short topics, seminars and "box" slide assessments.

Histopathology: four students wrote their board examination and all four were successful.

The following courses were attended by staff in 2017:

- Initiating and Chairing Disciplinary Hearings, KZN;
- Finance for non-finance Managers;
- Foundations of Laboratory Leadership and Management Course;
- First Aid;
- MS Excel and MS Word; and
- Fire Warden.

Resignation: one medical technologist resigned at the end of 2017. No new appointments were madie in 2017.
Cytopathology: registrar training: a total number of 15 practical lectures were conducted for registrar training in 2017. Five medical technology trainers were involved in facilitating/conducting training, revision programme and marking of tests. Two registrars passed their board exam in 2017.
Student medical technologists: six training sessions were covered in 2017 and these included lectures, assignments, tests and practical assessments. Nine trainers were involved in covering the syllabus, revision and marking of tests and assignments. Three students wrote their SMLTSA board exams in March 2017. One student passed and the other was unsuccessful. The student repeated in September and

passed.

Medical technologists: one was employed at Greys Cytology laboratory and the other two had their contracts terminated. Four medical technology Interns wrote the board examination in March 2018 and all were successful. There were no resignations, dismissals or new appointments in 2017.

4. Research

The higher degrees attained in 2017-2018 included three MMeds and one MMedSc. The latter passed cum laude.

5. Research output

5.1 Journal Publications

Bhigjee AI, Moodley AA, Roos I, Wells CL, Ramdial P, Esser M. The neuromyelitis optica presentation and the aquaporin-4 antibody in HIV-seropositive and seronegative patients in KwaZulu-Natal, South Africa. S Afr J HIV Med. 2017; 18: 1-7

Nhlonzi GB, Ramdial PK, Nargan K, Lumamba KD, Pillay B, Kuppusamy JB, Naidoo T, Steyn AJC. Vulval tuberculosis: The histomorphological spectrum in patients with HIV co-infection and AIDS. J AIDS Clin Res. 2017, 8: 8

Naidoo N, Ramdial PK, Kuppusamy JB, Naidoo T, Pillay B. Kaposi Sarcoma with Abscessing Clinicopathologic Morphology. J AIDS Clin Res. 2017; 8: 9

Msimang MZ, Ramdial PK, Kuppusamy JB, Nargan K, Sheik-Gafoor MH. AIDS-associated pediatric high-grade B-cell lymphoma with MYC and BCL2 translocations. J AIDS Clin Res. 2017; 8: 11

Loots E, Ramdial PK, Sartorius B, Mulder CM, Clarke DL. Malignant and pre-malignant oesophageal pathology in a South African teaching hospital. S Afr J Surg. 2017; 55: 1-4

Singh S, Ramdial PK, Sheik-Gafoor MH, Hadley GP. A comprehensive review of nephroblastoma with ureteric involvement. J Mod Hum Pathol. 2017; 2: 7-12

Reddy VP, Chinta KC, Saini V, Glasgow JB, Hull TD, Traylor A, Rey-Stolle F, Soares MP, Madansein R, Rahman MdA, Barbas C, Nargan K, Naidoo T, Ramdial PK, George JF, Agarwal A, Steyn AJC. Ferritin H Deficiency in Myeloid compartments dysregulates host energy metabolism and increases susceptibility to Mycobacterium tuberculosis infection. Frontiers in Immunology. 2018; 9

Chemical Pathology

Head of department: Dr V Gounden

1. About the department

The Department of Chemical Pathology at the Academic Complex of King Edward VIII Hospital (KEH) and Inkosi Albert Luthuli Central Hospital (IALCH) provides a 24-hour diagnostic and consultative service for the academic complex and is a referral centre for the entire KZN province for specialist tests. Consultative services and regional coverage across KZN are provided by five consultant chemical pathologists at the Academic complex and one at the Midlands complex. The department is involved in regional coverage, including presenting and participating in CPD activities and training for the KZN region (see figure UKZN 1).

Figure UKZN 1: One of the department senior registrars Dr Moodley, busy with a CPD presentation at a coverage sit

During the course of the financial year, the pathologists and senior registrars conducted over 30 site visits across the KZN region and worked with the KZN DoH laboratory coordinator on the electronic gate keeping roadshow. The department participates in undergraduate and postgraduate training at the UKZN. It trains specialists in chemical pathology and currently has five registrars in the programme. The department is also accredited for the training of intern medical scientists.The department provides in-service teaching and training to student medical technologists and technicians registered for both chemical and clinical pathology.

2. Diagnostic service

The total workload for the period 2017/2018 for the KEH laboratory is over one million tests, and for IALCH, the workload was over 2.2 million billable tests. The IALCH laboratory provides specialised testing services to KZN province. Intra-operative parathyroid testing was introduced by the laboratory at IALCH in March 2018. Both the KEH and IALCH laboratories retained their SANAS accreditation status in 2017. Staff shortages, particularly technical staff and failure of posts to be advertised continue to be a challenge. The laboratory participates in various EQA programmes throughout the year, such as Thistle, Royal College of Pathologists of Australia and United Kingdom National External Quality Assessment Service.

Table UKZN 1: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists		2				6	6
Medical scientists			2			2	2
Technologists					15		15
Intern scientists				1		1	1
Technicians					9	9	9
Support						13	13
All							46

3. Teaching, training and professional development

3.1 Undergraduate

The department contributed to lectures, student assessments, and to the content of the curriculum for the medical students at the Nelson R Mandela School of Medicine. Pathologists from the department are involved in the coordination of blocks, setting of exam questions and review of exam papers. The department also collaborates with the DUT and provides lectures for certain modules in the BTech programme.

3.2 Postgraduate

Registrars in chemical pathology participate in a four-year MMed course, which covers theoretical and practical training and includes the submission of a research project. Training provided to registrars includes regular tutorials, case and calculation discussions, essay writing practice and regular wet practical sessions. Registrars are assigned to different bench rotations and are involved in diagnostic service delivery. They also contribute to monitoring and troubleshooting of internal quality control and EQA schemes, as well as laboratory method evaluations. Registrars are involved in the teaching of medical students, technologists and technicians. The department also provides teaching for other specialty postgraduate students and is accredited to train intern medical scientists.

3.3 Technologists and technicians

The department provides in-service teaching and training to student medical technicians and technologists registered for chemical pathology and clinical pathology. It is also actively involved in coverage (outreach activities) across sites in KZN, assisting with educational activities, training and quality assurance matters.

3.4 Professional development

Academic meetings are conducted that include case presentations, seminars and journal reviews twice weekly. The department also engaged in educational activities for clinicians, covering optimal test requesting and sample collection.

Table UKZN 2: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern medical scientists	Honours	Technologists	South Africans
Total number of trainees			5	2			7
Final year trainees			3	0		8 (wrote in March awaiting results)	11
Successful completion			0	1			1

4. Awards

a) Gounden V: Loreal Women in Science (Africa) award for PhD study (November 2017); NRF Thuthuka Research Grant (February 2018); NHLS Trust Research Grant Award (Feb 2018).

b) An honourable mention at PathReD Congress 2017 for the following presenters: Rampursat Y, Warasally Z and Reddy A.

5. Research activities

5.1 Research units and study groups linked to the department

Project title: MANAGE Study
Principal investigator: Dr B Biccard (UKZN)
Sub-investigator: Dr Prebashini Naidoo (NHLS, UKZN)
Short description: The MANAGE clinical trial is a multicentre international study. It is coordinated by the Population Health Research Institute (PHRI) in Canada and commenced at IALCH in April 2014 where it is managed by the pre-operative research group led by Prof. Biccard. The aim of the trial is to investigate the usefulness of Dabigatran and Omeprazole following post-operative cardiovascular damage in non-cardiovascular surgery. To date, 65 patients have been recruited. Several biochemical markers are reviewed in the routine management of these patients. Additional testing is coordinated via the MANAGE team.
Project start date: 2013
Project end date: 2017

Project title: Primary hypertension prevalence and risk factors in Grade XII learners in Durban, South Africa
Principal investigator: Prof. R Bhimma (UKZN)
Sub investigator: Dr V Gounden (NHLS,UKZN)
Short description: The project is being coordinated by the paediatric and adult nephrology departments at IALCH/UKZN. The purpose of this study is to determine the prevalence of hypertension, and define its contributing risk factors in Grade XII learners in Durban, South Africa.
Project start date: 2017
Project end date: 2018

5.2 Research Projects [Please include short description, funder, start and end date of all the projects]

Project title: Effect of environmental endocrine disruptor Bisphenol A on epigenetic regulation of steroid hormone metabolism and influence on associated levels of hormones among mother and child pairs
Principal investigator: Dr V Gounden

Short description: Environmental pollutants have been shown to have significant effects on human health. Steroid hormone function has been shown to be affected by these pollutants in particular endocrine disruptors. Maternal exposure and the subsequent effects on progeny have been demonstrated to be not just through direct action of toxins on tissue, but also as a result of epigenetic changes. The objectives of this study were to:

- Determine the serum levels of common environmental endocrine disruptor Bisphenol A in a sample of mother-child pairs;
- Characterise the presence of epigenetic changes (DNA Methylation and microRNAs expression) affecting genes coding for key enzymes (CYP3A(4), CYP1B1, CYP1A1, EPHX1,CYP2D6) responsible for steroid metabolism;
- Determine the serum levels of steroid hormones within the sample; and
- Determine the presence of associations between levels of Bisphenol A and presence of de scribed epigenetic changes.

Project start date: 2017
Project end date: Ongoing

Project title:	Assessment of tumour marker test requesting practices pre- and post electronic gate keeping in KZN, South Africa
Investigator:	Dr IS Dlamini
Project title:	Comparison of 24-hour urine versus a random urine sample for determination and quantification of Bence Jones protein
Investigator:	Dr A Reddy
Project title:	Comparison of Procalcitonin to C-reactive protein for the diagnosis of bacterial meningitis in children.
Investigator:	Dr U Ngxamngxa
Project title:	The performance of the chronic kidney disease epidemiology collaboration equation in the South African Kwa Zulu-Natal population to measured glomerular filtration rate and a proposed population specific correction factor
Investigator:	Dr N Pillay
Project title:	The prevalence of cystic fibrosis transmembrane regulator protein mutations in a KZN population.
Investigator:	Mr Thabo Magwai
Project title:	An Audit of Critically Low Serum Cortisol Result Reporting in a South African Academic Laboratory
Investigator:	Dr Prisha Naidoo

6. Research output

6.1 Journal publications

Rampursat Y, Bhimma R, Naicker E, Peer F, Gounden V. Evaluation of the revised Schwartz creatinine-based glomerular filtration rate estimating equation in Black African children in KwaZulu-Natal, South Africa. Ann Clin Biochem. 2017 Nov 1:4563217734573. DOI: 10.1177/0004563217734573

Jialal I, Gounden V. Reporting LDL-cholesterol levels in the era of intensive lipid management: a clarion call. Clin Chem Lab Med. 2017 Aug 28;55(10):1447-1449

Gounden V. Considerations regarding point-of-care testing. SAMJ. 2018;108;250

6.2 Book chapters

Gounden V, Jialal I.Hyperpituitarism.StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. 2018 Jan 26.PMID: 29489207

Gounden V, Jialal I.Fructosamine.StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. 2018 Jan-.2017 Dec 3.PMID: 29262081

Gounden V, Jialal I.Hypopituitarism (Panhypopituitarism). StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. 2018 Jan. 2017 Nov 16.PMID: 29262053

6.3 Conference presentations

6.3.1 Orals

International

Title: Translation from big data to clinically useful test
Speaker: V Gounden
Conference: IFCC Worldlab congress Durban, South Africa, October 2017

National

Title: An Audit Of The Prevalence Of Variants Of Glycated Haemoglobin On The Tosoh G8 In Ialch, Durban From January-May 2016
Authors: U Ngxamngxa, P Naidoo and V Gounden
Conference: PathReD Congress 2018

Title: Positively Precipitating Prolactin
Authors: U Ngxamngxa1 and V Gounden1
Poster/Oral: Oral
Conference: SLMTA (Lab Medtech Congress)

Title: The Case of the Solid Serum
Authors: Dr N Moodley and Dr V Gounden
Conference: Laboratory Medicine Congress

Title: Can ALP handle the heat
Authors: A Reddy and V Gounden
Conference: Laboratory Medicine Congress

6.3.2 Posters

International

Title: A case of too much protein.
Authors: U Ngxamngxa , V Gounden and Y Rampursat.
Conference: International Conference of Paediatric Laboratory Medicine (ICPLM), Durban, October 2017.

Title: Survey of arterial blood gas (ABG) analyser use at IALCH and surrounding hospitals.
Authors: U Ngxamngxa and P Naidoo.
Conference: IFCC-WorldLab Congress, Durban, October 2017.

Title: A Case Series: Falsely elevated glucose readings in children with undiagnosed galactossemia.
Authors: Dr N Moodley and Dr V Gounden.
Conference: ICPLM. Durban, October 2017.

Title:Analysis Of Citrulline With Thin Layer Chromatography.
Authors: Dr N Moodley and Mr Zain Warasally.
Conference: IFCC-WorldLab Congress, Durban, October 2017.

Title: The Effect Of Triton X-100 On Chemistry Analytes.
Authors: N Moodley, P Moodley and V Gounden.
Conference: IFCC-WorldLab Congress, Durban, October 2017.

Title : A cross-sectional pilot study for identification of the CFTR gene Mutations (3120 + 1GàA, 2307InsA, A599T and 3849 + 10Kb CàT) using a quantitative real-time PCR method, for the improvement of the diagnosis of cystic fibrosis in a South African population.
Authors: Magwai Thabo, Warasally Zain and Gounden Verena.

Conference: IFCC-WorldLab Congress, Durban. October 2017.

Title:The Misunderstood Thyroid.
Authors: A Reddy and V Gounden.
Conference: ICPLM, Durban, October 2017.
Title: Retrospective analysis of urine drug of abuse testing at IALCH Durban.
Authors: A Reddy, P Naidoo, P Naidoo, T Magwai and Z Warasally.
Conference: IFCC-WorldLab Congress, Durban, October 2017.

Title: Blood borne Hepatitis B contamination in sample processing areas and lab automation systems.
Authors: S Dlamini, K Govender , N Msomi and V Gounden.
Conference: IFCC-WorldLab Congress, Durban, October 2017.

National

Title: Evaluation Of The Biorad Variant Ii Turbo Hba1c.
Authors: Warasally Zain, Magwai Thabo, Naidoo Prebashini and Gounden Verena.
Conference: PathReD.

Title : An Audit Of Vitamin D Status Within A South African Population.
Authors: Warasally Zain, Magwai Thabo, Naidoo Prebashini and Gounden Verena.
Conference: PathReD.

Title: Inversion of HbA1c sample prior to analysis: Outcomes of a local hospital study.
Authors: A.Reddy, V Gounden, T Magwai and Z Warasally.
Conference: PathReD.

7. Workshops attended/skills training

- RIQAS Roadshow, March 2018 attended by registrars and technologists from the department;
- Various training sessions for analysers and small equipment were held during the course of the year;
- A UCT Training in DNA diagnostics practical course was conducted in June 2017;
- An IFCC POC Workshop took place in October 2017;
- A seminar: Assessment in health sciences: how to move forward took place in UKZN in September 2017; and
- A CMSA exam workshop was conducted in Durban in May 2017.

Haematology

Head of Department: Dr VL Naicker (retired March 2017)
Acting Head: Dr N Rapiti (April 2017 – Current)

1. About the Division

The KZN Academic complex (includes Albert Luthuli Hospital, King Edward V111 Hospital and the Nelson Mandela School of Medicine) provides a 24 hour haematology pathology and clinical consultative service to KZN, and parts of Eastern Cape. Laboratory services fall under the NHLS KZN Academic complex, whilst clinical services at King Edward V111 hospital is jointly managed by DOH and NHLS. These laboratories service the clinical needs of the quaternary/tertiary services at IALCH as well as the tertiary/regional requirements of KEH.

Table UKZN 3 : Total number of NHLS-staff per profession and highest qualification

	Pathologist	PhD Scientist	Technologists	South African	All
Total	3	0	13	16	16

2. Diagnostic Servicesw

The diagnostic haematology platform includes general haematology, specialised haematology and immunology.
KEH has been SANAS accredited for 3 years, and IALCH is preparing for pre-SANAS accreditation later this year. At the clinician's request, the anti-Xa assay has been re-introduced. The Immunology laboratory is also preparing to take on the workload of the Public Health service.

The haematology laboratory at Albert Luthuli hospital provides a 24-hour service to clinical departments within the hospital, and serves as a referral laboratory for KZN for morphology, immunophenotyping, molecular testing and immunology. King Edward V111 Hospital Haematology lab provides a 24-hour service to the clinical units at KEH, Chesterville clinic, Cato Manor clinic, Masiphile Clinic and the South African Clothing and Textile Workers Union.

3. Teaching, Training and Professional Development

The department lost its accreditation for postgraduate training in September 2016. A formal teaching structure has been reinstituted, with the programme working towards university CAAB approval in July 2018. The plan is to re-apply for HPCSA review later this year.

The department lectures to the 3rd, 4th and final year medical students, and also contributes to the haematology teaching of the BSc students. Haematologists are involved in the undergraduate examination process, as well as postgraduate examinations. The medical undergraduate haematology programme has been reviewed, with an increase in lectures during the 3rd year module. A 6th year handbook has been drawn up, as a haematology pocket guide.

Registrars that wrote CMSA examinations April 2017 – March 2018

Dr L Chili	Part I	Successful (July '17)
Dr S Murugan	Part II	Successful theory/Unsuccessful practical
Dr Mahooa	Part 11	Unsuccessful
1 registrar resigned.		

Table UKZN 4: Total number of trainees per qualification category and rates of successful completions/pass rates

Student qualification	Total Number of enrolled students 2017	Final Year Trainees	Successful Completion	Percentage of Successful Completions
Haematology pathology trainees*	0	3	0	0%
Intern medical scientist	1	0	0	0%
Honours medical science	0			0%
MMed	2	2	2	100%
MSc Medical science	1	1	1	0%
PhD medical science	0	0	0	0%

4. Research Activities

4.1 Research Projects 2017-2018:

MMed Project title: The prevalence and aetiology of moderate /severe thrombocytopenia in a tertiary and quaternary laboratory in Durban KwaZulu-Natal South Africa.

Principal investigator: Dr AGP Jali
Supervisor: Dr. B Nkambule
Status: Completed
Funding: None

Short description: Retrospective analysis of FBC ® to assess prevalence and aetiology of moderate and server thrombocyto paenia in tertiary and quaternary laboratory in KZN
Project start date: October 2015
Project end date: 2018

MMed Project title: A review of Aplastic/Hypoplastic Anaemia diagnosed on bone marrow samples at the Haematology Laboratory at National Health Laboratory Service (NHLS), Inkosi Albert Luthuli Central Hospital, Durban, Kwa-Zulu Natal. Principal investigator: Dr Z Moorad

Supervisor: Dr F Fazel
Status: Completed
Funding: None
Short description: Retrospective review of cases with Aplastic Anaemia
Project start date: Jan 2016
Project end date: Nov 2017

MMed Project title: Distribution of PML-RARA isoforms in Acute Promyelocytic Leukemia Patients from a tertiary hospital in KZN, South Africa using qPCR.

Principal investigator: Ms Safiya Ebrahim
Supervisor: Dr M Gordon
Status: Completed
Funding: None
Short description: Indentification and distriction of PML – RARA isoforms in from samples collected routinely in 2007.
Project start date: 2012 Jan
Project end date: 2017 July

MMed Project title: Megakaryocyte morphology in clonal and reactive myeloid hyperplastic conditions.
Principal investigator: Dr S Murugan
Supervisor: Dr. Dashini Pillay

Co supervisor: Dr. N Rapiti
Short description: Restrospective descriptive study. Bone marrow aspirate and trephine slides of confirmed myeloproliferative neoplasms and reactive hyperplasia cases, with white cell counts of greater than 13 will be analysed blindly by the investigator. The megakaryocyte morphology of all cases will be analysed. The information obtained from this data will be used to determine whether changes noted in the megakaryo cyte morphology can assist in differentiating between the myeloproliferative disorders, as well as differen tiating between the myeloproliferative disorders and reactive myeloid hyperplasia cases.

Project start date: July 2016.
Ethics approved in July 2016.
Recertification approved now till July 2019

Project end date: December 2018

MMed Project title: Comparison of bonemarrow morphology, Ziehl Nielsen immunohistochemistry and TB cultures in diagnosing of bone marrow infection by tuberculosis. An Inkosi Albert Luthuli Central Hospital NHLS experience.

Principal investigator: Dr TH Mahooa
Supervisor: Dr R Singh
Co supervisor: Dr N Rapiti
Funding: None
Short description: To assess if TB histology correlates with TB culture finding in our section.
Project start date: 01/01/2013
Project end date: 31/12/2018

MMed Project title: Comparison of the diagnostic sensitivity of bone marrow trephine biopsy versus that of PET-CT for the diagnosis of bone marrow involvement in HIV-related lyphomas.

Principal investigator: Dr LH Chili
Supervisor: Dr. Nyakane (Nuclear Medicine)
Co supervisor: Dr. N Rapiti
Funding: None
Short description: Descriptive retrospective study of bonemarrow involvement on PET –CT and BM morphology assessment and radio-nucleotide imaging.
Project start date: 01/04/2017
Project end date: 30/06/2019

5. Research Outputs

None

5.1 Journal Publications

None

5.2 Conference Presentations

5.2.1 Oral presentations

AfriFlow workshop JHB 2017 cohosted by IALCH Haematology

5.2.2 Poster presentations

Aboratory Perspective On The Monitoring Of Polymerase Chain Reaction BCR-ABL Transcripts In Chronic Myeloid Leukemia Authors names: Mahooa Thabiso, Chili Lungisile Islam Ferdousi, Murugan Stephanie, Pillay Dashini , PathRed congress 2017

Naturally occurring anticoagulants (Protein c, Protein s and Antithrombin) assay requests at an academic laboratory
Author Names: Murugan Stephanie; Pillay Dashini
Affiliations: National Health Laboratory Services (NHLS), South Africa1

6. Academic and Research/Recognition Awards

None

7. Additional Information

None

Medical Microbiology

Head of department: Prof KP Mlisana

1. About the department

The KZN Academic Complex consists of laboratories at both IALCH and KEH. The microbiology department is the provincial referral laboratory for bacteriological, fungal and mycobacterial identification and susceptibility testing. The Microbiology Academic Laboratory currently covers all tertiary and regional hospitals in the province, mostly with onsite microbiologists. These include the Pietermaritzburg Complex (Northdale, Edendale and Greys hospitals), Addington, Prince Mshiyeni Memorial (PMMH), R.K Khan, King Dinizulu (KDH) and Mahatma Gandhi Memorial (MGMH) hospitals. All joint staff microbiologists are incorporated into the staff complement of the academic complex, which boosted service, research and the training capacity of the department. Well-structured and consistent consultative microbiology service, including regular visits and telephonic consultations were provided to all larger KZN hospitals with ICU wards. These include Madadeni, Ngwelezane, Stanger, Hlabisa, Benedictine, Greytown, Kokstad and Port Shepstone hospitals.

The research focus areas of the department include TB (diagnostics, drug resistance and paediatric TB), STIs and other multidrug resistant microorganisms. Within UKZN, research collaborations were established with CAPRISA, the Neurology Department, Paediatrics Department and the Department of Pharmaceutical Sciences. External collaborations include the Microbiology Department at UCT, Emory University (USA), TB Alliance, NY and Yale University.

The department is actively involved in the teaching and training of both undergraduates (medical students, health science students, medical technicians and medical technologists) and postgraduate students (registrars, infectious disease trainees, honours students, medical doctors and nurses, masters and PD students).

Table UKZN 1: Total number of staff per profession and highest qualification (as of 31 March 2018)

	Pathologists	Medical doctors	Scientists	Technologists	Support	South African	All
TOTAL	12	9	2	16	38	77	77

2. Diagnostic services

A 24-hour consultative service is offered by pathologists and registrars to all hospitals in KZN. This includes daily ward rounds, infection prevention and control and antibiotic stewardship activities in hospitals at which pathologists are based. In addition, pathologists are assigned to microbiology laboratories throughout the province. Services include monthly laboratory visits, extensive telephone and e-mail advice to improve the quality of microbiology results and telephonic consultations with clinicians. It is envisaged that this would greatly assist these laboratories towards achieving SANAS accreditation within the next financial year.

[1]The IALCH TB laboratory is the only culture facility in KZN that offers identification and susceptibility testing of M. tuberculosis. Susceptibility testing for both first- and second-line drugs are performed, using phenotypic and genotypic platforms. The identification of non-tuberculous mycobacteria using the line probe assay (LPA), is done routinely on all sterile sites. IALCH is the reference laboratory for all other microbiology laboratories in KZN for bacteriology and mycology. The bacteriology section offers confirmatory identification, susceptibility and serotype testing and the mycology section performs yeast and mould identification and susceptibility testing.

3. Teaching, training and professional development

Undergraduate and postgraduate students from UKZN, as well as technicians and technologists in training from DUT and Mangosuthu University of Technology receive teaching and training by the department. The TB laboratory, in collaboration with CAPRISA and DoH, is involved in training of doctors and nurses throughout the province. These comprehensive sessions discuss the laboratory diagnosis and management of MDR TB and other HIV-related co-morbidities. Postgraduate students and Post-doctoral fellows from other department, such as CAPRISA, Physiology and HPP, are furthermore trained in basic and advanced real-time PCR assays.

3.1 Undergraduate

Over 50 microbiology lectures and practical sessions are presented to approximately 250 undergraduate medical students in the first three years of the MBChB programme. During the second year, the medical students receive basic immunology lectures and lectures related to systems. Most of the microbiology teaching occurs in the third year, during a six-week infectious disease module. The department also run a series of lectures on Infectious Diseases for fourth-year medical students. A medical microbiology module is also offered to third-year BMedSc students. This second semester course, which is held at the Westville campus, includes didactic lectures and computer-based practical sessions. A module on Microbial pathogenesis is also offered to Medical Microbiology Hons students. Pathologists in the department supervise these Hons students on their research projects.

A practical, one-week course in Gene Expression, which includes RNA extraction from mammalian cells, complementary DNA synthesis, and basic and advanced real-time PCR is presented in the first semester to Hons students. Basic microbiology lectures are delivered to health sciences students, predominantly comprising audiology, physiotherapy and sport science students. The laboratory is accredited to provide experiential training to medical technologists and to train medical technicians. A weekly CPD-programme is conducted for all staff members.

3.2 Postgraduate

A comprehensive training programme that encompasses theory and practical aspects of medical microbiology is offered to MMed registrars, intern medical scientists and fellows in infectious diseases. Registrar training comprises daily informal teaching at the bench and bedside, as well as formal tutorials. In addition, registrars are involved in EQA programmes and have mock theory and practical examinations throughout the year. The department also trains Masters and PhD students.

Interdepartmental academic meetings include weekly journal presentations, seminars, infectious disease case presentations and monthly research updates on projects related to the department.

Table UKZN 2: Number of postgraduate trainees per category that completed/are still in training

	Total number of trainees	Final year trainees	Successful completion	% of Successful completions
BSc Hons	10	10	10	100%
MSc	4	2	2	-
PhD	7		1	
Registrars	9	2	2	100%
Med ech Student	6	4	4	100%
Intern Med Scientist	1	1		100%
Post doc	-	-	-	-
All	37	19	19	100%

4. Research activities

The department's research focus is on pathogenesis, newer diagnostics and antimicrobial resistance of infectious pathogens. There is a strong focus on TB and sexually transmitted infections, as well as multi-drug resistant organisms causing healthcare-associated infections. TB-related research includes understanding drug resistant TB [monoresistance (Rif & INH) and M(X)DR-TB]; transmission dynamics and rapid diagnostics. A molecular diagnostic laboratory for STIs was established, with a special focus on bacterial vaginosis and drug resistance in gonococcal infections.

Numerous STI detection assays were developed and validated and we are developing drug resistance assays for STIs, using Sanger sequencing and real-time PCR. Conventional minimal inhibitory concentrations (MICs) for STIs are also performed in the department with special attention to Neisseria gonorrhoeae.

4.1. Research units and study groups linked to the department Centre for the AIDS Research in South Africa

The Microbiology department built strong relations with CAPRISA, exploring newer diagnostics in STIs as part of understanding drivers of HIV transmission in young women as well as joint supervision of postgraduate students in TB pathogenesis research and healthcare workers' training.

SARChI: Antibiotic Resistance and "One Health": Antimicrobial Research Unit

Unit Director: Prof Sabiha Essack

Amongst other research priorities, this unit aims to comprehensively delineate the molecular epidemiology, nature and extent of ABR in human, animal and environmental health in the "One Health" context to inform evidence-based strategies for its monitoring, prevention and containment. Our department partnered with the unit to share expertise, laboratory resources and contribute to human capital development and post graduate training.

4.2. Research Projects

Project title: Laboratory detection of rifampicin low level resistance in Mycobacterium tuberculosis
Investigators: NR Dlamini (NHLS/UKZN), M Pillay (UKZN) and KP Mlisana (NHLS/UKZN)

Project title: A novel standardized approach to the treatment and management of significant Acinetobacter species infection in KwaZulu-Natal (PhD project)
Principle investigator: Dr KS Han (NHLS/UKZN)
Supervisor: Dr. M Pillay (UKZN)
Co-supervisors: Prof K Mlisana (NHLS/UKZN) and Dr. K Baba (2017 September - PhD Degree Awarded)

Project title: The Utility of Nybomycin and Related Compounds against Various Drug-Resistant Human Pathogens (PhD project)
Principal investigator: Dr. A Niehaus (NHLS/UKZN)
Supervisor: AW Sturm (UKZN)
Funding: NRF Thuthuka and the UKZN Medical Education Partnership Initiative (MEPI) REMETH Programme

Project title: Effect of the Capsular material of Cryptococcus neoformans on the interplay between microglial cells and neutrophils.
Principal investigator: Dr.P.Bhola (NHLS/UKZN) - PhD project
Supervisor: AW Sturm (UKZN)
Funding: NHLS

Project title: Antimicrobial Susceptibility Patterns of Uropathogens isolated from Pregnant women in KZN: 2011 – 2016
Investigators: P Bhola, N Mvelase and KP Mlisana

Project title: Triangulating the Molecular Epidemiology of Carbapenem-Resistant Enterobacteriaceae from humans, animals and the environment
Principal investigator: Dr Y Ramsamy (NHLS/UKZN) - PhD project
Supervisors: Prof K Mlisana (NHLS/UKZN) and Prof S Essack (UKZN)
Funding: SARChI (NRF)

Short description: The aim of this project is to comprehensively delineate the molecular epidemiology, nature and extent of CRE in human, animal and environmental health in the "One Health" context. Our aim is to draw comparisons of CRE carriage between humans, animals, environmental effluent and water within the same geographical area.

Project title: eAMR: ICT Solutions for Real-Time Electronic Monitoring of AMU (use) and AMR in the "One Health" Ap proach (SA MRC – UK MRC Collaborative Research Programme On AMR)

Principal investigator: S Essack
Co-investigator: K Mlisana
Funding: SARChi (NRF)

Project title: Rapid Diagnosis of Tuberculous Meningitis: Detection of Tuberculostearic acid in Cerebrospinal Fluid
Principal Investigator: K Mlisana
Funding: NHLS Research Trust

Project title: Laboratory diagnosis and susceptibility testing of sexually transmitted pathogens in young women at risk for HIV
Principal investigator: SA Karim (DST-NRF Centre of Excellence in HIV Prevention)
Co-investigator: K Mlisana
Funding: DST and NRF
Short description: In an effort to improve diagnosis and management of STIs in young women in KZN, this grant enabled the department to establish an STI diagnostic laboratory that currently supports various research organisa tions and creates a platform for training of both Masters and PhD students.
Project start date:
Project end date:

Project title: The Role of Casual Contact and Migration in XDR TB Transmission in South Africa: a Geospatial, Genomic and Social Network study
Principal investigators: K Mlisana and N Gandhi
Funding: NIH

Short description: This is a prospective, cross-sectional study of newly-diagnosed, culture-confirmed XDR TB cases, identified from the provincial TB reference laboratory. Geospatial and social network analysis will be used to identify epidemiologic links between participants. Each participant's TB isolate will undergo WGS to identify ge nomic connections. An integrated analysis of geospatial, genomic, and social network data will enable us to comprehensively characterize the contributions of casual contact and migration to XDR TB transmission.

Project start date:

Project end date:

Projects for registrars - MMed research projects

Project title: A proof of concept study investigating the capability of Staphylococcus aureus to form dry surface biofilms on stethoscope diaphragms and the capability of a commercially available biomimetic micropat terned surface technology in inhibiting Staphylococcus aureus dry surface biofilms
Student: Dr KS Aboo
Supervisor: Prof K Mlisana
Funding: None

Project title: Post-pasteurisation testing of breastmilk sterility at human milk banks (HMBs): an alternative to standard microbiological quality testing suitable for rural HMBs?
Student: Dr L Gumede
Supervisors: Prof K Mlisana and Prof A Coutsoudis

Funding: None

Project title: The Use of genotypic and phenotypic assays to determine pathogens causing chronic otitis media in children and adolescents
Student: Dr J de Meyer
Supervisor: Prof K Mlisana
Funding: Yale University

Project title: Phenotypic identification and characterization of Bacterial Vaginosis associated pathogens in vaginal swabs of sexually active women
Student: Dr N Mzimela
Supervisor: Prof K Mlisana
Funding: CoE for HIV Prevention (CAPRISA)

Project title: Laboratory Screening and prevalence of Carbapenemase Producing Enterobacteriaceae from Inkosi Albert Luthuli Central Hospital (IALCH)
Student: Dr S Maphumulo
Supervisors: Prof K Mlisana and Dr KS Han
Funding: NHLS

Project title: Urinary Tract infection in Paediatric patients; analysis of data, a retrospective study
Student: Dr B Seme
Supervisors: Prof K Mlisana and Prof Bhimma (IALCH)
Funding: None

Projects for Masters students

Project title: Evaluating molecular diagnostic tools for the identification and susceptibility profiles of Neisseria gonor rhoeae using phenotypic and molecular assays.
Student: N Mitchev N
Supervisors: R Singh and Prof K Mlisana
Funding: COE for HIV Prevention (CAPRISA)

Project title: Molecular characterization of Chlamydia trachomatis isolates using sequence variation in the major outer membrane protein gene (omp1) and evaluation of their antibiotic susceptibility profile
Student: T Khanyile
Supervisors: R Singh and Prof K Mlisana
Funding: COE for HIV Prevention (CAPRISA)

Project title: Resistance profiles in Mycobacterium tuberculosis to Bedaquiline in MDR and XDR patients
Student: M Dhooma
Supervisors: SV Omar (NICD) and Prof K Mlisana
Funding: None

Project title: Rifampicin MIC determination and molecular characterisation of Mtb isolates from persistently TB cul ture-positive individuals after 2 months of anti-TB treatment.
Student: W Mfati
Supervisors: R Singh and Prof K Mlisana
Funding: None

5. Research output

5.1 Journal publications

Seipone ID, Singh R, Patel VB, Singh A, Gordon ML, Muema DM, Dheda K, Ndung'u T; Tuberculous meningitis is associated with higher cerebrospinal HIV-1 viral loads compared to other HIV-1-associated meningitides. PLoS One. 2018 Feb 2;13(2)

Muenchhoff M, Healy M, Singh R, Roider J, Groll A, Kindra C, Sibaya T, Moonsamy A, McGregor C, Phan MQ, Palma A, Kloverpris H, Leslie A, Bobat R, LaRussa P, Ndung'u T, Goulder P, Sobieszczyk ME, Archary M; Malnutrition in HIV-Infected Children Is an Indicator of Severe Disease with an Impaired Response to Antiretroviral Therapy. AIDS Res Hum Retroviruses. 2018 Jan; 34(1):46-55. DOI: 10.1089/AID.2016.0261. Epub. 2017 Sep 6. PMID: 28670966

Naidoo A, Ramsuran V, Chirehwa M, Denti P, McIlleron H, Naidoo K, Yende-Zuma N, Singh R, Ngcapu S, Chaudhry M, Pepper MS, Padayatchi N; Effect of genetic variation in UGT1A and ABCB1 on moxifloxacin pharmacokinetics in South African patients with tuberculosis. Pharmacogenomics. 2018 Jan;19(1):17-29. doi: 10.2217/pgs-2017-0144. Epub. 2017 Dec 6. PMID: 29210323

Moosa Y, Tanko RF, Ramsuran V, Singh R, Madzivhandila M, Yende-Zuma N, Abrahams MR, Selhorst P, Gounder K, Moore PL, Williamson C, Abdool Karim SS, Garrett NJ, Burgers WA; Case report: mechanisms of HIV elite control in two African women. BMC Infect Dis. 2018 Jan 25;18(1):54

Singh-Moodley A, Duse A, Naicker P, Kularatne R, Nana T, Lekalakala R, Mbelle N, Dawood H, Swe-Han KS, Ramjathan P, Bohla P, Whitleaw A, Perovic O; Laboratory based antimicrobial resistance surveillance for Pseudomonas aeruginosa blood isolates from GERMS South Africa. Accepted 29 Jan 2018 from The Journal of Infection in Developing Countries. (As a Contributor).

Brust J, Shah NS, Mlisana K, Moodley P, Allana S, Campbell A, Johnson BA, Master I, Mthiyane T, Lachman S, Larkan LM; Improved survival and cure rates with concurrent treatment for MDR-TB/HIV co-infection in South Africa. Clinical Infectious Diseases. 2017 Dec 26. DOI: 10.1093/cid/cix1125. [Epub ahead of print]
Reddy S, Ntoyanto S, Sakadavan Y, Reddy T, Mahomed S, Dlamini M, Spooner B, Ramjee G, Coutsoudis A, Ngomane N, Naidoo K, Mlisana K, Kiepiela P; Detecting Mycobacterium tuberculosis using the loop-mediated isothermal amplification test in South Africa. The International Journal of Tuberculosis and Lung Disease. 2017 Oct; 21(10):1154-60

Mitchev N, Singh R, Naidoo J, Osman F, Samsunder N, Garrett N, Mlisana K; P3. 168 Evaluation of the point-of-care xpert® CT/NG and osom® trichomonas rapid tests against the anyplex™ ii STI-7 detection assay. (Abstract published: 28 September 2017)

Garrett N, Ngubane N, Osman F, Naicker N, Mitchev N, Mlisana K, Ngomane N, Ngobese H, Dlamini N, Naidoo J, Samsunder N; P3. 166 High chlamydia and bacterial vaginosis burden in HIV epicentre in South Africa. (Abstract published: 28 September 2017)

Dorward J, Garrett N, Quame-Amaglo J, Samsunder N, Ngobese H, Ngomane N, Moodley P, Mlisana K, Schaafsma T, Donnell D, Barnabas R; Protocol for a randomised controlled implementation trial of point-of-care viral load testing and task shifting: the Simplifying HIV TREAtment and Monitoring (STREAM) study. BMJ Open. 2017 Sep; 7(9):e017507

Goenka A, Jeena PM, Mlisana K, Solomon T, Spicer K, Stephenson R, Verma A, Dhada B, Griffiths MJ; Rapid Accurate Identification of Tuberculous Meningitis Among South African Children Using a Novel Clinical Decision Tool. The Pediatric Infectious Disease Journal. 2017 Aug 28

Khedr MA, Pillay M, Chandrashekharappa S, Chopra D, Aldhubiab BE, Attimarad M, Alwassil OI, Mlisana K, Odhav B, Venugopala KN; Molecular Modeling studies and anti-TB activity of trisubstituted indolizine analogues; Molecular docking and dynamic inputs. Journal of Biomolecular Structure and Dynamics. 2017 Aug 10:1-6

du Plessis M, Wolter N, Allam M, de Gouveia L, Moosa F, Ntshoe G, Blumberg L, Cohen C, Smith M, Mutevedzi P, Thomas J. Molecular Characterization of Corynebacterium diphtheriae Outbreak Isolates, South Africa, March–June 2015. Emerging infectious diseases. 2017 Aug;23(8):1308

Naidoo A, Ramsuran V, Chirehwa M, Denti P, McIlleron H, Naidoo K, Yende-Zuma N, Singh R, Ngapu S, Pepper M, Chaudhry M; The Effect of Genetic Variation in UGT1A and ABCB1 on Moxifloxacin Pharmacokinetics in South African Patients with Tuberculosis. Clinical Therapeutics. 2017 Aug 1;39(8):e44-5

Mahomed S, Archary M, Mutevedzi P, Mahabeer Y, Govender P, Ntshoe G, Kuhn W, Thomas, Olowolagba A, Blumberg L, Mccarthy K, Mlisana K, du Plessis M, von Gottberg A, Moodley P; An isolated outbreak of diphtheria in South Africa, 2015. Epidemiol. Infect. 2017 July; 146(5):1

Muenchhoff M, Healy M, Singh R, Roider J, Groll A, Kindra C, Sibaya T, Moonsamy A, McGregor C, Phan MQ, Palma A; Malnutrition in HIV-infected children is an indicator of severe disease with an impaired response to antiretroviral therapy. AIDS Research and Human Retroviruses. 2017 Jul 2

du Plessis M, Wolter N, Allam M, de Gouveia L, Moosa F, Ntshoe G, Blumberg L, Cohen C, Smith M, Mutevedzi P, Thomas J, Horne V, Moodley P, Archary M, Mahabeer Y, Mahomed S, Kuhn W, Mlisana K, McCarthy K, von Gottberg A; Molecular Characterization of Corynebacterium diphtheriae Outbreak Isolates, South Africa, March–June 2015. Emerg Infect Dis 2017 23(8):1308-15

Swe-Han KS, Mlisana KP and Pillay M; Analysis of clinical and microbiological data on Acinetobacter baumannii strains assist the pre-authorization of antibiotics at the patient level for an effective antibiotic stewardship program. Journal of Infection and Public Health. 2017 (10): 608–616

Khine SH, Kamaldeen B, Koleka P, Mlisana KP, Pillay M; Colistin exhibits diverse and species dependent synergy in combination with different antibiotics against Acinetobacter species. World Journal of Pharmacy and Pharmaceutical Sciences. 2017 June; 6(2): 183-199

Han KS, Pillay M, Schnugh D, Mlisana KP, Kamaldeen B, Pillay M; Horizontal transfer of OXA-23-Carbapenemase-producing Acinetobacter species in intensive care units at an academic complex hospital in Durban, KwaZulu -Natal, South Africa. South Africa Journal of Infectious Disease. 2017 June; 23:1-8

Mahomed S, Archary M, Mutevedzi P, Mahabeer Y, Govender P, Ntshoe G, Kuhn W, Thomas J, Olowolagba A, Blumberg L, McCarthy K; An isolated outbreak of diphtheria in South Africa, 2015. Epidemiology & Infection. 2017 May: 1-9

Adler H, Archary M, Mahabeer P, LaRussa P, Bobat RA. Tuberculosis in HIV-infected South African children with complicated severe acute malnutrition. The International Journal of Tuberculosis and Lung Disease. 2017 Apr 1;21(4):438-45

Ramsamy Y, Muckart DJJ, Han KSS, Hardcastle TC, Bruce JL, KP Mlisana; The effect of prior antimicrobial therapy for community acquired infections on bacterial isolates from early and late ventilator acquired pneumonia in a level I trauma intensive care unit. South African Journal of Infectious Diseases. 2017;Vol 32, No 3

Mahomed S, Dlamini-Mvelase NR, Dlamini M, Mlisana K; Failure of BACTEC MGIT 960 to detect Mycobacterium tuberculosis complex within a 42-day incubation period. African Journal of Laboratory Medicine. 2017;6(1):1-3

5.2 Book chapters

Cox H, Dickson-Hall L, Jassat W, Moshabela M, Kielmann K, Grant A, Nicol M, Black J, Mlisana K, Vanleeuw L, Loveday M. Drug-resistant tuberculosis in South Africa: history, progress and opportunities for achieving universal access to diagnosis and effective treatment. In: Padarath A, Barron P (eds). Chapter 15. South African Health Review 2017. Durban: Health Systems Trust. Pp.157-179.
URL: http://www.hst.org.za/publications/south-african-health-review-2017

Williamson C, Morris L, Garrett N, Moore P, Burgers W, Mlisana K. From Bench to Bedside: Lessons from HIV Natural History Cohort Studies. In Abdool Karim Q, Abdool Karim SS, Baxter C (eds). 2017. Chapter 10. The CAPRISA Clinical Trials: HIV Treatment and Prevention. New York: Springer. Pp.137-152. DOI: 10.1007/978-3-319-47518-9_4

4.3 Conference presentations

• International presentations:

Orals

Y Ramsamy. 5-year surveillance of WHO Global Priority Pathogens 2011-2015 in Kwazulu-Natal, South Africa. ECCMID (European Congress of Clinical Microbiology and Infectious Diseases) 2018, Madrid, Spain.

KS Swe-Han. Vitro Synergy of Colistin Combinations against Colistin Resistant Gram-negative Bacteria. Innovate Pharma, 2017. Sydney, Australia. Invited speaker.

KS Swe-Han. To Differentiate Significant Infection or Colonization: Essential for Preauthorisation and Prospective Audit to Optimize Treatment and Assist Antimicrobials Stewardship Programs (ASWPs). BIT's International Drugs Discovery Science and Technology, 2017. Japan. Invited speaker.

K Mlisana. Microbiology Lab Automation: Kiestra Platform, Netherlands, 15 – 19 Oct 2017.

Posters

K Mlisana. Evaluation of ESwabs™ versus Dry swabs for the detection of Neisseria gonorrhoeae using molecular assays in patients with urethritis. ECCMID Vienna 20 - 26 April. Poster presentation.

K Mlisana. Evaluation of the point-of-care Xpert® CT/NG and Osom® trichomonas rapid tests against the anyplex™ II sti-7 detection assay. STI World Conference 2017 Rio. Poster presentation.

NR Mvelase, M Pillay, KP Mlisana. rpoB Mutations Causing Discordant Rifampicin Susceptibility in Mycobacterium tuberculosis in Kwa-Zulu-Natal, South Africa. ASM Conference on Tuberculosis: Past, Present and Future: 1-4 April 2017: New York. Poster presentation. National and Local Presentations:

Orals

K Mlisana. Refocussing on STI management to impact HIV prevention. SA Aids 2017. Durban. Oral Presentation.

K Lutchminarain. Introduction of Drug resistant reflex testing in KZN and Descriptive analysis of Second line mutations. FIDSSA 2017. Oral presentation.

KS Swe-Han. Colistin resistant Acinetobacter species may be mediated by the absence of the IpxA gene at an Academic Complex Hospital in Durban, KwaZulu-Natal, South Africa. UKZN Symposium, 2017. Oral presentation.

K Mlisana. Management of STIs in SA: the new NSP 2017 - 2022!! 'Turning the spotlight on STIs'. FIDSSA 2017. Cape Town. Oral Presentation:

Posters

NR Mvelase, M Pillay, KP Mlisana. rpoB Mutations Causing Discordant Rifampicin Susceptibility in Mycobacterium tuberculosis in Kwa-Zulu-Natal, South Africa. FIDSSA 2017: Cape Town. Poster presentation.

KS Swe-Han, KP Mlisana. Amikacin resistant Acinetobacter species are mediated by the aphA6 gene at an academic complex hospital in Durban, KwaZulu-Natal, South Africa. FIDSSA 2017. Poster presentation.

AJ Niehaus, AW Sturm, R van Aarde, M Arai and P Moodley. The activity of nybomycins against drug-resistant Mycobacterium tuberculosis isolates. FIDSSA 2017, Cape Town, South Africa. Poster presentation.

P Bhola, N Mvelase, KP Mlisana. Urinary Tract Infections in Pregnant Women in KZN: Bacterial Aetiology and Susceptibility. FIDSSA 2017. Cape Town. Poster presentation.

Medical Virology

Head: Dr Pravi Moodley

1. About the department

The department provides all Virology diagnostic and clinical consultative services for all public health facilities in KZN. We also engage in teaching medical, science and technology students. In addition, we are involved in numerous local and international research projects. We had our four-year SANAS re-assessment from 7-8 December 2017 and have been accredited for the next cycle, until December 2021.

Figure UKZN 3: Department of Virology staff members

2. Diagnostic services

Testing of cytomegalovirus (CMV) viral load specimens on the Roche CAPCTM and the number of test requests for this assay increased. We received a new Roche CAPCTM due to the increase in workload. We released about 858 098 results in 2017/2018 of which 445 954 were Viral Serology. There was a 6% increase in HIV PCR workload. A total of 233 449 HIV viral load specimens were tested. The viral PCR workload increased by 11%. A total of 978 HIV DR specimens were tested. HIV drug resistance testing increased due to the CAPRISA Advanced Clinical Care training and the National HIV Treatment Guideline.

All viral serology enzyme-linked immunosorbent assays (ELISAs) for HIV, HAV, HBV, HCV, Rubella, Cytomegalovirus (CMV), Epstein-Barr virus, HSV 1/2 and toxoplasma serological markers are done in KZN routinely. These tests (Table KZN 8) continue to increase due to more requests for HBV from the clinics in the Comprehensive Care Management and Treatment (CCMT) Programme and the change in HIV guidelines.

We also do all viral PCRs (Table KZN 8) testing in KZN for CMV, VZV, HSV, Parvovirus, Respiratory Viruses and Enteroviruses.

Figure UKZN 4: Virology Management staff

Figure UKZN 5: Viral section staff

Figure UKZN 6: Molecular staff members

Figure UKZN 7: Virology reception staff members

Table UKZN 8 :Trends in diagnostic service workload: 2014–2018

	2014/15	2015/16	2016/17	2017/18
HIV Viral Loads	161 806	220 047	189 093	280637
HIV PCR	115 691	159 753	159 055	140690
Viral Serology	360 915	420 706	376 984	320317
Viral PCR	1 483	6 053	9527	5421
HIV Drug Resistance	74	312	385	317

Table UKZN 9: Total number of staff per profession and highest qualification

	Pathologists	Medical doctors	MSc scientists	Technologists	Student technologists	Support	South African	Total
Total	5	3	2	14	3	13	40	40

Table UKZN 10: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	1	6				5	5
Medical scientists	1		2	3		2	2
Technologists					14	14	14
Other*							
South Africans	2	6	2	3	14		

3. Teaching, training and professional development

3.1 Undergraduate level

Seven student medical technologists passed the SMLTSA Medical Technologist Board Examinations in March 2017. One medical technician will be rewriting examinations. Ten student medical technologists wrote in March 2018 and are awaiting their results. We currently have three student medical technologists and one intern medical scientist.

An average of 35 undergraduate science students is taught in their final year BSc (Biomedical Science) per year, with an annual pass rate of 81% in previous years. The pass rate in 2017 was 27 out of 35 students. There are currently 23 students registered in 2018. An average of 200 undergraduate medical students is taught in the first three years of the curriculum. The department plays a much more intensive role in this programme, especially in the third year.

3.2 Postgraduate level

We have four registered PhD students. One registrar wrote FCPath examinations in September 2017 and passed. Two registrars are currently writing these examinations. Two PhD students graduated in April 2017. One Masters student currently completing research.

3.3 Other

Table UKZN 11: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern medical scientists	Honours	All
Total number of trainees	4	1	3	1	2	11
Final year trainees			2			2
Successful completion	2		1			3

4. Awards

- Dr NB Msomi. NHLS Research Trust. Project: Occult Hepatitis B in Haemodialysis units- Durban, South Africa. R99 000;
- Dr NB Msomi. NRF Thuthuka Grant: R250 000 per annum for three years;
- Dr NB Msomi. CAPRISA Fellowship Award; R100 000;
- Miss L Singh. NRF Thuthuka Funding Instrument 2018: R214 000, Thuthuka Funding Instrument 2017: R200 000;
- Dr K Govender. CAPRISA Fellowship Award: R100 000;
- Dr K Govender. NRF Thuthuka Grant: R65 046 per annum for three years;
- Dr K Govender. NHLS Research Trust. Project: CMV pneumonitis in infants in KZN, South Africa and compartmentalisation in the lung compartment: R95 350.41;
- Dr P Moodley. NHLS Research Trust. Project: Clinical laboratory findings of Parvo B virus: R88 735, 90;
- Dr Raveen Parboosing. NHLS Research Trust. Project: Aptamer-functionalised carbosilane dendrimers to reactivate HIV-1 latency: R500, 000;
- Mr W Tebogo. PhD UKZN scholarship: R40,000; and
- Miss C Soobramoney. PhD UKZN scholarship: R40 000.

Student supervisors

Dr NB Msomi: two BSc Hons (Medical Microbiology) students and one BTech student;
Dr R Parboosing: two Masters (co-supervisor) and three PhD (co-supervisor) students and one BSc Hons (Medical Microbiology) student;
Dr K Govender: one BSc Hons (Medical Microbiology) and one BTech student; and
Dr P Moodley: one Masters student, one PhD student and three MMed (Virology) students.

5. Research activities

5.1 Research projects

Project title:	Occult Hepatitis B Virus infection in haemodialysis units-Durban, South Africa
Researcher:	Dr NB Msomi
Co-researchers:	K Ndlovu (UKZN/DoH) and K Mlisana (UKZN/NHLS)
Collaborators:	S Ijaz (Public Health England) and J Giandhari [KwaZulu-Natal Research Innovation and Sequencing Plat form (KRISP), UKZN]
Funding:	NHLS Research Trust
Project start date:	June 2017
Project end date:	July 2018

Project title:	Hepatitis B virus incidence in patients seeking HIV care- CAPRISA Antiretroviral Treatment Program cohort
Principal investigator:	Dr NB Msomi
Co-researchers:	K Naidoo (CAPRISA), N Yende-Zuma (CAPRISA) and K Mlisana (UKZN/NHLS)
Funding:	CAPRISA
Short description:	The objective of this project is to determine the prevalence and incidence of HBV infection in HIV infected individuals accessing HIV care. To this end, a retrospective data analysis of prospective trials with cohorts of HIV infected patients was followed up at six-month intervals, seeking HIV care in the CAPRISA treatment programme from 2003-2013. The incidence rate, incidence proportion and incidence odds of HBV will be analysed and reported.
Project start date:	November 2017
Project end date:	Ongoing

Project title:	Aptamer-functionalized carbosilane dendrimers to reactivate HIV-1 latency
Principal investigator:	Dr R Parboosing
Collaborator:	Aptus Biotech (Spain)
Funding:	NHLS Research Trust

Project title:	Highly active small interfering RNAs (siRNAs) for the treatment of HIV infection
Principal investigator:	Dr R Parboosing
Funding:	UKZN

Project title:	Eradication of HIV-1 from latent cellular reservoirs: An in vitro proof of concept study
Principal investigator:	Dr R Parboosing
Funding:	UKZN

Project title:	Hepatitis B Virus variants in HBV mono-infected and HIV/HBV co-infected patients in a high dual infection setting
Principal investigator:	Dr N Msomi
Co-researchers:	P Moodley, R Parboosing, and K Mlisana (UKZN/NHLS)
Collaborators:	S Ijaz (Public Health England), T de Oliviera, and J Giandhari (KRISP)
Funding:	NRF Thuthuka
Short description:	This is a prospective cohort study looking at the evolution of HBV variants in patients failing therapy.

Project start date: March 2017
Project end date: December 2019

Project title: Circulating microRNAs as a diagnostic tool for hepatocellular carcinoma-KZN, South Africa
Principal investigator: Dr N Msomi
Funding: UKZN

Project title: The role of evolving molecular technologies and compartmentalization in the clinical diagnosis of cyto megalovirus end organ disease in immunocompromised patients
Principal investigator: K Govender (UKZN)
Co-researcher: R Parboosing (UKZN)
Funding: None
Short description: A literature review of original scientific literature to describe the evolution of CMV diagnostic technologies over time in high and low HIV prevalence settings. The information is critically analysed and described in a review which summarizes current opinion. Gaps in basic science understanding and research priorities are highlighted.
Project start date: 01 January 2018
Project end date: 01 July 2018

Project title: Cytomegalovirus pneumonitis in infants in KwaZulu-Natal, South Africa and compartmentalization in the lungs
Principal investigator: K Govender (UKZN)
Co-researchers: R Parboosing (UKZN), P Moodley (UKZN) and M Gordon (UKZN)
Collaborator: N Suarez (Glasgow University)
Funding: NHLS Research Trust, CAPRISA and the NRF
Short description: This project aims to generate whole CMV genome sequences in lung and blood compartments of pa tients with CMV pneumonia and describe the genetic determinants of disease progression, using RNA bait technology, high throughput sequencing, and bioinformatics. Sequence differences between blood and lung compartments will be described. Associations between factors such as mixed infections, and CMV strains against the compartment are being tested and various other factors such as age of the patient, HIV status, degree of immunosuppression, and severity of illness. Infant pneumonia has significant public health importance. There is potential impact on pathogenesis, patient management, and drug and vaccine design.
Project start date: 01January 2017
Project end date: 01January 2019

Project title: Impact of Shifts to Birth Testing on Early Infant Diagnosis Program Outcomes in KwaZulu-Natal, South Africa
Principal investigator: S Smith (Columbia University)
Co-researchers: K Govender (UKZN), P Moodley (UKZN), P La Russa (Columbia University); L Kuhn (Columbia University) and M Archary (UKZN)
Fundingy: None
Short description: This project examines EID performance in KZn before and after implementation of birth PCR testing. Data was assembled on all HIV diagnostic PCR tests conducted for the province between January 2013 and April2016. Outcomes of birth cohorts of children born in 2013, 2014 and 2015 were analyzed. Laboratory barcodes allowed identification of repeat tests on the same child. We evaluated coverage, positivity rates, age at testing and frequency of repeat tests across birth cohorts. Shifts to recommending birth testing led to greater coverage of HIV-exposed infants and earlier PCR testing. This allows for earlier identification of HIV-infected infants who need urgent antiretroviral treatment initiation. Although follow-up testing rates may be under-estimated in this data source, repeat testing rates remained low. More effort is needed to ensure infants tested at birth, continue to be engaged in care and undergo follow-up testing.

Project start date: 1 January 2016

Project end date: 1June 2018

Project title:	KwaZulu-Natal HIV drug resistance surveillance study
Collaborators:	Y Moosa (UKZN); V Marconi and his team from Emory University School of Medicine, Atlanta, Georgia, USA; D Kuritzkes (Harvard University School of Medicine, Boston, Massachusetts, USA); with researchers from the University of Colorado, Denver, and the Centers for Disease Control, Atlanta, Georgia, USA
Funding:	NIAID (non-IND study)

Project title:	Targeted delivery of HIV-1 integrase inhibitors using nanoparticles
Principal investigator:	L Singh – PhD project
Collaborator:	Prof T Govender (Catalysis and Peptide Research Unit, UKZN)
Funding:	NRF and NHLS Research Trust

Project title:	HIV-1 transmitted drug resistance and clinical implications of minority variants on treatment outcome, in pa tients initiating antiretroviral treatment and followed up over a two-year period, in KwaZulu-Natal
Principal investigator:	B Chimukangrar – PhD project
Collaborators:	Dr P Moodley and Dr R Samuel (Virology), Dr K Naidoo (CAPRISA) and Prof T de Oliveria (Africa Centre)
Funding:	Africa Centre and CAPRISA

Project title:	Anaemia and pure cell aplasia secondary to Parvovirus in HIV-infected and un-infected patients
Researcher:	Dr KLA Francois – Virology MMed
Funding:	NHLS Research Trust

Project title:	Pattern of viral respiratory infection in children less than 5 years in KZN, South Africa
Researcher:	Dr T Famoroti – Virology MMed
Funding:	Virology UKZN

Project title:	A Simple Laboratory-Based Method Of Amplifying HIV Target Sequences Without Nucleic Acid Extraction In Patient Residual Blood Plasma Specimens
Supervisor:	Dr K Govender
Student:	BSc Hons
Funding:	UKZN

Project title:	Targeted delivery of siRNA into T-Lymphocytes using PEI-AuNP-Antibody complexes
Supervisor:	Dr R Parboosing
Student:	BSc Hons
Funding:	UKZN

Project title:	Evaluation and comparison of hepatitis B virus diagnosis between two PCR methods
Supervisor:	Dr Nokukhanyi Msomi
Student:	BSc Hons
Funding:	UKZN

Project title:	Target delivery of RNA Therapeutics by novel AntiCD32A-aptamer conjugates
Researcher:	William Serumula PhD project
Supervisor:	Dr R Parboosing
Funding:	UKZN

Project title:	Effective delivery of siRNAs using carbosilane dendrimers in an acutely infected cell line
Researcher:	C Soobramoney - PhD Project
Supervisor:	Dr R Parboosing
Funding:	UKZN

Project title: Good practice for Work Integrated Learning in Public Sector Medical Laboratories: Educational competencies of Training Supervisors
Researcher: M Baruth
Supervisor: Dr P Moodley

Project title: Specimen rejection trends as a pre-analytical quality indicator at an Academic Virology Laboratory in KwaZulu – Natal
Researcher: N Ramjugath
Supervisor: Dr P Moodley
Funding: DUT

Project title: Comparison of FilmArray® Respiratory Panel with FTD Respiratory pathogens 21 Multiplex PCR for detection of respiratory pathogens in KwaZulu-Natal
Researcher: Dr T Khosa (MMed Virology)
Funding: Virology UKZN

Project title: OBI in haemodialysis setting
Supervisor: Dr N Msomi
Student: BSc Hons
Funding: NRF, UKZN

6. Research output

6.1 Journal publications

Singh L. et al; Development and evaluation of peptide-functionalized gold nanoparticles for HIV integrase inhibition. Int J Peptide Res Ther. 2018.DOI 10.1007/s10989-018-9673-1

Singh L. et al; The role of nanotechnology in the treatment of viral infections. Ther Adv Infect Dis. 2017; 4(4):105-131

Gounder L, Moodley P, Drain PK, Hickey AJ and Moosa MYS; Hepatic tuberculosis in human immunodeficiency virus co-infected adults: a case series of South African adults. BMC Infectious Diseases. 2017; 17(115). DOI 10.1186/s12879-017-2222-2

Parboosing R, Chonco L, de la Mata FJ, Govender T, Maguire GE, Kruger HG; Potential inhibition of HIV-1 encapsidation by oligoribonucleotide-dendrimer nanoparticle complexes. International Journal of Nanomedicine. 2017;12: 317-325

Allana S, Shashkina E, Mathema B, Bablishvili N, Tukvadze N, Shah NS, Kempker RR, Blumberg HM, Moodley P, Mlisana M, Brust JCM and Gandhi NR; pncA Gene Mutations Associated with Pyrazinamide Resistance in Drug-Resistant Tuberculosis, South Africa and Georgia. Emerging Infectious Diseases. 2017; 23(3).

Shah NS,Auld SC, Brust JCM, Mathema B, Ismail N, Moodley P, Mlisana M, Allana S, Campbell A, Mthiyane T, Morris N, Mpangase P, van der Meulen H, Omar SV, Brown TS, Narechania A, Shaskina E, Kapwata T, Kreiswirth B, Gandhi NR; Transmission of Extensively Drug-Resistant Tuberculosis in South Africa. N Engl J Med. 2017; 376:243-253

Singh L, Kruge HG, Maguire GEM, Govender T and Parboosing R; The role of nanotechnology in the treatment of viral infections. Ther Adv Infectious Dis. 2017:4 105-131

Siedner MJ, Bwana MB, Moosa MS, Paul M, Pillay S, McCluskey S, Aturinda I, Ard K, Muyindike W, Moodley P, Brijkumar J, Rautenberg T, George G, Johnson B, Gandhi RT, Sunpath H, Marconi VC; The REVAMP trial to evaluate HIV resistance testing in sub-Saharan Africa: a case study in clinical trial design in resource limited settings to optimize effectiveness and cost effectiveness estimates. HIV Clin Trials. 2017: 1-7. doi: 10.1080/15284336.2017.1349028

Magee MJ, Yan V. Sun YV, Brust JCM, Shah NS, Ning Y, Allana S, Campbell A, Hui Q, Mlisana K, Moodley P, Gandhi NR; Polymorphisms in the vitamin D receptor gene are associated with reduced rate of sputum culture conversion in multidrug resistant tuberculosis patients in South Africa. PLoS ONE. https://doi.org/10.1371/journal.pone.0180916

Gillian H, Dokubo E, Takuva S, de Oliveira T, Ledwaba J, Dube N, Moodley P, Sabatier J, Deyde V, Morris L, Elliot R; Rates of Virological Suppression and Drug Resistance in Adult HIV-1 positive patients attending primary health care facilities in KwaZulu-Natal, South Africa. Journal of Antimicrobial Chemotherapy. https://doi.org/10.1093/jac/dkx252

Kapwata T, Morris N, Campbell A, Mthiyane T, Mpangase P, Nelson KN, Allana S, Brust JCM, Moodley P, Mlisana K, Gandhi NR and Shah NS. Spatial distribution of extensively drug-resistant tuberculosis (XDR TB) patients in KwaZulu-Natal, South Africa. PLoS ONE

Khan A; Need for advocacy for maternal immunization. S Afr Med J. 2017;107(7):547

Parboosing R, Govender T, Maguire GEM, Kruger HG; Synthesis, characterisation and biocompatibility of a multifunctional gold nanoparticle system for the delivery of single stranded RNA to lymphocytes. S. Afr. J. Chem. 2018; 71: 1-14

Jeena P, Govender K, Parboosing R, Adhikari M. Significance of cytomegalovirus in children with HIV associated pneumonia admitted to PICU. International Journal of Tuberculosis and Lung Disease. 2017;21(12):1230-6

6.2 Conference presentations (oral, poster)

- ### National congresses

A Case Report of Neuro-Symptomatic HIV Cerebrospinal fluid Viral Escape with Multi Drug Resistance from a rural hospital in KwaZulu-Natal. Dominique Kabengele Kayembe and Temitayo Famoroti; Neurological Association of South Africa (NASA) Congress 2017. Poster Presentation. Bloemfontein. 01-04/03/2017

6 .3 Poster presentations

- ### International congresses

Novel Approaches to HIV/AIDS in KZN,South Africa. Pravi Moodley. Royal Society of Medicine, London. April 2017. Oral Presentation.

Multidrug-Resistant Neuro-Sympotomatic HIV cerebrospinal Fluid (CSF) viral escape (CVE): A case report of an uncommon but significant clinical phenomenon. Dominique Kabengele Kayembe, Temitayo Famoroti and Michelle Gordon. SA AIDS Conference. Durban, SA. June 2017. Poster Presentation.

Local congresses (university academic days)

Impact of Birth Testing on Early Infant Diagnosis in KwaZulu-Natal, South Africa. Shayla Smith, Louise Kuhn, Moherndran Archary, Pravi Moodley, Phillip LaRussa, Kerusha Govender. Conference on Retroviruses and Opportunistic Infections (CROI). 2018. Poster Presentation.

- ### Local congresses (university academic days)

The relationship between Human Immunodeficiency Virus (HIV) Status and Cytomegalovirus(CMV) Respiratory Infection in children under the age of 5 years. UKZN LMMS Research Day. Temitayo Famoroti. August 2017.

Cervical Cancer. UKZN School of Laboratory Medicine and Medical Sciences, Kerusha Govender. August 2017.

6.4 Patents

South African Provisional Patent Application No. 2017/00545 – "Novel DNA aptamers against CCL21 protein" filed 25 January 2017, Raveen Parboosing and Louis Chonco

United Kingdom - Priority Patent Application No. 1802418.2, Identification of Molecules Associated with Capsid Assembly, Packaging and Disassembly, Raveen Parboosing, Filing date: 14 February 2018

University of Limpopo

Foreword

Prof Ruth Lekalakala-Mokaba (Pathology Representative)

The University of Limpopo (UL) opened its doors to medical students in January 2016 to register itself as the ninth medical school in South Africa. This newly established School of Medicine is situated at the erstwhile Turfloop campus of the UL, in the Faculty of Health Sciences, and remains the first medical school to be established under the new dispensation in the Republic of South Africa.

The school offers undergraduate MBChB and postgraduate (MMed) programmes in various disciplines – thus creating an opportunity to train much-needed general practitioners and specialists in the province and the rest of the country. The location and the involvement of the school in community outreach activities offer students in non-rural areas of the country the opportunity to appreciate and understand the health needs of people in rural settings. We are hopeful that the school will add value and produce well-equipped doctors and specialists who will change the lives of those who were previously disadvantaged.

The Department of Pathology has five units namely: Anatomical Pathology, Chemical Pathology, Haematology, Medical Microbiology & Virology and Forensic Medicine. These units are slowly growing and have two 2 additional members to increase the total staff complement to seven pathologists (one haematology pathologists, one Head of Microbiology, one pathologist, one anatomical pathologist from private practice, one clinical virologist and two forensic medicine specialists from the DoH). There is a critical need to accelerate the staffing of other units (Chemical Pathology) to complement the current staff and to effectively execute the NHLS mandate, as well as the umbrella- and bilateral agreement.

What we do

The units are a joint initiative with the university and contribute to teaching, training and research activities. In addition, we offer a 24-hour comprehensive diagnostic service to all hospitals and clinics in the province. Haematology provides a comprehensive routine diagnostic service and specialised tests for general haematology and the diagnosis of hematological malignancies to the oncology clinicians, whilst the Microbiology Unit serves as a referral site for all TB, bacterial and fungal cultures in the province. Clinical Virology takes responsibility for all virology diagnostic services in the province. The three units provide consultation service and support to clinicians and regional and district laboratories via telephone and occasional visits. It also coordinates the year one to three pathology modules for undergraduate medical students and participates in the teaching of pathology-related topics in various modules. Academic ward rounds are supported by various units and training is provided for registrars in Paediatrics, as well as medical technologists and technicians.

Highlights

The Anatomical Pathology lecturer, Dr Mahlakwane, was awarded the best lecturer of the year trophy.

Haematology

Head of department : Vacant

Pathologist in charge: Dr Tebogo Pheeha

1. About the department

The Haematology Unit provides a comprehensive 24-hour diagnostic service to the provincial hospital, and serves as a referral laboratory for regional and district hospitals (36) and primary health care facilities (>50) in Limpopo Province. The unit also provides support and consultation service for technical staff in regional and district laboratories and the clinicians of Limpopo DoH. This had a positive impact on laboratory staff skills development, and resulted in improvement of the overall quality of service provided by the laboratory in the province, i.e. improved turnaround times (TATs) on consultations, facilitated early diagnosis and timeous referral and intervention for patients with haematological conditions, especially haematology oncology patients. The unit particpates in some of the departmental academic meetings. The Haematology Unit furthermore teaches undergraduate medical students at the UL.

2. Diagnostic service

The Haematology Unit provides a high quality diagnostic service to the Limpopo DoH. The test volumes for the year under review are estimated from data based on the period from 01/04/2017 to 31/03/18.

Table UL 1: Test Volumes – Diagnostic service

Routine	Test Volumes	Coagulation	Test Volumes	Immuno	Test volumes
FBC	43817	APTT	7 043	ABO	20 932
FBCD	38	PT/INR	9 361	RH	27 332
WBC	388	D-dimer	4 230	Coomb's test	698
RBC	156	Fibrinogen	1000	Ind.Coomb`s	1 766
HB	38 819	FVIII	72	CDARV	118 384
HCT	160	FIX	27	Crypto Ag	3 090
PLT	198	Malaria (RDT)	670		
DIFF	105 23	Malaria (micro)	798		
Morph/Film	992	Reticulocytes	784		
ESR	4 727	BMA cytology	251		

Table UL 2: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	0	1				1	1
Technologists	0	0	0	0	4	4	4
Other*	0	0	0	0	3	3	3
South Africans							
All							8

**Technicians*

3. Teaching, training and professional development

3.1 Technical staff

The unit is involved with teaching and training of medical technologists and, technician students, and conducted workshops and courses on the following topics:

- Morphology;
- ABO Rh;
- CD4 refresher;
- CD4 beginners;
- Sysmex Coagulation analyser refresher;
- Advia training;
- Randox International Quality Assessment Scheme (RIQS) EQA; and
- QMS.

3.2 Undergraduate medical students

The Haematology Unit is involved in the mapping of the MBChB curriculum, coordination and teaching of the Essentials of Disease Module for MBChB I students. The unit is also coordinating and teaching the Reticuloendothelial System and Haematology module for year three.

Medical Microbiology

Head: Dr Ruth Lekalakala-Mokaba

1. About the department

The Medical Microbiology Unit is the referral site for all TB, bacterial and fungal cultures in the province and supports peripheral laboratories. It also participates in the teaching of undergraduate medical students at the UL. The unit supports clinical ward rounds and training for registrars in non-pathology disciplines and also contributes to the training of medical technologists and technicians. The department is gradually growing with the increase in number of pathologists from one to three (two medical microbiologists and one clinical virologist).
The unit participates in various committees at intuitional, district and provincial levels. These are the Pharmacy and Therapeutics, Antibiotic Stewardship and Infection Control Committees. The unit remains actively involved in the infection prevention and control programmes for the hospitals and partners with provincial and district managers to strengthen infection prevention and control and outbreak response initiatives. The unit is one of the enhanced surveillance sites for the NICD, participating in the GERMS-SA surveillance programmes for enteric pathogens, mycology, parasitology and respiratory and meningeal pathogens. Clinical consultation services are provided to clinicians at local and in remote areas of Limpopo.

2. Diagnostic services

The Microbiology Laboratory provides a comprehensive 24-hour diagnostic service to all Limpopo hospitals, as well as the surrounding clinics. This includes a full range of diagnostic services for TB, including Xpert MTB/RIF, culture and genotypic drug susceptibility testing. The laboratory is a referral site that provides diagnostic and consultative support to peripheral laboratories and clinicians in regional and district hospitals.

The introduction of the rapid Rota/Adenovirus test from diarrhea stool added value to the diagnosis and management of childhood diarrheal diseases. The laboratory continues to add value toward a reduction in TB transmission in the province and it is our pleasure to announce that we successfully completed the proficiency testing and implemented the LPA for second line TB drugs.

The unit continues to support clinical ward rounds and laboratory-based consultations from all Limpopo districts, either telephonically or with occasional visits to laboratories and clinicians' forums. The utilisation of the laboratory by clinicians has gradually increased, which is evidenced by the increase in demand for blood culture service and feedback on positive cultures. Smaller hospitals are now also benefiting from the pathologist services.

Table UL 3: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	0	3				3	3
Medical Scientists	0	0	0	0		0	
Technologists	0	0	0	0	5	5	4

3. Teaching, Training and Professional Development

3.1 Undergraduate Level

The unit participates in the delivery of lectures, tutorials and assessments of year one to three MBChB students in various modules. We also coordinate the year one Pathology Module and participate in curriculum review meetings and workshops.

3.2 Postgraduate level

The unit is collaborating with the Medical Science Department at the UL, the School of Health Systems and Public Health and the UP, with regards to postgraduate student supervision and dissertation marking.

4. Research activities

4.1 Research project

Project title:	Microbiological profile of organisms causing bloodstream infections between 2004 and 2016 in a tertiary hospital, Limpopo Province, South Africa
Principal investigators (MSc Clinical Epidemiology):	S Maweya (UP)
Supervisors:	B Girdler-Brown (UP) and MR Lekalakala-Mokaba (UL)
Short description:	Nosocomial bloodstream infections constitute a significant public health problem and are usually an important cause of morbidity and mortality in patients who are hospitalized. These are serious invasive infections requiring urgent antimicrobial therapy. Mortality associated with bloodstream infections may range from 20 to 50% and depends on several factors, including the pathogen, host and environmental factors. Most septic episodes are nosocomial and may be due to microorganisms with increased antimicro bial resistance. The aim of this study was to determine the microbiological profile of the organisms causing bloodstream infections in a tertiary hospital between 2004 to 2006 and 2014 and determine the trends in the two-time period.
Project start date:	January 2016
Project end date:	Completed October 2017 (student graduated April 2018)5.

5. Research output

5.1 Journal publications

Perovic O, Singh-Moodley A, Govender NP, Kularatne R, Whitelaw A, Chibabhai V, Naicker P, Mbelle N, Lekalakala R Quan V, Samuel C, Van Schalkwyk E; A small proportion of community-associated methicillin-resistant Staphylococcus aureus bacteraemia, compared to healthcare-associated cases, in two South African provinces. European Journal of Clinical Microbiology & Infectious Diseases. August 2017

Maningi NE, Malinga LA, Antiabong JF, Lekalakala RM, Mbelle NM; Comparison of line probe assay to BACTEC MGIT 960 system for susceptibility testing of first and second-line anti-tuberculosis drugs in a referral laboratory in South Africa. BMC infectious diseases 17 (1), 795

Sefako Makgatho Health Sciences University

Foreword

Prof Maphoshane Nchabeleng

Pathology Representative

Who we are

Sefako Makgatho Health Sciences University (SMU) is an institution which was established to replace Medunsa Campus of the UL in 2015. Pathologies at SMU formed part of the School of Pathology and Preclinical Sciences until December 2016, and as from January 2017, it forms part of the School of Medicine. There are five departments, namely Microbiology, Virology, Haematology, Chemical Pathology and Anatomical Pathology. Immunology is perfomed at the Department of Microbiology.

Due to the geographical location of the institution, it is difficult to fill a number of critical posts. The posts of academic head for two departments, Virology and Anatomical Pathology remain vacant. This poses a risk to our continued ability to provide a relevant diagnostic service and training.

What we do

The service activities encompass comprehensive pathology diagnostic and consultation services to the Dr George Mukhari (DGM) Academic Hospital and Tshwane District (hospitals and clinics). The national coverage programmes extend to parts of Limpopo, Mpumalanga and North West provinces. All fice service laboratories in the business unit are SANAS-accredited. Like in many parts of the country, the service is linked to the pathology specialist training programme.

The business unit is also involved in teaching and training of several undergraduate programmes, including MBChB, BDS, BCur, BSc Diet, B Pharm and Physiotherapy for Sefako Makgatho Health Sciences University. In addition, the department offers niche research services that contribute to the provision of training for postgraduate students. This is offered in collaboration with other institutions, both nationally and internationally.

Anatomical Pathology

Head of Department: Dr Nemukongwe (Acting Head from March 2017- March 2018)

1. About the department

The department comprise 15 academic staff members that includes both registrars and consultants. The team is extremely cohesive, with solid relationships between the registrars and consultants. We meet regularly to discuss and address issues regarding the general running of the department, which includes teaching and learning matters. We have an open door policy and histopathologists and students feel free to consult the Acting Head directly, for any pressing matters.

The academic staff is currently on a strong drive to develop skills and as such, we are attending a multitude of workshops. We also appointed a visiting consultant and an associate professor who assist in teaching postgraduate students.

The staff members collaborate well and there is a good working relationship between the academic team and the laboratory staff. We often celebrate events together, including birthday parties and Christmas- or yearend functions. We are currently not involved in any outreach programmes, but we have earmarked it as part of our future plans.

2. Diagnostic services

Immunohistochemistry:

We extended our battery of immunohistochemichal markers to involve newer tests that improved our diagnostic platform.

Immunofluorescence:

The university bought a new microscope with a camera system that improved the quality of our results. High-quality images are taken and can be stored electronically.

Table SMU 1: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	South Africans	All
Pathologists	1	6				7	7
Medical Scientists	0					0	0
Technologists				7	9	16	16
Tecnicians					5	5	5
Registrars		8				8	8
Other*						18	18
South Africans						54	54
All						54	54

*Student technicians and other laboratory staff

3. Teaching, training and professional development

To support our current focus on skills development, numerous members of our academic staff are either studying, or attended work-shops as follows:

- Dr Nemukongwe (Acting Head): currently studying MSc Cytopathology (Stellenbosch) and attended the Ticket to Teach work shop at (SMU);
- Dr Kekana: attended a Research for Supervisors and Teachers workshop;
- Dr Motlagomang: also attended the Research for Supervisors workshop; and
- All histopathologists are trained to use LOOOP and Blackboard, which are online learning platforms that enhances under

3.1 Undergraduate level

Undergraduate training is offered to MBChB histopathologists and Allied health registrars. The teaching format and platforms used are as follows:

- Formal lectures;
- Tutorials;
- Practicals;
- Mentoring sessions; and
- Autopsy demonstrations.

3.2 Postgraduate level

We currently have nine registrars. These registrars are involved in training undergraduate students. We have a planned academic programme that runs daily. Training is presented in different formats and on different platforms as follows:

- Journal presentations;
- Topic seminars;
- Clinico-pathological correlations;
- Slide seminars; and
- Grand round presentations.

3.3 Other

Table SMU 2: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern medical scientists	Honours	All	South Africans
Total number of trainees	1		8	0	1	10	All
Final year trainees	1		2			3	All
Successful completion			0		1	1	

4. Awards

None.

5. Research activities

5.1 Research projects

Project title: Expression of E-cadherin and B-catenin in pre-invasive conjunctival intraepithelial neoplasia and invasive conjunctival squamous cell carcinoma at DGM Academic Hospital in South Africa, 2012-2016.
Principal investigators: MM Mohlala (SMU) and MB Nemukongwe(SMU)
Co-researchers: Nkosi M(SMU)
Funding: NRF
Project start date: January 2017
Project end date: May 2018

6. Research output

6.1 Journal publications

None.

6.2 Complete books

None.

6.3 Book chapters

None

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6.4 Conference presentations (oral, poster)

6.4.1 Oral presentations

International congresses

None.

National congresses

Dr Bapela:
Oral presentation at WITS
CASE: placental transmogrification of the lung

Summary:

The department has not performed well on the research platform, over the past three years. We are currently attempting to implement measures to assist in the improvement of the departmental research output.

Measures in place:

1. Appointment of Prof J.P. Bogers

We successfully motivated the appointment of Prof JP Bogers by the university. He has been appointment as research associate on contract for three years (2018 - 2021), to assist with research output. He is currently in charge of our PhD students and regularly provides input in registrars' research projects.

2. Prof Ogunbanjo:

Prof Ogunbanjo from the School of Medicine volunteered to guide the department and currently assists with co-supervision of some of our projects. He is also co-supervising two of our senior registrars.

We trust that these endeavours will soon result in a notable improvement in our research output.

6.5 Research translations

None.

Chemical Pathology

Head of department: Prof. Aye Aye Khine-Wamono

1. About the department

Our department is one of the Pathology disciplines that form part of the School of Medicine at SMU. We provide routine and special biochemical testing for DGM Academic Hospital as well as provincial, regional and district hospitals in Gauteng North, North West and Limpopo regions. We also service 27 nearby clinics. We teach undergraduate medicine from second to sixth years and in the fourth year, we teach the whole year as a core curriculum. Teaching includes didactic lectures, tutorials and small group facilitations, as well as assessments (five times a year). We train postgraduate students (MMed, BSc Hons and MSc), as well as medical technology students. We also provide in-service training for our own staff members in laboratory management and quality assurance. In addition, we conduct independent research through MRC- and NHLS-funded projects and we supervise students' research projects. The academic staff complement is one Head of Department, one secretary (employed by SMU), four pathologists (one is dedicated for national coverage), three registrars and one junior medial scientist. There are two BSc Hons and two MSc students.

2. Diagnostic services

Amongst the routine clinical laboratory services, we provide serum, urine and CSF electrophoresis, stone analysis and metabolic screening with thin layer chromatography. Our routine laboratory is accredited by SANAS.

Table SMU 3: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	HoD- Enrolled	5			1		5
Medical Scientists			1(junior)			1	1
Technologists						14	14
Other*							
South Africans							20
All							20

3. Teaching, training and professional development

3.1 Undergraduate level

We are teaching undergraduate Medicine Chemical Pathology as a year-long curriculum in the fourth year, as well as every module in the Practice of Medicine integrated module from year two to six. Teaching includes didactic lectures which comprise four weekly sessions, a monthly small group tutorial, four semester tests and two exams [one standard exam and one re-exam]: (compilation of questions, memos and marking, are performed via the online computer system).

The curriculum is equally divided into six for six lecturers, including the HoD. Each provides lecture material, assessment questions, memos and feedback. Small group tutorials are also divided into six groups with about 40 students in each group. Our undergraduate Chemical Pathology for MBChB programme, is accredited by the HPCSA.

3.2 Postgraduate level

We train postgraduate programmes of MMed, BSc (Hons) and MSc in Chemical Pathology. We also offer training for medical scientist interns. All postgraduate training programmes are accredited by the HPCSA. We currently have three registrars, two BSc (Hons) and two MSc students, as well as one intern.

3.3 Other

We also participate in the training of medical technologist interns in preparation of their national board examination. Other training includes training of medical technologists at our laboratory, as well as the laboratories in our national coverage (online and via email) in the form of capacity building. We conducted onsite assessments of four different levels of laboratories in Limpopo Province in 2017. The report and recommendations were submitted to the area manager, business manager and laboratory managers. We are continuously supporting the laboratories in Limpopo, Gauteng North and Bojanala regions with their IQC/EQA troubleshooting, preparation for accreditation and clinical consultations.

Table SMU 4: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern medical scientists	Honours	All	South Africans
Total number of trainees	0	2	3	1	2	8	7 (1 from Swaziland)
Final year trainees	0	0	2	0	0	2	2
Successful completion	0	0	0	0	0	0	0

4. Awards

We received the Best Teaching Department Award from the SMU School of Medicine for 2017. This is the fifth consecutive award since 2013. Nominations are submitted by MBChB students from the fourth to the final year and the award is issued at the oath taking ceremony by the School of Medicine.

5. Research activities

5.1 Research projects

Project title: Conceptions of students regarding racial and socio-cultural diversities in the learning environment of Pathology training

Principal investigators: AA Khine (SMU/NHLS) and N Hartman (UCT)

Funding: DHET

Short description: Training of registrars in Pathology disciplines is a complex process that is both labour- and cost intensive, whilst the outcomes are expected at metacognitive level of knowledge, skills and attitude. A cognitive apprenticeship model was recommended in the training of all medical specialities, globally and in South Africa. Threats to this model include constraints in contact time between trainees and trainer, person ality clashes and relationships between peers and with the trainers, all of which can influence the degree of engagement and interaction between training parties. The study explored how previous students (who left the programme and who qualified) conceived the racial and socio-cultural differences in their learning environment and how it influenced their learning and outcomes. The study also explored how qualified students managed the difficulties of such differences.

Project start date: 1 Jan 2016
Project end date: 31 Dec 2017

Project title: Biochemical and Haematological Parameters in chronic Nyaope users
Principal investigators: AA Khi]9ne (SMU/NHLS) and KE Mokwena (SMU)
Co-researcher: V Moodley (SMU/NHLS)
Funding: MRC

Short description: Constituents in street drug Nyaope mixture were analysed by the NHLS DGM laboratory in collaboration with PerkinElmer research laboratory in Midrand, SA in 2016 and the findings were published. Opiates such as morphine, codeine and heroine were prevalent, whilst others included opioids, CNS sup pressants and stimulants. Unexpected compounds such as plasticizers, calcium oxide (concrete ground material), lignocaine- local anaesthetic, fentanyl, antibiotics and antiretro virals were also found in a few Nyaope specimens collected from 35 townships in and around Gauteng. This study aimed to explore how the chronic use of Nyaope affects the users' body systems and organ functions. It specifically examinedelectrolyte status, renal function, liver function, endocrine function (thyroid and go nad), blood counts and immune cells. Findings were compiled in a manuscript and was sent for publication in an accredited journal.

Project start date: 1 May 2017
Project end date: 31 Dec 2017
Project title: Performance of free prostate-specific antigen ratio in differentiating between prostatic cancer and benign prostatic lesions at a referral hospital in South Africa
Principal investigator: B Phiri-Ramongane (SMU/DGM NHLS)
Co-researcher: AA Khine (SMU/DGM NHLS)
Funding: None
Short description: The study was conducted to assess the performance of the %FPSA ratio at the 25% cut-off and its ability to distinguish between prostate cancer and benign prostatic lesions. The study was retrospec tively conducted on male patients with total prostate-specific antigen values <10ng/ml and with prostate histology results. Male patients with total prostate-specific antigen between 4 and 10ng/ml had their free prostate-specific antigen de termined together with the calculation of the free prostate-specific antigen ratio. The ratio was then correlated with prostate histology results to determine the presence of prostate cancer at the cut-off ratio of 25%. The study demonstrated that a %FPSA ratio of 25% is not a good discriminator between prostatic cancerous and benign lesions. Prostate biopsy should be based on clinical examination findings.

Project start date: June 2016
Project end date: June 2017
Project title: HbA1c enzymatic assay evaluation at the Dr George Mukhari academic laboratory
Principal investigator: B Phiri-Ramongane (SMU/DGM)

Funding: None

Short description: The aim of the study was to evaluate the analytical performance of the HbA1c enzymatic assay on the Abbott Architect ci8200. The method's precision, reportable range and bias were determined by following CLSI EP05, EP06 and EP15 respectively. Bias was determined by comparison between theAbbott Architect and Variant II. The new enzymatic HbA1c assay demonstrated good precision and has the advantage of quick analysis which in turn enables quick results reporting. The study also demonstrated acceptable agreement of the Abbott Architect and Bio-Rad Variant method across the measured range. Notably, the assay meets the analytical goal for diagnosis and monitoring DM using the enzymatic method, as the total allowable error was 1.13% and 1.03% respectively, which is below the 3% total allowable error from the biological data.

Project start date: Jan 2017
Project end date: June 2017

Project title: Relationship between mean blood glucose from home-based monitoring and estimated average glucose calculated from measured Haemoglobin A1c in patients attending the Diabetic outpatient clinic at Dr

George Mukhari Academic Hospital
Principal investigator: MK Nkoana (SMU)

Co-researcher: AA Khine (SMU)

Collaborator: S Mda

Funding: NHLS Research Trust

Short description:

Project start date: Ethics clearance was received in 2014 and the data collection was completed in Dec 2017. The data is currently being analysed and findings are noted.

Project end date: Nov 2018

Project title: The ratio of cortisol and cortisone metabolites in 24 hour urine of women presenting with polycystic ovary syndrome (PCOS)

Principle investigator: RB Sepuru (SMU)

Co-researchers: Dr LC Bekker (SMU) and Dr SP Fuma (SMU)

Funding: Application still in progress

Short description: To establish a ratio between cortisol metabolites and cortisone metabolites in females presenting with PCOS, using an established gas chromatography mass spectrometry steroid detection method and to establish a feasible reference range in the diagnosis of PCOS with the use of urinary steroid metabolites. The use of a gas chromatography – mass spectrometry (GCMS) is employed in the extraction of cortisol and cortisone metabolites.

Project start date: February 2018

Project end date: November 2019

Project title: Prevalence of macroprolactinemia in clinical samples presenting with hyperprolactinemia at Dr George Mukhari tertiary laboratory, Garankuwa

Principal investigators: Hlati L (Sefako Makgatho Health Sciences University) and KB Sedumedi (Sefako Makgatho Health Sciences University and NHLS)

Co-researcher: A Rab (Sefako Makgatho Health Sciences University and NHLS)

Funding: NHLS

Short description: The study aims to determine the prevalence of macroprolactinemia and to validate the NHLS procedure of precipitating Macroprolactin using polyethylene glycol (PEG) in hyperprolactinaemic samples sent for patient management. A total of 1015 samples were requested for prolactin and 131(12.9%) were found to be hyperprolactinaemic. After excluding repeat requests, 85 samples met the inclusion criteria and 12(14%) were found to have macroprolactinemia. These samples rarely had PRL levels >100ng/ml. Although the study>100ng/ml. Although the study confirmed an overlap of symptoms between macr oprolactinemia and true hyperprolactinaemic patients, headache and visual disturbances seemed to be more specific for true hyperprolactinemia, particularly due to prolactinoma. Although the prevalence of macroprolactinemia seems to be relatively low at this setting compared to the world literature of 27-35%, the overall ost associated with unnecessary further investigations and treatment of patients with macroprolactin the routine screening of Macroprolactin.

Project start date: January 2016

Project end date: December 2017

Project title: Measurement of androgen levels in 24 hour urine of patients with polycystic ovary syndrome

Principal investigators: Mr T Ramaswe (Sefako Makgatho Health Sciences University) and Dr L Bekker (Sefako Makgatho Health Sciences University, supervisor)

Co-researcher: Dr A Pema A (Sefako Makgatho Health Sciences University, co-supervisor)

Collaborator: Prof AA Khine (Sefako Makgatho Health Sciences University, Head of Department)

Funding: Sefako Makgatho Health Sciences University

Short description: Polycystic ovary syndrome (PCOS) is an endocrinopathy which affects young women of reproductive age. It is exhibited by various clinical presentations such as anovulation, hirsutism, oligomenorrhoea

and a biochemical presentation of characteristically high androgen levels. This study aims to measure androgen levels in 24 hour urine of women diagnosed with PCOS. This will aid in monitoring characteristic androgen levels in the progression, prognosis and analysis of the syndrome in var ied patients. It will further validate the gas chromatography-mass spectrometer (the method that is to be used) as a qualitative clinical biochemical diagnostic tool in the use of the diagnosis of PCOS, which is often underdiagnosed.

Project start date: January 2018
Project end date: December 2019

Project title: Simultaneous analysis of plasma lactate and pyruvate in whole blood, using a UV/visible spectrophotome ter: application in hypovolemic shock and hypoxia
Principal investigator: WV Dube (Sefako Makgatho Health Sciences University)
Co-researchers: Prof AA Khine (Sefako Makgatho Health Sciences University/NHLS/DGM) and Dr LC Bekker (Sefako Mak gatho Health Sciences University)
Funding: NRF
Short description: L:P ratio was found to be a reliable marker, compared to lactate in tissue hypoxia and concurrent meta bolic decomposition. Two different samples are required to obtain an L:P ratio, thus posing a risk of pre-analytical errors. The aim of this study was to explore the feasibility of pyruvate measurements in a NaF anticoagulated protein-free supernatant of the same whole blood sample on which lactate concentration was determined, using a UV/ visible spectrophotometer. We concluded that due to the bias subject to both serum and plasma, further studies are needed. This project was presented at the SMU Research Day in August 2017 and won a first prize in the poster presentation category.
Project start date: 9 Jan 2016
Project end date: 13 Dec 2017

Project title: The use of N-terminal pro-Brain Natriuretic Peptide as a biomarker in diagnosing acute heart failure
Principal investigator: T Mapheto (Sefako Makgatho Health Sciences University)
Funding: Roche diagnostics
Short description: The aim of the study is to determine whether NT-proBNP is a useful marker in diagnosing acute heart failure in patients diagnosed with heart failure at DGM Hospital. The study participants were selected from the casualty department, medical out-patients unit and cardiology clinic, and were patients diagnosed with heart failure by the attending physician also classified them according to the New York Heart Association (NYHA) classification.
Project start date: 2013
Project end date: 2018

6. Research output

6.1 Journal publications

Duma Z, Khine AA; Methyl Tetra Hydro Folate Reductase Enzyme Polymorphism in the Mothers with Previous Autosomal Aneuploidy Birth in the Indigenous African Population of Northern Region of South Africa. Journal of Down syndrome & Chromosome Abnormalities. 2017, 3:2, DOI: 10.4172/2472-1115.1000122

Khine AA, Mokwena KE; Drug interactions in Street Drug Nyaope mixture. A mini-review. African Journal of Drug and Alcohol Abuse. Volume 15, Number 2, 2016

Khine AA, Hartman N; Strategies in overcoming racial and socio-cultural differences in the learning environment of post-graduate medical specialty training in South Africa. AMEE. MedEdPublish 13/03/2018. https://doi.org/10.15694/mep.2018.0000062.1

Pema A; Under-investigation of patients with calcium abnormalities at DGMAH and recommendations for requesting serum intact Parathyroid hormone. 3 March 2017

Phiri-Ramongane B, Khine AA; Performance of free prostate-specific antigen ratio in differentiating between prostatic cancer and benign prostatic lesions at a referral hospital in South Africa. South African Family Practice 2018. 1(1):1–4, https://doi.org/10.1080/20786190.2018.1432139

6.2 Conference presentations (oral, poster)

6.2.1 Oral presentations

International congresses

Khine AA. Value-based laboratory testing. IFCC-WorldLab conference. Durban, South Africa. 22-25 Oct 2017.

M Mapheto. A case report on Male Turner's syndrome with a 45 X and 9q deletion with SRY translocation. IFCC-WorldLab conference Durban, South Africa. 22-25 Oct 2017

National congresses

Khine AA. Decolonisation of Teaching and Learning practices at SMU. Decolonisation workshop. SA Committee of Medical Deans. 4 April 2017.
Khine AA. Cost-effectiveness of using various limits on the internal quality control performance evaluation in routine laboratory testing. PathReD National Conference. NHLS. 23-24 June, 2017.
Khine AA. Relationship of socio-cultural factors in training of medical specialities. SAAHE National Conference. 2-5 July 2017.

Local congresses

Khine AA. Drug interactions in Nyaope mixture. Oral presentation at the SAMRC SAENDU Congress. Pretoria MRC offices. 4 April, 2017.

Workshops presentations/facilitations

Khine AA. Adult learning principles and teaching practices. SMU Academic staff induction workshop. 14 Feb 2017.
Khine AA. Curriculum development and student support. SMU teaching and learning strategic workshop. 6 March 2017.

6.2.2 Poster presentations

International congresses

None (only oral presentations).

National congresses

Nkoana MK. Interference of monoclonal protein in serum phosphate estimations by dye-binding method. NHLS PathReD Congress. 23-24 June, 2017.
TM Mapheto. A case report on Male Turner's syndrome with a 45 X and 9q deletion with SRY translocation. NHLS PathReD Congress. 23-24 June, 2017.
Z Duma. Methyl tetra hydro reductase enzyme polymorphism in the mothers with previous aneuploidy births amongst the indigenous African population of Northern region of South Africa. NHLS PathReD Congress. 23-24 June, 2017.
Pheeha SM. A case report on unusual Triple X syndrome identified in an infant. NHLS PathReD congress. 23-24 June, 2017.

Local congresses (university academic days)

Khine AA. Cultural tools of intellectual adaptations narrated by the fourth year medical students of SMU. SMU Research Day. 22 Aug 2017.
Nkoana MK. Interference of monoclonal protein in serum phosphate estimations by dye-binding method. NHLS PathReD Congress. 23-24 June, 2017.
Z Duma, Khine AA. Methyl tetra hydro reductase enzyme polymorphism in the mothers with previous aneuploidy births amongst the indigenous African population of Northern region of South Africa. NHLS PathReD Congress. 23-24 June, 2017.
Pheeha SM, Khine AA. A case report on unusual Triple X syndrome identified in an infant. NHLS PathReDCcongress. 23-24 June, 2017.

6.3 Research translations

6.3.1 Research translated to policy

None.

6.3.2 Research translated to service

None.

Haematological Pathology

Head of department: Prof V Moodley

About the department

The Department of Haematological Pathology continues to offer a comprehensive 24-hour diagnostic and clinical consultative service to the DGM Hospital, as well as to referral hospitals and clinics situated in Gauteng, North West, Mpumalanga and Limpopo Provinces. Our particularly successful SANAS accreditation in 2018, combined with the fact that we continuously exceeded our targets for TATs (including CD4 tests), bears testament to our strong focus on rendering a quality service, within the shortest possible time.
Some of the department's key strategic achievements for 2017/2018 include enhancing quality assurance within the NHLS, ensuring rational use of the laboratory in a cost-constrained health environment and implementing effective teaching methodologies at both undergraduate and postgraduate levels. Education is embedded in all activities, from delivering a quality service, to teaching and training that ultimately leads to an expanding departmental research portfolio. Departmental research continues to focus on the haematological changes that result from infection with the human immunodeficiency virus, as well as haematological malignancies. We also persevere in our efforts to include collaborative initiatives that embrace and advance public health.
In spite of nuemorus challenges within the health and educational sectors, the past financial year has proven to be successful for the department, due to the continuous commitment and dedication demonstrated by the Haematology team.

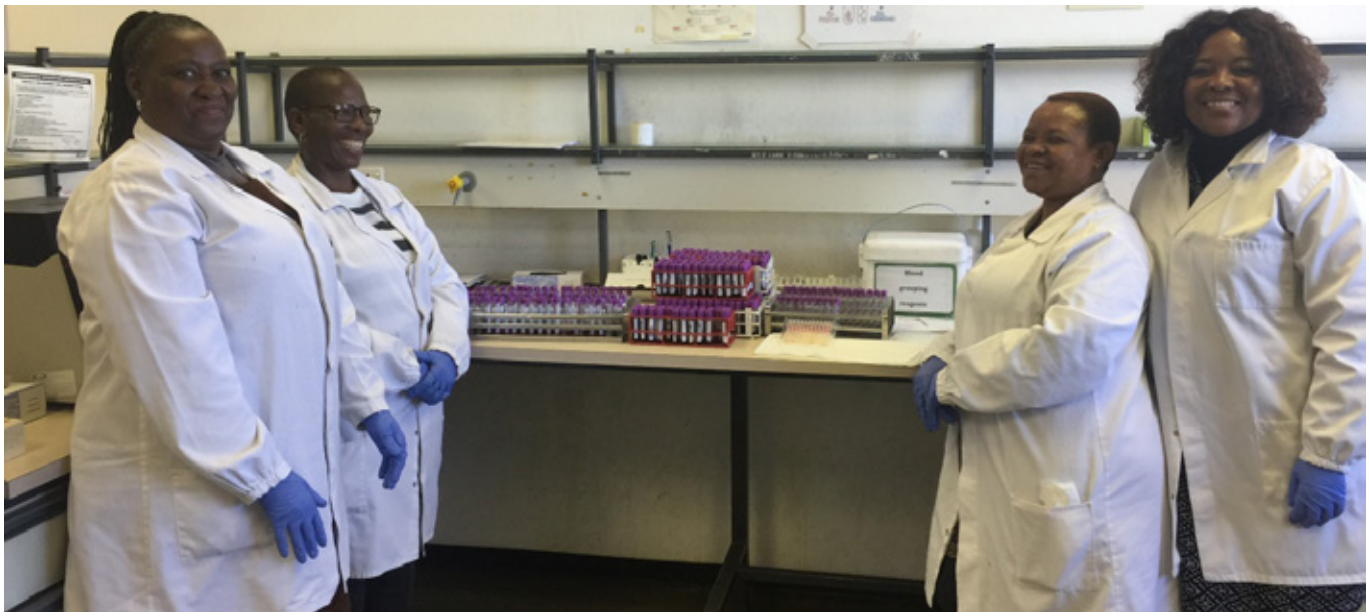


Figure SMU 1: The dedicated Special Haematology and Immunohaematology team.
From the left: Ms M Kwatsha, Ms LM Maboe, Ms S Moeketsi and Dr RK Rankapole.

The Immunohaematology platform is semi-automated and labour intensive. The substantive increase in specimen numbers in the reporting period signals the crucial need for automation of this unit.
Dr Rankapole and Ms Moeketsi facilitated two Immunohaematology workshops in the Limpopo Province in 2017.

2. Diagnostic services

A total of 458 563 tests were performed in the Haematology Laboratory in the year under review, which translates to an increase of 7.8%, when compared to the previous financial year. The increase in test volumes was largely attributable to an increase in volumes on the immunohaematology, clinical flow cytometry and coagulation platforms.

The growing number of specimens necessitated the division of the Haematology Laboratory into four specialised units viz. Automated and Morphology; Special Haematology and Immunohaematology, Coagulation, and a Clinical Flow Cytometry. Dedicated teams were assigned to each unit, each of whom performs under the guidance of a pathologist.

The Immunohematology Unit experienced a substantial increase in workload from 47 279 specimens processed in 2016/2017, to 79 617 in the current reporting period, which constitutes a 68% increase, year-on-year. This spike is due to the high number of referrals received from other provinces. This unit also offers advice and support to other diagnostic immunohaematology laboratories in the country. Should the requirement for processing of such high volumes of specimen continue in the upcoming year, it will become critical to automate this diagnostic platform, to maintain the current quality standards.

The Clinical Flow Cytometry Unit also experienced an increase of greater than 100% in test volumes, which can predominantly be ascribed to the receipt of referral specimens. 2017 also saw the redirection of trephine biopsies from the Limpopo Province to the DGM Tertiary Laboratory, the reporting of which is solely the responsibility of the Haematology Department.

Figure SMU 2: The Clinical Flow Cytometry Unit.
From the left: Mr EB Mtshali (Haematology supervisor) and Mrs L Mamosebo.

The clinical flow cytometry unit expanded significantly in the last year, particularly with respect to the processing of haematology/ oncology specimens. This growth is understandable due to the rapid evolution in the field of flow cytometry in the last decade and the significance of immunophenotyping underpinned in the WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues.

Consultants and registrars in the department continue to be involved in the adult haematology outpatient clinics, including the Haemophilia Clinic, which helps to further strengthen the excellent working relationships between the clinical and pathology disciplines. Our teams remain actively involved in the paediatric haematology/oncology ward rounds and clinico-pathological meetings, which in turn strengthens our working relationships with the clinical disciplines.
In addition to delivering a routine diagnostic service, the aim of the department in the year under review was to assist in the improvement of quality assurance within the NHLS and to ensure rational laboratory usage. To this end, we amongst other:

- Facilitated two immunohaematology workshops in the Limpopo Province;
- Commenced with pathology seminars at DGM Academic Hospital;
- Commissioned a consultant haematologist to atively participate in pre-SANAS audits of NHLS laboratories; and
- Conducted presentations to various clinical disciplines on thrombophilia testing

Figure SMU 3: Dr J Alant presents on Rational Thrombophilia Testing.

In an effort to ensure rational laboratory use in the currently cost-constrained health sector, presentations were made to various clinical disciplines. The aim was to engage, debate and foster a closer working relationship amongst pathologists and clinicians that will hopefully translate into more efficient use of the laboratory.

Table SMU 5: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Degree / Diploma	All	South Africans
Pathologists	-	5				5	5
Medical scientists	-	-	-	-		-	-
Technologists	-	-	-	-	14	14	14
Other*	-	-	-	1	-	3	3
South Africans	-	5	-	1	14	22	22
All	-	5	-	1	14	22	22

***3 Technicians (1 with honours)**

3. Teaching, training and professional development

A strategic goal for 2017/2018 was to implement effective teaching techniques at both undergraduate and postgraduate level. Various methodologies were adopted to achieve this goal, including the professional development of staff and the introduction of basic blended learning strategies, such as the flipped classroom. Two consultants in the department registered and successfully completed a Postgraduate Diploma in Health Professions Education, whilst another consultant is completing the "Ticket to Teach" certificate programme that is hosted by the university. In addition, our consultants attended a number of health science education workshops, ranging from curriculum design, to assessment methodologies and moderation processes. These interventions led to the implementation of more effective teaching methods and improved assessment techniques.

3.1 Undergraduate level

The consultants in the Department of Haematological Pathology are actively involved in the teaching and training of medical (MBChB), pharmacy and science students. Haematology is taught as a fully integrated subject to second- and third-year MBChB students, as part of the Practice of Medicine curriculum. Haematology teaching also extends as a selective to fourth-year medical students. The initiative of haematology being offered to fifth year medical students, with the focus placed on laboratory testing and result interpretation, was a great success and is now also a permanent addition to the curriculum. Weekly tutorials for the sixth year medical students is an additional teaching and learning opportunity that has become firmly embedded as part of the undergraduate medical curriculum. These initiatives by the department resulted in the continuous exposure of medical students to haematology during their training, which will hopefully translate into prompt recognition of haematological disorders and to rational laboratory usage in haematology when they graduate and become practicing clinicians.

3.2 Postgraduate level

The MMed programme in Haematology is modelled on the spiral curriculum. It is an inclusive practical and theoretical training programme that spans over a four-year period, with regular assessments. Dr J Alant's recent graduation maintains the department's 100% pass rate of registrars who wrote the final College of Medicine Haem Path examination and successfully passed on their first.
In addition to the MMed programme, the department also offers an MSc and BSc (Hons) degree, as well as teaching and training of intern medical scientists, medical technology and technician students.

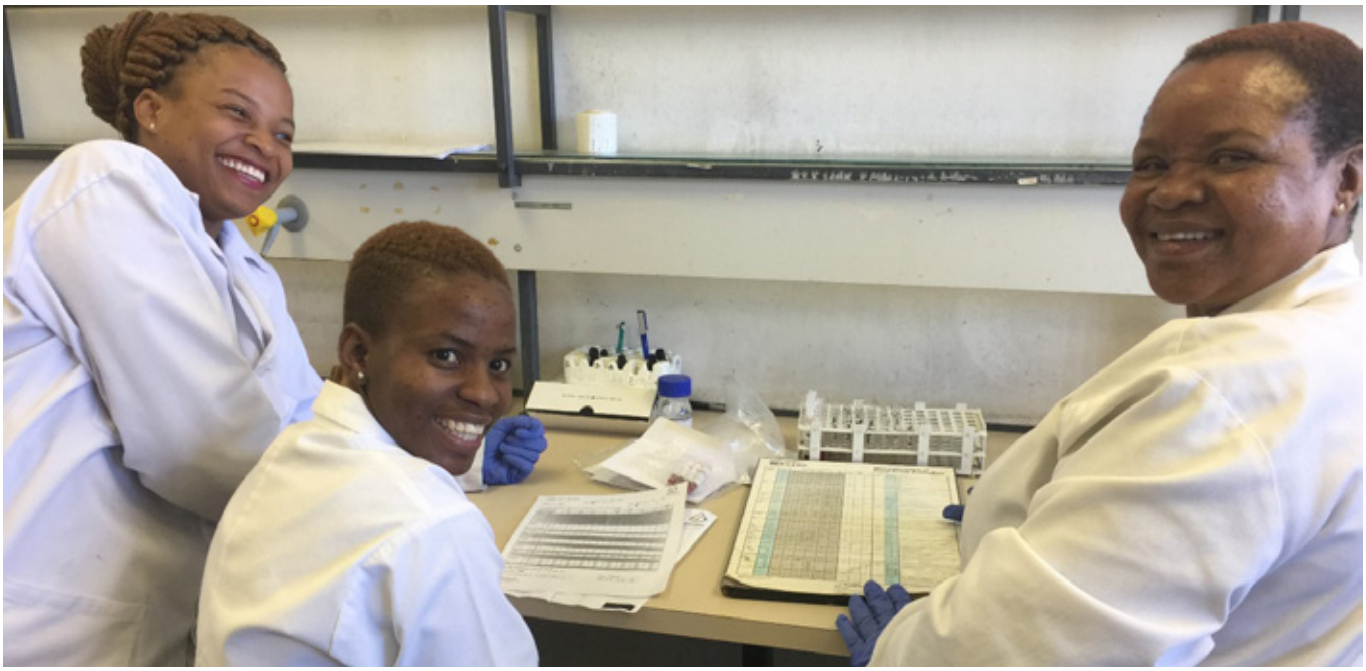


Figure SMU 4:Teaching and training of intern medical scientists by Ms S Moeketsi.
From the left: Ms C Hlophe, Ms M Mahlase and Ms S Moeketsi.

The Haematology Department has a robust, inclusive training programme in place for intern medical scientists.

3.3 Other

The consultants in the unit are actively involved in the external examination and moderation of dissertations and examinations, including the College of Medicine of South Africa Examinations. The Department convened another successful Semester I CMSA FC Path (Haem) Part I and II examination in 2017.

They are also hands-on involved in NHLS and university committees and working groups which include the academic planning and curriculum development committee for MBChB II and III, the School of Medicine Research and Ethics Committee, the Haematology Expert Committee and the Clinical Pathology Expert Committee.

Table SMU 6: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern medical scientist	Honours	All	South Africans
Total number of trainees	-	3	6	3	4	16	16
Final year trainees	-	-	1	-	2	3	3
Successful completion	-	-	100%	-	100%	100%	100%

4. Awards

Dr L Mafisa received an Honourable mention for her oral presentation in the Haematology, Immunology and Human Genetics category at the PathRed 2017 Congress held at Emperor's Palace from 22 – 24 June 2017.

5. Research activities

5.1 Research projects [Please add funder, short description, start and end date]

Project title: An investigation of the nutritional and immunological status, organ function and excretion pattern of drug metabolites in Nyaope users
Principal investigators: Prof K Mokwena
Co-investigators: Prof AA Khine and Prof V Moodley

Project title: A comparative analysis of the use of liquid monoclonal reagents versus DuraClone™ dried monoclonal reagents in the immunophenotypic investigation of suspected plasma cell dyscrasias and lymphomas with plasmacytic differentiation at Dr George Mukhari Tertiary Laboratory
Principal investigator: Dr J Alant - MMed
Supervisor: Prof V Moodley
Co-supervisor: Prof R Pool

Project title: A profile of bone marrow aspirates received at Dr George Mukhari Unit, NHLS during 2015 and 2016
Principal investigator: Ms CM Hlophe – BSc Honours
Supervisor: Ms Y Harris
Co-supervisor: Dr RP Mashele
Project end date:

Project title: The full blood count and the biochemical iron profile in patients with depleted bone marrow iron stores at Dr George Mukhari Academic Hospital during 2015 and 2016
Principal investigator: Ms MM Mahlase – BSc Honours
Supervisor: Ms Y Harris
Co-supervisor: Dr AN Dlova

Project title: The epidemiology and outcome of patients admitted with skull fractures secondary to assault at Dr George Mukhari Academic Hospital, Pretoria
Principal investigators: Dr A Kelly - MMed
Supervisor: Prof P Lekgwara
Co-supervisor: Prof V Moodley

Project title: Parvovirus B19 prevalence in bone marrows of patients with cytopenias at Dr George Mukhari Academic Hospital
Principal investigator: Dr AN Dlova

Project title: The profile and management of patients who tested positive for Cryptococcal antigen on reflex testing at Dr George Mukhari Tertiary Laboratory

Principal investigator:	Dr J Alant
Co-investigators:	Dr AM Pooe, Prof V Moodley, Dr L Coetzee and Dr N Cassim
Project Title:	Awareness and knowledge of medical practitioners regarding multiple myeloma at the regional and district hospitals in Pretoria
Principal investigator:	Dr AN Dlova
Co-investigators:	Dr J Alant, Dr RP Mashele and Prof Modiba
Project title:	The clinical profile, management and complications of haemophilia patients at Dr George Mukhari Aca demic Hospital
Principal investigator:	Dr L Mafisa - MMed
Supervisor:	Dr AN Dlova
Project title:	Optimisation of criteria for peripheral blood smear review following automated blood cell analysis at the haematology laboratory of the Dr George Mukhari Unit in Ga-Rankuwa, Pretoria
Principal nvestigator:	Dr MP Ntseke-Maseko - MMed
Supervisor:	Dr RK Rankapole
Project title:	The full blood count manifestations associated with Listeria monocytogenes infection at Dr George Mukhari Academic Laboratory
Principal investigator:	Mr L Dweba – BSc Honours
Supervisor:	Ms Y Harris
Supervisor:	Dr J Alant
Project title:	An assessment of the automated myeloperoxidase index as a screening tool for deficiencies of vitamin B12 and/or folate
Principal investigators:	Ms TE Mashila – BSc Honours
Supervisors:	Ms Y Harris and Dr J Alant

6. Research output

6.1 Journal publications

Moodley V and Alant J; The straight and marrow - a primary care approach to anaemia. South African Family Practice. 2018; 60(2):28–31

6.2 Conference presentations (oral, poster)

6.2.1 Oral presentations

National congresses

Mafisa L, Rankapole R, Pooe A, Mmusi M, Ngwane T and Boy S. A rare case of plasmablastic lymphoma in a paediatric patient at Dr George Mukhari Academic Laboratory – 2016. PathReD Congress, Johannesburg. 22 – 24 June 2017.

Mafisa L, Dlova AN and Ngwane T. The role of clinicopathological correlation in the diagnosis of a Haemophilia patient. MASAC Symposium, Johannesburg. 2- 3 November 2017.

Local congresses (university academic days)

Mafisa L, Rankapole R, Pooe A, Mmusi M, Ngwane T and Boy S. A rare case of plasmablastic lymphoma in a paediatric patient at Dr George Mukhari Academic Laboratory – 2016. SMU Health Sciences Research Days, Pretoria. 22 – 24 August 2017.
Pooe A, Zelaya-Torres C, Nel C, Ngqandu M and Adu A. A plasmacytoma causing pressure to the brain in a patient with plasma cell myeloma. SMU Health Sciences Research Days, Pretoria. 22 – 24 August 2017.

6.2.2 Poster presentations//

National congresses

Alant J, Dlova AN and Mntla P. Myeloid and lymphoid neoplasm with eosinophilia presenting as mixed valvular heart disease. PathReD Congress, Johannesburg. 22 – 24 June 2017.
Pooe A, Zelaya-Torres C, Nel C, Ngqandu M and Adu A. A plasmacytoma causing pressure to the brain in a patient with plasma cell myeloma. PathReD Congress, Johannesburg. 22 – 24 June 2017.
Rankapole RK, Sibandze D and Moodley V. The evaluation of the efficacy of plastic tubes versus glass tubes in the determination of the ABO and Rhesus blood grouping at the DGM Academic Unit of the NHLS, Ga-Rankuwa. Laboratory Medicine Congress, Durban. 19 – 21 May 2017.

Medical Microbiology

Head: Prof M Nchabeleng

1. About the department

The Department of Microbiology provides teaching and training for students at SMU and diagnostic services for DGM Hospital and the surrounding clinics. It also provides national coverage of pathology services for the regional and district laboratories for some parts of North West and Mpumalanga Provinces.

2. Diagnostic services

Table SMU 7- Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists –excluding HOD		2				2	2
Medical scientists			1			1	1
Technologists					17	17	17
Other*						10	10
South Africans							
All						30	30

***Technicians**

The department renders 24-hour microbiology services for DGM Academic Hospital and the surrounding clinics; serving as a referral laboratory for regional laboratories and some parts of North West and Mpumalanga Provinces. The overall volumes decreased by 1.07% and
SANAS accreditation was maintained, using ISO15189. The department also supports the infection prevention and control (IPC) activities, the Antibiotic Stewardship Programme and the Pharmacy and Therapeutic Committee of the DGM Academic Hospital.

3. Teaching, training and professional development

3.1 Undergraduate level

The department teaches Medical Microbiology to the following undergraduate students: MBChB I (Introduction), II, III (whole-year course) and IV (Selectives); BDS III (semester); BCur (semester); and BSc Diet (semester).

3.2 Postgraduate level

There are postgraduate training programmes for registrars (MMed and FCPath examinations), PhD, MSc, BSc Hons and intern scientist students. The department is also providing an interfaculty molecular biology course for postgraduate students in the institution.

3.3 Other

Table SMU 8: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern medical scientists	Honours	All	South Africans
Total number of trainees	1	5	6	1	5	18	18
Final year trainees	1	4	4	0	5	14	14
Successful completion	0	4	1	0	5	10	10

4. Awards

- Dr P Phahladira (registrar): second prize for an oral presentation by a postgraduate student at the SMU Health Sciences Re search Day, 22 - 24 August 2017.
- Ms IK Ngwenya (MSc student): Best oral presentation at the FIDSSA Congress, Cape Town, 9 -11 November 2017.

5. Research activities

5.1 Research projects

COMPLETED PROJECTS

Project Title: Investigation of Haemophilus influenzae colonising the nasopharynx of children aged 2 months to 14 years attending the paediatric clinic at DGMA Hospital
Researchers: Dr C Maluleka* and Dr AM Musyoki

Project title: An investigation of tetracycline-resistant ureaplasma isolates from patients at the DGM Academic Hospital in 2012 and 2014
Researchers: Dr M le Roux and Ms B de Villiers

Project title: An investigation of Streptococcus pneumoniae colonizing the nasopharynx of children attending the paediatric clinic at DGM Academic Hospital
Researchers: Ms O Kgasha and Dr C Maluleka*

Project title: Characterisation of rpoB gene mutations from the clinical samples of Mycobacterium tuberculosis at DGM Tertiary Laboratory
Researchers: NA Makhado* and B de Jong (Antwerp University)

Project title: An evaluation of the validity of three molecular assays for the detection of drug resistant Mycobacterium tuberculosis at the DGM Tertiary Laboratory , using the phenotypic BACTEC MGIT 960 as the gold standard
Principal investigator: Ms N Makhado*
Co-researcher: C Maluleka*

Project title: Investigation of the prevalence and molecular patterns of carbapenem resistant organisms and the effica cy of the phenotypic detection methods used for detecting carbapenem resistant organisms
Principal investigator: C Maluleka*
Co–researcher: B de Villiers

ON-GOING PROJECTS

Project title: Molecular characterisation and antimicrobial susceptibility testing of group A streptococcus isolates from patients with invasive and non-invasive infections at DGM Tertiary Laboratory and selected local clinics
Principal investigator: M Nchabeleng*
Co–researcher: O Kgasha

Collaborators: RHD Team (SMU and UCT)
Funding: MRC

Project title: Prevalence and characterization of selected sexually transmitted pathogens in groups of women at DGM Academic Hospital
Principal investigators: MC le Roux and B de Villiers
Co-researchers: RMM Ditsele* and TS Monokoane (Obstetrics and Gynaecology)
Funding: NHLS Trust
Project title: Characterisation of mycobacterial strains from clinical specimens of patients with tuberculosis at the DGM Tertiary Laboratory, South Africa
Principal investigator: NA Makhado* (PhD)
Co–researchers: M Nchabeleng*
Collaborator: B de Jong (Antwerp University)
Funding: NHLS Trust/Vlaamse Interuniversitaire Raad (VLIR) project
Project title: Different antimicrobial resistance mechanisms in microbes.

i. Comparison of lipopolysaccharides and outer membrane protein profiles of Pseudomonas aeruginosa isolates from selected wards at DGM Academic Hospital
   Student: RM Mokgatla (MMed)
ii. Detection of carbapenemase encoding genes in multidrug-resistant Acinetobacter baumannii isolates at DGMA Academic Hospital
   Student: T Phofa (MMed)
iii. Phenotypic and genotypic detection of Extended Spectrum Beta-lactamases amongst Gram negative organisms isolated at NHLS, DGM Academic Hospital

Principal investigators: Prof M Nchabeleng* and C Maluleka*
Student: U Matodzi (BSc Hons)
Co- researchers: B de Villiers and Dr AM Musyoki

Project title: Discordancy of rifampicin susceptibility in mycobacterium complex isolates from DGM Tertiary Laboratory
Student: G Shikwambane-Ntlemo* (MMed)
Principal investigator: N Makhado*
Co-researcher: M Nchabeleng*

Project title: Comparison of GeneXpert and MTBDRplus line probe assay and review of the implementation of the national diagnostic algorithm for diagnosis of Mycobacterium tuberculosis at DGM Tertiary Laboratory
Principal investigator: M Nchabeleng*
Student: PM Pahladira (MMed)*
Co-researcher: MN Makhado*

Project title: Prevalence of Mycobacterium kansasii and its subtypes from patients with tuberculosis at DGM Tertiary Laboratory
Principal investigator: MN Makhado*
Collaborator: B de Jong (Antwerp University)

Project title: Prevalence and characterisation of Neisseria gonorrhoeae and Chlamydia trachomatis in genital and extra-genital sites among men having sex with men at Ga-Rankuwa, South Africa.
Principal investigator: MC le Roux
Co–researchers: L Nemarude; B de Villiers and RMM Ditsele*
Collaborators: M Nchabeleng* and Medunsa Clinical Research Unit (MeCRU) team

Project title: Investigating Persea americana "avocado" seed extract for antibacterial activity against Acinetobacter baumanii, Enterococcus faecalis and Enterococcus faecium
Principal investigator: A Musyoki
Co-researcher: C Maluleka*

Collaborator:	Dr MO Ogunrombi (Pharmacy Department)
Project title:	Human Papilloma Virus and Selected Related Pre-Cancerous and Cancer Lesions in Men Who Have Sex with Men in the area North West of Pretoria
Principal investigator:	M Nchabeleng*
Co-researchers:	MP Mathebula, M le Roux, L Lebelo, G Selabe,* RMM Ditsele* and MeCRU team
Collaborator:	JP Bogers (Antwerp University)
Funding:	VLIR project
Project title:	HVTN 702 - A pivotal phase 2b/3 multi-site, randomized, double-blind, placebo-controlled clinical trial to evaluate the safety and efficacy of ALVAC-HIV (vCP2438) and Bivalent Subtype C gp120/MF59 in preventing HIV-1 infection in adults in South Africa
Principal investigator:	M Nchabeleng*
Co-researchers:	MeCRU team
Funding:	DAIDS (HVTN)

*** Indicates an NHLS employee**

6. Research output:

6.1 Journal publications

Le Roux MC, Hoosen AA; Quantitative real time Polymerase Chain Reaction for the diagnosis of Mycoplasma genitalium infection in South African men with and without symptoms of urethritis. Sex Trans Dis. 2017. 44(1):17-20

Olivier MT, Muganza FM, Shai LJ, Gololo SS, Nemutavhanani LD;*. Phytochemical screening antioxidant and antibacterial activities of ethanol extracts of Asparagus suaveolens aerial parts. SA J Botany. 2017; 108: 41-46

Keddy KH, Musekiwa A, Sooka A, Karstaedt A, Nana T, Seetharam S, Nchabeleng M*, Lekalakala R, Angulo FJ, Klugman KP, for GERMS-SA; Clinical and microbiological features of invasive non-typhoidal Salmonella associated with HIV-infected patients, Gauteng Province, South Africa. Medicine Baltimore. 2017 Mar; 96 (13):e6448

NON – SUBSIDISED JOURNAL

Dochez C, Burnett RJ, Musyoki A, Trovoada D, Mphahlele MJ; Strengthening HPV vaccination and adolescent health programmes in Africa. World Health Organization Global Immunization News. January 2017, p8

6.2 Complete books:

None.

6.3 Book chapters:

None.

6.4 Conference presentations (oral, poster)

6.4.1 Oral presentations

International congresses

Makhado N*, Goeminne L, Matabane RE, Boutachkourt F, Gros R, Nchabeleng M*, de Jong B, André E. Missed opportunities for detecting multidrug resistant tuberculosis in South-Africa. ECCMID, Vienna Austria, 22-25 April 2017.

Makhado N*, Colebunders R, Nchabeleng M*, de Jong B.C. Identification of Non-tuberculous Mycobacteria isolated from clinical Specimens at Dr George Mukhari Tertiary Laboratory, South Africa. ECTMIH, Antwerp, Belgium, 16-20 October, 2017.

Nchabeleng M*. Project 4 – Laboratory science and public health management of sexually transmitted infections. Joint Steering Committee meeting – VLIR Project, University of Antwerp, Belgium. 18 – 21 April 2017.

National congresses

Phahladira MP*, Mokgatla M*, Shikwambane-Ntlemo G*, Ncube B*, Phofa T*, Maluleka C*, Ditsele RMM*, Nchabeleng M*. The value of screening for extended spectrum Beta- Lactamase producing Enterobateraciae in blood culture samples, using direct susceptibility testing. 24th National Congress of the SMLTSA, Durban, 19-21 May 2017.
Matabane E, Makhado N*, Nchabeleng M*. Increasing epidemiological importance of a rifampicin resistance mutation undetected by commercial molecular assays. 2nd PathReD Congress, Johannesburg, 23-24 June 2017.
Shikwambane-Ntlemo G*, Maluleka C*, de Jong B, Makhado N*, Nchabeleng M*.The incidence of discordant rifampicin susceptibility results between genotypic and phenotypic methods in Mycobacterium tuberculosis complex isolates at DGM Tertiary Laboratory. 7th FIDSSA Congress, Cape Town, 9-11 Nov 2017.

Le Roux MC, Mafunise M, de Villiers BE, Ditsele RMM*.Prevalence and molecular analysis of Mycoplasma genitalium strains isolated from pregnant women at an academic hospital in Pretoria, South Africa. 7th FIDSSA Congress, Cape Town, 9-11 November 2017.
Ngwenya IK, de Villiers BE, Ditsele RMM*, le Roux MC. Evaluation of two commercial nucleic acid amplification tests for detection of Chlamydia trachomatis, Neisseria gonorrhoeae and Trichomonas vaginalis in endocervical swabs collected from pregnant women attending the DGM Academic Hospital. 7th FIDSSA Congress, Cape Town, 9-11 November 2017. (Winner of best student oral presentation).
Leah Nemarude, Tebogo Mashishi, Teboho Tiiti, Gloria Selabe, John-Paul Bogers, Maphoshane Nchabeleng*, Ramokone Lebelo. HPV infections and co-infection with selected sexually transmitted infections in women attending DGM Academic Hospital, Pretoria, South Africa. 7th FIDSSA Conference 2017, 9 -11 November 2017, Cape Town, South Africa.

Local congresses (university academic days)

Ditsele RMM*, le Roux MC, Nemarude L, de Villiers BE, Ngwenya IK, Nchabeleng M*, MeCRU. Sexually transmitted infections among men having sex with men in Ga-Rankuwa, South Africa. 3rd SMU Health Sciences Research Days, Pretoria. 22-24 August 2017.
Rahulani L, Maluleka C, Kgasha O. An investigation of Streptococcus pneumoniae colonization of the nasopharynx in children attending paediatric clinic at DGM Academic Hospital. 3rd SMU Health Sciences Research Days. Pretoria. 22-24 August 2017.
Phahladira MP, Mokgatla M, Shikwambane-Ntlemo G, Ncube B, Phofa T, Maluleka C, Ditsele RMM, Nchabeleng M. Evaluation of two commercial nucleic acid amplification tests for detection of the usefullness of screening for extended spectrum beta-lactamase producing Enterobateraciae in blood culture samples, using direct susceptibility testing. 3rd SMU Health Sciences Research Days, Pretoria. 22-24 August 2017 (Winner: 2nd best postgraduate presentation).

6.4.2 Poster presentations

International congresses

None.

National congresses

LD Nemutavhanani, RM Mokgatla, C Maluleka, M Mabogo, M Nchabeleng. Aspergillus flavus keratitis in a male patient admitted to Ophthalmology ward at DGM Academic Hospital. 24th National Congress of the SMLTSA, Durban, 19-21 May 2017.

T Phofa, RM Mokgatla, C Maluleka, M Nchabeleng. Evaluation of modified mueller-hinton agar for the detection of carbapenemase production by Acinetobacter baumannii isolates in DGM Tertiary Laboratory. 24th National Congress of the SMLTSA, Durban, 19-21 May 2017.

BA Siwele, RM Mokgatla, C Maluleka, M Nchabeleng. Late diagnosis of multidrug resistant tuberculosis in a child at the DGM, Ga-Rankuwa, South Africa: a case report. 24th National Congress of the SMLTSA, Durban, 19-21 May 2017.

LD Nemutavhanani, RM Mokgatla, C Maluleka, M Mabogo, M Nchabeleng. Aspergillus flavus keratitis in a male patient admitted to Ophthalmology ward at DGM Academic Hospital. 24th National Congress of the SMLTSA, Durban, 19-21 May 2017.

T Phofa, RM Mokgatla, C Maluleka, M Nchabeleng. Evaluation of modified mueller-hinton agar for the detection of carbapenemase production by Acinetobacter baumannii isolates in DGM Tertiary Laboratory. 24th National Congress of the SMLTSA, Durban, 19-21 May

2017.

BA Siwele, RM Mokgatla, C Maluleka, M Nchabeleng. Late diagnosis of multidrug resistant tuberculosis in a child at the DGM Academic Hospital, Ga-Rankuwa, South Africa: a case report. 24th National Congress of the SMLTSA, Durban, 19-21 May 2017.

Shikwambane-Ntlemo G, B de Jong, Makhado N, Nchabeleng M. The incidence of discordant rifampicin susceptibility results between genotypic and phenotypic methods in Mycobacterium tuberculosis complex isolates at DGM Tertiary Laboratory. 2nd PathReD Congress, Johannesburg, 23-24 June 2017.

De Villiers BE, De Villiers BE, Le Roux M, Ditsele M, Towobola O, Monokoane S. An investigation of tetracycline-resistant ureaplasmas colonising patients at DGM Academic Hospital in 2012 and 2014. 7th FIDSSA Congress, Cape Town, 9-11 November 2017.

Maluleka C, Adem IR, Musyoki AM. Investigation of the molecular patterns of carbapenem resistant Pseudomonas aeruginosa and Acinetobacter baumanii, and the efficacy of the phenotypic detection methods used. 7th FIDSSA Congress, Cape Town, 9-11 November 2017.

Musyoki A, Adem IR, Maluleka C. Klebsiella pneumoniae prevalence and antimicrobial susceptibility profile: telling the Dr George Mukhari Academic Hospital's story. 7th FIDSSA Congress, Cape Town, 9-11 November 2017.

Musyoki AM, Poopedi E, Newton C, Maluleka C. Report on Haemophillus influenzae carriage in children attending DGM Academic Hospital: a big boost for Hib vaccination. 7th FIDSSA Congress, Cape Town, 9-11 November 2017.

Maluleka C, Adem IR, Musyoki AM. Prevalence and susceptibility profile of Acinetobacter baumanii isolated at high care wards at DGM Academic Hospital in 2015. 7th FIDSSA Congress, Cape Town, 9-11 November 2017.

Kgasha O, Rahulani L, Maluleka C. An investigation of Streptococcus pneumoniae colonization of the nasopharynx in children attending paediatric clinic at DGM Academic Hospital. 7th FIDSSA Congress, Cape Town, 9-11 November 2017.

Khosa X, Kgasha O, Mabuza H, Haribhai A, Moshe M, Nchabeleng M. Molecular characterisation and antimicrobial susceptibility testing of Group A streptococcus isolates from invasive and non-invasive infections at Phedisong 4, Soshanguve and DGM Academic Hospital. 7th FIDSSA Congress, Cape Town, 9-11 November 2017.

Ditsele RMM, le Roux MC, Nemarude L, de Villiers BE, Ngwenya IK, Nchabeleng M, MeCRU Team. Sexually transmitted infections among men having sex with men in Ga-Rankuwa, South Africa. 7th FIDSSA Congress, Cape Town, 9-11 November 2017.

Nemarude AL, Lebelo L. HPV infections and co-infection with selected sexually transmitted infections in women attending DGM Academic Hospital, Pretoria, South Africa. 7th FIDSSA Congress, Cape Town, 9-11 November 2017.

Local congresses (university academic days)

Adem IR, Maluleka C, Musyoki AM. Klebsiella pneumoniae prevalence and antimicrobial susceptibility profile: telling the DGM Academic Hospital's story. 3rd SMU Health Sciences Research Days, Pretoria. 22-24 August 2017.

Adem IR, Maluleka C, Musyoki AM. Prevalence and susceptibility profile of Acinetobacter baumanii isolated at high care wards at DGM Academic Hospital in 2015. 3rd SMU Health Sciences Research Days, Pretoria. 22-24 August 2017.

Musyoki AM, Poopedi E, Newton C, Maluleka C. The first ever report on Haemophillus influenzae carriage in children attending DGM Academic Hospital: a big boost for Hib vaccination. 3rd SMU Health Sciences Research Days, Pretoria. 22-24 August 2017.

Nemutavhanani LD,Mokgatla RM, Maluleka C,Mabogo M, Nchabeleng M. Aspergillus flavus keratitis in a male patient admitted to ophthalmology ward at DGM Academic Hospital. 3rd SMU Health Sciences Research Days. Pretoria. 22-24 August 2017.

Raidani T, Makhado NA, Maluleka C, Malinga L. An evaluation of the validity of three molecular assays for the detection of drug resistant Mycobacterium tuberculosis at the DGM Tertiary Laboratory, using the phenotypic BACTEC MGIT 960 as the gold standard. 3rd SMU Health Sciences Research Days, Pretoria. 22-24 August 2017.

Ratshibvumo R, Nemarude AL, Maluleka C, Newton C. An investigation of group A Streptococcus colonization of the nasopharynx in children attending paediatric clinic at DGM Academic Hospital. 3rd SMU Health Sciences Research Days, Pretoria. 22-24 August 2017.

Shikwambane-Ntlemo G, B de Jong, Makhado N, Nchabeleng M. The incidence of discordant rifampicin susceptibility results between genotypic and phenotypic methods in Mycobacterium tuberculosis complex isolates at DGM Tertiary Laboratory. 3rd SMU Health Sciences Research Days, Pretoria. 22-24 August 2017.

Le Roux MC, Mafunise M, de Villiers BE, Ditsele RMM. Prevalence and molecular analysis of Mycoplasma genitalium strains isolated from

pregnant women at an academic hospital in Pretoria, South Africa. 3rd SMU Health Sciences Research Days, Pretoria. 22-24 August 2017.

Ngwenya IK, de Villiers BE, Ditsele RMM, le Roux MC. Evaluation of two commercial nucleic acid amplification tests for detection of Chlamydia trachomatis, Neisseria gonorrhoeae and Trichomonas vaginalis in endocervical swabs collected from pregnant women attending the DGM Academic Hospital. 3rd SMU Health Sciences Research Days, Pretoria. 22-24 August 2017.

6.4. 3 Patents :

None.

6.5 Research translations

None.

Medical Virology

Head: Prof Maphoshane Nchabeleng (Acting)

1. About the department

The Department of Virology provides pathology services as a DGM tertiary laboratory in Northern Gauteng region, NHLS, as well as an academic department at SMU Health Sciences. This includes servicing peripheral laboratories in Gauteng, North West, Mpumalanga and Limpopo Provinces. The department comprises joint appointees who are responsible for the laboratory service, as well as academic functions of the university, full-time university staff members, and fulltime NHLS staff members. We host three research units: the (MRC/UL Diarrhoeal Pathogens Research Unit (DPRU), the HPV, HIV and Hepatitis Research Unit and the South African Vaccination and Immunisation Centre (SAVIC). The department furthermore has national, regional and international linkages and collaborations.

2. Diagnostic services

The DGM virology laboratory offers routine diagnostic testing for varieties of viral infections using immunological-based methods and molecular methods. The laboratory maintains its SANAS accreditation status and provides its service to private and public hospitals, as well as clinics in the north of Pretoria. It continues to serve as a referral site for a number of NHLS laboratories in Mpumalanga, North West and Limpopo provinces. The laboratory is one of the referral laboratories for HIV viral load testing in the NPP.

Additionally, the virology laboratory was identified as one of five laboratories within the NHLS to offer HIV drug resistance routine testing for the South African public sector As such, the HIV drug resistance laboratory has been operational since February 2018. The virology laboratory has furthermore participated in the National Antenatal HIV Surveillance Programme for 17 years. It is also a teaching platform for intern medical technologists and technicians, intern medical scientists and pathology registrars.

Table SMU 9: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	-	2				2	2
Medical scientists	1	-	-	-		1	1
Technologists	-	-	-	-	10	10	10
Technicians	-	-	-	-	2	2	2
Support	-	-	-	-	-	1	1
All	1	2	-	-	12	16	16

3. Teaching, training and professional development

3.1 Undergraduate level

The department coordinates the training courses in virology for medical and dental health professionals, allied health professionals, medical scientists, medical technologists and medical technicians. The laboratory is also accredited to provide experiential training to medical technologists and to train medical technicians.

3.2 Postgraduate level

The Department offers courses leading to qualifications such as MMed., BSc (Med.) Hon, MSc (Med.) and PhD in Virology.

3.3 Other

A number of training activities were organised by the department, SAVIC and the MRC SMU DPRU. The department is accredited by HPCSA for training of undergraduate and postgraduate medical professionals, as well as medical scientists.

Table SMU 10: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern medical scientists	Honours	All	South Africans
Total number of trainees	3	12	3	1	-	19	18
Final year trainees	1	4	1	-	-	6	
Successful completion	1	2	0	-	-	3	2

4. Awards

- Lebelo RL. Best Poster presentation, FIDSSA, 2017, Certificate/R5000; and
- Seheri LM: C3- rating from NRF (1 Jan 2017- 31 Dec 2022).

5. Research activities

5.1 Research rojects

Project title: Hepatitis B virus infections in HIV-positive and negative patients at the DGM Academic Hospital, Pretoria, South Africa
Principal investigator: SG Selabe (SMU/NHLS)
Co-researchers: RJ Burnett (SMU), TJ Mashamba (SMU) and OE Simani (SMU)
Collaborators: JT Blackard (University of Cincinnati) and MJ Mphahlele (MRC)
Funding: NRF and NHLS Research Trust
Short description: The aim of the study is to investigate the serological and molecular characteristics of HBV infections in HIV infected and uninfected patients, men who have sex with men (MSM), HBV/HIV pregnant women and their babies. The study samples were tested for HBV serological markers, using the Cobas 6000 analyser. Quantitative and qualitative HBV DNA tests were conducted, using real-time and inhouse PCR assays. The surface and polymerase genes were amplified and sequenced. Phylogenetic analysis was conducted, using MEGA6.0. From an MSM cohort, only 80 samples were tested. Of these, 39 (21.54%) were found to be HBsAg positive, 5 (2.76%) were anti-HBs positive and 11 (6.08%) were anti-HBc positive. Eighteen percent of those testing negative for HBsAg were HBV DNA positive (i.e. had occult HBV infection). The results so far show a high prevalence of hepatitis B virus in MSM and HIV positive patients, as well as occult hepatitis B patients. Occult HBV infection however remains prevalent in our study population and requires further investigation. Molecular characterization to identify mutations and genotypes associated with HBV infections is ongoing.
Project start date: Jan 2017
Project end date: Dec 2019

Project title: Prevalence of selected sexually transmitted infections as well as the assessment and acceptability of vaginal self-sampling device for HPV infection detection and cytology in South African women
Principal investigator: RL Lebelo (SMU)
Co-researchers: Prof SG Selabe (SMU), Prof M Nchabeleng (SMU), Prof JP Bogers (UA, Belgium) and Dr M Le Roux (SMU)
Collaborators: Dr B Nomukongwe (SMU), Prof S Monokoane and Dr Mosehle (SMU)
Funding: VLIR-IUC and a Research Development Grant (RDG)
Short description: The study aims to:

- Determine the prevalence of HPV, Chlamydia trachomtis, Trichomonas vaginalis, Mycoplasma homonis, Mycoplasma genitalium,Ureaplasma urealyticum, Ureaplasma parvum and Neisseria gonorrhoeae infections and the association with HPV infection;
- Evaluate the acceptance and attitude of women towards self-sampling for cervical cancer screening (cytology);
- Test the sensitivity of the self-collected liquid based cytology (LBC) samples for HPV detection and cytology testing; and
- Investigate whether HPV viral load and mRNA expression can be predictors of progression of cervical lesions in women attending the gynecology clinics, at DGM Academic Hospital.

353 Patients were enrolled on the stidy and 706 self-collected and doctor-collected LBC samples were collected. These samples are tested for HPV DNA, using the Abbott m2000 system as well as the HPV mRNA, using the Aptima test on the Panther system. The other STIs are tested using Anyplex II STI-7. The viral load will be determined using the illumina real-time PCR system for 14 HR HPV. The cytology slides are prepared using the ThinPrep 5000 system and are stained manually, with H7E stains. The preliminary results show that almost half of the patients have detectable HPV and the most common HPV type is HPV 16. Close to 70% of the HPV DNA positive patients furthermore show active HPV infection.

Project start date: Jan 2016
Project end date: Dec 2019

Project title: HBV in South African healthcare workers (HCWs)
Principal investigator: RJ Burnett (SMU)
Co-researchers: SG Selabe (SMU/NHLS); JN Rakgole (SMU) and TH Sondlane (until December 2016; SMU)
Collaborator: MJ Mphahlele (SAMRC)
Funding: SAMRC
Short description: This study aims to investigate HBV in HCWs from Gauteng and Mpumalanga provinces, specifically inves tigating HB vaccination uptake; prevalence of HBV antibodies (anti-HBs and anti-HBc), HBV surface anti gen(HBsAg) and HBV DNA; HBV viral loads; HBV genotypes; mutations; and factors associated with HBV status. The study population includes stored sera and questionnaire data collected from Gauteng and Mpumalanga HCWs for an over-arching study (MREC/PH/87/2008: IR), and HCWs from health facilities not previously surveyed, from whom blood samples and questionnaire data were collected during 2017. Following informed consent, laboratory tests include HBsAg, anti-HBc, anti-HBs, and HBV DNA viral loads. HBV DNA positive sera will be sequenced and genotyped. Questionnaire data include demographics, vaccination status, HIV status and antiviral treatment. Ethics clearance was obtained from the SMU Research Ethics Committee (SMUREC/P/24/2015:PG).

Project start date: Jan 2015
Project end date: Dec 2017

Project title: Anti-vaccination (AV) lobbying in South Africa
Principal investigator: RJ Burnett (SMU)
Co-researchers: JC Meyer (SMU), LM Seheri (SMU), AM Musyoki (SMU), VV Nkwinika (SMU), D van der Merwe (North West University) and Bagina B (UCT)
Collaborators: C Dochez (University of Antwerp), MJ Mphahlele (SAMRC), M Madumo (SMU) and T Tau (SMU)
Funding: NRF
Short description:

This study serves to fully investigate AV lobbying in South Africa, to develop effective interventions. Objectives aim to:

(a) Characterise AV lobbying in South Africa;

(b) Measure the extent of AV lobbying in South Africa;

(c) Determine the proportion of South African children who are not vaccinated because their parents subscribe to AV messag ing;

(d) Establish the proportion of South African HCWs who are not vaccinated because they believe AV messages;

(e) Identify and develop interventions that can be used to counteract the effect of AV lobbying in South Africa; and
(f) Measure the effectiveness of these interventions.
Identify and develop interventions that can be used to counteract the effect of AV lobbying in South Africa; and
Measure the effectiveness of these interventions.

Project start date: Jan 2011
Project end date: Dec 2021

Project title: Understanding virus-host interactions and rotavirus vaccine impact at the DGM Academic Hospital and Oukasie Primary Healthcare Centre

Principal investigator: LM Seheri (SMU)

Co-researchers: D Mawela (SMU), K Rakau (SMU), I Peenze (SMU), MJ Mphahlele (SAMRC) and NA Page NA (NICD)

Collaborators: Jason Jiang (University of Cincinnati Children's Hospital Medical Center), Roma Chilengi (Centre for Infectious Disease Research in Zambia) and Tan Gene (J Craig Venter Institute (JCVI), Maryland, Washington DC, USA)

Funding: SAMRC

Short description: The study serves to provide critical evidence on why rotavirus vaccines may be displaying relatively lower performance in South Africa as compared to higher efficacy in developed countries. The project focused on the following broad aims:

(a) Understanding the histo-blood group antigens (HBGAs) as potential receptors for rotaviruses;
(b) Exploring the asymptomatic neonatal P[6] strains as a possible vaccine candidate in Africa in depth;
(c) Evaluating the potential contributions of breast milk components (Lactoferrin and Lactoadherin) in failed rotavirus seroconversion in infants following immunisation with rotavirus vaccines;
(d) Defining correlates of protection conferred by the current vaccines;
(e) Exploring rotavirus genomics to uncover how the strains evolve in response to vaccine selective pressure;
(f) Evaluating genotype specific vaccine efficacy and identifying viral correlates of immune protection; and
(g) Monitoring the impact of rotavirus vaccination at DGM Academic Hospital and other surrounding hospitals, clinics and private laboratories in the region.

Project start date: Jan 2016

Project end date: Dec 2020

Project title: African Rotavirus Surveillance Network and the World Health Organization Regional Office for Africa (WHO-AFRO) Paediatric Diarrhoeal Surveillance Network

Principal investigators: MJ Mphahlele (SAMRC) and LM Seheri (SMU)

Co-researchers: I Peenze (SMU), NB Magagula (SMU), K Mothapo (SMU), K Rakau (SMU), J Lisoga (SMU) and T Masindi

Collaborators: J Mwenda (WHO African Regional Office, Brazzaville, Congo), Ministries of Health (MoH) in the WHO African Region (AFRO), (Angola, Cameroon, DRC, Ethiopia, Eritrea, Kenya, Lesotho, Madagascar, Mauritius, Namibia, Rwanda, Seychelles, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe), E Houpt (University of Virginia Tan Gene (JCVI, Maryland, Washington DC, USA) and NA Page (NICD)

Funding: WHO Centers for Disease Control and Prevention Foundation, in Atlanta and the Bill and Melinda Gates Foundation

Short description: Apart from the African Rotavirus Surveillance Network and WHO Global Paediatric Diarrhoeal Surveillance Network (GPDSN), the diarrhoeal pathogens research unit is testing multiple enteropathogens (viruses, bacteria, fungi and parasites) from the stool samples using the TaqMan Array Card (TAC), a novel quantitative polymerase chain reaction (qPCR) with the capacity to simultaneously detect 63 pathogens to investigate the burden of diarrhoeal disease in African children ≤ 5 years of age, in the era of rotavirus post-vaccination introduction. The objectives of the study are to:

a) Generate data on the circulating rotavirus strains in the region;
b) Support awareness and regional advocacy for the introduction of rotavirus vaccines;
c) Generate baseline surveys on viral, bacterial, fungi and parasites enteropathogens associated with diarrhoea post rotavirus vaccine introduction in Africa; and
d) Investigate genetic characterization of noroviruses strains in African children ≤ 5 years of age.

Project start date:	an 2018
Project end date:	Ongoing
Project title:	Investigation of the role of gut microbiota in diarrhoeal disease in children attending the Oukasie Primary Healthcare Centre in Brits, and the DGM Academic Hospital in Pretoria
Principal investigator:	KM Mothapo (SMU)
Co-researchers:	LM Seheri (SMU), I Peenze (SMU) and S Mahlangu (SMU)
Collaborators:	D Mawela (SMU), MJ Mphahlele (SAMRC) and K Nelson (JCVI)
Funding:	RDG
Short description:	The study aims to investigate gut microbiota in children <5 years who are attending the Oukasie Health Care Centre in Brits, and the DGM Academic Hospital in Pretoria. Gut microbiota has been associated with many diseases that are common in South Africa, including obesity, diabetes and enteric diseases. Enteric diseases modify gut integrity and promote increased susceptibility to other infections. Gut microbiota alterations in infants could affect the development and functioning of the immune system, which may increase the risk of acquiring diseases later in life. Infectious diseases are among the diarrhoea,with high mortality rates in children <5 years of age in South Africa. An estimated 20-40% of the diarrhoeal cases are not accounted for or the etiological agent is unknown. agent is unknown. Data on the gut microbiota composition in South African children, and its potential role in health and disease, are lacking. The current study will hence generate gut microbiota data from children below 5 years old.
Project start date:	
Project end date:	

6. Research output

6.1 Journal publications

Dochez C, Burnett RJ, Mbola Mbassi S, Were F, Musyoki A, Trovoada D, Mphahlele MJ; Improving skills and institutional capacity to strengthen adolescent immunisation programmes and health systems in African countries through HPV vaccine introduction. Papillomavirus Research. 2017;4:66-71

Dochez C, Burnett RJ, Mphahlele MJ; Introduction of a new vaccine into national immunisation programmes in Africa: the role of capacity building. BMJ Glob Health. 2017 suppl 2: A53

Gededzha MP, Mphahlele MJ, Blackard JT, Selabe SG; Prevalence of NS5B Resistance Mutations in Hepatitis C Virus (HCV) Treatment in Naive South Africans. Hepat Mon. 2017;17 (6):e14248

Seheri LM, Magagula NB, Peenze I, Rakau K, Ndadza A, Mwenda JM, Weldegebriel G, Steele AD, Mphahlele MJ; Rotavirus strain diversity in Eastern and Southern African countries before and after vaccine introduction. Vaccine. 2017 Dec 1. pii: S0264-410X(17)31679-1. DOI: 10.1016/j.vaccine.2017.11.068. [Epub ahead of print] PubMed PMID: 29203181

Page NA, Seheri LM, Groome MJ, Moyes J, Walaza S, Mphahlele J, Kahn K, Kapongo CN, Zar HJ, Tempia S, Cohen C, Madhi SA; Temporal association of rotavirus vaccination and genotype circulation in South Africa: Observations from 2002 to 2014. Vaccine. 2017 Oct 27. pii: S0264-410X(17)31470-6. DOI: 10.1016/j.vaccine.2017.10.062. [Epub ahead of print] PubMed PMID: 29110933

Ndombo PK, Ndze VN, Fokunang C, Ashukem TN, Boula A, Kinkela MN, Ndode CE, Seheri ML, Bowen MD, Waku-Kouomou D, Esona MD; Pre-vaccine circulating group a rotavirus strains in under 5 years children with acute diarrhea during 1999-2013 in Cameroon. Virology (Lond). 2017 Aug;1(4). DOI: 10.15761/VRR.1000120. Epub 2017 Jul 25. PubMed PMID: 29051924; PubMed Central PMCID: PMC5645035

Rahajamanana VL, Raboba JL, Rakotozanany A, Razafindraibe NJ, Andriatahirintsoa EJPR, Razafindrakoto AC, Mioramalala SA, Razaiarimanga C, Weldegebriel GG, Burnett E, Mwenda JM, Seheri M, Mphahlele MJ, Robinson AL; Impact of rotavirus vaccine on all-cause diarrhea and rotavirus hospitalizations in Madagascar. Vaccine. 2017 Sep 25. pii: S0264-410X(17)31205-7. DOI:10.1016/j.vaccine.2017.08.091. [Epub ahead of print] PubMed PMID: 28958809

Operario DJ, Platts-Mills JA, Nadan S, Page N, Seheri M, Mphahlele J, Praharaj I, Kang G, Araujo IT, Leite JPG, Cowley D, Thomas S, Kirkwood

CD, Dennis F, Armah G, Mwenda JM, Wijesinghe PR, Rey G, Grabovac V, Berejena C, Simwaka CJ, Uwimana J, Sherchand JB, Thu HM, Galagoda G, Bonkoungou IJO, Jagne S, Tsolenyanu E, Diop A, Enweronu-Laryea C, Borbor SA, Liu J, McMurry T, Lopman B, Parashar U, Gentsch J, Steele AD, Cohen A, Serhan F, Houpt ER; Etiology of severe acute watery diarrhea in children in the global rotavirus surveillance network using quantitative polymerase chain reaction. Journal of Infectious Diseases. 2017 Jul 15;216(2):220-7. Epub 2017 Jun 21. [Original] DOI: 10.1093/infdis/jix294

Gikonyo JN, Nyangao J, Mbae C, Sang C, Njagi E, Ngeranwa J, Esona M, Seheri ML, Gitau GW, Raini K, Kariuki S; Molecular characterization of group a rotaviruses in Mukuru slums Kenya: Detection of novel strains circulating in children below 5 years of age. BMC Research Notes. 2017 Jul 17;10(1):290. [Original] DOI: 10.1186/s13104-017-2611-z

Research articles in non-subsidised publications

Burnett RJ; Essential vaccines for senior citizens. Immunise Today. 2017; 8(2):2

Dochez C, Burnett RJ, Musyoki A, Trovoada D and Mphahlele MJ; Strengthening HPV vaccination and adolescent health programmes in Africa. World Health Organization Global Immunization News. January 2017, p8

Lissens JO, Selabe SG, van Geertruyden JP, Bogers JP; African HPV pathology and control: the work of the WAKA network. Cancer Control. 2017: 36 -39

Baleka MA, Tozin R, Simoens C, Ramokone L, Bogers J, Van Geertruyden JP, Jacquemyn Y. Efficacy of antiviral drug AV2 in the treatment of human papillomavirus-associated precancerous lesions of the uterine cervix: A randomized placebo-controlled clinical trial in Kinshasa, Democratic Repulic of Congo. (KINVAV study). Contemporary Clinical Trials Communications. 8, 2017, 135-139

6.2 Complete books

None.

6.3 Book chapters

None.

6.4 Conference presentations (oral, poster)

6.4.1 Oral presentations

International congresses

Burnett RJ. Training of vaccinators: the relevance of continuous training in Africa – experience from South Africa. 13th Annual African Vaccinology Course (AAVC), UCT. Southern Sun Newlands, Cape Town. 13-17 November 2017.

Lebelo RL. HPV prevalence in MSM population rom North West of Pretoria. 4th WAKA HPV Africa Symposium, 31st International Papillomavirus Conference (IPVC), Basic Science and Global Health Impact. 28 February - 4 March 2017, Cape Town International Convention Centre Convention Square (CTICC), Cape Town.

Magagula NB. Rotavirus genotyping data in ESA (Retrospective and Current). Vaccine Preventable Disease Surveillance Laboratory, 21-24 August 2017, Birchwood Hotel & OR Tambo Conference Centre, Johannesburg.

Seheri LM. The role of the laboratory in expanded rotavirus surveillance, WHO-AFRO Pediatric Diarrheal Surveillance Network, Southern Sun Hotel, OR Tambo, South Africa, 27 February - 3 March 2017.

Seheri LM, Magagula NB, Peenze I, Rakau K, Ndadza A, Mwenda JM, Weldegebriel G, Steele AD, Mphahlele MJ, African Rotavirus Surveillance Network. Rotavirus strain distribution in East and Southern Africa pre and post- rotavirus vaccine introduction. Vaccine Preventable Disease Surveillance Laboratory, 21-24 Aug 2017, BirchWood Hotel & OR Tambo Conference Centre, Johannesburg.

Seheri LM. Overview of rotavirus strains diversity in the Eastern and Southern African region before and after vaccine introduction, Global Rotavirus and Pediatric Diarrheal Surveillance Network meeting from 17 -18 November 2017, Hotel Royal, Geneva, Switzerland.

National congresses

Burnett RJ. Hepatitis B vaccination of healthcare workers. Vaccinology 2017, Mount Grace Country House, Magaliesberg, 1-3 October 2017.
Nemarude L, Mashishi T, Tiiti T, Selabe G, Bogers JP, Nchabeleng M, Lebelo R. HPV infections and co-infection with selected sexually transmitted infections in women attending the DGM Academic Hospital in Pretoria, South Africa. 7th FIDSSA Conference 2017, 9 -11 November 2017, Cape Town, South Africa.

Lebelo R, Mashishi T, Tiiti T, Nkwinika V, Selabe G. HPV mRNA expression and HPV DNA prevalence in women attending gynecology clinics at the DGM Academic Hospital in Pretoria, South Africa. 7th FIDSSA Conference 2017, 9 -11 November 2017, Cape Town, South Africa.

Local congresses (university academic days)

Makua KS, Lebelo RL and Wood NH. Oral human papillomavirus infection and associated risk factors in oral /oropharyngeal mucosa of adults attending the SMU Health Sciences Oral Health Centre in Pretoria. SMU Health Sciences Research Days 2017. 22-24 August 2017..

Malivhoho PL, Gededzha MP, Seheri LM, Mphahlele MJ. Whole genome analyses of G8 rotavirus strains from Africa. SMU Health Sciences Research Days, Pretoria, 21-23 August 2017.

Rakau KG, Gededzha MP, Mphahlele MJ, Seheri LM. Molecular characterisation of rotavirus infections in children attending DGM Academic Hospital and Oukasie Primary Healthcare Centre and their association with histo blood group antigen profiles. SMU Health Sciences Research Days, Pretoria, 21-23 August 2017.

6.4.2 Poster presentations

International congresses

Dochez C, Burnett RJ, Mphahlele MJ. Improving skills and institutional capacity to strengthen adolescent immunisation programmes and health systems in African countries through HPV vaccine introduction. HPV 2017; 31st IPVC. CTICC, Cape Town, South Africa. 28 February – 4 March 2017.

Lebelo RL, Dlamini NS, Ratlabala B, Bida MN, Nkwinika VN, Mphahlele MJ. HPV prevalence in anal carcinoma cases from DGM Academic Hospital, Pretoria, South Africa. 31st IPCV, Basic Science and Global Health Impact. 28 February - 4 March 2017, CTICC, Cape Town.

Lebelo RL, Thys S, Benoy I, Depuydt C, Bogers JP, Mphahlele J. Identification of HPV types causing lesions in penile cancerous, pre-cancerous and benign lesions, using laser microdissection. 31st IPVC, Basic Science and Global Health Impact. 28 February - 4 March 2017, CTICC, Cape Town.

Nunu S, Fernandes L, De Schryver A, Burnett RJ. A baseline study of hospital policies for HBV of HCWs in Botswana in 2012. 11th Vaccine Congress. Paradise Point, San Diego, United States of America. 17 - 20 September 2017.

National congresses

Nunu S, Fernandes L, De Schryver A, Burnett RJ. A baseline study of hospital policies for HBV of HCWs in Botswana in 2012. Public Health Association of South Africa (PHASA) Conference 2017. Indaba Hotel, Johannesburg, 4-7 September 2017.

Rakau KG, Gededzha MP, Mphahlele MJ, Seheri LM. Molecular characterisation of rotavirus infections in children attending the DGM Academic Hospital and Oukasie Primary Healthcare Centreand their association with histo blood group antigen profiles, 11th annual Early Career Scientific Convention, SAMRC, 12-13 October 2017.

Local congresses (university academic days)

Matshonyonge F, Selabe G, Nchabeleng M, Bogers JP and Lebelo R. HPV types that are associated with ano-rectal precancerous and cancerous lesions in MSM in the North West area of Pretoria, South Africa. SMU Health Sciences Research Days, Pretoria, 22-24 August 2017.

Matshonyonge F, Selabe G, Nchabeleng M, Bogers JP and Lebelo RL. The prevalence of HPV infections and associated risk factors in MSM in the North West area of Pretoria, South Africa. SMU Health Sciences Researcg Days, Pretoria, 22-24 August 2017.
Nkwinika VV, Dlamini NS, Mphahlele MJ, Rabatlala B, Bida M, and Lebelo RL. Prevalence of HPV infections in anorectal cancers at the DGM Academic Hospital from 2005 to 2012. SMU Health Sciences Research Days, Pretoria, 21-23 August 2017.

Ngonyolo L, Ngoato MH Amponsah-Dacosta E, Mphahlele MJ and Selabe SG. Prevalence of HBV and hepatitis C virus infection in a South African population born after the introduction of the hepatitis B vaccine in 1995. SMU Health Sciences Research Days, Pretoria, 22-24 August 2017.

Nunu S, Fernandes L, De Schryver A, Burnett RJ. A baseline study of hospital policies for hepatitis B vaccination of HCWs in Botswana in 2012. SMU Health Sciences Research Days. Pretoria, 22-24 August 2017.

6.5 Research translations

None.

University of Pretoria

Foreword

Professor Roger Pool, Pathology Representative

The University of Pretoria (UP) has six pathology departments; Anatomical Pathology, Chemical Pathology, Haematology, Immunology,

Medical Microbiology and Medical Virology within the School of Medicine in the Faculty of Health Sciences. There is also a Division of

Clinical Pathology which falls under the Department of Chemical Pathology. It is located at Prinshof Campus. The Division of Clinical

Pathology is currently within the Department of Chemical Pathology. The Faculty of Health Sciences at the University of Pretoria (UP) enjoys a national and international reputation in terms of its undergraduate and postgraduate teaching programmes, research output and clinical service. The Faculty of Medicine came into being in 1943 with an initial complement of 57 students. In 1999 the Faculty of Medicine merged with three other schools to become the Faculty of Health Sciences.

The School of Medicine offers training for the following degrees:

- MBChB;
- MMed in different specialties;
- MPharm Med;
- MPhil (Philosophy and Ethics of Mental Health);
- BClinical Medical Practice;
- MPhil (Pain Management);
- Master of Early Childhood Intervention;
- BSc Hons;
- MSc;
- Doctor of Medicine; and
- Doctor of Philosophy.

The six pathology departments are all involved in service delivery, teaching and research. The teaching programme is directed towards both undergraduate (MBChB, BChD, BCMP, BDietics, BNurs, BOT, BPhysio, BRad, BSportSci) and postgraduate students. Postgraduate studies in the School of Medicine cover all categories from diplomas up to doctoral level, while postgraduate short courses and seminars for compliance with the requirements of Continued Professional Development (CPD) are also offered.

Besides training registrars in all of the pathology disciplines, support is also provided to medical students and registrars from various clinical departments. All laboratories within the complex are accredited to ISO 15189 by SANAS and provide laboratory services to primary, regional and tertiary healthcare services within Gauteng, North West and Mpumalanga.

Staff members of pathology departments serve on a wide range of committees within the School of Medicine with Prof R Pool and Prof T Pillay both being members of the School of Medicine Executive Committee.

What we do

This academic complex is involved in teaching and training and service, as well as research. The complex has an extensive teaching programme for both undergraduate students (MBChB, BCur, BPhys and BDiet) and postgraduate students (BSc Hons), MMed, MSc and PhD), as well as post- doctoral fellows. Support for training required by clinical departments at Steve Biko Academic Hospital (SBAH) is

also given to medical students and registrars within the faculty. The complex is an ISO: 15189-accredited referral laboratory that supports tertiary, regional and primary healthcare services within the Tshwane region as well as Mpumalanga Province. Community engagement activities took place in Gauteng, North West and Mpumalanga provinces. Significant research output was achieved, some in high impact journals enabled by national and international collaboration.

Highlights

Several NRF-rated scientists serve in the departments. The SARChI Chair of Infectious Diseases in Animals (Prof. Markotter) and the Rand Water Chair in Public Health (Prof. Taylor) are located in the Medical Virology Department. Dr Potgieter serves on the advisory Committee of the SA Haemophilia Federation and the Global Alliance for Progress. Prof. Pillay serves on the American Association of Clinical Chemistry and is a member of the Academy of Science of SA. Prof. Mbelle serves on the Medicines Control Council of SA and Prof. JDD Pitout in Medical Microbiology is on the Thomas Reuter 2016 highly cited researcher list. Prof. Millar in Immunology was awarded the John F Herschel Medal of the Royal Society of South Africa and the MRC South Africa Platinum Medal. He also serves on several internationa

I **Chemical Pathology**

Prof Pillay (HOD Chemical Pathology) was integrally involved in the organisation of two International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) conferences in Durban in October 2017; these were IFCC Worldlab-Durban 2017 (as co-President and chair of the Scientific Committee) and the XIV International Congress of Paediatric Laboratory Medicine (as part of the local organising committee).

Microbiology

A successful Listeria symposium was hosted which attracted an audience made up of the UP community as well as delegates from the wider Pretoria and Midrand areas as well as Mpumalanga and Limpopo provinces.

There was a 100% registrar pass rate during the last period and distinctions were obtained by many post graduate students.

There was a significant increase in research outputs including oral presentations, locally and internationally.

Medical Virology

The research and teaching and training capacity of TAD Virology/Department of Medical Virology, UP has been enhanced by the appointment of NICD staff members as extra-ordinary lecturers (Dr J Weyer, Dr J Paweska, Dr P Jansen van Vuuren and Prof NA Page) to the UP establishment.

The collaboration with Drs Paweska, Weyer and Jansen van Vuuren has facilitated research on Filoviruses for which BSL-4 laboratory facilities are needed. These extraordinary appointments have resulted in an increase in the number of post-graduate students enrolled with a resultant increase in research outputs and publications.

Dr Sim Mayaphi (senior pathologist/clinical virologist) received the following awards:

- Second prize for an oral presentation in the category "Clinical" at the Faculty Day, Faculty of Health Sciences, University of Pretoria 22-23 August 2017; and

- Exceptional Young Researcher's Award, UP
  Prof Maureen Taylor (acting HOD) was one of the finalists for the 2017 The National Science and Technology Forum (NSTF)-South 32 -Water Research Commission (WRC) Award for a contribution by an individual or an organisation to SET in South Africa towards sustainable water management, knowledge generation and solutions over the last 5-10 years (sponsored by the Water Research Commission).

Haematology

Dr Johan Potgieter served as chairperson of the Medical and Scientific Advisory Committee of the National Haemophilia Foundation. The department showed a significant increase in publications as well as success in Masters and Honours examinations.

Anatomical Pathology

Head of Discipline: Prof NM Bida

1. About the department

The Department of Anatomical Pathology provides service and academic coverage. Service is delivered to the hospitals and clinics in Northern Gauteng as well as Mpumalanga. The academic component covers the relevant teaching to both undergraduate and post-graduate medical students and the Allied Health Sciences of the UP.

The department has recently regained accreditation after operating without a full-time HOD for an extended period of about five years.Staff morale deteriorated during this period and some consultants left the department. This placed additional strain on the remaining staff members, who subsequently had to carry a higher service load. Due to this staff shortage, the post-graduate academic training programme also became challenging to run, and registrar training was reduced to the bare minimum.

Over the last year, the staff numbers continued to decline with only three consultants present in the beginning of 2018. The registrar number increased from four to ten.

Table UP 1: Total number of staff per profession and highest qualification

	Pathologists	Registrars	Medicalscientist	Technologists	Student technologists	Technicians	Student technicians	Support	All
TOTAL	3	10	1	21	3	7	2	17	64

2. Diagnostic service

We provide a diagnostic service in histo- and cyto-pathology to Northern Gauteng and Mpumalanga. Post mortem services are rendered to the larger hospitals of Northern Gauteng. Medical staff are available for consultation to clinical colleagues and for consultations from private laboratories. A 24-hour emergency service is rendered to SBAH.

We now perform immunofluorescence for kidney biopsies and skin biopsies, a service which was not available prior to 2017. The renal biopsy service used to be referred to the Charlotte Matleke Academic Hospital, but this is now executed inhouse.

The muscle biopsy service is also currently available in the department. We are SANAS accredited and maintained this accreditation status in the last SANAS evaluation.

The following statistics apply to the histology service unit from April 2017 to March 2018:

Total cases	24 878
Cases referred to Lancet	4473
Immunohistochemistry stains	22042
Electron Microscopy cases	236
Special stains	6912
Frozen sections	24
Post mortems	65

Cytology diagnostic services

The following statistics apply to the Cytology Diagnostic Service Unit for the financial year from April 2017 to March 2018:

- Gynaecologic smears: there was a total number of cases 97 552 and 99378 smears;
- FNA cases: there was a total number of 3226 cases and 5926 smears; and
- Non- gynaecologic cases: there was total number of 4494 cases and 11862 smears.

Staff complement

The staff complement is as follows:

- One supervisor;
- 12 Cytotechnologists;
- Three cytotechnicians;
- One lab assistant;
- Four clerks; and
- Two students.

Molecular laboratory services

The molecular laboratory unit processed the following number of specimens from April 2017 - 31 March 2018:

- FISH: 81 tests on 48 cases; and
- PCR: 126 tests on 121 cases.

3. Teaching, training and professional development

3.1. Undergraduate teaching

Teaching is provided to the medical students and the students of Occupational Therapy, Physiotherapy and Radiography. The teaching is inclusive of theory and practical post mortem and histopathology exposure, where possible and appropriate.

3.2. Postgraduate teaching

Postgraduate teaching includes students from our own department, rotating registrars from Oral Pathology and Forensic Pathology, as well students as from other departments e.g. Internal Medicine. The department runs a full academic postgraduate programme with activities such as seminars (slides, topic, electron microscopy and molecular), journal clubs, virtual microscopy and specialised microscopy sessions. There is a regular monthly formative assessment for all inhouse registrars, with performance review sessions.
In addition, a monthly research meeting is conducted to review registrar research progress and to discuss independent research activities.

Table UP 2: Total number of trainees per qualification category and rates of successful completion/pass rates

	Total number of trainees	Final year trainees	Successful completion	Percentage of successful completions
All	10	2	0	0%

4. Research activities

Although we continue to experience staff constraints, research is encouraged and we create a platform to brainstorm in our monthly research forum. Several research projects are currently underway. Due to severe staff shortage research activity has been very limited. We assist with and participate in research projects from other departments. Registrar project supervision is done.

5. Research output

5.1. Journal publications

Muller M, Kalmeir G, Eyal P, de Bruin A, Pool R, du Rant C, Ehlers E, Stander A., van Schoor A, Nortje E, du Toit P; An endometrial histomorphometry study of CD56 natural killer cells in women with unexplained infertility: S Afri Obs Gyn. 2017:11 (2) 1145

Gaxa L, Bida M; Greater omental torsion secondary to the right inguinal hernia: a rare case and a literature review. S. Afr J Rad. Vol 3 (2) 2018

Kgomo MK, Bida NM; Sinus Histiocytosis with massive lymphadenopathy (Rosai-Dorfman disease) presenting with cholestasic jaundice in an HIV positive young adult. SAMJ. Vol 108 (3) April 2018

Carrim YO, Gaxa L, van der Schyff F, Bida NM, Omar F, Lockhat Z; Does radiotherapy prior to surgery improve long term prognosis in pediatric colorectal cancer in lower- and upper-middle income countries with limited resources? Our experience and literature review. Journal of the Egyptian National Cancer Institute. Vol 29, Issue 4, Dec 2017, pp201-206

Kisansa ME, Chokoe-Maluleke MJ, Bida NM, Mutati P, Ramoroko PS; Case of a giant pericardial adhesion masquerading as a malignant disease. SAJR. Vol 21, No 2 (2018)

Slavik T, Lauwers GY; Navigating the jungles of tropical infectious gastrointestinal pathology: a pattern-based approach to the endoscopic biopsy. Virchows Arch. May 2017, pp 2166-3

Solomon C; p16 and ki-67 immunohistochemical staining reduces inter- and intra-observer variability in the grading of cervical squamous intraepithelial lesions of South African women. SAJGO. Aug 21, 8, 2017

Chemical Pathology

Head: Prof TS Pillay

1. About the Department

The academic Department of chemical pathology is located in the Pathology Building on the south Prinshof campus of the UP whilst the core diagnostic laboratory is situated at theSBAH.

The department has a registrar academic training programme and research training programme. The Hons and Masters training programme in chemical pathology is geared towards meeting theneed for the training of scientists in chemical pathology/ clinical biochemistry. Since the inception of the HPCSA registration requirements, the department has also been accredited for the training of intern scientists in clinical biochemistry. The BSc (Hons) degree course has been running since 1998 and is co-ordinated by senior scientists in the department. The department also has a specialist training programme in chemical pathology and there are currently six registrars in training for chemical pathology, as well as three registrars who train in clinical pathology. The department is also responsible for the training programme in Clinical Pathology.

In addition, the department is responsible for the training programme in Clinical Pathology. Within the programme, the registrars gain clinical experience from dealing with the core diagnostic laboratory, attending ward rounds, clinics and clinical meetings in the hospital and through active liaison with the clinicians in all clinical departments. The department has a variety of research programmes, ranging from molecular genetics and molecular cell biology, to molecular modeling and pharmacoinformatics. The ethos of the department is underpinned by the aim to develop specialists who can bridge the gap between the clinical laboratory and the wards and who have insight into chemical pathology as it relates to diagnosis and management.

Table UP 3: Total number of staff per profession and highest qualification

	Pathologists	PhD Scientists	Technologists	South African	All
Total	3	1	12	16	16

2. Diagnostic service

The Department of chemical pathology provides diagnostic services to the SBAH, Tshwane District and Weskoppies hospitals, as well as sixty clinics in the Pretoria region and also providesafter-hours laboratory services to Mamelodi Hospital. In addition, the laboratory receives referrals from private and NHLS laboratories across the country. For the period 2017/18, our total workload was 2 390 866 tests, representing a 22% increase over the previous year and a net profit of R83 925 120.

In February 2016, the laboratory acquired new automated chemistry and immunochemistry instruments (Abbott Architect Ci8200) to replace the old Beckman instruments. These new analysers were integrated with the laboratory information system (LIS), to assist in sample management and improve workflow and data management. A new benchtop HbA1c Variant II High-performance liquid chromatography (HPLC) instrument was also installed and is linked to the existing TrakCare LIS, which will make a notable contribution towards optimising the TATs of HbA1c tests.

TrackCare auto-verification was implemented in July 2017,which assisted in the improvement ofTATs. The auto management system (AMS) by Abbott, is expected to be implemented by end of May 2018. The department experienced challenges in meeting TATs of other benches such as special chemistry and protein electrophoresis, due to limitedstaff capacity. Very few medical technologists were trained on these specialized tests. Staff shortages due to vacant posts and other staff on maternity leave, also made it difficult to rotate and train more staff on these benches. All vacant posts were onlyfilled in February 2018, whichenabled the department to train more staff on the specialized benches.

3. Teaching, training and professional development

3.1 Undergraduates

The department contributes to the undergraduate MBChB programme across several years of the curriculum. In a typical period, thirty five lectures were delivered to MBChB students and these are focused on pathophysiology and laboratory

investigation of a wide range of disorders grouped under the following teaching blocks: Homeostasis, Diseases of Childhood, Abdomen and Breast, Traumatology and Genito-urinary Disorders.
The Diagnostic Laboratory Medicine and Imaging block (GNK 689) is chaired by Prof T.S. Pillay. This block provides teaching to final-year medical students on appropriate selection and interpretation of laboratory tests in all pathology disciplines and includes lectures in radiology, nuclear medicine and evidence-based medicine. Feedback from students has been positive. An academic bootcamp to support MBChB students sitting their final GNK689 examination was introduced in 2018 and its enhancement of undergraduate teaching will be continuously reviewed. The introduction of e-learning modules is also currently being formulated in association with an educational specialist team to benefit case-based problem discussions during contact undergraduate chemical pathology lectures.

3.2 Postgraduates

3.2.1 MMed and other disciplines

The department also delivers teaching and assessment in MMed programmes for paediatrics, internal medicine, neurology, nuclear medicine and family medicine. Registrars in paediatrics and internal medicine attend a compulsory two-year pathology course and they are required to present seminars on pathology topics in the schedule. In the other disciplines, chemical pathologists present tutorials and set examinations, which the registrars must pass.

3.2.2 MMed Chemical Pathology and Clinical Pathology

Chemical pathology registrars play a key role in delivery of the diagnostic service and contribute to clinical liaison, monitoring of internal quality control and TAT, evaluation of diagnostic methods and review of laboratory standard operating procedures. Formal assessments during the first year used to include examinations in physiology (primary) and clinical chemistry (at MBChB VI level). This has now been replaced by the FCPath (Chem) part I examination introduced by Prof Pillay during his term on the council of the College of Pathologists. During the second year, registrars attend an eight-month molecular pathology module.

Previously, registrars wrote intermediate examinations in chemical pathology, that are aligned to the CMSA format, after 24 months in the training programme. This practice has now been replaced by the introduction of a College Part I Examination, from 2017. For the research component of the MMed degree, attendance at an applied research methodology module is required, along with the completion of a research project that must be presented in a mini-dissertation and/or published in a peer-reviewed scientific journal.

In accordance with CMSA regulations, all registrars compile a portfolio that details different aspects of training for the duration of the course. There are four formal contact sessions per week: Tuesday departmental seminar, Wednesday combined endocrine meeting, Thursday laboratory calculations/management tutorial and Friday Journal Club/Case discussion. Registrars are also encouraged to forge links with other units such as intensive care and nephrology to develop clinical interests in these areas, if they so wish.

Registrars furthermore conduct wet-practicals that are aligned to the requirements of the CMSA study guideline. One wet-practical topic is undertaken per month, and registrars must interpret their findings upon completion of their wet-practical.

Clinical pathology registrars follow the same programme when they rotate through the department, initially for a six-month period, followed by two four-month rotations after successful completion of the university primary examinations.

3.2.3 BSc (Hons) and MSc Chemical Pathology

The BSc (Hons) programme includes the following modules:

(a) Principles and Practice of Clinical Chemistry;
(b) Pathophysiology;
(c) Laboratory Management;
(d) Medical Biostatistics;
(e) Molecular Pathology; and
(f) Applied Research Methodology.

The Medical Biostatistics module is presented over fourteen weeks by lecturers from the Department of Statistics at UP. Hons students are expected to complete the same Molecular Pathology module as registrars. It is comprised of weekly lectures, and several practical and formal examinations.

Theoretical knowledge of chemical pathology is assessed during seven written tests and a final year-end examination. Each student has to complete a research project under supervision, and present and write up their work in the form of a mini-dissertation. Skills taught during practical sessions and rotation through the diagnostic laboratory at SBAH, are honed by performing semi-independent laboratory work on the bench during the course of conducting the research project. Upon completion the BSc (Hons) degree, many graduates proceed to enroll for the MSc in chemical pathology or allied disciplines.

In 2017, four students enrolled for the BSc (Hons) in chemical pathology and six for 2018. Three of the BSc (Hons) students of 2017 received their degrees with distinction at the 2018 April graduation ceremony.

3.2.4 Technologists

The department provides in-service teaching and training to student medical technologists registered for chemical pathology and clinical pathology. The lectures presented for the BSc (Hons) programme, of which there are 26 per year, are attended by technologists/ technicians as well as technologist interns for CPD purposes. 1 Medical Technologist wrote exams in October 2017 and passed, achieving a 100% pass rate.

Table UP 4: Current staff complements

HOD	1
Pathologists	3
Secretary	1
Registrars	6
Laboratory manager	1
Laboratory supervisor	1
Medical Scientist	1
Intern medical scientists	-
Medical technologists	11
Student medical technologists	2
Technicians	1
Student medical technicians	2
Technical assistants	5
Total	**35**

Table UP5: The effect of increased volumes

Department	TrakCare Volumes			Oracle Volumes		
	Jan 18	Feb 18	Mar 18	Jan 18	Feb 18	Mar 18
Chemical Pathology	253 652	262 910	271 260	164 506	178 035	193 174

The table demonstrates the variance of volumes between TrakCare and Oracle. TrakCare volumes show the actual volumes handled by staff within the laboratory, whereas Oracle only produces billable statistics.

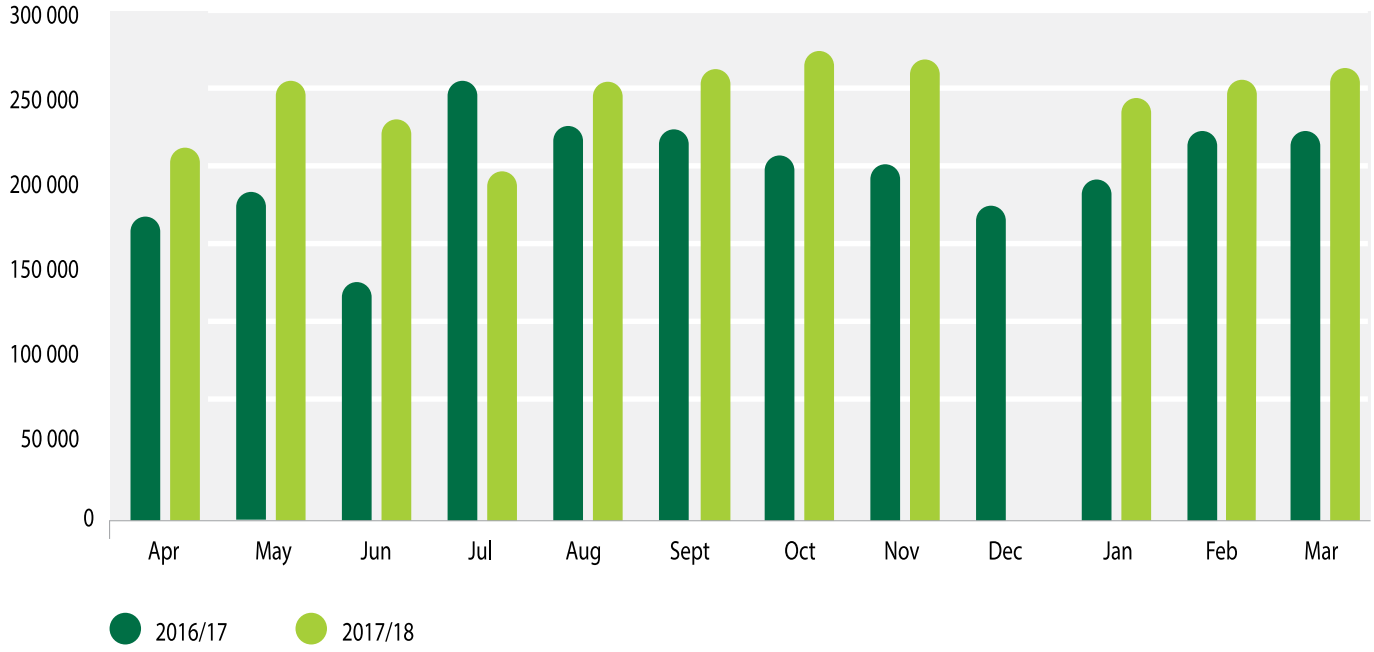


Figure UP1: Increase in volumes – month-to-month and year-to-year (TrakCare volumes were used).

3.2.5 Professional development

Table UP 6: Total number of postgraduate students enrolled and passed

	PHD	MMed	MSc	Hons (BSc)	All
Postgraduate students enrolled	1	7	1	5	14
Postgraduate students graduated	-	-	2	2	4

Table UP 7: Total number of trainees per qualification category and rates of successful completion/pass rates

	Total Number of Trainees	Final year trainees	Successful completion	Percentage of successful completions
All	16	-	-	-

4. Research activities

4.1 Research units

Staff members in the department have active links with:

- The Institute of Cellular and Molecular Medicine, directed by Prof M Pepper;
- The Bioinformatics Unit, UP, directed by Prof F Joubert;
- The Discipline of Medical Biochemistry, UKZN, headed by Prof A Chuturgoon; and
- Division of Chemical Pathology, UCT, where Prof Pillay is an Honorary

Research projects

4.2.1 Completed projects

None.

4.2.2 Existing and ongoing projects

Project title:	Post mortem genetic determination of age and sex for unidentifiable remains admitted to Pretoria Medico-Legal Laboratory
Principal investigators:	Dr C van Niekerk (NHLS) and Ms R Vernall (MSc candidate)
Co-investigators:	Dr L du Toit-Prinsloo, Forensic and Analytical Science Service (FASS), New South Wales
Funding:	NRF
Total funding of entire project:	R 150 000 – 00
Short description:	The aim of this study is to genetically determine the age and sex of visually unidentifiable human remains admitted to the Pretoria Medico-Legal laboratory (PMLL) from DNA extracts of bone and teeth samples, using various molecular techniques. A genetic "calculator" will be developed to aid in forensic identification of remains.
Project start date:	2017
Project end date:	2018

Project title:	Development of a cardiac channel molecular autopsy in a South African cohort of sudden unexplained deaths in the young
Principal investigators:	Dr C van Niekerk (NHLS), Mrs BS van Deventer (PhD candidate)
Co-investigator:	Dr L du Toit-Prinsloo (FASS, New South Wales)
Total funding of entire project:	R 600 000 - 00
Short description:	: The aim of this study is to determine the prevalence of identified variants in the four major genes linked to inherited cardiac arrhythmogenic disorders in sudden unexpected death cases in the young that were admitted and subjected to a medico-legal autopsy at the Pretoria MLL, in order to set up routine testing for these genetic variations to assist in determining cause of death.
Project start date:	2017
Project end date:	2019

Project title:	Plasma D-Lactate as a diagnostic tool in acute appendicitis, diverticulitis and blunt abdominal trauma
Short description:	The aim of this project is to evaluate the potential use of plasma D-Lactate as a diagnostic tool in acute appendicitis, diverticulitis and blunt abdominal trauma in humans and compare the usefulness of D-lactate, in conjunction, with white blood cell count, CRP and serum amylase, and to determine whether D-lactate will be a useful test to assist in clinical diagnosis and investigation of patients presenting with acute abdominal pain.

4.2.3 New projects

Project title:	Mechanisms of insulin resistance caused by anti-retroviral drugs: investigation of the role of microRNAs
Principal investigators:	Prof T.S. Pillay and Ms KG Mphahlela (MSc candidate)
Co-investigator:	Dr C. van Niekerk
Funding:	NRF Competitive fund for rated researchers

Project title:	Analysis of the role of nuclear factor-kappa B in insulin resistance caused by antiretroviral drugs using CRSPR/Cas9 gene editing
Principal investigators:	Prof T.S. Pillay; Mr Charles Mabugana (MSc candidate)
Funding:	NRF Competitive fund for rated researchers

Project title:	Development of a cardiac channel molecular autopsy in a South African cohort of sudden unexplained deaths in the young
Principal investigators:	Dr C van Niekerk (NHLS) and Mr T Wallace (MSc candidate)
Co-investigator:	Mrs BS van Deventer (Department of Forensic Medicine, UP)
Funding by:	
Short description:	The aim of this study is to conduct mutational analyses on the human RyR2 gene in an attempt to obtain a better understanding of the prevalence of variations in the RyR2 gene in cases of SUD in the young and in infancy.

Project start date: 2018

Project end date: 2019

Project title: Development and validation of a reverse phase high performance thin layer chromatography (RP-HPTLC) method for the separation of porphyrins in the investigation of suspected porphyrias

Short description: The diagnosis of the porphyrias is based on the analysis of porphyrin levels in serum, urine and stool. The most common method for analysis involves extraction and analysis by chromatography. Whilst HPLC meth ods are ideal, they require expensive, dedicated equipment and highly skilful expertise. In most diagnostic hospital laboratory settings, thin layer chromatography is used, but often this method cannot separate isocoproporphryin as a distinct band. In this project, the utility of a novel reverse-phase High-Performance Thin Layer Chromatography (HPTLC) method will be evaluated for urine and faecal prophyrin separation, with the idea to introduce this method nationally, if it proves to be robust.

Project title: The anti-cancer actions of vitamin D in cervical cancer
Princpal investigators: Punchoo R. (UP); Marais S. (UP) and Joubert A. (UP)
Short description: The extra-skeletal anti-cancer actions of vitamin D (VD) have been described in patient and in in vitro studies. This study investigates the anti-cancerous action of VD in in vitro cervical cell lines and aims to provide an understanding of VD intracellular metabolism and differential regulation of cell death modes in early and late cervical cancer cell line phenotypes.

Project title: A case-control study of vitamin D's anti-cancer action in cervical cancer
Principal investigators: Punchoo R. (UP); Marais S. (UP) and Stoltz A. (UP)
Short description: Cervical cancer prevalence is higher in HIV-infected women. The anti-cancerous action of VD in the carcinogenesis of cervical cancer, is poorly understood. This study will provide baseline data on the association of cervical cancer cytological abnormalities and serum VD levels in HIV-infection.

Project start date:

Project end date:

4.3 Research Funding

The Department was awarded an NRF postdoctoral fellowship for Dr MA Islam to continue work on molecular modeling of ligand-receptor interactions.

Project title: Molecular modeling of ligand-receptor interactions and application to communicable and non-communicable diseases

The department also received over R2 million in support from the NRF in the 2017 year. This was awarded to Prof. TS Pillay and includes a competitive award for rated researchers as well as a conference grant.
A NRF Thutuka grant was awarded to Dr Punchoo in 2017-2018 for completion of doctoral studies.

Project title: The anti-cancer action of vitamin D in cervical cancer
A SAMRC self-initiated grant was awarded to Dr Punchoo in 2017 to support the investigation of VD's in vitro anti-cancer action in cervical cancer.

Project title: The anti-cancer action of vitamin D in in vitro cervical cancer
A research and development grant from UP was awarded to Dr Punchoo 2017-2018 to support research into the anti-cancerous actions of vitamin D in cervical cancer.

Project title: The anti-cancer action of cholecalciferol in cervical cancer

5. Research output

5.1 Journal publications

Chale-Matsau B, Van Niekerk C, Pillay TS. 2018; Discordant calcium and parathyroid hormone with presumed epileptic seizures. Clinical Chemistry. 64(3): 442-446

Van Deventer BS, Du Toit-Prinsloo L, Van Niekerk C. 2017; Long QT syndrome and sudden unexpected deaths in infants. Journal of Clinical Pathology. 70(9): 808-813

Prinsloo A, Pool R, Van Niekerk C. 2017; Preliminary data on micro-RNA expression profiles in a group of South African patients diagnosed with chronic myeloid leukaemia. Molecular and Clinical Oncology. 7:386-390

Chirambo GM, Van Niekerk C, Crowther NJ. 2017; The role of alkaline phosphatase in intracellular lipid accumulation in the human hepatocarcinoma cell line, HepG2. Experimental and Molecular Pathology. 102(2): 224-229

Chirambo GM, Van Niekerk C, Crowther NJ. 2017; Specific knock-down of tissue non-specific alkaline phosphatase mRNA levels inhibits intra-cellular lipid accumulation in 3T3-L1 and HepG2 cells. International Journal of Experimental Pathology. 98(5): 260-268

Pema A, Kiabilua O, Pillay TS; Demand management by electronic gatekeeping of tests requests does not influence requesting behaviour or save cost dramatically. Annals of Clinical Biochemistry. 24 June 2017, DOI: 10.1177/00045 6321770 7980

Satekge T, Kiabilua O, Pillay K, Biljon V, Pillay TS; A toddler with Anasarca caused by congenital nephrotic syndrome (A case report). Journal of International Federation of Clinical Chemistry (e JIFCC). Vol 28 Number 2. May 2017. Pages 156-163 Jifcc

Chale-Matsau B, Van Niekerk C, Kemp T, Pillay TS; Discordant Calcium and Parathyroid Hormone with presumed epileptic seizures. Authors Clinical Chemistry. 2018. Vol 64,Pages 442-445

Islam MA, Bhayye S, Adeniyi AA, Soliman ME, Pillay TS;Diabetes mellitus caused by mutations in human insulin: Analysis of impaired receptor binding of insulins Wakayama, Los Angeles and Chicago using pharmacoinformatics. Journal of Biomolecular Structure and Dynamics. 2017 Mar; 35(4):724–737

Pillay TS. The new MedTech Europe directive: implications for educational activities in pathology and laboratory medicine. Journal of Clinical Pathology. 2017 Mar; 70(3):185–186. DOI: 10.1136/jclinpath-2017-204372

Pillay TS; 70 years of the Journal of Clinical Pathology: Quo vadis? J Clin Pathol. 2017 Feb; 70(2):93. DOI: 10.1136/jclinpath-2016-204314Islam MA, Pillay TS; Identification of promising DNA GyrB inhibitors for tuberculosis using pharmacophore-based virtual screening, molecular docking and molecular dynamics studies. Chemical Biology and Drug Design. 2017 Jan 21

Islam MA, Pillay TS; β-secretase inhibitors for Alzheimer's disease: identification using pharmacoinformatics. Journal of Biomolecular Structure and Dynamics. 2018 Feb 1:1-20. DOI: 10.1080/07391102.2018.1430619. [Epub ahead of print]

5.2 Conference presentations

5.2.1 National

Oral presentations

Pillay TS: Molecular modelling of ligands, receptors and enzymes for in silico drug discovery. Keynote presentation; Centre for High Performance Computing (CHPC) National Conference, December 2017.

Pillay TS: Conflict management in the clinical laboratory; Plenary presentation; Lab Medicine Congress, Durban May 2017.

Kotsovolos N, Islam MA, van Niekerk C, Pillay TS: Plasmodium falciparum dihydrofolate reductase-thymidylate synthase inhibitors: identification using pharmacoinformatics approaches, 3rd Malaria Research Conference, SAMRC, November 2017, Johannesburg, South Africa.

Poster presentations

Islam MA, Pillay TS: Pharmacoinformatics-based identification of chemical entities for therapeutic application in Ebola virus disease, CHPC National Conference, December 2017, Pretoria, South Africa.

Islam MA, Pillay TS: β-site amyloid precursor protein cleaving enzyme1 as a target for treatment in Alzheimer's disease: identifying inhibitors using pharmacoinformatics, IFCC-WorldLab, October 2017, Durban, South Africa.

Pillay TS: 70 years of the Journal of Clinical Pathology: contributions to Clinical Biochemistry; Association of Clinical Biochemistry (UK), May 2017, Leeds.

5.3 International

Oral presentations

Pillay TS: IFCC CPD Symposium; "Online resources for patients and healthcare professionals"; EuroMedLab, Athens, June 2017.

Pillay TS:IFCC CPD Symposium, plenary presentation: "How effective is electronic gatekeeping in influencing test requesting behavior and cost savings: a re-evaluation"; EuroMedLab, Athens, June 2017.

Pillay TS: PathFinders – Global Pathology Conference, plenary presentation: "Developing new diagnostic probes for the clinical laboratory using nanobodies and CRISPR-directed nucleic acid detection methods"; Bangalore, October 2017.

Pillay TS: International Conference of Cell Signalling, plenary presentation: "Understanding Cell Communication for human well-being"; Malaysia, July 2017.

Pillay TS: International Conference of Cell Signalling: "Workshop on molecular modelling of ligands and receptors"; Malaysia, July 2017.

Pillay TS: International Conference of Cell Signalling: "Challenges in journal publishing: perspectives of an Editor-in-Chief"; Malaysia, July 2017.

Pillay TS: AACC annual meeting: "Challenges at the clinical laboratory interface - Investigation of interferences in the laboratory"; San Diego, July 2017.

Pillay TS: IFCC-WorldLab Association of Clinical Pathologists (UK) Workshop: "70 years of the Journal of Clinical Pathology"; Durban, October 2017.

Pillay TS: IFCC-WorldLab Symposium on Risk Management: "Continuous quality improvement in the risk management process"; Durban, October 2017.

Pillay TS: IFCC-WorldLab Symposium on Risk Management: "Preventive and corrective action in Risk management"; Durban, October 2017.

Pillay TS: "Fundación Bioquímica Argentina"; Argentinian Foundation for Biochemistry; plenary session: "New diagnostic probes for the clinical laboratory based on nanobodies"; Buenos Aires, March 2018.

A Rampul, O Kiabilua, TS Pillay: IFCC-WorldLab: Incidence of Seasonal Pseudohyperkalemia in a temperate climate, Durban, October 2017.

Mageza T, Kiabilua O, Pillay TS: IFCC-WorldLab:Congenital Hypopituitarism and Congenital Cholestatic Jaundice in a 6-month old infant (Case presentation). International Congress of Paediatric Laboratory Medicine, Durban, October 2017.

Chale-Matsau B, Pillay TS: IFCC-WorldLab: Propionic acidemia (case presentation), Durban, October 2017.

Chale-Matsau B, Pillay TS: IFCC-WorldLab: Porphyria Cutanea Tarda in a HIV patient, Durban, October 2017.

6. Academic and research honours awards and recognition

Prof Pillay was elected to membership of ASSAf in recognition of his contributions. The academy only recognises the country's most outstanding and celebrated scholars by electing them to membership;

- Prof Pillay was elected to membership of Academy of Science of South Africa (ASSAf) in recognition of his contributions. The academy only recognises the country's most outstanding and celebrated scholars by electing them to membership;
- Prof Pillay was appointed to the Publications Core Committee of the AACC in 2016, the only person from outside North Amer ica to be a member of one of the AACC core committees;
- Prof Pillay was re-appointed as Honorary Professor at the Division of Chemical Pathology, UCT in 2016;
- Prof Pillay was re-elected to the Council of the College of Pathologists in 2017 and will

  serve as Senator in the CMSA; and
- Dr Punchoo was awarded the Sub-Saharan Africa FAIMER medical education fellowship in 2017/2018, which improves medi cal pedagogic practices in undergraduate and postgraduate medical curriculae.

7. Additional information

- Prof. Pillay serves as:
  - Editor-in-Chief of the Journal of Clinical Pathology, a British Medical Journal (BMJ) group that is based in London;
  - A member of the International Committee of the Royal College of Pathologists;
  - Senator of the CMSA; and
  - Council member of the College of Pathologists, South Africa.
- Prof. Pillay is country advisor for South Africa at the Royal College of Pathologists, London and Chair of the Policy, Advocacy and Communications group of the Royal College of Pathologists International Committee; and
- Prof. Pillay was also elected as President of the South African Association for Clinical Biochemistry and Laboratory Medicine from 2017.

Haematology

Head of Department: Prof Roger Pool

1. About the department

The mission of the Department of Haematology is to:

- Provide a high quality, cost effective diagnostic haematology service;
- Produce research relevant to the patient population and disease profile of the community which we serve;
- Equip undergraduate students with the knowledge to effectively utilise a haematology laboratory and interpret results, as well as enable them to investigate and manage patients with haematological disease; and
- Create a postgraduate teaching programme which leads to the production of pathologists of an internationally acceptable standard.

The department renders tertiary laboratory and clinical services to the SBAH, Tshwane District Hospital, Kalafong Hospital and surrounding clinics. It also acts as a referral centre for Mpumalanga and certain teaching centres associated with UP (Tembisa, Mamelodi). Diagnostic tests are performed both in the Core Laboratory as well as in the Prinshof Laboratory. The department is involved in a wide range of formal and informal teaching activities and provides lectures and tutorials to second, third, fifth and sixth year undergraduate medical students.

Postgraduate training is provided to MMed students as part of a formally structured registrar training programme, as well as to BSc(Hons) and MSc students. Tutorials are also offered to postgraduate students in the Departments of Internal Medicine and Paediatrics, as part of their training programme.

The department follows an active research programme with special emphasis on inflammation and the role of neutrophils, haemophilia, the in utero and early post-natal environment and how it is altered by maternal HIV infection, as well as factors involved in the activation of platelets. As part of the requirements for their degrees, all registrars, BSc(Hons) and MSc students in the department participate in research projects. These projects are supervised by consultants and scientists within the Department. Currently both scientists in the department are completing their PhD degrees.

Staff members from the department are also responsible for the running of the Haematology Clinic and the Haemophilia Clinic in the SBAH.

Figure UP1: Haematology Department

2. Diagnostic services

Laboratory services are offered from two separate sites viz. the SBAH Core Laboratory and the Institute of Pathology at Prinshof Campus. The bulk of the diagnostic work in terms of test volumes is performed at the core laboratory. In total, 403838 tests were performed in this laboratory during the period under review, which represents a 16% increase from the previous reporting period.

2.1 Flow cytometry

Specimens are analysed in the Department of Immunology and are interpreted and reported on by pathologists in the Department of Haematology. This is done taking into cognisance the clinical presentation of the patient, often in consultation with the referring physician.

2.2 Clinical haematology

The adult haematology clinic continues to provide a consultation service, both to the SBAH and the wider medical community of Pretoria and the surrounding areas. The clinic serves as an important vehicle for teaching of undergraduate medical students, as well as haematology and internal medicine registrars. During the period under review, 410 patients were seen at the clinic. Members of the department also provided valuable input into the paediatric haematology clinic.

2.3 Haemophilia care

In total, 218 visits were made to the clinic during the year, with the majority of patients having severe Haemophilia A.

Table UP 8: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	1	5				5	5
Medical scientists			2			2	2
Technologists					11	11	11
Other*						14	14
South Africans	1	5	2		11	32	32
All	1	5	2		11	32	32

*Registrars, Academic Secretary, Messenger, Student Technologists, Medical Technicians, Student Technicians

3. Teaching, training and professional development

3.1 Undergraduate level

BLOCK 280 (Homeostasis) for MBChB II

Feedback from students on the newly designed lecture series was generally favourable. The results of the last group of students were excellent, with the overwhelming majority being promoted after the first examination.

SA12 (Haematological Malignancy) for MBChB III

Case studies for this course were revised and rotations were divided into laboratory, radiological and clinical modules. Assessment was also changed to include both a 600-word case report and a multiple choice, computer-based examination. Students spent time in haematology, immunology, histopathology, genetics and radiation oncology, as well as medical and paediatric oncology, as part of their rotation in this block.

SA13 (Laboratory Medicine) for MBChB VI

This is the last formal instruction to student interns on laboratory medicine. Topics covered include full blood count, nutritional and haemolytic anaemia, bleeding disorders, hyercoagulable states and blood transfusion.

3.1.2 Small group tutorials

Student interns spend two days in the Department of Haematology as part of the student intern rotation. During this period, they have tutorials on a significant number of haematological conditions, and are taught how to interpret the most frequently requested haematological tests. At the end of the training session, a test is written to evaluate the students' knowledge of the material covered.

Figure UP 3: Registrars at teaching microscope

3.2 Postgraduate level

3.2.1 MMed (Path)

A comprehensive practical and theoretical teaching programme was established for registrars in haematology which seeks to cover the whole syllabus over a four-year period. Registrars in haematology are expected to attend and pass courses in research methodology and molecular pathology within the first 18 months of starting in a registrar post. Formal written assessments occur four times a year and are tailored to the seniority of registrars. As soon as the assessments are marked, feedback is given to each registrar on a one-to-one basis.

3.2.2 PhD

Two staff members are involved in PhD studies. One is researching factors impacting on foetal and infant immunity and growth in HIV- and antiretroviral-exposed, uninfected children, while the other is studying inflammagen, a lipopolysaccharide which induces factor XII activation and causes hyper-aggregation of platelets.

3.2.3 MSc

The focus of the MSc programme is on the laboratory diagnosis of myeloproliferative neoplasms.

3.2.4 BSc (Hons)

The degree is based on course work, tutorials, oral presentations and a dissertation. Compulsory modules include applied research methods, medical biostatistics and molecular pathology. At the request of the university, the weighting of the research component was increased to align the course with overall academic policy.

Table UP 9: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern medical scientists	Honours	All	South Africans
Total number of trainees	2	1	7	2	2	14	14
Final year trainees	0	0	2	2	2	6	6
Successful completion	0	1	1	2	2	5	5

4. Awards

Mr Francois van Niekerk was awarded his BSc(Hons) Degree from UP, with distinction.

5. Research activities

5.1 Research projects

Project title: Lupus Anticoagulant Screen Interpretation Discrepancies and Cost Wastage in a Haematology Laboratory Pretoria, South Africa
Principal investigators: WJ Kruger (NHLS TAD Haematology/UP)
Co-researchers: JG Nel (NHLS TAD Haematology/UP), PWA Meyer NHLS TAD Immunology/UP)
Funding: Researchers
Short description: This cross-sectional study was done to determine whether the current set of evaluation criteria used for dilute Russell Viper Venom Time (dRVVT) investigations meet expectations and identify possible short comings. All dRVVT assays requested from January 2015 to December 2015 were appraised. The raw data panels were compared to the new reference interval, established in 2016, to determine the sequence of assays that should have been performed. Interpretive comments according to three interpretation guidelines were compared. The reagent cost per assay was determined, and reagent cost wastage, due to redundant tests, was calculated. Redundant mixing tests resulted in R 7477.91 (~11%) reagent cost wastagein 2015.
Project start date: May 2017
Project end date: December 2017

Project title: Verification of schizocytes, normoblasts and reticulocyte count accuracy with the Symex XN 2000®
Principal investigator: A Mphaphuli (UP)
Co-researcher: T Netshidzivhani (NHLS, UP)
Funding: Researchers
Total Funding for the entire project: R1000.00
Short description: The aim of the study is to compare both manual and automated differential count for normoblasts, reticu locytes and red cell fragments. Also, to perform full blood count using the Sysmex 2000 analyser and to prepare blood smears on slides and stain them with Wrights stains to perform schizocyte and normoblast counts. To prepare blood smears on slides and stain them with new methylene blue to perform reticulo cyte count and compare the accuracy of the Sysmex 2000 analyser to manual counting.
Project start date: January 2018
Project end date: December 2018

Project title: Performance verification of the Sysmex XN 2000® full blood count haematology analyser in a tertiary diag nostic laboratory setting
Supervisors: Dr Potgieter J.J (University of Pretoria), Dr N.L Ntabeni (University of Pretoria)
Funding: Roche South Africa, National Health Laboratory Services (NHLS)
Total funding of entire project: R9564.54

Short description:	The NHLS at the Steve Biko Academic Hospital has acquired a new haematology analyser, the Sysmex XN-2000, which will be utilised for routine FBC measurements.The aim of this study was to verify the manufacturer's claims for their method performance characteristics, under our current laboratory envi ronmental conditions, e.g. temperature, humidity, operator skills and our laboratory's patient population. The performance of the newly acquired haematology analyser was compared to that of the ADVIA 2120 (reference method). A total of 429 anonymous surplus samples that were available following routine FBC testing in the laboratory were used. The variables that were assessed in this analysis included: precision, accuracy, analytical measuring interval, linearity, carry-over, sensitivity and specificity.
Project start date:	04 July 2017
Project end date:	awaiting feedback from the supervisor / statistician

Project Title:	MSc student throughput in the School of Health Care Sciences and factors impacting on it
Principal investigator:	Dr JG Nel (UP/NHLS)
Supervisor:	Dr R Grant (UP)
Funding:	Not applicable
Total funding of entire project:	Not applicable
Short description:	An audit is being performed to determine the through put time of MSc studies and factors influencing it in the school of health care sciences, hopefully this audit will identify opportunities to improve current practice in the faculty.
Project start date:	1 March 2018
Project end date:	30 June 2018

Project Title:	Assessment of Anaemia severity in HIV- and antiretroviral-exposed uninfected children
Principal investigators:	Potgieter J , Vaz-Van der Riet DC Co-researchers: Makin J, Seopela L
Collaborators:	Feucht U, Rossouw T
Total funding for the entire project:	Not applicable
Funding:	K-number or NHLS development fund
Short Description:	The aim of this study is to investigate the effects of antiretroviral drug exposure, cART with or without AZT exposure, by comparing haematological parameters at birth, 10 weeks and 6 months of life in three groups of newborns; HIV non-exposed, HIV exposed low risk and HIV exposed high risk infants. The newborns born to HIV negative mothers will be the control group. This a prospective analytical cohort study with two HIV-exposed and a HIV-unexposed comparison group. Results will be available once the mothers have delivered and the infants can be evaluated based on a FBC collection on cord blood at birth and peripheral blood at 10 weeks and 6 months follow up visits.
Project start date:	January 2018
Project End date:	December 2019

Project Title:	An assessment of the health-related quality of life in adults attending a treatment centre in Pretoria
Principal Investigator:	Dr R Khoosal
Co-researchers:	None
Collaborators:	None
Funding:	None
Short Description:	The primary aim of this study is to assess the health-related quality of life of adult people with haemophilia (PWH) attending a tertiary level haemophilia clinic in Pretoria. The secondary aim was to determine if highly correlated variables as discussed in the literature impact on quality of life in our patient population. Patients with moderate and severe haemophilia A or B were recruited from the Steve Biko Academic Hospital Haemophilia Clinic from April to August 2017. Additional demographic information and information relating to age, haemophilic arthropathy and annualized bleeding rate was collected from patient records. HRQoL in our cohort was comparable with that of Greek and Brazilian cohorts despite the unavailability of prophylactic treatment in the state sector in South Africa.
Project start date:	May 2017

Project end date:	September 2017
Project title:	Investigating the effects of in utero HIV exposure on infant T-cell function/activation and regulation of immune-modulatory pathways
Principle investigator:	Prinsloo A (NHLS & University of Pretoria)
Co-researchers:	Rossouw T (University of Pretoria)
Collaborators:	Connor K & Cassol E (Carleton University, Canada)
Funding:	CIPHER & NHLS Trust grants
Total Funding for entire project:	To date, we have secured a total of R 1.489 715 for the umbrella project including this PhD research project to date. We will apply for additional funding if needed.
Short Description:	This study aims to investigate the effects of in utero HIV exposure on infant T-cell activation and monocyte/macrophage activation/responsiveness and regulation of immune-modulatory pathways. The study will assess whether maternal HIV status and inflammatory/anti-inflammatory cytokine profile impact basal infant T-cell activation and regulation at birth and in infancy.
Project start Date:	December 2017
Project end date:	December 2019
Project Title:	Analysis of flow cytometric immunophenotyping requests for haematological malignancies in seven tertiary hospitals
Principle investigator:	Gevers C (UP)
Co-researchers:	Prinsloo A (NHLS & UP)
Funding:	Research fund, Department of Haaematology
Total Funding for entire project:	R 7 500.00
Short Description:	In this study the number of sites will be increased to seven, namely Charlotte Maxeke Johannesburg Academic Hospital, Universitas, Inkosi Albert Luthuli Hospital, Nelson Mandela Tertiary Hospital, Tygerberg Hospital, Groote Schuur and Red Cross War Memorial Children's Hospital, in order to compare nationwide statistics of all seven sites in the year 2014 to those gathered at the TAD in the original study to evaluate the utilisation of flow cytometry. This will allow laboratory technicians and doctors to streamline tests and requests in order to conserve funds for important tests and not use them on tests that will likely not result in a diagnosis.
Project Start Date:	Jan 2018
Project End Date:	Nov 2018

6. Research Output

6.1 Journal Publications

Repsold L, Pool, R, Karodia M, Tintinger G, Joubert A An overview of the role of platelets in angiogenesis, apoptosis and autophagy in chronic myeloid leukaemia Cancer Cell International Cancer Cell Int (2017) 17:89

Prinsloo A, Nel J, Pool R, Retrospective data analysis of all requests for flow cytometry in a tertiary hospital setting Medical Technology SA 30:2

Swart N, Pool R, Prinsloo A Cancer diagnosis profile of bone marrow specimens in a tertiary academic setting Medical Technology SA 31:1

Prinsloo A, Pool R, van Niekerk C Preliminary data on micro RNA expression profiles in a group of South African patients diagnosed with chronic myeloid leukaemia Molecular and Clinical Oncology 7 386-390

Muller M, Kalmeer E, Eyal P, de Bruin A, Pool R, Durandt C, Ehlers R, Stander B, van Schoor A, Nortje E, du Toit P An endometrial histo-morphometric study of CD56 positive natural killer cells in women with unexplained infertility South African Journal of Obstetrics and Gynaecology 23:2

Kappala S, Alessandrini M, Matlhako-Kgopa T, Beltchev E, Pool R, Pepper M Application of the AMLprofiler® diagnostic microarray in the South African setting Stem Cells International Vol 2017 Article ID 2560191 8 pages

Anderson R, Nel J, Feldman C Multifaceted role of Pneumolysin in the pathogenesis of myocardial injury in community acquired pneumonia International Journal of Molecular Sciences 19:1147

Senamela T, Kock M, Becker P, Potgieter J Detection of the Janus kinase 2 V617F mutation using a locked nucleic acid, real time polymerase chain reaction assay African Journal of Laboratory Medicine 7 (1) 2018

Kruger W, Meyer P, Nel J Dilute Russel Viper Venom Time analysis in a Haematology Laboratory: An audit Int J Lab Hem. 2018;00:1–6. https://doi.org/10.1111/ijlh.12825

7. Research Translations

A research project undertaken by Drs Kruger and Nel in our Department has led to a change in the Lupus Anticoagulant SOP and a published article.

Immunology

Head of Department: Dr Pieter W.A. Meyer (Acting)

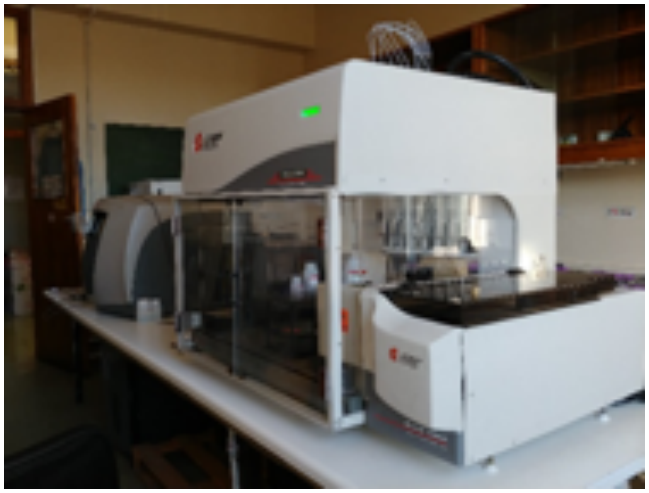
1. About the Department

The Department of Immunology, Tshwane Academic Division, is one of only three autonomous Immunology units in the country, the others being situated at the Universities of Cape Town and Witwatersrand. The Department offers a comprehensive routine diagnostic service encompassing all immunological sub-specialities including; autoimmune screening, HLA tissue-typing, infectious disease serology, immunophenotyping, immune-regulatory protein studies, allergology analysis and primary / acquired immunodeficiency serodiagnostic testing. The SAMRC flagship ICMM (Institute for Cellular and Molecular Medicine) with Prof Pepper as director and the CNE (Centre for Neuro-Endocrinology) under Prof Millar also resides in the Department. The Department of Immunology also have an active teaching and training program that caters for student technicians, technologist, intern medical scientist, registrars as well as post-graduate qualifications. We have a comprehensive research facility with leading experts focused on the following areas of interest:

- Stem cell therapies, pharmacogenetic and pharmacogenomics - Prof Michael Pepper;
- Immune-modulation of HIV in infants – Prof Theresa Rossouw;
- Immunotherapy in cancer – Prof Bernardo Rapoport;
- Infectious Diseases (TB, Community acquired pneumonia, HIV-Infection) – Prof Ronald Anderson, Prof Anette Theron, Dr Moloko Cholo;
- Inflammation (immunotoxicology, immunopharmacology) - Prof Ronald Anderson, Prof Anette Theron, Dr Helen Steel; and
- Biomarkers in non-communicable diseases (NCD) – RA, Cancer, association of nicotine and tobacco usage in NCDs, immune checkpoint inhibitor targeted therapy - Prof Ronald Anderson, Prof Anette Theron, Prof Bernardo Rapoport, Dr Pieter Meyer.

2. Diagnostic Services

Our department offers routine laboratory services to SBAH (Steve Biko Academic), TDH (Tshwane District Hospital), Kalafong and several Tshwane District clinics. We also act as referral laboratory for Limpopo and Mpumalanga as well as catering for specialised Immunology testing for a large contingent of NHLS laboratories nationally. Our test volume workload for 2017/18 financial year exceeded 320 000 tests, an increase of ±4% from the previous year. The routine laboratory is currently operating with only 10 qualified permanent staff members, 1 academic joint staff member and 5 students.



We also offer a specialised leukaemia immunophenotyping service in conjunction with the Department of Haematology, mainly for SBAH, but also analyse samples from Tembisa, Emalahleni and the North West provincial hospitals.

Of note, we recently introduced neuronal associated autoantibody screening at our facility due to amplified requests from SBAH. Since inception we have observed an upsurge in neuronal antibody positivity of samples submitted of late, which may be ascribed to better clinical acuity when requesting serodiagnostic autoimmune neuronal antibody screening. A testament of establishing well-informed rapport with our clinicians.

Table UP 10: Total number of trainees and successful completion per qualification/profession

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	0	0				0	0
Medical scientists	2	0	1	0		3	3
Technologists	0	0	0	2	3	5	4
Other*	0	0	0	1	0	8	9
South Africans	2	0	1	3	2		15
All	2	0	1	3	2		16

3. Teaching, Training and Professional Development

The Department is a HPCSA accredited training facility for Technicians, Technologist as well as Intern Medical Scientists wo want to specialise in Medical Immunology. We also provide Basic and Advanced Immunology lectures to undergraduate and post graduate students and registrars from other disciplines at TAD in. Prof Anette Theron has retired from the NHLS after 35 years of service with the Department of Immunology. Prof Theron has published a 104 peer-reviewed articles in her career with an h index = 24. Her contribution to the Department of Immunology is considerable and we are indeed grateful that we can maintain her in the Department on a contract basis for her to pass on her years of experience to the young and upcoming researchers.

Undergraduate Level

Joint-appointed staff from the NHLS lecture for the Faculty of Health Sciences, University of Pretoria, specifically:

GNK 123/124/125	1st year MBChB
GNK 214/215	2nd year BSc (B.Diet / B.Phys / B.Cum)
GNK 252/253/254	2nd year MBChB
Special Activity 5: GNK 283	2nd year MBChB
GNK370	3rd year MBChB
GNK 689	6th MBChB

Postgraduate Level

The Department of Immunology offers post-graduate degrees in Medical Immunology at BSc Hons, MSc and PhD level. We currently have 16 MSc and 22 PhD students enrolled in our department. We are very proud of the 2 NHLS employees, Dr Jan-Gert Nel and Molie-hi Potjo, who have obtained their PhD degrees in Medical Immunology in this financial year.

Other

Table UP 11: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern Medical Scientist	Honours	All	South Africans
Total Number of Trainees	3	0	0	1	0	1	1
Final Year Trainees	2	0	0	0	0	2	2
Successful Completion	2	0	0	0	0	0	2

*Table reflects only NHLS employees, not post graduate UP students in the Department.

4. Research Activities

4.1 Research projects

Project Title: Optimising histocompatibility testing in living-donor renal transplantation
Principal Investigators: Kwofie, L (NHLS)
Co-researchers: Meyer, PWA (NHLS/UP)
Collaborators: None
Funding: NHLS Research Grant Trust
Total Funding for the entire project: R 335 000
Short Description: This study is set to optimise screening protocols for improving graft versus host organ survival in awaiting kidney transplant patients of the greater Tshwane area. Testing protocols will be optimised by using, i) a novel, 5, 6-carboxyfluorescein diacetate-based, flow cytometric two-way mixed lymphocyte reaction (MLC); ii) flow cytometric detection of expression of early markers (CD25, CD69, HLA

class II) of T-cell activation in the two-way MLC; and iii) fluoro-analysis of T-cell-derived cytokines in the supernatant fluids generated in the two-way MLC in conjunction with existing HLA cytotoxicity screening protocols used in conventional histocompatibility testing in our laboratory. A panel of histocompatibility tests will be identified as the most sensitive set of tests that best predicts and identify the formation of HLA antibodies and T cell activity (both pre- and post-transplantation) to be implemented as a standard testing panel.

Project End Date: April 2013
Project End Date: June 2018

Project Title: The effects of dabigatran and rivaroxaban on markers of neutrophil activation.
Principal Investigators: Richards GA (WITS)
Co-researchers: Anderson, R (UP); Rapoport, B (UP); Feldman, C (WITS); Tintinger, G (SBAH/UP)
Collaborators: None
Funding: Bayer and Boehringer Ingelheim
Total Funding for the entire project: R 30 000
Short Description: Dabigatran is an oral direct thrombin inhibitor, and rivaroxaban a factor Xa inhibitor. Dabigatran has been implicated in the aetiology of acute coronary syndromes and as these occur following inflam matory changes in the endothelium, we investigated the inflammatory potential of these agents in vitro. In order to do so neutrophils were isolated from heparinized venous blood from non-smoking healthy adults and exposed to dabigatran or rivaroxaban. Generation of reactive oxygen species (ROS), elastase release, cytosolic Ca2+ fluxes, neutrophil extracellular trap (NET) formation, and cell viability were measured using chemiluminescence, spectrophotometric and flow cytometric procedures and neither agent at concentrations of up to 10 µM affected these markers of neutrophil activation.
Project Start Date: Jan 2017
Project End Date: Dec 2017

Project Title: Evaluation of circulating host- and pathogen-derived markers of infection and inflammation in the laboratory diagnosis of sepsis
Principal Investigators: Potjo, M
Co-researchers: Anderson, R (UP); Tintinger, G (SBAH/UP); Theron, A (NHLS/UP); Meyer, PWA (NHLS/UP)
Collaborators: None
Funding: SAMRC
Total Funding for the entire project: R 200 000
Short Description: Evaluating the role of systemic, host- and pathogen-derived biomarkers of inflammation in distinguishing sepsis from the systemic inflammatory response syndrome (or SIRS) in patients admitted to SBAH with clinical evidence of systemic inflammation. The findings of the current study have identified clinical parameters and biomarkers of inflammation that may be useful in differentiating sepsis from SIRS and predicting those patients at highest risk of mortality.
Project Start Date: April 2014
Project End Date: June 2017

Project Title: Identifying biomarkers indicative of severe erosive disease in RA patients at early onset: GREAT Study.
Principal Investigators: Meyer, PWA
Co-researchers: Anderson, R (UP); Ally, MTMM (SBAH/UP); Tikly, M (CHBAH/WITS)
Collaborators: None
Funding: NHLS & UP Development Grands, NRF, Astra Zeneca. Further applications pending.
Total Funding for the entire project: R 450 000
Short Description: The GREAT (Gauteng Rheumatoid Early Arthritis Trial) Study initiative endeavours to study the impact of RA disease, pathogenic mechanisms, serve as a data repository of clinical and laboratory biomarkers associated with RA, to communicate key finding through publishing data in peer-reviewed journals and related congresses. The GREAT study set out to investigate the role of several known and novel markers in identifying patients with severe RA disease in the South African Black population.

Project Start Date: April 2012
Project End Date: Ongoing

Project Title: Screening rheumatoid arthritis patients for single-nucleotide polymorphisms of STAT4 (rs7574865), TRAF1/C5 (rs3761847) and PTPN22 (rs2476601) using real-time PCR and melting curve analysis.
Principal Investigators: Meyer, PWA
Co-researchers: Mojodo, G
Collaborators: None
Funding: NHLS Development Grand submitted
Total Funding for the entire project: R 100 000
Short Description: To establish a routine procedure to type gene polymorphisms in STAT4 (Signal transducer and activator of transcription 4), TRAF1/C5 (Tumour necrosis factor-receptor associated factor 1/complement component 5) and PTPN22 (Protein tyrosine phosphatase, non-receptor type 22) will contribute greatly to improve the diagnosis and treatment of RA patients at risk of severe disease and comorbidities (e.g. Cardiovascular disease).
Project Start Date: April 2017
Project End Date: Ongoing

Project Title: Clofazimine potentiates platelet activation in vitro
Principal Investigators: Anderson, R (UP);
Co-researchers: Theron, AJ (NHLS/UP); Tintinger, GR (SBAH/UP); Nel, JG (NHLS/UP), Durandt, C (ICMM, UP); Cholo,MC (UP).
Collaborators: Feldman, C (CMAH, WITS)
Funding: Partially funded by NRF; Balance provided from departmental funds.
Total Funding for the entire project: R 100 000
Short Description: Although the inclusion of clofazimine in the chemotherapeutic regimens of patients with MDR tubercu losis has contributed to improved outcomes, concerns remain about the cardiotoxic potential of this agent. Objective of the study was to investigate the effects of clofazimine on platelets in vitro as a possible mechanism of cardiotoxicity. Methods: Platelet-rich plasma prepared from the blood of healthy, adult humans was treated with either clofazimine, as well as bedaquiline and the primary anti-TB agents, isoniazid and rifampicin followed by addition of either ADP or thrombin and measurement of platelet activation according to the magnitude of expression of CD62P (P-selectin) using flow cytometry. Results: Clofazimine, but none of the other test anti-TB agents, caused dose-related potentiation of both ADP- and thrombin-activated expression of CD62P by platelets.
Project Start Date: Jan 2017
Project End Date: Dec 2017

Project Title: Investigating the relationship between markers of immune activation and cigarette smoking in HIV infected individuals.
Principal Investigators: Rossouw, TM (UP);
Co-researchers: Theron, AJ (NHLS/UP); Steel, HC (UP); Anderson, R (UP);
Collaborators: Feldman, C (CMAH, WITS)
Funding: Partially funded by NRF; Balance provided from departmental funds.
Total Funding for the entire project: R 100 000
Short Description: The potential harmful effects of smoking were investigated in HAART naïve HIV infected individuals, and those on virologically suppressive HAART. The samples were obtained from the Charlotte Maxeke ARV clinic. Various markers of immune activation and microbial translocation were measured by using ELISA methodology and the multiplex bead array system. The data is currently being analysed.
Project Start Date: Jan 2016
Project End Date: Dec 2018

5. Research Output

The Department of Immunology have published 31 articles in peer-reviewed journals, 5 Book chapters and 3 published abstracts in 2017. Below are the references of those with NHLS affiliations.

5.1 Journal Publications

Bokaba RP, Anderson R, Theron AJ, Tintinger GR. Cigarette smoke condensate attenuates phorbol-mediated neutrophil extracellular trap formation. African Health Sciences 2017; 17(3):896–904. Doi: 10.4314/ahs.v17i3.33.

Nel JG, Durandt C, Theron AJ, Tintinger GR, Pool R, Richards GA, Mitchell TJ, Feldman C, Anderson R. Pneumolysin mediates heterotypic aggregation of neutrophils and platelets in vitro. Journal of Infection 2017; 74(6): 599–608. doi: 10.1016/j.jinf.2017.02.010.

Opolot JO, Theron AJ, MacPhail P, Feldman C, Anderson R. Effect of smoking on acute phase reactants, stress hormone responses and vitamin C in pulmonary tuberculosis. African Health Sciences 2017; 17(2): 337–345. doi: 10.4314/ahs.v17i2.7.

Theron AJ, Anderson R, Rossouw TM, Steel HC. The role of transforming growth factor beta-1 in the progression of HIV/AIDS and development of non-AIDS-defining fibrotic disorders. Frontiers in Immunology 2017; 8: 1461. Doi: 10.3389/fimmu.2017.01461.

Medical Microbiology

Head of Division: Prof N Mbelle

1. About the Department

The Department of Medical Microbiology provides diagnostic and consultative services to three tertiary hospitals; Steve Biko Academic Hospital (SBAH), Kalafong and Tembisa; regional and primary hospitals such as Tshwane District Hospital (TDH), Pretoria West and Mamelodi Hospitals, as well as clinics in the Tshwane District. It is involved in Infection Prevention and Control Programmes for hospitals in the Tshwane region, as well as partnering with the Gauteng Department of Health in coordinating such activities in the province as well as at national level. The Medical Microbiology Laboratory continues to serve as an enhanced surveillance site for the National Institute of Communicable Diseases (NICD), through the GERM-SA surveillance programmes for enteric pathogens, mycology, parasitology and respiratory and meningeal pathogens, as well as the pneumococcal vaccine surveillance programme.

The Department of Medical Microbiology continues to have an extensive teaching and training programme for both undergraduate students (MBChB, BDS, BCur, BPhys and BDiet) and postgraduate students (BSc (Hons), MMed, MSc, PhD) and postdoctoral fellows. Clinical departments supported by the department are internal medicine, paediatrics, surgery, neurosurgery, cardiothoracic surgery, nephrology (incl. renal transplant unit) and the different ICUs. Nine registrars are currently in training, including a supernumery. Academic personnel are joint appointees with the University of Pretoria.

There are four main research themes in the department which are: the human microbiome and its role in disease; antibiotic resistance and epidemiology of clinically important pathogens; microbial surveillance; as well as new drug delivery methods and candidate vaccines for tuberculosis.

Table UP 12: Total number of staff per profession and highest qualification

	Pathologist	Pathologist	PhD Scientist	Technologists	Technicians	Support	South African	All
Total	2	9	3	2	2	2	37	38

2. Diagnostic Services

The department provides diagnostic laboratory services for Steve Biko Academic and Tshwane District Hospitals. It further provides referral diagnostic and clinical services for Kalafong, Mamelodi and Tembisa Hospitals as well as several Primary Health Care Clinics in the Tshwane District. It serves as one of the referral laboratories for hospitals in the Gauteng area of the NHLS structure as well as primary healthcare clinics served by the Tshwane district. The volume of tests performed during the review period was 554,227, a 16% increase since the previous year. GeneXpert testing stabilised at 40,988 tests. A The Pneumocystis jirovecii molecular assay test volumes continue to increase steadily month on month as a referral test, with an overall increase of 50% when compared to last year. The Clostridium difficile detection algorithm has proven to be cost-saving with increased sensitivity when compared to the previous test method, and has improved turnaround time.

2.1 Clinical and consultative support

Clinical staff (pathologists and registrars) participate in several ward rounds at SBAH. These include adult ICU, surgery ICU, neurosurgery, cardiothoracic ICU, nephrology and the renal transplant unit. In addition to structured ward rounds, on-going clinical support is given to all other disciplines at SBAH as well as Tshwane District Hospital. Telephonic consultations are held with clinicians from Kalafong, Tembisa and Mamelodi hospitals. The clinical support is extended to Ermelo and other hospitals in Mpumalanga province as part of our national coverage activities.

The pathologists are actively involved in various committees at SBAH and TDH. These are the Pharmacy and Therapeutics Committee, Antibiotic Stewardship in collaboration with the Division of Infectious Diseases, Pathology Task Team and the Infection Control Committee. The department remains actively involved in the infection prevention and control programmes (e.g. assistance in management of outbreaks) for the hospitals served,particulary Kalafong and Tembisa hospitals and partners in national, provincial and district infection prevention and control initiatives.

3. Teaching, Training and Professional Development

3.1. Undergraduate

Teaching and training are provided to medical technologists, undergraduate medical and dental students, as well as allied healthcare students in the disciplines of nursing, physiotherapy and dietetics. Interaction with medical undergraduates is over five years, with intensive teaching done during the second semester of the second year for medical and dental undergraduates. The dental undergraduates now receive intensive training during the first semester of the third year.

3.2. Postgraduate

Training is offered for BSc (Hons), MSc and MMed, PhD. The department also supports postdoctoral training. Registrars are prepared for both the MMed and the College of Medicine of South Africa examinations through a structured training programme. Support is offered to rotating registrars from the internal medicine, paediatrics and neurology departments.

3.3. Other Training Information

Intern medical Technologists: None
Student Technicians: None
Intern Medical Scientists: None

Table UP 13: Total number of trainees per qualification category and rates of successful completion/pass rates

	Total Number of Trainees Final Year Trainees	Final Year Trainees	Successful Completion	Percentage of Successful Completions
BSc Hons	4	24	24	100%
MSc	18	10	6*	60%
PhD	8	2	1	50%
Registrars	9	2	2*	100%
Med Tech Students	4	1	1	100%
Intern Med Scientist	0	0	0	100%
Post doc	0	-	0	100%
All	59	20	14	70%

4. Research Activities

Research in the department is predominantly laboratory-based. The leading focus areas of research in the department are:

The human microbiome research programme

The human microbiome and its role in human diseases are studied extensively in this programme. The current projects focus on the microbiome associated with bacterial vaginosis, pre-eclampsia, cystic fibrosis, chronic obstructive pulmonary disease and bronchochietasis. Senior researchers include: Prof. NM Mbelle, Prof. MM Ehlers, Prof. RPH Peters and Dr MM Kock. Projects are funded by the NHLS Research Trust and the National Research Foundation. Collaborators include Professor Green (Department of Paediatrics/ University of Pretoria), Professor Ncube (Department of Biotechnology/ University) Prof HA Lombaard (Rahima Moosa Mother and Child Hospital/University of the Witwatersrand), Prof. R Masekela (Department of Pediatrics, KZN) Dr M Mooij (Maastricht University, the Netherlands) and Dr J Atiabong (Centre for Infectious Diseases Research & Experimental Therapeutics, Baylor Research Institute University of Texas).

Antibiotic Resistance and Epidemiology Programme

The focus of research projects in this research programme is on the molecular identification and characterisation of emerging and re-emerging pathogens, with special emphasis on the detection of specific antimicrobial resistance, virulence genes and where applicable their molecular epidemiology. The research focuses on both Gram-negative (family Enterobacteriaceae, Pseudomonas aeruginosa) and Gram-positive bacteria (Enterococcus, Staphylococcus, Streptococcus and Mycobacterium tuberculosis). The sexually transmitted

pathogens and their antibiotic resistance and epidemiology are also investigated in this programme. Several postgraduate students are conducting projects linked to this programme. The researchers include Prof. NM Mbelle, Prof. MM Ehlers, Dr MM Kock, Prof. JDD Pitout, Prof. RPH Peters, Dr N Maningi and Dr M Said. Active collaborators include: Prof. S Enany (Suez Canal University, Egypt and a scholar at the Division of Infectious Diseases, School of Medicine, University of California, San Diego, USA), Prof. S Essack (University of KwaZulu-Natal), Dr P Geertsma (GDARD), Prof C Feldman (University of the Witwatersrand), Dr E Moshokoa (Department of Urology, University of Pretoria), Prof V Naidoo, School of Veterinary Medicine, University of Pretoria, Prof B Kreiswirth (Rutgers University, New Jersey, USA), Prof J Klausner (University of California, Los Angeles, USA), Prof. S. Morré (Maastricht University, the Netherlands), Dr J Coetzee, K-A Strydom and Dr E Hoosien (Ampath, Centurion) and Dr LMalinga (TB Research Unit, SAMRC

Surveillance Research Programme

This programme focuses on the continuous monitoring and surveillance of clinical pathogens, such as carbapenemase producing Enterobacteriaceae, Clostridium difficile and methicillin resistant Staphylococcus aureus strains associated with outbreaks in ICU wards and the risk to public health. It further explores the diversity and clonal relatedness of methicillin resistant Staphylococcus aureus and clinically significant Enterococci. The determination of the circulating Streptococcus pneumoniae serotypes and sequence types, in children presenting for routine immunisation was also studied. Funding has been obtained from the NHLS Research trust and the NRF. Senior researchers include Prof. NM Mbelle, Prof. MM Ehlers, Dr MM Kock, Dr M Said, Dr K-A Strydom and Mr Y Dangor.

Tuberculosis vaccine and drug delivery programme

The research programme focuses strongly on identifying new tuberculosis vaccine drug targets as well as exploring alternative drug delivery for the treatment of tuberculosis. Old drugs are evaluated and repurposed using alternative drug delivery systems. Senior researchers include Prof. BF Fourie, Prof. RPH Peters and Prof. NM Mbelle as well as Dr Maningi. Funding has been obtained from the NRF, SAMRC and Longhorn Vaccines (USA). Collaborations include both private and public stakeholders.

5. Research Output

5.1. Journal Publications

Tshisevhe V, Lekalakala MR, Tshuma N, Janse van Rensburg S and Mbelle N (2017) Outbreak of carbapenem-resistant Providencia rettgeri in a tertiary hospital. SAMJ 107: 31-33 (IF: 1.712).

Palacios-Baena ZR, Gutiérrez-Gutiérrez B, De Cueto M, Viale P, Venditti M, Hernández-Torres A, Oliver A, Martínez-Martínez L, Calbo E, Pintado V, Gasch O, Almirante B, Antonio Lepe J, Pitout JDD, Akova M, Peña-Miralles C, Schwaber MJ, Tumbarello M, Tacconelli E, Origüen J, Prim N, Bou G, Giamarellou H, Bermejo J, Hamprecht A, Pérez F, Almela M, Lowman W, Hsueh PR, Navarro-San Francisco C, Torre-Cisneros J, Carmeli Y, Bonomo RA, Paterson DL, Pascual Á, Rodríguez-Baño J and REIPI/ESGBIS/INCREMENT Group. Development and validation of the INCREMENT-ESBL predictive score for mortality in patients with bloodstream infections due to extended-spectrum-β-lactamase-producing Enterobacteriaceae. J Antimicrob Chemother 72: 906-913 (IF: 4.919).

Cholo MC, Mothiba MT, Fourie B and Anderson R (2016) Mechanisms of action and therapeutic efficacies of the lipophilic antimycobacterial agents' clofazimine and bedaquiline. Journal of Antimicrobial Chemotherapy 72: 338-353 (IF: 4.919).

Jung HS, Ehlers MM, Lombaard HA, Redelinghuys MJ and Kock MM (2017) Etiology of bacterial vaginosis and polymicrobial biofilm formation. Critical Reviews in Microbiology 43: 651-667 (IF: 6.281).

Schmidt T, Kock MM and Ehlers MM (2017) Molecular characterization of Staphylococcus aureus isolated from bovine mastitis and close human contacts in South African dairy herds: genetic diversity and inter-species host transmission. Frontiers in Microbiology 8: 1-15 (IF: 4.165).

Peirano G, Bradford PA, Kazmierczak KM, Chen L, Kreiswirth BN and Pitout JD (2017) The importance of clonal complex 258 and IncFK2-like plasmids among a global collection of Klebsiella pneumoniae with blaKPCs. Antimicrob Agents Chemother 61(4): e02610-16 (IF: 3.34).

Antiabong JF, Kock MM, Mbelle NM and Ehlers MM (2017) Diversity of multidrug efflux genes and phenotypic evaluation of the in vitro resistance dynamics of clinical Staphylococcus aureus isolates using methicillin; a model β-lactam. The Open Microbiology Journal 11: 132-141 (IF: 2.50).

Zhanel GG, Parkinson K, Higgins S, Denisuik A, Adam H, Pitout JDD, Noreddin A and Karlowsky JA (2017) Pharmacodynamic activity of fosfomycin simulating urinary concentrations achieved after a single 3-g oral dose versus Escherichia coli using an in vitro model. Diagn Microbiol Infect Dis 88: 271-275 (IF: 2.45).

Stoesser N, Sheppard AE, Peirano G, Anson LW, Pankhurst L, Sebra R, Phan HTT, Kasarskis A, Mathers AJ, Peto TEA, Bradford P, Motyl MR, Walker AS, Crook DW and Pitout JDD (2017) Genomic epidemiology of global Klebsiella pneumoniae carbapenemase (KPC)-producing Escherichia coli. Sci Rep 7(1): 5917 (IF: 4.259).

Mudau M, Peters RP, de Vos L, Olivier D, Davey DJ, Mkhwanazi E, Feucht U, McIntyre JA, Klausner JD and Medina-Marino A (2017) High prevalence of asymptomatic sexually transmitted infections among HIV-infected pregnant women in a South African township. Int J STD AIDS Jan 1:956462417724908. doi: 10.1177/0956462417724908. [Epub ahead of print] (IF: 1.35).

Kabongo-Kayoka PN, Obi CL, Nakajima C, Suzuki Y, Hattori T, Eloff JN, Wright J, Mbelle N and McGaw LJ (2017) Novel Mycobacterium avium Complex Species Isolated From Black Wildebeest (Connochaetes gnou) in South Africa. Transboundary and Emerging Diseases 64: 929-937 (IF: 3.585).

Seni J, Moremi N, Matee M, van der Meer F, DeVinney, R, Mshana SE and Pitout JDD (2017) Preliminary insights into the occurrence of similar clones of extended-spectrum beta-lactamase-producing bacteria in humans, animals and the environment in Tanzania: A systematic review and meta-analysis between 2005 and 2016. Zoonoses Public Health 00:1-10 (IF: 2.323).

Matsumura Y, Peirano G, Devinney R, Bradford PA, Motyl MR, Adams MD, Chen L, Kreiswirth B and Pitout JDD (2017) Genomic epidemiology of global VIM-producing Enterobacteriaceae. J Antimicrob Chemother. 72(8): 2249-2258 (IF: 4.919).

Matsumura Y, Pitout JDD, Peirano G, DeVinney R, Noguchi T, Yamamoto M, Gomi R, Matsuda T, Nakano S, Nagao M, Tanaka M and Ichiyama S (2017) Rapid identification of different Escherichia coli ST131 clades. Antimicrob Agents Chemother 61(8): e00179-17 (IF: 4.302).

Harris PNA, Pezzani MD, Gutiérrez-Gutiérrez B, Viale P, Hsueh PR, Ruiz-Garbajosa P, Venditti M, Tumbarello M, Navarro-Francisco C, Calbo E, Akova M, Giamarellou H, Oliver A, Almirante B, Gasch O, Martínez-Martínez L, Schwaber MJ, Daikos G, Pitout JDD, Peña C, Hernández-Torres A, Doi Y, Pérez F, Tuon FF, Tacconelli E, Carmeli Y, Bonomo RA, Pascual Á, Paterson DL, Rodríguez-Baño J and ESGBIS/REIPI/INCREMENT group. Geographical variation in therapy for bloodstream infections due to multidrug-resistant enterobacteriaceae: a post hoc analysis of the INCREMENT study. Int J Antimicrob Agents. 50: 664-672 (IF: 4.307).

Hoogendoorn JC, Ranoto L, Muditambi N, Railton J, Maswanganyi M, Struthers HE, McIntyre JA and Peters RP (2017) Reduction in extrapulmonary tuberculosis in context of antiretroviral therapy scale-up in rural South Africa. Epidemiol Infect 145(12): 2500-2509 (IF: 2.365).

Redelinghuys MJ, Ehlers MM, Bezuidenhoudt JE, Becker PJ and Kock MM (2017) Assessment of Atopobium vaginae and Gardnerella vaginalis concentrations in a cohort of pregnant South African women. Sexually Transmitted Infections 93(6): 410-415 (IF: 3.015).

Schaftenaar E, Khosa NS, Baarsma GS, Meenken C, McIntyre JA, Osterhaus AD, Verjans GM and Peters RP (2017) HIV-infected individuals on long-term antiretroviral therapy are at higher risk for ocular disease. Epidemiology & Infection 145(12):2520-2529 (IF: 2.515).

Peters RP, Doyle R, Redelinghuys S, McIntyre JA, Verjans GM, Breuer J and Kock MM (2017) Genital Chlamydia trachomatis biovar L2 infection in South African women. Emerging Infectious Diseases 23: 1913-1915 (IF: 8.22).

De Waaij DJ, Dubbink JH, Peters RP, Ouburg S and Morre SA (2017) Prevalence of Trichomonas vaginalis infection and protozoan load in South African women: a cross-sectional study. BMJ Open Oct 8; 7(10):e016959. doi: 10.1136/bmjopen-2017-016959. (IF: 2.369).

Senamela T, Kock M, Becker P and Potgieter JC (2017) Detection of the Janus kinase 2 V617F mutation using a locked nucleic acid real time PCR assay. Accepted in African Journal of Laboratory Medicine.

Price CM, Peters RPH, Steyn J, Mudau M, Olivier D, De Vos L, Morikawa E, Kock MM, Medina-Marino A and Klausner JD (2017) Prevalence and detection of Trichomonas vaginalis in human immunodeficiency virus-infected pregnant women. Accepted in Sexually Transmitted Diseases (IF: 2.968).

Rees K, Radebe O, Arendse C, Modibedi C, Struthers HE, McIntyre JA and Peters RP (2017) Utilization of sexually transmitted infection services at two health facilities targeting men who have sex with men in South Africa: a retrospective analysis of operational data. Sex Transm Dis 44(12):768-773 (IF: 2.968).

Palacios-Baena ZR, Gutiérrez-Gutiérrez B, Calbo E, Almirante B, Viale P, Oliver A, Cantón R, Gasch O, Martínez-Martínez L, Pitout JDD, Akova M, Peña C, Molina Gil-Bermejo J, Hernández A, Venditti M, Prim N, Bou G, Tacconelli E, Tumbarello M, Hamprecht A, Giamarellou H, Almela M, Pérez F, Schwaber MJ, Bermejo J, Lowman W, Hsueh PR, Paño-Pardo JR, de la Torre-Cisneros J, Souli M, Bonomo RA, Carmeli Y, Paterson DL, Pascual A, Rodríguez-Baño J on behalf of REIPI/ESGBIS/INCREMENT Group (2017) Empiric therapy with Carbapenem-sparing regimens for bloodstream infections due to extended-spectrum β-lactamase–producing Enterobacteriaceae: Results from the INCREMENT Cohort. Clin Infect Dis. 50: 664-672 (IF: 8.216).

Peters R, de Vos L, Maduna L, Mudau M, Klausner J, Kock M and Medina-Marino A (2017) Laboratory validation of Xpert® CT/NG and TV testing as performed by nurses at three primary healthcare facilities in South Africa. Accepted in Journal of Clinical Microbiology 55: 3563-3565 (IF: 3.712).

Mbelle NM, Maningi NE, Tshisevhe V, Modipane L, Amoako DG and Sekyered JO (2017) Draft genome sequence of a clinical Enterococcus faecium Sequence Type 18 strain from South Africa. Genome Announcements 5: e01381-17 (IF: 1.3).

Maningi NE, Malinga LA, Antiabong JF, Lekalakala RM and Mbelle NM (2017). Comparison of line probe assay to BACTEC MGIT 960 system for susceptibility testing of first and second-line anti-tuberculosis drugs in a referral laboratory in South Africa. BMC Infectious Diseases 17:795 (DOI 10.1186/s12879-017-2898-3) (IF: 2.768).

Peirano G, Gregson DB, Kuhn S, Vanderkooi OG, Nobrega DB and Pitout JDD (2017) Rates of colonization with extended-spectrum β-lactamase-producing Escherichia coli in Canadian travellers returning from South Asia: a cross-sectional assessment. CMAJ Open 13;5(4): E850-E855 (IF: 3.373).

5.2. Book Chapters

None

5.3. Conference Presentations

5.3.1 Oral Presentations

National Congresses

Ramoshaba K, Mbelle N and Said M (2017) Laboratory exposure to Brucella melitensis. The Society for Medical Technologists of South Africa conference, Durban, on 19 to 21 May 2017.

Peters RP (2017) Of man and microbes: a tale of two epidemics. The 7th Annual Rural Health Research Day, Ukwanda Centre for Rural Health, University of Stellenbosch, Worcester, 18 of May 2017.

Peters RP (2017) Challenges in the management of sexually transmitted infections in pregnant women. The 8th Southern African AIDS conference held on 15 June 2017, at the International Convention Centre, Durban.

Ismail N, Peters RPH, Omar SV and Ismail NA (2017) Evaluation of methods for generation of in vitro mutants resistant to bedaquiline, clofazimine and linezolid from Mycobacterium tuberculosis reference strains. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Lowings M, Kock MM, Coetzee J, Hoosien E, van Greune J, Ehlers MM, Peirano G, Chen L, Kreiswirth BN and Pitout JDD (2017). Klebsiella pneumoniae ST307: a silent pathogen on the rise in South Africa. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Nyazema KB, Antiabong JF, Onwuegbuna OO, Malinga LA and Mbelle NM (2017) Investigation of discrepancies between phenotypic and molecular methods for detection of rifampicin susceptibilities from a tertiary diagnostic laboratory in Pretoria: towards a consensus in

rpoB mutations. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.
Schmidt T, Kock MM and Ehlers MM (2017) Diversity and antimicrobial susceptibility of staphylococci causing bovine mastitis. Allerton Scientific Day, 9 November, Allerton Provincial Veterinary Laboratory (KZN Department of Agriculture & Rural Development), Pietermaritzburg.

Schmidt T, Kock MM and Ehlers MM (2017) Molecular characterisation of Staphylococcus aureus isolated from cases of bovine mastitis and close human contacts. Allerton Scientific Day, 9 November, Allerton Provincial Veterinary Laboratory (KZN Department of Agriculture & Rural Development), Pietermaritzburg

5.3.2 Poster Presentations

National Congresses

Schmidt T, Kock MM and Ehlers MM (2017) Investigating the transmission of Staphylococcus aureus between bovines and humans working in the dairy environment. SA Large Herds conference held on 5 to 7 June 2017, Drakensberg.

Bolukaoto JY, Kock MM, Strydom K-A and Ehlers MM (2017) Virulence profile of enterohaemorrhagic Escherichia coli O157:H7 isolates from clinical specimens and environmental samples in Gauteng region, South Africa. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Geldenhuys J, Lombaard HA, Ehlers MM, Valverde A and MM Kock (2017) The diversity of the gut, vaginal and oral microbiome among pregnant women in South Africa with pre-eclampsia. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Kingsburgh C, Kock MM, Mbelle N and Ismail F (2017) Characterization of Inhibitor Resistant Lemonier (IRT) producing strains of Escherichia coli and Klebsiella pneumoniae in Pretoria, South Africa. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Koekemoer C, Kock MM and Ehlers MM (2017) Prevalence of antibiotic resistance and virulence genes of Escherichia coli O157:H7 isolated from porcine in Gauteng, South Africa. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Modipane L, Reva O, Antiabong JF, Magazi BT and Mbelle NM (2017) Genetic diversity of Mycobacterium bovis BCG strains; clinical and vaccine. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Mogale R, Kock MM and Ehlers MM (2017) Morphological diversity of Panton-Valentine leukocidin positive Staphylococcus aureus macrophages identified in SA and Nigeria. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town, South Africa.

Moloto K, Pitout JDD, Ehlers MM, Ismail F and Kock MM (2017) Prevalence of carbapenemase producing Pseudomonas aeruginosa circulating in Pretoria, South Africa. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Naidoo R, Said M and Mbelle N (2017) Verification of the Uriselect 4 plate for the routine processing of urine samples at the Tshwane Academic Laboratory. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Ndlovu S, Malinga LA, Fourie B and Mbelle NM (2017) Evaluation of Genotype® MTBDRsl (ver 2.0) against second-line drug susceptibility testing and impact of gyrA mutations on fluoroquinolone susceptibilities. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Said M, Onwuegbuna O and Mbelle N (2017) Verification of the Hain MTBDRsl and BD MGIT phenotypic drug susceptibility testing (DST) for tuberculosis at the Tshwane Academic Laboratory (TAD). 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Skosana LB, Bosch A, Amutenya VM, Lowe M, Ismail F, Mbelle NM, Kock MM and Strydom K (2017) Comparison of the modified carbapenem inactivation method with the Rapidec® CarbaNP test (BioMérieux, France) and modified Hodge test for the phenotypic confirmation of carbapenemase production in Enterobacteriaceae. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Skosana ZT, Mohale T, Olorunju S, von Gottberg A and Mbelle NM (2017) Investigating a real-time PCR assay to serotype pneumococcal carriage isolates in infants and children presenting for routine immunization. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Steyn J, Kock MM, Said M, Meidany P and Ehlers MM (2017) Genetic relatedness of clinical Clostridium difficile isolates in the Pretoria region. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

Tshisevhe V, Onwuegbuna O and Mbelle N (2017) Comparison of commercial MPT64Ag-based assays for rapid identification of Mycobacterium tuberculosis in clinical isolates. 7th FIDSSA Congress 2017, 9-11 November 2017, Century City Conference Centre, Cape Town South Africa.

5.3.3 Oral Presentations

International Congresses

Peirano G, Matsumura Y, Adams MD, Bradford P, Motyl M, Chen L, Kreiswirth BN and Pitout JDD (2017) Genomic epidemiology of global of carbapenemase-producing Enterobacter spp. ASM Microbe June 2017, New Orleans, LA, USA.

Pitout J (2016) Metallo enzymes in North America. ID Week 26 to 30 October 2016, New Orleans, LA, USA.

Schmidt, Kock MM and Ehlers MM (2016) Molecular characterisation of Staphylococcus aureus isolated from cases of bovine mastitis and close human contacts in KwaZulu-Natal, South Africa. The 6th International Dairy Federation Mastitis conference Nantes, France 6 to 9 September 2016.

Potgieter M, Kock M, Ismail F and Ehlers M* (2016) Characterization and genetic relatedness of methicillin-susceptible Staphylococcus aureus strains circulating in the Pretoria region, South Africa: a cross-sectional study. The 26th European Congress of Clinical Microbiology and Infectious Diseases (ECCMID) Congress, in Amsterdam, Netherlands, 9 to 14 April, 2016.

Masemola K, Strydom K, Ismail F, Shey B-A, Maningi N, Said M, Tshisevhe V and Mbelle N (2017) OXA-181 producing Klebsiella pneumoniae isolated from blood cultures in atertiary academic hospital, Pretoria, South Africa. The 27th European Congress of Clinical Microbiology and Infectious Diseases (ECCMID), Vienna, Austria, 22 to 25 April (Mini Oral and ePoster presentations).

Modipane L, Reva O, Antiabong JF, Magazi BT and Mbelle NM (2017) Expanding a web-based programme for identification of invasive M. bovis BCG. International Society for Vaccines Annual Congress, 5 to 7 October 2017, at the Institute Pasteur, Paris, France.

Maningi NE, Daum LT, Worthy SA, Rodriguez JD, Said HM, Peters RPH, Fischer GW, Chambers JP and Fourie PB (2018) Frequency of mutation Arg463Leu of the katG gene in historical multidrug resistant tuberculosis in South Africa. 48th Union World Conference on Lung Health, 11 to 14 October 2017, at the Expo Guadalajara Convention Centre, Guadalajara, Mexico.

5.3.4 Poster Presentations

International Congresses

Prof RP Peters: "Towards Chlamydia trachomatis control in South Africa: fighting a losing battle?" On the 10th of February at the 12th Annual Amsterdam Chlamydia Meeting, Amsterdam, The Netherlands.

Ismail F, Meidany P, Kock M, Said M, Mbelle N and Strydom K (2017) Rapid and accurate detection of OXA-48 like carbapenemases in Enterobacteriaceae using the OXA-48 K-SeT kit. The 27th European Congress of Clinical Microbiology and Infectious Diseases (ECCMID), Vienna, Austria, 22 to 25 April.

Lowings, M; Ehlers, MM; Pitout JDD, Ismail, F and Kock, MM (2017) Characterisation of clinical multidrug resistant A. baumannii isolates in Tshwane, South Africa: a two-year observational study. The 27th European Congress of Clinical Microbiology and Infectious Diseases (ECCMID), Vienna, Austria, 22 to 25 April.

Moloto K, Pitout JDD, Ehlers MM, Ismail F and Kock MM (2017) Prevalence of carbapenemase producing Pseudomonas aeruginosa circulating in Pretoria, South Africa. The 27th European Congress of Clinical Microbiology and Infectious Diseases (ECCMID), Vienna, Austria, 22 to 25 April.

Naidoo R, Kock MM, Green RJ and Ehlers MM (2017) Antibiotic resistance and virulence profiles of Pseudomonas aeruginosa and Staphylococcus aureus isolated from bronchiectasis and cystic fibrosis patients at a tertiary academic hospital in Pretoria. The 27th European Congress of Clinical Microbiology and Infectious Diseases (ECCMID), Vienna, Austria, 22 to 25 April.

Schmidt T, Kock MM and Ehlers MM (2017) Identification and characterisation of Staphylococcus devriesei from bovine intramammary infections in KwaZulu-Natal, South Africa. The 27th European Congress of Clinical Microbiology and Infectious Diseases (ECCMID), Vienna, Austria, 22 to 25 April.

Schoonraad NJ, Kock MM, Van der Zel GA, Geertsma P and Ehlers MM (2017) Genetic relatedness of Enterococcus faecalis and Enterococcus faecium from slaughtered pigs and abattoir workers in Gauteng, South Africa. The 27th European Congress of Clinical Microbiology and Infectious Diseases (ECCMID), Vienna, Austria, 22 to 25 April.

Schoonraad NJ, Kock MM, Van der Zel GA, Geertsma P and Ehlers MM (2017) Molecular characterisation of Staphylococcus aureus isolates obtained from slaughtered pigs and abattoir workers in Gauteng, South Africa. The 27th European Congress of Clinical Microbiology and Infectious Diseases (ECCMID), Vienna, Austria, 22 to 25 April.

Strydom K, Lowings M, Kingsburgh C, Ismail F, Said M, Mbelle NM, Ehlers MM and Kock MM (2017) Emergence of mcr-1 in Escherichia coli isolates at a tertiary referral laboratory in Pretoria, South Africa. The 27th European Congress of Clinical Microbiology and Infectious Diseases (ECCMID), Vienna, Austria, 22 to 25 April.

Lowings M, Kock M, Coetzee J, Hoosien E, van Greune J, Ehlers M, Peirano G, Chen L, Kreiswirth BN and Pitout JDD (2017) The rapid emergence of Klebsiella pneumoniae ST307 with blaOXA-181 in South Africa. ASM Microbe June 2017, New Orleans, LA, USA.

Chen L, Peirano G, Bradford P, Motyl M, Kreiswirth B and Pitout JDD (2017) Genomic Diversity and Global Epidemiology of Carbapenem-Resistant K. pneumoniae (CRKp) Clonal Group 147 (CG147) ASM Microbe June 2017, New Orleans, LA, USA.

Peters RP, Radebe O, Hamiwe T, Maboko L, Struthers HE, McIntyre JA and Kock MM (2017) High rate of repeat sexually transmitted infections among men who have sex with men in South Africa. The STI & HIV World Congress, at the Windsor Barra Hotel in Rio de Janeiro, Brazil, 9 to 12 July 2017.

Peters RP, Redelinghuys MJ, McIntyre JA, Doyle R, Verjans GM, Breuer J and Kock MM (2017) Presence of Chlamydia trachomatis serotype L2 genital infection in South African women. The STI & HIV World Congress, at the Windsor Barra Hotel in Rio de Janeiro, Brazil, 9 to 12 July 2017.

Davey DJ, Medina-Marino A, Mudau M, de Vos L, Olivier D, Peters RP, McIntyre JA and Klausner JP (2017) Risk factors associated with sexually transmitted infections among HIV-infected pregnant women in South Africa. The STI & HIV World Congress, at the Windsor Barra Hotel in Rio de Janeiro, Brazil, 9 to 12 July 2017.

Medical Virology

Head of Department: Prof LM Webber (April - November)
Acting Head of Department: Prof MB Taylor (December - March)

1. About the Department

Activities in the Department of Medical Virology include diagnostic and consultative services, undergraduate and postgraduate training and an active and diverse research programme. At the SANAS audit in February 2018 the TAD Virology diagnostic laboratory retained their ISO 15189-accreditation status with no non-conformances raised.

Research in the department addresses HIV, HPV, arboviruses, respiratory viruses, zoonotic diseases and enteric virus and environmental research. These programmes are supported by a number of national and international collaborators. The research and teaching and training capacity of TAD Virology/Department of Medical Virology, University of Pretoria has been enhanced by the appointment of NICD staff members as extra-ordinary lecturers (Dr J Weyer, Dr J Paweska, Dr P Jansen van Vuren) and professor (Prof NA Page) to the University of Pretoria establishment. The collaboration with Drs Paweska, Weyer and Jansen van Vuren has extended and facilitated research on filoviruses for which BSL-4 laboratory facilities are needed. These extraordinary appointments have resulted in an increase in the number of post-graduate students enrolled with a parallel increase in research outputs and publications.

Staff members serve on a number of national and international committees. Dr S Mayaphi, and Prof Maureen Taylor and Dr Janet Mans, serve on the NDoH National Hepatitis Guideline and Diarrhoeal Disease working groups, respectively. Prof Marietjie Venter attended the respiratory syncytial virus (RSV) surveillance meeting in Washington DC, December 20, 2017 as expert advisor on RSV. Academic staff members also served as internal and external examiners for dissertations and theses from national and international tertiary institutions, and reviewers for manuscripts for national and international journals.

2. Diagnostic Services

The SANAS-accredited TAD virology diagnostic laboratory offers a 24-hour diagnostic and telephonic consultation service with samples being referred from the Steve Biko and Kalafong Academic Hospitals, as well as Tembisa, Mamelodi and other peripheral hospitals and clinics in Gauteng, Limpopo, North West and Mpumalanga. Ward rounds are conducted with clinicians at the Steve Biko Academic Hospital. The laboratory serves as a referral laboratory for the early infant diagnosis priority programme.

The diagnostic capability of the laboratory has been enhanced by the installation of the Cobas E601 (replaces Modular E170) and Cobas 8800 platforms. The TAD virology diagnostic laboratory provides practical training for registrars from pathology and clinical specialities, student medical technologists, intern medical scientists and technicians.

Table UP14: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	1	3				3	3
Medical scientists	2					2	2
Technologists					9	9	9
Other*						9	9
South Africans							
All	3	3			9	23	23

***** 4 x Technicians; 1 x Lab assistant; 1 x Messenger; 1 x Secretary; 2 x Student technologists***

3. Teaching, Training and Professional Development

The Department contributes to both undergraduate and postgraduate teaching programmes. The Department is a HPCSA-accredited facility for the training of medical scientists.

3.1 Undergraduate Level

The Department co-ordinated and provided formal medical virology lectures to the MBChB, BChD and Allied Health Professions students. Innovative e-learning and hybrid teaching techniques were introduced to accommodate the large number of students. Appropriate lectures were also presented to student medical technologists and technicians.

3.2 Postgraduate Level

The Department provided a comprehensive training programme for registrars (M Med [Path] students) in Medical Virology, Medical Microbiology and Clinical Pathology, while tutorials were given to registrars from Paediatrics and Internal Medicine. There is an intensive teaching programme for the BSc (Hons), MSc and PhD Medical Virology students, many of whom are supported from bursaries from the Poliomyelitis Research Foundation and the NRF.

3.3. Other

Staff members and postgraduate students have attended various CPD workshops and courses, and were actively involved in training and lectures to external organisations and societies. Postgraduate students from other tertiary institutions in the SADC region, namely the Botswana International University of Science and Technology (BIUST), Palapye, Botswana and Instituto Nacional de Saúde (INS), Maputo, Mozambique have been hosted and trained, in specific molecular techniques, namely the typing of noroviruses from clinical specimens and environmental samples.

Staff members and students from the Centre for Viral Zoonoses have provided training in microarray analysis for meningoencephalitis in Malawi and identification of mosquito populations in Maputo, Mozambique.

Table UP15: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern Medical Scientist	Honours	Student Technologist	All	South Africans
Total Number of Trainees	10	15	2	2	15	4	48	46
Final Year Trainees	6	7	0	1	10	0	24	24
Successful Completion	2	2	1	0	5	1	11	9

4. Awards

- Dr Sim Mayaphi (senior pathologist/clinical virologist) received the following awards:
  - Second prize for an oral presentation in the category "Clinical" at the Faculty Day, Faculty of Health Sciences, University of Pretoria 22-23 August 2017; and
  - Exceptional Young Researcher's Award, University of Pretoria.
- Prof Maureen Taylor (acting Head of Department) was one of the finalists for the 2017 The National Science and Technology Forum (NSTF)-South 32 -Water Research Commission (WRC) Award for a contribution by an individual or an organisation to SET in South Africa towards sustainable water management, knowledge generation and solutions over the last 5-10 years (sponsored by the Water Research Commission); and
- Prof Marietjie Venter re-awarded a C2-rating (established researcher) by the National Research Foundation

4.1 Other Academic and Research Recognition

- Prof Wanda Markotter was invited to present the Poliomyelitis Research Foundation 12th James HS Gear Memorial lecture with a presentation entitled "Linking bats with Emerging viral diseases: Do we know for sure?" 20 Nov 2017 Johannesburg, South Africa; and
- Prof Marietjie Venter was invited to serve as a panel member for the One Health session at the "Infectious Diseases" Symposium, 11 – 13 April 2018 presented by the Academy of Science of South Africa (ASSAf), the Uganda National Academy of Sciences (UNAS) and the German National Academy of Sciences Leopoldina.

5. Research Activities

5.1 Research projects

There are a number of research themes in the Department, each focussing on specific health problems in South Africa and the southern Africa region.

Centre for Viral Zoonosis: Biosurveillance and ecology of emerging zoonoses (BEEZ) research group.
Head of research group & DST-NRF South African Research Chair (SARChi) in Infectious Diseases of Animals (Zoonoses): Prof W Markotter

Project title: Strengthening of South Africa's laboratory and epidemiology capacity to detect and respond to zoonotic disease outbreaks

Principal investigator(s): Markotter W (UP)

Co-researchers: Venter M, Nel LH (University of Pretoria), Bastos AD (Faculty of Veterinary Sciences, UP)

Collaborators: Weyer J, Paweska J, Grobbelaar A. Jansen van Vuren P, Centre for Emerging, Zoonotic and Parasitic Diseases, NICD, NHLS), Kearney T (Ditsong National Museum of Natural History), Seamark E (African Bats), Keith M (Centre for Wildlife Management, University of Pretoria), De Almeida APG (Institute for Hygiene and Tropical Medicine, Universida de Nova Lisboa, Portugal) Braack L (Centre for Sustainable Malaria Control, University of Pretoria), Cornell A (UC Davis), Global Alliance for Rabies Control - Quiambao B (Research Institute for Tropical Medicine, Philippines), Rabies Advisory Group. South Africa - Sabeta C (ARC-OVI Rabies Division), le Roux K (KwaZulu-Natal Department of Agriculture), Rossouw J (NICD), von Maltitz E (Agricultural Research Council)

Funding: Global Disease Detection Programme, Centres for Disease Control and Prevention (CDC), USA

Total funding for the entire project: R 24 000 000-00

Short description: This cooperative agreement focuses on the following main objectives:

- Develop and expand South Africa's diagnostic capacity for detection of zoonotic diseases in animals and humans;
- Establish surveillance for key zoonotic diseases;
- Improve and develop real-time electronic reporting systems and dissemination of data on relevant stakeholders and local and international health agencies;
- Development and implementation of prevention and control strategies;
- Build strong collaborations between key partners in UP, governmental organizations, other relevant partners in South Africa and international partners;
- Training of students as well as professionals in zoonotic disease prevention, surveillance, detection and response to outbreaks; and
- Determining the burden of disease for important zoonotic diseases using existing data.

Project Start date: Sept 2015

Project end date: Sept 2020

Project title: Disease ecology in small mammals

Principal investigator(s):	Markotter W (UP) Collaborators: Nel LH (University of Pretoria), Paweska JT, Weyer J; Jansen van Vuren P (NICD NHLS), Sabeta C(OVI-ARC), Kearney T (Ditsong National Museum of Natural History), Seamark (E (Africanbats), Dietzschold B (Thomas Jefferson University, Philadelphia, USA), Fooks T (Animal and Plant Health Agency, Weybridge, UK) Dietrich M (Universit de La Reunion, Plateforme de Recherche CYROI, Reunion)
Funding:	DST- NRF South African Research Chair in Infectious Diseases of Animals (Zoonoses)
Total funding for the entire project:	R1 700 000 per annum
Short description:	This project focus on surveillance of potential zoonotic pathogens in bats and other small mammals. It includes diagnostic development to be able to detect the diversity of pathogens on the African continent. It also follows a multidisciplinary approach also focusing on host ecology and environmental factors that can influence pathogen spill over to other species including humans.
Project Start date:	Jan 2016
Project end date:	Dec 2021

Centre for Viral Zoonosis:	Emerging arbo and respiratory virus program
Head of research group:	Prof M Venter

Project Title:	Epidemiology and aetiology or acute febrile disease of unknown cases (AFDUC)
Principal investigator:	Venter M (UP)
Co-researchers:	Mendes A (Post-doctoral fellow); Fourie I (Students)
Collaborators:	Robert Koch Institute (Berlin, Germany)
Funding:	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
Total funding:	R 8 112 810-00 (€ 540 854.00)
Short description:	The goal of the acute febrile disease of unknown cause (AFDUC) section of ANDEMIA is to identify non-malarial pathogens associated with cases of fever and neurological symptoms in South Africaand other West African partners (Burkina Faso, Democratic Republic of Congo and Cote d'Ivoire).This will be carried out via an international surveillance programme involving both an urban and rural hospital in each partner country, utilising differential diagnosis technology developed in our laboratory at UP. Once identified these pathogens will also be further characterised using molecular and virological methods in order to improve the understanding of febrile disease causes in Africa. The program also involves an epidemiology study aimed at identifying which factors may be responsible for the transmission of these diseases.
Project start date:	January 2017
Project end date:	January 2022

Project title:	Surveillance for zoonotic arboviruses and their epidemiology in South Africa (a One Health approach)
Principal investigator:	Venter M (UP)
Co-researchers:	Williams J & Steyl J (Faculty of Veterinary Science, UP
Collaborators:	Kortekaas J, (Wageningen University), > 100 veterinarians that contribute specimens to the programme.
Funding:	Long-term Europe-Africa Research Network on neglected arboviral zoonotic diseases (LEARN)
Total funding:	~R1 820 000-00
Short description:	A One Health approach to trace zoonotic arboviruses across the country using syndromic surveillance in animals with neurological signs and molecular screening for the major arboviruses.
Project Start date:	January 2012 / Current funding cycle January 2018
Project end date:	December 2020

Project title:	Establishment of a multi-pathogen diagnostic platform for the rapid detection, outbreak and epidemio logical investigation of vector borne and zoonotic viruses in unexplained febrile and neurological disease in South Africa.

Principal investigator(s): Venter M (UP)
Co-researchers: Mendes A, Ridden M (Post-doctoral fellows)
Collaborators: Paweska J (NICD), Williams J (Faculty of Veterinary Science, UP); Jonas Winchell (US-CDC)
Funding: NHLS Research Trust
Short description: Up to 60% of emerging infectious diseases are zoonotic in nature and have a significant impact on global economics and public health as seen in the 2014-2015 Ebola and the 2015-2016 Zika virus outbreaks. Zika virus an endemic African virus had not been considered important to public health before its emergence in the Americas. Although Zika virus has not yet been detected in South Africa, several endemic zoonotic arboviruses occur here with little information about their disease burden in humans and animals. Acute Febrile Illness and aseptic meningoencephalitis is associated with substantial morbidity and mortality worldwide, yet an etiological agent is more often than not identified. Yellow fever, Chi kungunya, Dengue and Zika viruses are endemic in neighbouring countries while CCHF, WNV, RVF, Sinbis and several less known arboviruses are endemic in South Africa. The aim of this study will be implementation of a multi-pathogen TAC assay and a serological multiplex system to detect zoonotic viruses, aid in solving outbreaks and investigate the epidemiology in South Africa. Leading to expansion of the public health sector diagnostic capacity.
Project Start date: January 2017
Project end date: December 2020

Enteric virus and environmental research group
Head of research group & Rand Water Chair in Public Health: Prof MB Taylor

Project title: Norovirus surveillance in clinical specimens and sewage in South Africa.
Principal investigator: Mans J (UP)
Co-researcher: Taylor MB (UP), Mabasa V (Student)
Funding: NRF (2016-2018)
Amount: R860 000-00
Short description: This project focused on determining the prevalence and diversity of noroviruses in hospitalised children under 5 years of age as well as environmental norovirus surveillance. In addition, complete genomes of selected norovirus strains will be determined and an antibody capture assay optimised to enrich norovirus specimens prior to next generation sequencing.
Project Start date: January 2016
Project End date: December 2018

Project title: Molecular epidemiology and characterisation of norovirus infections in HIV- infected, HIV-exposed unin fected and HIV-unexposed children with gastroenteritis in Gauteng, South Africa.
Principal investigator: Brauer M (UP)
Co-researcher: Mans J (UP), Vermeulen A (Student)
Collaborators: Avenant T (UP), du Plessis N (UP)
Funding: Discovery Foundation Academic Fellowship Award (2016-2018)
Amount: R405 000-00
Short description: This project investigates the prevalence of five enteric pathogens in children < 5 years of age hospitalised with diarrhoea. Norovirus, rotavirus and sapoviruses are characterised and the secretor status of infected children is determined by FUT2 genotyping and saliva phenotyping. A possible link between rotavirus and norovirus and host secretor status is investigated.
Project Start date: January 2016
Project End date: December 2018

Project title: Surveillance and characterisation of major and minor norovirus GII.4 variants in South Africa.
Principal investigator: Mans J (UP)
Co-researcher: Page NA (NICD)
Funding: Poliomyelitis Research Foundation (2015-2017)
Amount: R320 000-00

Short description: The aim of this project was to perform surveillance for noroviruses in children with gastroenteritis and to characterise epidemic and local GII.4 variants of norovirus in terms of binding interactions between the virus capsid (virus-like particles) and host histoblood group antigens.
Project Start date: January 2015
Project End date: December 2017

Project title: Optimisation and application of fucosyltransferase-2 (FUT2) genotypingon whole blood and stored dried blood spots to investigate norovirus host susceptibility.
Principal investigator: Mans J (UP)
Co-researcher: Page NA (NICD), Vermeulen A (Student)
Total funding: UP Research Development Programme (2016-2017)
Amount: R100 000-00
Short description: This project optimised genotyping of the FUT2 gene from dried blood spots to enable the study of host secretor status and susceptibility to norovirus infection in children.
Project Start date: January 2016
Project End date: December 2018

Project title: Assessment of environmental norovirus infectivity in human intestinal enteroid cell cultures.
Principal investigator: Mans J (UP), Mabasa V (Student)
Co-researcher: Page NA (NICD)
Total funding for the entire project: NHLS Research TrustAmount: R500 000-00
Short description: Noroviruses are a major cause of viral gastroenteritis worldwide. Noroviruses have a very low infectious dose, are very stable in the environment and frequently cause food- and waterborne gastro enteritis outbreaks. Continuous surveillance in the clinical setting and environment is essential to monitor circulating genotypes and detect emerging strains to inform vaccine development. Noroviruses are regularly detected in wastewater and surface water, but their infectivity is unknown and the public health significance of such data is unclear. This study aims to monitor noroviruses in children with gastroenteritis and in the environment in South Africa and to use the recently reported human intestinal enteroid cell culture system to assess whether noroviruses in the environment are infectious and thereby generate data to help estimate the risk of environmental norovirus exposure.
Project Start date: December 2017
Project End date: December 2020

Project title: Rand Water Chair in Public Health - Multiple projects.
Principal investigator: Taylor MB (UP)
Co-researchers: Mans J, van Zyl W, Magwira C (UP), Ramalwa N, Rachida S, Baloyi I, Mabasa V. (Students)
Collaborators: Ehlers MM, Kock M (Department of Medical Microbiology, UP), de Jager C, Aneck-Hahn N (Environmental Chemical Pollution and Health Research Unit, UP), Hamiwe T, Maboko I, Ngcobo S (Students)
Total Funding: R 5 000 000-00
Project Start date: October 2013
Project End date: June 2018

Project title: Genetic Assessment of infectious hepatitis A virus strains detected in selected water sources in Gauteng, South Africa.
Principal investigator: Taylor MB (UP)
Researchers: Rachida S (Student)
Total funding: Poliomyelitis Research Foundation (2017-2018)
Amount: R100 000-00
Project Start date: January 2017
Project End date: December 2018

Project title: Molecular detection and genotyping of human adenoviruses from clinical and environmental samples.

Principal investigator:	van Zyl WB (UP/NHLS)
Co-researchers:	Mans J (UP) & Davids M (Student]
Collaborators:	None
Funding:	UP Research Development Programme
Total funding for the entire project:	R50 000-00
Short description:	Human adenoviruses consist of >80 types and cause a variety of clinical diseases, including gastroenteritis, conjunctivitis and respiratory illness. Adenovirus-associated gastroenteritis is predominantly caused by types 40 and 41, but other types have also been implicated, namely 1, 3, 7, 12, 15, and 31. There is limited information on the types of HAdVs that are currently causing gastroenteritis in Tshwane communities. This research is aimed to investigate the types of HAdVs in raw sewage and treated effluent samples from a wastewater treatment works in Pretoria. The analysis of sewage for the presence of HAdVs provides a broader picture of the involvement of HAdV infection in the surrounding communities. Furthermore, the project is planned to establish seasonality of HAdV infections and to determine whether there is a change in the HAdV types predominating throughout the year.
Project start date:	1 January 2018
Project end date:	31 December 2018

Human papillomavirus virus research group
Head of research group: Dr A Lukhwareni

Project Title:	The Screen South Africa trial: HC2 hrHPV DNA test.
Principal Investigator:	Dreyer G (UP), Dr K Richter (University of Pretoria / Lancet Laboratories)
Co-researchers:	Lukhwareni A.
Funding:	Qiagen
Total Funding for the entire project:	R457 100-00
Short Description:	This translational research project will target cervical cancer, one of the most devastating and prevalent non-communicable diseases in sub Saharan Africa, implementing and testing bio-technology and self- collection in a clinical research setting that differs dramatically from regions where the test was developed. The proposed study will be performed in South Africa. The project will evaluate the Hybrid Capture 2 (HC2) test against biopsy proven cancer precursors and will provide treatment to those with lesions. The additional aim will be to evaluate and validate self-collected samples on the HC II platform.
Project Start Date:	September 2017
Project End Date:	December 2019

HIV and opportunistic infections research group
Head of research group: Dr S Mayaphi

Project title:	Detection and characterisation of primary (acute and early) HIV-1 Infections in an HIV hyper-endemic area.
Principal investigator:	Mayaphi SH (UP / NHLS-TAD)
Collaborators:	Stoltz AC (UP), Martin DJ (UP / Toga Laboratories), Olorunju SAS (SAMRC), Tintinger GR (UP), Williams BG (Stellenbosch University), Hunt G (University of the Witwatersrand / NICD), Quinn TC (Johns Hopkins University School of Medicine / NIH), Laeyendecker O (Johns Hopkins University School of Medicine / NIH), Reynolds SJ (Johns Hopkins University School of Medicine / NIH), Redd A (Johns Hopkins University School of Medicine / NIH)
Funding:	NHLS Research Trust fund; University of Pretoria research assistant grant; FIDSSA-GSK grant; SAMRC-SIR grant; Discovery Foundation grant; The Division of Intramural Research, NIAID, NIH; Hamilton Naki PhD Scholarship
Total funding for the entire project:	R1 400 868.88

Short description: The study aimed to detect and characterise acute and early HIV infections in an HIV hyper-endemic setting (South Africa). This was a cross-sectional diagnostic study that enrolled individuals who had negative rapid HIV results from five clinics. Pooled nucleic acid amplification testing (NAAT) was done, followed by individual sample testing in positive pools. NAAT-positive participants were recalled to the clinics for confirmatory testing and appropriate management. Follow-up rapid test done at a 4-week interval detected acute, early and chronic HIV infections initially missed by rapid HIV testing. This is a practical and affordable strategy for earlier detection of these infections in resource-constrained settings. Molecular characterisation of identified infections showed transmission of ARV-resistant strains of HIV.

Project Start date: 2012

Project end date: 2018

6. Research Output

5.1 Journal Publications

Bażanów B, Jansen van Vuren P, Szymański P, Stygar D, Frącka A, Twardoń J, Kozdrowski R, Pawęska JT. A survey on West Nile and Usutu viruses in horses and birds in Poland. Viruses 2018 Feb; 10(2): 87.

Braack L, de Almeida APG, Cornel AJ, Swanepoel R, de Jager C. Mosquito-borne arboviruses of African origin: review of key viruses and vectors. Parasites & Vectors 2018 Jan; 11(1):29.

Bravo-Barriga D, Gomes B, de Almeida APG, Serrano-Aguilera FJ, Pérez-Martín JE, Calero-Bernal R, Reina D, Frontera E, Pinto J. The mosquito fauna of the western region of Spain with emphasis on ecological factors and the characterization of Culex pipiens forms. Journal of Vector Ecology 2017 Jun; 42(1):136-147.

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Geldenhuys M, Mortlock M, Weyer J, Bezuldt O, Seamark ECJ, Kearney T, Gleasner C, Erkkila TH, Cui H, Markotter W. A metagenomic viral discovery approach identifies potential zoonotic and novel mammalian viruses in Neoromicia bats within South Africa. PLoS ONE 2018 Mar; 13(3): e0194527.

Haeri Mazanderani A, Moyo F, Kufu T, Sherman GG. Declining baseline viremia and escalating discordant HIV-1 confirmatory results within South Africa's early infant diagnosis program, 2010-2016. Journal of Acquired Immune Deficiency Syndrome. 2018 Feb; 77(2): 212-216.

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Hellferscee O, Treurnicht FK, Tempia S, Variava E, Dawood H, Kahn K, Cohen AL, Pretorius M, Cohen C, Madhi SA, Venter M. Enterovirus 68 and other enterovirus serotypes identified in South African patients with severe acute respiratory illness, 2009-2011. Influenza and other Respiratory Viruses 2017 May; 11(3):211-219.

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João ED, Strydom A, O'Neill HG, Cuamba A, Cassocera M, Acácio S, Mandomando I, Motanyane L, Page N, de Deus N. Rotavirus A strains obtained from children with acute gastroenteritis in Mozambique, 2012-2013: G and P genotypes and phylogenetic analysis of VP7 and partial VP4 genes. Archives of Virology 2018 Jan; 163(1):153-165.

Mabasa VV, Meno KD, Taylor MB, Mans J. Environmental surveillance for noroviruses in selected South African wastewaters 2015-2016: Emergence of the novel GII.17. Food and Environmental Virology 2018 Mar; 10(1):16-28.

Mayaphi SH, Martin DJ, Olorunju SAS, Williams BG, Quinn TC, Stoltz AC. High risk exposure to HIV among sexually active individuals who tested negative on rapid HIV tests in the Tshwane District of South Africa-The importance of behavioural prevention measures. PLoS One 2018 Feb; 13(2):e0192357.

Moyes J, Walaza S, Pretorius M, Groome M, von Gottberg A, Wolter N, Haffejee S, Variava E, Cohen AL, Tempia S, Kahn K, Dawood H, Venter M, Cohen C, Madhi S for the South African Severe Acute Respirtory Illness (SARI) Surveilance Group. Respiratory syncytial virus in adults with severe acute respiratory illness in a high HIV prevalence setting. Journal of Infection 2017 Oct; 75(4):346-355.
Page NA, Groome MJ, Nadan S, Netshikweta R, Keddy KH, Poonsamy B, Moyes J, Walaza S, Kahn K, Madhi SA, Taylor MB, Mans J, Cohen C. Norovirus epidemiology in South African children <5 years hospitalised for diarrhoeal illness between 2009 and 2013. Epidemiology and Infection 2017 Jul; 145(9):1942-1952.

Seleka M, Treurnicht FK, Tempia S, Hellferscee O, Mtshali S, Cohen AL, Buys A, McAnerney JM, Besselaar T, Pretorius M, von Gottberg A, Walaza S, Cohen C, Madhi SA, Venter M. Epidemiology of Influenza B/Yamagata and B/Victoria lineages in South Africa, 2005-2014. PLoS ONE 2017 May; 12(5): e0177655.

Sherman GG, Haeri Mazanderani A, Barron P, Bhardwaj S, Niit R, Okobi M, Puren A, Jackson DJ, Goga AE. Toward elimination of mother-to-child transmission of HIV in South Africa: how best to monitor early infant infections within the prevention of mother-to-child transmission program. Journal of Global Health 2017 Jun; 7(1):010701.

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5.2 Complete Books

None

5.3 Book Chapters

None

5.4 Conference Presentations

5.4.1 Oral Presentations

International Congresses

Chepkorir E, Tchouassi DP, Mulwa F, Arum S, Venter M, Sang R. The prevalence of Yellow fever and Dengue viruses among the human populations in Kacheliba, West Pokot. 5th Medical and Veterinary Virus Research in Kenya (MVVR-K) Symposium December 7th - 8th 2017 Nairobi, Kenya.

Chepkorir E, Tchouassi DP, Mulwa F, Venter M, Sang R. Assessing the risk of transmission of Yellow Fever and Dengue viruses by Aedes (Stegomyia) mosquito populations in Kacheliba, West Pokot, Kenya. Governing Council meeting, International Centre of Insect Physiology and Ecology (icipe) 20 November 2017 Nairobi, Kenya.

Coertse J, Le Roux K, Richardson E, White W, Markotter W. Lagos bat virus in South Africa, 2013-2017. Infectious Diseases of Bats Symposium June 29-July 1, 2017 University Center for the Arts, Colorado State University, Fort Collins, USA.

de Vries L, McCulloch S, Paweska J, Markotter W, Body mass index of the Egyptian fruit bat, Rousettus aegyptiacus: An indicator of infection status. Infectious Diseases of Bats Symposium June 29-July 1, 2017, University Center for the Arts, Colorado State University, Fort Collins, USA.

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Geldenhuys M, Mortlock M, Weyer J, Bezuidt O, Seamark E, Kearney T, Gleasner C, Erkkila T, Cui H, Markotter W. A metagenomic approach identifying a MERS-related coronavirus in a bat from South Africa. Infectious Diseases of Bats Symposium June 29 - July 1 2017. University Center for the Arts, Colorado State University, Fort Collins, USA.

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Markotter W, Dietrich M, Kearney T, McCulloch S, Mortlock M, Seamark E, Paweska J. Presence of zoonotic bat pathogens correlate with reproductive seasons in South African bat populations. Infectious Diseases of Bats Symposium June 29-July 1, 2017 University Center for the Arts, Colorado State University, Fort Collins, USA.

Mortlock M, Weyer J, Paweska J, Markotter W. Detection of rubula- and related viruses in an Egyptian fruit bat (Rousettus aegyptiacus) colony in South Africa. Infectious Diseases of Bats Symposium June 29-July 1 2017 University Center for the Arts, Colorado State University, Fort Collins, USA.

Steyn J, Botha EM, Steyl J, Rakgotho MP, Stivaktas PI, Williams J, Venter M. Investigation of species sensitive to West Nile Virus and associated clinical presentation as early warning system for outbreaks in Africa. 5th Medical and Veterinary Virus Research Symposium 6-8 December 2017 Nairobi, Kenya.

Storm N, Jansen van Vuren P, Markotter W and Paweska JT. The role of passive and acquired humoral immunity in the maintenance of Marburg virus in Rousettus aegyptiacus bat colonies. 9th International Filovirus Symposium, September 13-16 2017 Marburg, Germany.

Steyn, J, Steyl J. Botha E, Pretorius M, van Eeden C, Rakgotho M, van Niekerk S, Stivaktas V, Williams J, Venter M. Detection of zoonotic arboviruses in wildlife with neurological and respiratory signs in South Africa. 8th International Conference on Emerging Zoonoses May 7-10 2017 Manhatten, Kansas, USA.

Venter M, Botha E, Steyn J, Guarido M, Johnson T, Fourie I, Motlou T, Rakgantho M, Stivaktas V, Almeida P, Braack L, Williams J. One Health epidemiology and ecology of zoonotic arboviruses associated with neurological disease in South Africa (2008-2017). 8th European Meeting on Viral Zoonoses, 22-25 Oct 2017 Saint-Raphaël, France.

National Congresses

Markotter W. Bat-borne pathogens and public health significance. 2nd PathReD 2017 Congress 23 -24 June 2017 Emperors Palace in Johannesburg, South Africa (Invited speaker).

Taylor MB. Polio containment: Perspectives from an academic research laboratory. Polio Eradication: Managing Laboratories with Infectious or Potentially Infectious Materials in South Africa. Organised by the World Health Organization and Department of Health, South Africa 25 August 2017 Birchwood Hotel & OR Tambo Conference Centre, Johannesburg (Invited speaker).

Taylor MB. Emerging and re-emerging contaminants in water sources: What are the risks? 3rd Annual Symposium and Workshop on Environmental Persistent Pollutants (EPP 2017) 2-3 October 2017 Holiday Inn Express, Sunnyside, Pretoria (Keynote speaker).

Local Congresses (university academic days)

Baloyi I, van Zyl WB, Page NA, van Abel NA, Taylor MB. Potential health risks posed by rotaviruses in selected surface waters in Gauteng: 2013-2016. Faculty Day, Faculty of Health Sciences, University of Pretoria 22-23 August 2017 HW Snyman Building North, Pretoria.

Mayaphi SH, Martin DJ, Reynolds SJ, Hunt G, Redd A, Stoltz AC, Quinn TC. Transmitted antiretroviral drug-resistance mutations among individuals with newly diagnosed HIV infection. Faculty Day, Faculty of Health Sciences, University of Pretoria 22-23 August 2017 HW Snyman Building North, Pretoria.

5.4.1 Poster Presentations

International Congresses

Mans J, Mabasa VV, Vermeulen A, Murray TY, Nadan S, Botha JC, Netshikweta R, Page NA, Taylor MB. Norovirus epidemiology and diversity in South Africa (2009-2017). 22nd International Bioinformatics Workshop on Virus Evolution and Molecular Epidemiology (VEME) August 27 - September 1 2017 Instituto de Higiene e Medicina Tropical, Lisbon, Portugal.

Mayaphi S, Martin DJ, Reynolds S, Hunt G, Redd A, Stoltz A, Quinn TC. Transmitted Antiretroviral Drug-Resistance Mutations among Individuals with Newly Diagnosed HIV Infection in the Tshwane district of South Africa. XXVI International Workshop on HIV Drug Resistance and Treatment Strategies, 6 - 8 November 2017, Johannesburg, South Africa.

Sekwadi P, Govender N, Mosam A, Essel V, Ntshoe G, Ravhuhali K, McCarthy K, Rakgantso M, Taylor M, Mans J. An outbreak of gastroenteritis on the KwaZulu-Natal South Coast, South Africa, Dec 2016/Jan 2017. TEPHINET (Training Programs in Epidemiology and Public Health Interventions Network) 9th Global Scientific Conference 7-11 August 2017 Chiang Mai. Thailand.

National Congresses

Sekwadi P, Ravhuhali K, Mosam A, Essel V, Ntshoe G, Rakgantso M, McCarthy K, Mans J. Taylor MB, Page N, Govender N. Outbreak of gastroenteritis on the KwaZulu-Natal South Coast, South Africa, 2016/2017. PHASA (Public Health Association of South Africa) Conference 2017 7-11 September 2017 Indaba Hotel, Spa and Conference Centre, Fourways, Johannesburg.

Local Congresses (university academic days)

Kuča A, Mans J. Genetic characterisation of norovirus genogroup II, genotype 15 (GII.15). Faculty Day, Faculty of Health Sciences, University of Pretoria 22-23 August 2017 HW Snyman Building North, Pretoria.

Steyn J, Botha E, Stivaktas V, Rakgotho M, Pretorius M, Williams J, Steyl J, Buss P, Venter M. Investigation of wildlife & livestock as possible reservoir host for zoonotic neurological arboviruses in South Africa & Swaziland. Faculty day, Faculty of Health Sciences, University of Pretoria, Pretoria, 22-23 August 2017 HW Snyman Building North, Pretoria.

Vermeulen A, Page NA, Mans J. Clinical surveillance for norovirus in South Africa. Faculty Day, Faculty of Health Sciences, University of Pretoria 22-23 August 2017: HW Snyman Building North, Pretoria.

5.5 Patents

None

5.6 Research Translations

5.6 1 Research Translated to Policy

None

5.6.2 Research Translated to Service

None

University of the Witwatersrand

Foreword

Prof Johnny Mahlangu

Who we are

The School of Pathology of Wits and the NHLS comprise seven disciplines of pathology and seven research units that are recognised by Wits, Johannesburg. Our school remains the largest centre of pathology and molecular medicine research, diagnostic service provision and teaching and training in Africa. It is located at six campuses in Johannesburg, including the CMJAH, Wits Health Sciences Campus, Helen Joseph Hospital, Chris Hani Baragwaneth Hospital, Braamfontein Campus and the Sandringham Campus of the NHLS and NICD.

The 217 strong staff complement comprise 27 university-funded, 190 NHLS-funded and 22 external joint and honorary appointees. The school has 45 professors, three of whom are NRF A-rated. Trainees in the school include registrars across six disciplines of pathology (82 in 2017), post-doctoral fellows (five in 2017), medical scientists (33) and medical technologists (350).
The school delivers 17 courses in the the undergraduate teaching programmes at Wits, including training of medical students, dentists, physio therapists, nurses and biomedical engineers. The school collaborates with several universities of technology in the teaching and experiential training of technologists and technicians.

What we do

Our School of Pathology at Wits has an international standing with over 75% of its research output featured in international journals. We collaborate with over 30 institutions nationally and around the world, including the NDoH, WHO, World Bank, NIH, Universities in Africa, USA and Europe, as well as many other organisations and individuals throughout the world.
The school's core functions include provision of laboratory diagnostic service which is responsive to needs of the developing countries; and teaching and training of the next generation of health workers in medical technology, medical science and pathology disciplines, as well as research and innovation in health.

Highlights

The research output highlights in the period under review included 151 articles in peer International Scientific Indexing (ISI)-accredited journals which is an increase from the 141 articles in 2016/2017. Pulications included high impact journals such as Science, Nature, New England Journal of Medicine, Nature Genetics, Lancet, Lancet Microbiology, and Blood. There were 181 presentations at national and international scieintific meetings, as well as 15 book chapters written by members of our school.
The school graduated 27 postgraduate students. Twenty awards were conferred onto members of the school in the period under review and these are highlighted under each divisional report .
Aug 21, 8, 2017

Anatomical Pathology

Head: Prof Martin Hale

1. About the department

The Department of Anatomical Pathology of Wits provides all the pathology requirements inclusive of histology, cytology and autopsy pathology for patients admitted to the academic hospitals in the Johannesburg region, namely CMJAH, Chris Hani Baragwanath, Helen Joseph, Raheema Moosa Hospitals and the Transplant Unit at the Donald Gordon Medical Centre. In addition, the department is responsible for offering similar care to all provincial hospitals in Gauteng and North West provinces. It also offers a referral consultation service to the SADC countries, including Namibia, Botswana, Zimbabwe, Lesotho, Kenya and Swaziland, as well as private sector pathology practices.

The Anatomical Pathology laboratories at the CMJAH and the Chris Hani Baragwanath Hospital remain SANAS-accredited laboratories. The Cytology laboratory at Braamfontein is also SANAS-accredited.

Table W 1: Total number of staff per profession and highest qualification (CMJAH, CH Bara and Cytology)

Total	Pathologists	Medical Doctors	Registrars	MSc Scientist	Technologists	Student technologists	Technicians	Student technicians	Support	Nurses
157	24	2	25*	1	41	7	13	3	39	2

*Includes three supernumerary registrars

2. Diagnostic service

During the period from 1 April 2017 to 30 March 2018, the department based at the CMJAH saw a total of 45144 routine cases, including 80 neuropathology, 416 renal pathology, 1110 oral pathology and 3038 bone marrow trephines. A total of 353 specimens required electron microscopy and 42967 immunohistochemistry tests were performed. A total number of 772 PCR tests were performed, including 342 B-cell rearrangement studies and 268 T-cell rearrangement studies, 29 Bartonella studies, 38 HHV8 (herpesvirus 8) studies, 24 microsatellite instability studies, 2 Parvovirus studies, 28 Mycobacterium studies and 41 rt-PCR studies (synovial sarcomas). 106 Frozen sections were performed.

172 Consultations and reviews were received internationally from Namibia and Kenya and nationally from Pietersburg, Cape Town, East London, Port Elizabeth and Bloemfontein. These also included consultations from private practice laboratories in Johannesburg, Pretoria, Durban, Port Elizabeth and Cape Town. 54 Post mortems were performed from the CMJAH and Helen Joseph Hospitals, and 68 post mortems were executed in conjunction with Forensic Pathology.

The histopathology unit located at Chris Hani Baragwanath Hospital, was responsible for a further 15068 routine histology specimens, including 33 neuropathology cases and 106 renal biopsies. 28 Post mortems were performed and 6417 immunohistochemistry tests were conducted. 12 Consultations were received and reported.

The cytology unit reported 121983 gynaecological cases, 9974 non-gynaecologic exfoliative cases and 7955 FNAss, including palpable masses, radiologic-guided FNAs and intraoperative FNAs.

3. Teaching, training and professional development

3.1. Undergraduates

Consultants and registrars within the department contribute extensively to lectures and practical theme sessions to the graduate entry medical programme (GEMP) 1 and 2, and all registrars participate as facilitators in the GEMP small-group problem-based learning. In addition, students undergoing their surgical rotations in GEMP 3 and 4, receive weekly clinicopathological teaching at both Charlotte Maxeke Academic and Chris Hani Baragwanath hospitals. Consultants and registrars in the department coordinate and deliver the anatomical pathology curricula for the BPharm, BSc (physiotherapy and occupational therapy) and BDS degrees.

3.2. Postgraduate

Anatomical pathology lectures are given over four blocks during the academic year to MSc students in physiotherapy and occupational therapy. The department is also involved in the teaching of pathology for the Diploma in Tropical Medicine and Hygiene offered by Wits. All registrars in the Department of Anatomical Pathology are registered for the degree of MMed (Anatomical Pathology) with Wits. In addition to their surgical pathology training, registrars in anatomical pathology follow a formal academic programme that is compiled annually by the department.

Two pathologists and one scientist are registered for their PhD degrees. The department is accredited by the HPCSA for an Intern Scientist Programme. We also introduced a Bachelor of Health Sciences Hons programme in the field of Anatomical Pathology and ended the last year (2017) successfully with all three students passing. We have five students enrolled for 2018. The cytology unit trains registrars in anatomical pathology, medical officers, technologists, technicians, and laboratory assistants.

Table W 2: Record of pass rates in FCPath (Anat) exams 2017/2018

Year 2017			
FCPath (Anat)	Dr	R	Padayachee
	Dr	D	Van der Byl
	Dr	N	Ntshwanti
MMed	Dr	R	Padayachee
	Dr	D	Van der Byl
MSc	Ms	S	Naidoo

3.3. Other training information

Technologist training

Medical technologists and technicians are given theoretical and on-the-bench training. Laboratory supervisors conduct a one-hour lecture per week, and also give students assignments/tasks to complete. The students are trained on the bench by supervisors and senior technologists. On a weekly basis, from Tuesdays to Thursdays, students are given an hour and a half each day for studying, completion of assignments or other matters related to their training. During this time they are not involved in any routine work.

International outreach

- Prof. M Hale is involved in an initiative called "ASAP" – African Strategies for the Advancement of Pathology;
- Prof M Hale is the Chair of the Finance Committee of the International Academy of Pathology; and
- Prof M Hale is the Vice President for Southern Africa for the International Academy of Pathology.

4. Research activities

- Prof M Hale hosted and coordinated the IAP 2017 Congress which was held at the Wits Medical School, Parktown, Johannesburg from 23 – 24 June 2017;
- Prof W Grayson hosted the 13th Annual Johannesburg Dermatopathology Symposium on 20 January 2018 at the Faculty of Health Sciences, Wits;
- Dr E McAlpine presented a case on Emmonsiosis at the Johannesburg Dermatopathology Symposium;
- Dr C Nel presented a case on malignant chondroid syringoma at the Johannsburg Dermatopathology Symposium;
- Dr P Swart, Dr A Czajkowski and Dr R Wadee attended the International Paediatric Pathology Association (IPPA) course which was held in Venice, Italy from 29 September – 4 October 2017. Dr Swart and Dr Wadee completed the five-year course and graduated;
- Dr R Wadee attended a Zotero workshop held at Wits University in May 2017;
- Dr S Pather presented a case of Pineal Germinoma at the 2017 Paediatric Brain Tumour workshop which was held in Cape Town in November 2017;
- Dr P Mosiane was invited to attend the 2017 KDIGO HIV-Related Kidney Diseases Conference which took place in Yaounde, Cameroon from 17 - 20 March 2017;

The department hosted the Fine Needle Aspiration, Effusion and Gynaecological Cytology Tutorial which took place from 4 – 7 January 2018 at the Wits Education Campus. The tutorial was convened by The Royal College of Pathologists of Australasia Foundation, Wits, Lancet Laboratories and the NHLS. Dr Pamela Michelow presented these two workshops at the tutorial:

- Problems and Pitfalls in cervical cytology; and
- Body Cavity Effusions.

4.1. Visitors to the department:

- Prof K Cooper, Professor of Anatomic Pathology, Hospital of the University of Pennsylvania, Pathology and Laboratory Medicine, Philadelphia, presented a slide seminar to the department on Friday, 27 October 2017;
- Prof Claude Cuvelier, Professor at the Department of Medical and Forensic Pathology at Ghent University, Belgium, visited the department in June 2017 as a special guest lecturer to the IAP 2017 Congress; and
- Prof Pieter Wesseling, Professor in Neuro-oncological Pathology, Radboud University Medical Center, (RadboudUMC), Nijmegen, The Netherlands (2008 – 2016) and VU Universit/y Medical Center (VUMC), Amsterdam, The Netherlands (since 2012) also visited the department as a special guest for the IAP 2017 Congress.

4.2. Research projects

Project title:	Prevalence of anal dysplasia using anal cytology testing and associated risk factors
Principal investigators:	E Jong and C Firnhaber (Right to Care – Helen Joseph Hospita) and P Michelow (Cytology Unit, Department of Anatomical Pathology, NHLS, Wits)
Funding:	Centers for AIDS Research (CFAR)
Project title:	Evaluation and impact of screening and treatment approaches for the prevention of cervical neoplasia in HIV+ women in Burkino Faso and South Africa, HPV in Africa Research Partnership (HARP)
Sponsor:	LSHTM, London, UK
Principal investigators:	Reproductive Health Research Unit at Wits, Dr P Michelow (Cytology Unit and Department of Anatomical Pathology at Wits, NHLS), NICD, LSHTM, University of Ouagadougou and Montpellier University
Funding:	European Commission/ FP7-HEALTH. 2010.2.4.1-4
Project title:	Molecular profiling of colorectal cancer in a cohort of South African patients
Principle investigator:	M McCabe (School of Pathology, Division of Anatomical Pathology, NHLs and Wits)
Supervisor:	Dr Y Perner (School of Pathology, Division of Anatomical Pathology, NHLs and Wits)
Collaborator:	Dr L Cronje (Division of Microbiology, School of Pathology, Wits)
Project Title:	ACTG A5282 trial.
Investigator:	Dr P Michelow (Cytology Division, Anatomical Pathology Department)
Project title:	Her2 over-expression in gastric carcinoma: A study of the prevalence in the South African population and the concordance between FISH and bright-field dual in situ hybridization (BDISH)
Researcher:	Dr T Pitjadi (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Supervisor:	Dr P Swart (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Funding:	NHLS Research Trust
Project title:	Does human immunodeficiency viral (HIV) infection affect the integration of the HPV by using p16 as a marker: A retrospective study.
Researcher:	Dr D Fassom (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Supervisor:	Prof M Hale (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Funding:	NHLS Research Trust
Project title:	The role of HPV in oropharyngeal squamous cell carcinoma – A clinicopathologic and molecular analysis
Researcher:	Dr D Disenyane (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Supervisor:	Dr S Meer (Oral Pathology Division, Wits)

Project title: The spectrum of mycobacterium species from paraffin-embedded tissue showing granulomatous inflammation
Researchers: R Magobo and Dr Y Perner (Department of Anatomical Pathology, School of Pathology, NHLS and Wits)

Project title: Double-hit lymphomas
Principal investigator: Dr P Willem (Cytogenetics Department, NHLS)
Co-investigator: Dr Y Perner (Department of Anatomical Pathology, NHLS)

Project title: Extracorporeal irradiation in malignant bone tumours
Investigators: Prof M Lukhele (School of Clinical Medicine, Department of Orthopaedics), Prof M Hale (School of Pathology, Division of Anatomical Pathology, NHLS and Wits), Prof Shamar and Dr Linda (Orthopaedic Tumour and Infection Unit at CMJAH)

Project title: Evaluation of the performance of an automated slide profiler in the detection of cytological abnormalities in the screening of cervical smears
Researcher: Dr N Ntshwanti (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Supervisor: Dr T Omar (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)

Project title: KRAS expression in pancreatic adenocarcinoma
Researcher: Dr SNgwenya (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Supervisor: Dr SPather (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)

Project title: Utility of breast FNA in children and adolescent cancers
Researcher: Dr YReddy (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Supervisor: Dr P Michelow (School of Pathology, Division of Cytology in Anatomical Pathology, NHLS and Wits)

Project title: The role of histopathology in the diagnosis of BK virus associated nephropathy in post-transplant biopsies
Researcher: Dr N Mbatha (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Supervisors: Dr P Mosiane (School of Pathology, Division of Anatomical Pathology, NHLS and Wits) and Prof M Altini (School of Pathology, Division of Anatomical Pathology, Wits)

Project title: High risk pathological features in retinoblastoma
Researcher: Dr LNgobese (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Supervisors: Dr E van den Berg (School of Pathology, Division of Anatomical Pathology, NHLS and Wits) and Prof M Altini (School of Pathology, Division of Anatomical Pathology, Wits)

Project title: Discordances in biological markers ER, PR, HER2 and Ki-67 after neoadjuvant chemotherapy in breast cancer
Researcher Dr M Bromfield (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Supervisor: Dr R Mohanlal (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)

Project title: HPV genotypes in carcinoma of the cervix in HIV positive women in Zimbabwe
Researcher: Dr W Mudini (supernumerary registrar in the School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Supervisors: Prof M Hale (School of Pathology, Division of Anatomical Pathology, NHLS and Wits) and Prof M Altini (School of Pathology, Division of Anatomical Pathology, Wits)

Project title: Molecular epidemiology of Azole resistant Candida species in South Africa
Researcher: R Magobo (School of Pathology, Division of Anatomical Pathology, Wits - for PhD)
Supervisor: Dr N Govender (NICD and NHLS)

Project title: Endometrial carcinoma: Microsatellite instability and suspected Lynch Syndrome in the greater Johannesburg area (2009-2015)" (for PhD)
Researcher: Dr R Wadee assisted by Ms S Naidoo (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Supervisor: Professor W Grayson (School of Pathology, Division of Anatomical Pathology, Wits)
Funding: FRC Grant (Wits); Seed Funding (Wits); NHLS Research Trust and NRF Thuthuka Fund

Project title:	Prognostic influence of MYC aberrations and other clinicopathological factors of high grade B-cell non-Hodgkin lymphomas in adult and paediatric patients (for PhD)
Researcher:	Dr S Pather (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Supervisor:	Prof M Hale (School of Pathology, Division of Anatomical Pathology, NHLS and Wits) and Prof Moosa Patel (Division of Haematology, Chris Hani Baragwanath Hospital)
Funding:	FRC Grant (Wits) and Seed Funding (Wits)

Project title:	Molecular studies in oral plasmablastic lymphomas (For PhD in Anatomical Pathology)
Researcher:	Dr S Meer (School of Oral Health Sciences, Division of Oral Pathology, Wits)
Supervisor:	Dr P Willem (School of Pathology, Division of Cytogenetics, NHLS and Wits)

Project title:	Prognostic significance of PHH3, Ki-67 and BCL-2 in prostate cancer
Researcher:	Dr A Phillips (Supernumerary registrar in the School of Pathology, Division of Anatomical Pathology, NHLS and Wits)
Supervisor:	Dr M Louw (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)

Project title:	CHAMPS (Child Health and Mortality Prevention Surveillance Network)
Collaborators:	Prof M Hale, Dr S Pather, Dr E van den Berg and Dr P Swart (School of Pathology, Division of Anatomical Pathology, NHLS and Wits), Prof S Madhi (Respiratory Meningeal Pathogens Research Unit, NICD) and Dr S Zaki (Centers of Disease Control & Prevention, Atlanta)
Funding:	Bill and Melinda Gates Foundation

Project title:	Syndromic Surveillance for Non-Cryptococcal Invasive Fungal Infections
Principal investigator:	Dr N Govender (NICD and NHLS)
Collaborators:	Dr N Govender, Dr S Iyaloo, Ms T Maphanga and Ms R Mpembe(NICD), Prof A Karstaedt, Dr F Shaid, Prof C Menezes, Dr M Tsitsi, Dr K Roberg, Dr J Nkehli, Dr AMotau, Dr J Wadula, Dr S Seetharam (Chris Hani Baragwanath Hospital) and Dr E van den Berg (Anatomical Pathology)
Funding:	NICD and NHLS Research Trust

Project title:	A Methylated marker based test to distinguish benign from malignant disease in resource poor communities
Principal investigator:	Prof S Kumar (Johns Hopkins University,USA)
Collaborators:	MJ Fackler, E Gabrielson, L Cope, D Euhus, C Umbricht, K Visvanathan, AC Wolff, SW Cho and E van den Berg (Anatomical Pathology, NHLS, Cris Hani Baragwanath Hospital)
Funding:	Principal investigator from the USA

Project title:	The coding genome for HIV-associated plasmablastic lymphoma in South Africa
Principal investigator:	Dr S Meer (Oral Pathology Department, Wits)
Collaborators:	P Willem (School of Pathology, Division of Cytogenetics, NHLS and Wits), and Dr Y Perner (School of Pathology, Division of Anatomical Pathology, NHLS and Wits)

Project title:	South African Breast Cancer study
Principal investigator:	H Cubasch
Collaborators:	Dr E van den Berg (Department of Anatomical Pathology, School of Pathology, NHLS and Wits), M Joffe, S Rinaldi and I Romieu [International Agengy for Research on Cancer (IARC)]

New research:

Project title:	Characterization of a cancer-supportive T helper cell subset that infiltrates Burkitt's lymphoma tumors
Principal investigator:	Dr S Bürgler (Switzerland)
Collaborators:	Dr S Pather, Dr Y Perner, W Kempf (BSc – candidate) and A Berisha
Funding:	Swiss National Science Foundation and Swiss Cancer League

Project title:	Molecular assessment of circulating cell-free DNA in HIV-infected patients with and without lymphoma
Principal investigator:	Dr S Vogt (USA)

Collaborators:	Dr Armbinder, Prof M Patel, Dr S Pather and Dr T Omar.
Funding:	USA-sourced funding
Project title:	The receptor profiles of primary breast cancer paired with synchronous metastasis in women with newly diagnosed breast cancer seen at the Charlotte Maxeke Breast Clinic, Johannesburg, South Africa
Collaborators:	Dr C Nel (Department of Anatomical Pathology, NHLS and Wits), Prof Manell and Dr S Nietz (Department of Surgery and Department of Radiology at Wits, J Haberfield and J. Smilg
Funding:	Departmental funds and Department of Surgery funds
Project title:	Hue discrimination amongst pathologists using a computer-based Farnsworth-Munsell 100 hue test
Principal investigators:	Dr E McAlpine and Dr R Maritz (Department of Anatomical Pathology, NHLS and Wits)
Project title:	Simulation of the appearance of histopathological slides to colour deficient individuals
Principal investigator:	Dr E McAlpine (Division of Anatomical Pathology, NHLS and Wits)
Funding:	None
Project title:	Genomic Characterization of HIV-associated Burkitt Lymphoma to improve treatment strategies
Collaborators:	Dr E McAlpine (Department of Anatomical Pathology and Department of Cytogenetics), Dr P Willem and H Bothma
Project title:	Double/triple hit lymphoma study
Principal investigators:	Dr E McAlpine, Dr Y Perner, Dr P Magangane (Department of Anatomical Pathology, NHLS and Wits) and Dr T Wiggil (Haematology, NHLS and Wits)
Funding:	NHLS Research Trust Development Grant
Project title:	Ki67 immunohistochemistry quantification in breast carcinoma: A comparison of visual estimation, counting and immunoratio
Principal investigator:	Dr E van den Berg (Department of Anatomical Pathology, NHLS and Wits - for MMed)
Collaborators:	Dr R Mohanlal (Department of Anatomical Pathology, NHLS and Wits) and Dr R Duarte(Wits)
Project title:	Intrinsic subtype in HIV positive and negative patients with breast cancer
Principle investigator:	Dr B Phakath.
Supervisors:	Dr R Duarte; Dr S Nietz; Prof P Ruff and Dr E van den Berg (Anatomical Pathology, NHLS and Wits)
Funding:	MRC
Project title:	Association of Genetic Variants with Breast Cancer Intrinsic subtypes and splice variants of the Fibroblast Growth Factor Receptor 2 in a South African Population
Principal investigator:	T Dix-Peek
Collaborators:	Dr R Duarte (Wits) and Dr E van den Berg (Department of Anatomical Pathology, NHLS and Wits)
Funding:	MRC
Project title:	Standardised reporting system for breast cytopathology
Principal investigator:	A Field
Collaborators:	P Michelow (Department of Anatomical Pathology, NHLS and Wits), W Raymond and F Schmidt
Project title:	LBC within the NHLS
Principal investigator:	S Jordaan
Collaborators:	P Michelow, L Fatman, T Omar and Prof M Hale (Department of Anatomical Pathology, NHLS and Wits)
Project title:	High risk HPV prevalence in tumours of patients with non verrucous invasive penile cancer from Johannesburg, South Africa
Principal investigator:	Dr C Mathye
Supervisors:	Prof Martin Hale (Department of Anatomical Pathology, NHLS and Wits) and Prof M Haffejee (Urology Department, Wits)

Project title:	A descriptive study of non-melanoma skin cancers in patients attending Charlotte Maxeke Academic Hospital and Helen Joseph Hospital from July 2013 to June 2016
Principal investigator:	Dr J Ndakunda
Supervisor:	Prof M Hale (Department of Anatomical Pathology, NHLS and Wits)

Project title:	Histopathological spectrum of autoimmune bullous dermatosis at CMJAH and Helen Joseph Hospital, from July 2013 to June 2017.
Principal investigator:	Dr Z Muya
Supervisor:	Prof M Hale (Department of Anatomical Pathology, NHLS and Wits)

Project title:	A descriptive study of melanoma skin cancers in patients attending CMJAH and Helen Joseph Hospital from July 2013 to June 2016
Principal investigator:	Dr T Awotedu
Supervisor:	Prof M Hale (Department of Anatomical Pathology, NHLS and Wits)

4.3. Grant funding

NHLS Research Trust; CFAR; Departmental funds; Bill and Melinda Gates Foundation,
European Commission/ FP7-HEALTH, NICD; FRC Grant (Wits); NRF Thuthuka Fund and MRC.

4.4. National and international collaborative research:

Dr Pam Michelow	Right to Care ACTG- AIDS clinical trials group
Luvo Fatman	University of Pennsylvania (with CH-Bara Endocrinology Unit)
Dr Tanvier Omar	Johns Hopkins University, Unitat de Tuberculosi Experimental, Fundació Institut d'Investigació en Ciències de la Salut Germans Trias i Pujol, Barcelona
Prof Martin Hale	Dr Sherif Zaki, Centre for Disease Control and Prevention, Atlanta
Dr Yvonne Perner	UCT, Prof B Mayosi. Cardiomyopathy (IMHOTEP Study)
Dr Eunice van den Berg	Johns Hopkins University. Dr Saraswati Sukumar
Dr Tanvier Omar	University Medical Centre, Utrecht. Annemarie Wensing.
Professor Martin Hale	African Strategies for Advancing Pathology - ASAP (encompassing the Universities below): British Division of IAP, National Cancer Institute, USA, University of Burundi, Muhimbili University, Tanzania AGA Khan University, Nairobi,Makerere University, Uganda Harvard University, University of New South Wales University of Colorado

5. Research output

5.1. Journal publications:

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5.2 Book chapters

Michelow Pamela, Dubb Michelle. Kidney, Adrenal Gland and Retroperitoneum.
Chapter 7. In Lisa A Teot &Sara E, Monaco (eds.). Pediatric Cytopathology. 2017. (pp. 119-149). Berlin: Springer Verlag. 978-3-662-53439-7

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5.3. Conference presentations

International

W Mudini, P Mosiane.HIV and the kidney; Clinicopathological analysis of biopsy-proven renal disease in Johannesburg. Poster presented by Washington Mudini, a supernumerary registrar in our department at the 2018 United States and Canadian Academy of Pathology (USCAP) 107th Annual Conference which was held in Vancouver, Canada from 17 – 23 March 2018.

Prof M Hale presented invited talks, "Global harmonisation of Pathology training – Southern Africa" and "Fungal Mimics in Histopathology" at the 2018 USCAP 107th Annual Conference which was held in Vancouver, Canada from 17 – 23 March 2018. Prof Hale also attended the Executive meeting of IAP (VP for Southern Africa) and chaired the Finance Committee of the IAP.

RM Wake, T Omar, A Karat, J Jarvis, NP Govender and T Harrison conducted a poster presentation on: "Post-mortem cryptococcal meningitis following treatment for cryptococcal antigenaemia," at the Conference on Retroviruses and Opportunistic Infections (CROI), from 4 -7 March 2018 in Boston Massachusetts, USA.

A Phillips from Lagos University Teaching Hospital (Primary Presenter), M Louw from NHLS, AAF Banjo from Lagos University Teaching Hospital and C Chidozie Anunobi from Lagos University Teaching Hospital/College of Medicine University of Lagos presented a poster entitled, "Can Ki67 Predict Outcome for Prostatic Adenocarcinoma Patients on Androgen-Ablation Therapy? The Nigerian Experience" at the USCAP 107th Annual Meeting, from 17 – 23 March 2018, in Vancouver, Canada.

Local presentations:

Drs M Keyter, L Mekoa, C Modimola, T Kashamba, M Savage-Reid and L Pillay, all registrars from the Department of Anatomical Pathology, NHLS and Wits presented at the Young Pathologists Slide Seminar at the IAP 2017 Congress which was held at Wits Medical School from 23 – 24 June 2017. The sessions were chaired by Dr M Louw from the Department of Anatomical Pathology, NHLS and Wits.

Dr P Michelow presented a session on Cytology, Prof C Wright presented a session on Pathology of the Placenta, Dr Y Perner presented a session on Haematolymphoid Pathology and Dr A Gildenhuys presented a session on Soft Tissue Pathology at the IAP 2017 Congress which was held at Wits Medical School from 23 - 24 June 2017.

Prof M Hale presented a College of Medicine workshop at the IAP 2017 Congress which was held at Wits Medical School from 23r – 24 June 2017.

Dr C Nel presented a poster at the PathReD Conference 2017 entitled "A plasmacytoma causing pressure to the brain in patient with plasma cell myeloma."

Dr P Michelow attended and presented at the AIDS Malignancy Consortium meeting held in Johannesburg, South Africa, from 19-20 July 2017. Her presentation was entitled, "Laboratory Quality Assurance and Lessons Learned from the ACTG5282 Study."

6. Academic and research recognitions and awards

Dr R Wadee was awarded an NRF Thuthuka and URC grant to the value of R 114 578.00.
Michelle McCabe was awarded an FRC grant from Wits to the value of R 8000.00.

6.1. Number of postgraduate students

At the end of March 2018 there were 25 (including three supernumerary) registrars enrolled for MMed.

Dr T Pitjadi, Dr S Ngwenya and Dr E van den Berg, who are consultants in the department, are also registered for MMed at Wits.

Dr R Wadee, Dr S Pather and Dr S Meer are registered for their PhD degrees in Anatomical Pathology.

Ms M McCabe is registered for a PhD degree in Anatomical Pathology.

Drs Swart, Nel, Omar and Mohanlal are all registered for the Diploma in Health Science Education.

6.2. Number of postgraduate students that qualified

- Three FCPath Anat – Dr R Padayachee, Dr D van der Byl and Dr N Ntshwanti;
- Two MMed – Drs R Padayachee and D van der Byl; and
- One MSc- Ms S Naidoo.

7. Additional Information

7.1. Quality assurance programmes:

The department subscribes to the following RCPA Quality Assurance Programmes:

- General Diagnostic;
- Breast Diagnostic;
- Specialist Diagnostic Dermatopathology;
- Specialist Diagnostic Gynaecological;
- Specialist Diagnostic Neuropathology;
- Specialist Diagnostic Paediatric;
- Specialist Diagnostic Urology;
- Specialist Diagnostic Oral Pathology;
- Specialist Gastrointestinal Pathology Module;
- Electron Microscopy Programme Diagnostic and Technical Module; and
- Immunohistochemistry Modules.

The Department also subscribes to the following UK Neqas Quality Assurance Programmes:

- IgH/TCR Clonality; and
- Molecular Genetics programme for MSI testing.

Chemical Pathology

Head of Department: Prof JA George

1. About the department

The department provides diagnostic services through the laboratories at Chris Hani Baragwanath Hospital and CMJAH to the Gauteng Region and serves as a referral laboratory for several specialised tests for the entire country.
We are also extensively involved in training. We train medical technologists, intern medical scientists, clinical- as well as chemical pathology registrars and undergraduate medical students from MBChB II through to the final year of medicine, as well as Hons-, Masters- and doctoral students.

Our staff serve on several committees in the NHLS, such as the Expert Committee, Bid Adjudication Committee and the Operational Efficiency Committee, to name a few. We have recently increased our outreach to Klerksdorp and Tshepong as well.

2. Diagnostic services

We introduced measurement of anti-retroviral drugs a few years ago and these tests have increased in volume. We moved our HbA1c testing from immunoassay to HPLC, which is the golden standard method and we are busy with the validation of a number of steroid tests on mass spec and hope to have these available by the end of the year.

Both CMJAH and Chris Hani Baragwanath Hospital had new instruments placed in the autolabs. For CMJAH this meant a change of supplier, but despite the challenges that typically accompany such a change-over and the training required, both laboratories were successfully accredited. This is no doubt a testament to the hard work and dedication of the staff.

Table W 3: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	1	5				8	8
Medical scientists	5		2	1	1	7	
Technologists					49		49
Other*							
South Africans	4	5	2	1	50		57
All							

3. Teaching, training and professional development

3.1 Undergraduate level

The department is involved in training medical students from the second to the final year. The bulk of training is done in the third and fourth years, by means of formal lectures and tutorials.

3.2 Postgraduate level

A few years ago we introduced an Hons in Chemical Pathology and saw our numbers grow to about eight students per year. After graduation, students typically pursue a career in medicine, or accept internships in laboratory medicine. A couple returned to the department to complete their MSc degrees. We are fortunate to have 10 accredited HPCSA medical intern posts and are currently training a few. One of our interns completed her training this year, and she is waiting to be placed.

Two of our registrars wrote the FCPath Part II final and were successful. They managed to complete their MMEds and were absorbed by the department to fill some of our vacancies.

3.3 Other

Table W 4: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern medical scientists	Honours	All	South Africans
Total number of trainees	3	6	9		8	26	26
Final year trainees		2	1				
Successful completion	1	1	2		8		11

4. Awards

Prof N Crowther was promoted to full research professor.

5. Research activities

5.1 Research projects

The focus of the department is diabetes and cardiovascular disease. Research into other diseases, such as kidney disease and HIV that impact on these, is encouraged. A number of researchers presented posters at the IFCC-WorldLab in Durban and at the Congress of the Society of Endocrinology and Diabetes of South Africa.

We have strong collaborations with several departments and divisions which include the divisions of Endocrinology and Haematology, the School of Public Health and the MRC Developmental Pathways to Health Research Unit (DPRHU). These collaborations enhanced our research output.

Table W 5: Reseach projects

Funding agency	Project title	Grant holder	Amount
1) NHLS Research TrustT	The prevalence of the proprotein convertase subtilisin/kexin type 9 (PCSK9) gene polymorphism (E670G) and its effect in serum lipid levels in different South African Population groups	N Naran	R93 276
2) MRC	Serum circulating miRNA profiling for identification of potential biomarkers of diabetic nephropathy in black type 2 diabetic South Africans	C Padoa	R198 760
3) NHLS Research Trust	Vitamin D Binding Protein (VDBP) and type 1 diabetes in the South African Black population	C Padoa	R100 000
4) NHLS Research Trust	Investigating the role of vitamin D binding protein plays in the aetiology of type 1 diabetes in the South African black population	C Padoa	R 100 000

Funding agency	Project title	Grant holder	Amount
5) NHLS Research Trust	Serum circulating miRNA profiling for identification of potential biomarkers of diabetic nephropathy in black type 2 diabetic South Africans	C Padoa	R496 445
6) NHLS Research Trust	Functional Analysis of HIV-1 Nef Polymorphisms on Endothelial Function	N Crowther and G Mezoh	R100 000
2018 - 2019			
7) Iris-Ellen Hodges	Functional Analysis of HIV-1 Nef Polymorphisms on Endothelial Function	N Crowther and G Mezoh	R90 000
8) PRF	Investigation into the Effect of HIV Viral Proteins on Endothelial Function in the HIV infected Population	N Crowther and G Mezoh	R300 000
2017-2019			
9) NHLS Research Trust	Investigation into the Effect of HIV Viral Proteins on Endothelial Function in the HIV infected Population	N Crowther and G Mezoh	R100 000
2017-2018			
10) EMBO Travel Grant	Travel Grant	G Mezoh	€ 500
11) NRF-equipment-related travel grant	Investigation into the Effect of HIV Viral Proteins on Endothelial Function in the HIV infected Population	N Crowther and G Mezoh	R35 000
12) NRF-CPRR	Investigation into the Effect of HIV Viral Proteins on Endothelial Function in the HIV infected Population	N Crowther and G Mezoh	R523 000
2018-2020			
13) FRC	Association of branched chain amino acid and aromatic amino acids with cardio-metabolic risk factors	L Khambule	R10 000
14) NHLS Research Trust	Determining the effect of tissue non-specific alkaline phosphatase on the phosphorylation status of the lipid droplet phosphoproteins perilipin, vimentin and caveolin		
	E Cave	R97 296	
15) NHLS Research Trust			

Funding agency	Project title	Grant holder	Amount
Determining the effects of CREB3L4 copy number and polymorphisms on obesity and metabolic profiles in South Africans			
	E Cave	R100 000	

6. Research output

6.1 Journal publications

Gradidge PJ, Crowther NJ; Metabolic syndrome in black South African women. Ethn. Dis. 2017 Apr 20;27(2):189-200

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Mcebula V, Crowther NJ, Nagel SE, George JA; Diabetes and abnormal glucose tolerance in subjects with tuberculosis in a South African urban center. Int. J. Tuberc. Lung. Dis. 2017 Feb 1;21(2):208-213

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Chirambo GM, van Niekerk C, Crowther NJ; The role of alkaline phosphatase in intracellular lipid accumulation in the human hepatocarcinoma cell line, HepG2. Exp. Mol. Pathol. 2017 Feb 13;102(2):224-229

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Reiger S, Jardim TV, Abrahams-Gessel S, Crowther NJ, Wade A, Gómez-Olivé FX, Salomon J, Tollman S, Gaziano TA; Awareness, treatment, and control of dyslipidemia in rural South Africa: the HAALSI (Health and Aging in Africa: A Longitudinal Study of an INDEPTH Community in South Africa) study. PLoS One. 2017 Oct 27;12(10): e0187347. doi: 10.1371/journal.pone.0187347

Ngwuluka NC, Choonara YE, Modi G, du Toit LC, Kumar P, Meyer L, Snyman T, Pillay V; Ex vivo and in vivo characterization of interpolymeric blend/nanoenabled gastroretentive levodopa delivery systems. Parkinsons Dis. 2017;2017:7818123. DOI: 10.1155/2017/7818123

Adu-Gyamfi CG, Snyman T, Hoffmann CJ, Martinson NA, Chaisson RE, George JA,
Suchard MS; Plasma indoleamine 2, 3-dioxygenase, a biomarker for tuberculosis in human immunodeficiency virus-infected patients. Clin. Infect. Dis. 2017 Oct 15;65(8):1356-1358. DOI: 10.1093/cid/cix550
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Waziri B, Duarte R, Dickens C, Dix Peek R, George J, Rekhviashvili V, Paget G, Naicker S; Racial Variations in the Markers of Mineral Bone Disorders in CKD Patients in South Africa. Kidney International Reports. 2017 12; 3(3):583-591. DOI: 10.1016

Naran NH, Crowther NJ; Association of the PCSK9 gene polymorphism E670G and the risk of coronary artery disease in the South African Black population. Clin Chem Lab Med. 55, (special suppl. ppS1506-S1630), S1588, 2017 (abstract)

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Svosve L, Musarurwa C, Matarira HT, Mhandire K, Tanyanyiwa DM; Performance of the Prostate Health Index for Diagnosis of Prostate Cancer in the Southern African Population. International Journal of Medical Science and Health Research. Vol. 2, No. 01; 2018. ISSN: 2581-3366

Tanyanyiwa DM, Wadula J, Brown J, Velaphi S; Performance of Procalcitonin (pct) tested in an African Paediatric Intensive Care Setting. Global Journal for Research Analysis. Volume-7, issue-1, January-2018. issn no 2277 – 8160 Journal Publications

6.2 Conference presentations

6.2.1 Poster presentations

International congresses

Table W 6: International congresses

Conference	Title of Presentation	Presenter	Date	Oral/Poster
International Federation of Clinical Chemistry Durban				
IFCC-WorldLab	Association of the PCSK9 Gene Polymorphism E670G and the Risk of Coronary Artery Disease in the South African Black Population	**N Naran**	October 2017	poster
	LC-IDMS/MS method for serum creatinine validation and comparison to enzymatic method	**P Ntuli**	'"	poster
	Detection of the presence of Lipoprotein-X using a direct homogenous LDL-Cholesterol assay	**S Khan**	'"	poster
	Validation of Multi-drug ARV panel on LCMS/MS	**D Legg-E'Silva**	'"	poster
	Higher glycated haemoglobin (HbA1c) concentrations on high performance liquid chromatography (HPLC) versus Immunoassay	**NV Kone**	'"	poster

Conference	Title of Presentation	Presenter	Date	Oral/Poster
	The FOK1 polymorphism within the vitamin D receptor gene is protective against the development of T1D within the black South African population	**S Bhola**	'"	poster
	Relation between the vitamin D system and autoimmunity in African type 1 diabetic patiens	**D Msibi**	'"	poster
	Comparing the in vitro level of foam cell formation in young and older adults	**G Maile**	'"	poster
	Association of branched chain amino acid and aromatic amino acids with cardio-metabolic risk factors	**L Khambule**	'"	poster
		T Snyman	did not present	
EMBO workshop	Investigation into the Effect of HIV Viral Proteins on Endothelial Function in the HIV infected Population	**G Mezoh**	Nov. 2017	oral

National congresses

Table W 6: National congresses

Local: Society for Endocrinology and Diabetes of South Africa			
An investigative of the PCSK9 Gene Polymorphism E670G and the risk of coronary artery disease in the South African black population	**N Naran**	May 2017	poster
The FOK1 polymorphism within the vitamin D receptor gene is protective against the development of T1D within the black South African population	**S Bhola**	May 2017	poster
Association of branched chain amino acid and aromatic amino acids with cardio-metabolic risk factors	**L Khambule**	May 2017	oral
Comparing the in vitro level of foam cell formation in young and older adults	**G Maile**	May 2017	oral

Clinical Microbiology and Infectious Diseases

Head of Department: Prof AG Duse

1. About the department

The Department of Clinical Microbiology and Infectious Diseases of the NHLS and the School of Pathology at Wits is responsible for the delivery of comprehensive clinical microbiology diagnostic and consultative services to academic (teaching) hospitals of the Faculty of Health Sciences of Wits. The division offers high quality microbiology and IPC services throughout South Africa, with research into preventive and control strategies, while playing a leading role in education and training.

Teaching and training is offered to medical technologists, undergraduate students in medicine and thereapeutic sciences, as well as postgraduate for scientists and specialist training for registrars. From 2018, the division also offers a honours programme from and the Diploma of Tropical Medicine and Hygiene.

The mission of the division is to strengthen the disciplines of microbiology and infectious diseases, and positively impact on the diagnosis, treatment, and control of infectious and communicable diseases.

Grant-funded activities

Global Fund to Fight AIDS, Tuberculosis, and Malaria Funded Activities
IPC training for the Correctional Services and IPC activities relating to the South African Police Service (SAPS): Adriano, Antoinette, Lesley.

Title: Infection Prevention and Control (IPC) Training for the Correctional Services
Overview

On 11 December 2012, the Constitutional Court delivered a judgement upholding an appeal against a decision of the Supreme Court of Appeal, which overturned the decision of the Western Cape High Court in an action for delictual damages. The case concerned a Mr. Lee who contracted TB while in prison. He sued the Minister for damages on the basis that his infection was caused by poor prison health management. The High Court upheld the claim on the basis that the prison authorities failed to take "reasonable steps" to prevent Mr. Lee from contracting TB. Subsequent to the judgement, in 2014, a National Task Team (NTT) was formed to address the issue of TB prevention in the Department of Correctional Services (DCS). The NTT included representatives of the DCS, the NDoH and partners.

The Laboratory and IPC (Lab/IPC) sub-committee working group of the NTT commenced with in-depth baseline IPC audits, which were conducted in 20 correctional centres spanning the six DCS management areas in the country. The centres were selected by the regional DCS health services leadership.

Operations

Professor Adriano Dusé and the IPC team at the NHLS and Wits, together with the NPP unit of the NHLS, developed an IPC Training course supported by Trainer and Trainee manuals. The first round of training was completed in 2016 and 205 health managers (nursing staff) in DCS were trained. A second round of training was completed in February 2018 in all six DCS regions countrywide, that targeted Security, Food Services, Environmental Hygiene Officials, Occupational Health and Safety Officers, and Supply Chain Management. An additional training session requested by the DCS for newly appointed regional coordinators was completed in the first week of December 2017.
In parallel with the second round of training for the DCS, the team conducted follow up assessments in all six regions. A Quality Improvement Tool (QIT) was developed and piloted which aims to track progress of the quality improvement interventions committed to by the facilities after completion of training. The QIT also provides guidance on addressing the findings raised by the in-depth baseline IPC assessments. These assessments were conducted according to a schedule approved by the Commissioner of Correctional Services on 23 March 2017.

The aim of the follow up visits was to assess whether sufficient measures were implemented in the DCS facilities to address the Constitutional Court expectation of "reasonable steps" being taken to prevent transmission of TB. A further series of enabling/support visits to selected centres has commenced with the aim of assisting DCS officials in implementing and monitoring IPC quality improvement projects.

Outputs

- Development of a DCS-specific IPC Policy;
- IPC Standard Operating Procedures to support the IPC Policy were completed in draft format and submitted to DCS National for inputs;
- Development of and training on the DCS-approved IPC short audit tool which is currently in use as a six monthly rapid IPC assessment tool which identifies key "red flag" issues;
- Initial training of 205 DCS health managers, consisting of nursing staff at facility and management levels;
- The second round of training of 185 custodial and non-nursing officials was completed in February 2018;
- The evaluation forms completed by the attendees reflect that the training was understandable, "an eye opener", practical, and applicable to all DCS officials;
- The piloting of Trainee and Trainer DCS-specific IPC manuals, which were printed and used in the second round of training;
- The training curriculum, written especially for the Correctional Services, os directly aligned to the assessed IPC needs of the DCS; and
- Development of a QIT to assist the DCS with tracking of progress of the implementation of IPC interventions. The tool is dynamic and is adapted as the need arises.

The QIT covers all findings raised from the in-depth baseline assessments. It provides guidance on the selection of three action items at a time, for each of the 10 IPC themes derived from the in-depth DCS baseline audits, until all actions items are addressed. The QIT details actions required and assessment methods, it prioritises ranks actions, assigns responsibility and requires timeframes for completion of actions.The tool also allows derivation of a compliance score and progress measurement, adding significant value to the quality improvement programme.
Figure W1: IPC DCS Training

Title: Infection Prevention and Control Activities relating to the South African Police Service

Overview:

In late 2016, the SAPS in the Eastern Province requested IPC TB training from the TB/HIV Care Association. The request was forwarded to Professor Dusé at Wits. The Lab/IPC working group committed to extending the model used for the DCS, to address the issue of preventing TB transmission during the time offenders are in police custody. The offender's journey commences at the scene of arrest, continues through transport to the police holding cells and from there to the Courts and back, before incarceration at a DCS facility or release. At several stages in this journey, there are points of aggregation at which the risk of transmission of not only TB, but also other infectious diseases and conditions is high. It was considered vital to address the whole continuum of the offender's journey in the effort to prevent disease transmission and to empower the police service personnel to apply basic principles of IPC in the cell blocks, in police transport vehicles and in the Court cells.

There was a further request to consider introducing an IPC module into basic police training in the police colleges. This is a unique initiative in the country and possibly in the world. A steering committee was established to progress this work, which consists of members from the NDoH, TB/HIV Care Association representatives, police representation at provincial and local Cluster Commander level, and representatives of the Courts.

Operations:

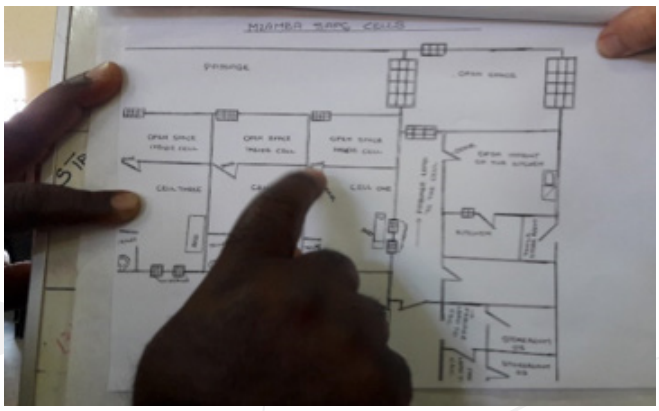
Five assessments of SAPS stations and cellblocks were completed and findings raised were used to develop a draft audit tool that can be used across all SAPS facilities. Common themes were identified to inform an IPC TB training package. The training curriculum was developed and approved by SAPS and partners. Training dates were arranged and training commenced in June 2017. Seven hundred and eighty-seven SAPS officials in the Eastern Cape were targeted for training over 11 sessions in 2017. These officers represented the 22 clusters of police stations in the Eastern Cape Province. A formal 'call-up instruction' was issued by the provincial SAPS office to the clusters. Training materials were forwarded to the cluster commanders a week in advance of each training session. All the sessions were organised and attended by representatives of SAPS at provincial level. The partners and the NDoH in the Eastern Cape were invited to attend and provide input during training sessions. The involvement of the NDoH in training strengthened ties between the SAPS and the NDoH in this province.

Outputs:

- Development of an audit tool for SAPS police stations and holding cells;
- Completion of five audits of police stations, large and small, rural and urban;
- Development of a SAPS-specific training programme in IPC which was piloted and amended as required;
- Eleven scheduled IPC SAPS trainings were completed;
- 787 Police officers were called up for training with 74% attendance of expected delegates on the first training day, and 61% attendance on the second day;
- Full buy-in, support and drive from top management (Eastern Cape Provincial management) was obtained;
- Marketing opportunities were identified by SAPS to showcase the initiative and encourage adoption by other provinces in South Africa; and
- A medical screening form was developed and is being piloted in the Eastern Cape. The screening form will accompany the detainee to Court and to the correctional facility on incarceration, and will serve as an early warning of the need to separate and isolate presumptive TB sufferers on admission to DCS;
- Development of a medication control form to assist in the continuity of care of detainees taking chronic and TB medication and prevent defaulting on treatment;
- By venturing into training of police officials in IPC, the entire continuum of the offender's journey will be covered;
- Medical screening and medication monitoring before the offender's arrival at a DCS facility may ensure earlier separation, isolation, and continuity of medical care;
- A pocket guide was developed and printed. Five hundred and fifty-five copies were handed over to the national SAPS at the last training session in Grahamstown in mid-November 2017;
- Feedback on training was provided to a combined Department of Justice/DoH meeting on 6 February 2018; and
- A plan of action for SAPS Eastern Cape structures to take IPC interventions forward was shared and feedback has been received from the provincial office on plans to implement the medical screening form.

Figure W2: SAPS training in the Eastern Cape

Conference presentation:



The SAPS project was presented, with SAPS and collaborators' permission, at the FIDSSA conference on 11 November 2017.

The division supports the NHLS/Wits academic complex that includes hospitals and the mycobacteriology referral laboratory, located on the Braamfontein NHLS campus.

Divisional and NHLS laboratories are as follows:

- Infection Control, Medical School
- CMJAH;
- Mycobacteriology Referral Laboratory, NHLS, Braamfontein;
- Chris Hani Baragwanath Hospital;
- Helen Joseph Hospital; and
- Rahima Moosa Mother and Child Hospital.

2. Diagnostic services

2.1. Infection control laboratory

Acting Laboratory Manager: Nocawe Ndukula
Pathologist: Dr Teena Thomas

The unit is based at the CMJAH. This unit hosts a diverse range of functions. These include processing of selected clinical samples, enhanced antibiotic testing, environmental and public health sample testing (water, air samples, environmental swabs, milk and food) and molecular diagnostics (please see table 1 for the tests offered). In addition, the unit offers clinical guidance for appropriate IPC measures at CMJAH.

The unit also assists with infection outbreak responses (clinical or public health related) and performs IPC audits as requested by public/ private hospitals or the environmental health department in & around the Gauteng region.

There is a strong drive for research and development within the unit. This includes the verification/validation of microbiological diagnostic tests, investigating new technologies and research on multi-drug resistant organisms.

Table W3: Tests offered at the Infection ControlLlaboratory, CMJAH

Unit	Tests offered
Clinical	Processing of: • Catheter tips • Peritoneal dialysis bags • Food poisoning samples (food, vomitus, stool) • MDRO screening swabs (MRSA,CRE & VRE) • Sterility testing of blood products from SANBS
Specialised antibiotic testing	• E-tests • Broth micro-dilution tests • Synergy testing • hGISA testing • CRE phenotypic antibiotic resistance screening tests
Public Health (for microbial contamination and/or certain pathogens)	• Water • Food • Milk
Environmental	• Environmental swabs • Air sampling • Legionella

Molecular	• Roche diagnostics Bordetella pertussis/parapertussis PCR (PCRBP) • Hain-line probe Vancomycin-resistant Enterococci PCR (PCRVRE) • GeneXpert PCR for Clostridium difficile (GXPCD) • GeneXpert PCR for Influenzae A, Influenzae B and RSV (GXPFL) • PCR and sequencing of 16S rRNA for bacterial identification (PCRB) • PJP PCR (introduced in 2017) • Pulsed-field gel electrophoresis (PFGE)

Staff compliment based on highest qualification (in March 2018)

Table W4: Staff complement based on highest qualification as at March 2018

	Pathologists	PhD Scientists	MSc Scientists	BSc Hons Scientists	Technologists	Bio-technologists	Technicians	Support Staff	South African	All
Black	-	-	-	2	3	5	2	2	14	14
Indian	1	1	1		-	-	-	-	1	3
White	1	-	2	-	1	-	-	-	4	4
South African	2	-	2	2	4					
5										
2	2	19	19							
Total	2	1	3	2	4	5	2	2	19	21

3. New developments

Several verifications and/or validations of new diagnostic tests are underway at the unit, which includes validation of several kits of the BD Max system, namely:

- Enteric bacterial;
- MRSA;
- CRE;
- Meningeal bacterial and viral;
- Pan-bacterial and pan-fungal PCR;
- Legionella PCR from Roche diagnostics;
- Disinfectant testing;
- Listeria monocytogenes PCR from Roche diagnostics;
- Culture based Listeria monocytogenes identification and quantification; and
- Comparison of Colistin broth microdilution testing to the Sensitest & Sensititre panels.

In addition, the public health laboratory is preparing for re-accreditation of certain tests in October 2018. The following tests have been proposed for accreditation:

- Water:
  - TPC;
  - Coliforms; and
  - E.coli
- Food:
  - TPC;
  - Coliforms; and
  - E.coli
- Salmonella spp, E.coli O157, Campylobacter spp, Listeria; and
- Monocytogenes, Staphylococcus aureus toxin and Listeria monocytogenes PCR.

4. Service delivery and coverage

When an institution requests a Legionella audit, the unit staff perform field trips to assess the risks of the organism contaminating the water sources and collect water samples from the environment, as required. This service is offered nationwide. Samples are received from the DoH, various water treatment companies, pharmaceutical companies and several NHLS laboratories nationwide.

4.1 Sample Turnaround times (TATs) (1 April 2017 to 31 March 2018)

The unit requires that a minimum of 80% of all tests should be within the set TAT targets. The results were as follows:

- Molecular tests:
  - PCRBP (89%);
  - PCRVRE (92%);
  - GXPFL (93%);
  - GXPCD (94%);
  - PCRB (69%); and
  - PCRPJ (79%).

The delayed TAT for PCRB (sequencing) was due to the fact that these samples were referred to INQABA for testing. This was done as there was no functional sequencer in the complex, but the issue has since been resolved. The delayed TAT for PJP PCR testing was an incorrect recording on TrakCare. For the months of October and November, TrakCare calculated the TAT from date of sample collection and not from the date of sample receipt in the laboratory. This issue was referred to IT in October but was only resolved in December 2017.

- Clinical diagnostics tests:
  - CVP tips (93%);
  - CRE phenotypic antibiotic resistance screening tests (86%);
  - Broth micro-dilution testing (99%); and
  - Peritoneal dialysis fluid testing (97%).

- Public Health tests:
  - Food (81%);
  - Milk (71%);
  - Water (62%);
  - Legionella (88%);
  - Air settle plates (100%); and
  - Sterility swab (100%).

Milk and water testing did not occur timeously due to the high volumes of food samples received for the Listeriosis outbreak investigation. To address the backlog of samples, a roster was compiled for the staff to rotate on additional weekend and night shifts. The backlog has since been successfully resolved.

5. Teaching and training

Table W5: Postgraduate courses in Microbiology

	Honours	MSc	MMED	Phd
Registered	0	2	1	1
Completed	0	1	0	0

Other training programmes:

- Training site for intern scientists;
- Training site for microbiology registrars in IPC;
- IPC course for SANBS staff conducted twice per year;
- IPC course for nurses conducted annually;

- Staff members train on the course for the Diploma in Tropical Medicine & Hygiene;
- Training lecture: Sampling to West Rand EHPs, Yusuf Dadoo Hospital 20 June 2017;
- Exams: Clin Path & Micro Exit, 17 – 19 October 2017 (organised by the ICS laboratory);
- A half-day workshop was conducted at the Tshwane Academic Hospital on "IPC in the hospital setting" in June 2017. Several pertinent topics were discussed. This was a workshop conducted for Gauteng, Mpumulanga and Limpopo IPC practitioners and microbiologists; and
- Training on the Listeriosis outbreak was provided at the Potchefstroom Hospital in March 2017.

6. Stakeholder relations

- Local collaboration: GERMS-SA laboratory surveillance site for the NICD, South Africa.
- International collaboration: collaboration with Dr MY Wani of Brown Foundation Institute of Molecular Medicine, Texas, Therapeutics Institute, University of Texas Health Science Center at Houston 77054, TX,USA, on an MRC funded project entitled: "Apoptosis and pathogenicity modulations in Candida albicans by Eugenol-tosylate and its Congeners."

7. Current research

Table W6: Current research

	Name	Project	Comment
MMed	Teena Thomas (0110629N)	Epidemiology of carbapenem-resistant Enterobacteriaceae (CRE) and comparison of the phenotypic versus genotypic screening tests for the detection of carbapenemases at a tertiary level institution in South Africa	• Under review by examiners
Post doc	Musa Marimani (NRF Fellow)	Identification of molecular mechanisms leading to reactivation of Mycobacterium tuberculosis from latent state.	• Was submitted to SAJID for publication
PhD	Shabir A Lone (1311748):	Modulation of cell death and pathogenicity by eugenol tosylate congeners in Candida species	Tentative date of submission: November 2019
MSc	Yvonne Dube (1156158):	Effect of probiotic cell free extracts on antifungal drug resistance and virulence expression in Candida albicans	Tentative date of submission: November 2018
MSc	Evida Poopedi (350208)	Expression and activity of oxidative stress enzymes in mediating fluconazole resistance in Candida albicans and their regulation by berberine	Tentative date of submission: November 2018
MSc	Londanani Rahulani (387377):	Effect of tetrazole derivatives on apoptosis and ergosterol biosynthesis pathway in Candida albicans	Tentative date of submission: November 2018
MSc	Siham Ibrahim Ahmad Shaban (1764671):	Identification of virulence factors in Candida auris and anti-fungal activity of monoterpene phenols against this pathogen	Tentative date of submission: June 2019

8. Research output

8.1 Journal publications

Ahmad A, Wani MY, Patel M, Sobral AJ, Duse AG , Aqlan FM , Al-Bogami AS; Synergistic antifungal effect of cyclized chalcone derivatives and fluconazole against Candida albicans. MedChemComm. 2017. Oct; 8, 2195-2207

Abrams EJ, Woldesenbet S, Soares Silva J, Coovadia A, Black V, Technau KG, Kuhn L; Despite Access to Antiretrovirals for Prevention and Treatment, High Rates of Mortality Persist Among HIV-infected Infants and Young Children. Pediatr Infect Dis J. 2017 Jun;36(6):595-601.

Chibabhai V, Nana T, Bosman N, Thomas T, Lowman W; Were all carbapenemases created equal? Treatment of NDM-producing extensively drug-resistant Enterobacteriaceae: a case report and literature review. Infection. 2018 Feb;46(1):1-13. DOI: 10.1007/s15010-017-1070-8. (case report and literature review Dr Teena Thomas is a corresponding author)

Coleman J, Bohlin KC, Thorson A, Black V, Mechael P, Mangxaba J, Eriksen J; Effectiveness of an SMS-based maternal mHealth intervention to improve clinical outcomes of HIV-positive pregnant women. AIDS Care. 2017 DOI: 10.1080/09540121.2017.1280126

Duse A, Miot J, Perovic O; A situational analysis of current antimicrobial governance, regulation and utilisation in South Africa. International Journal of Infectious Diseases. 2017, 64 pp. 100 - 106

Gumede S, Black V, Naidoo N, Chersich M; Attendance at antenatal clinics in inner-city Johannesburg, South Africa and its associated birth outcomes: analysis of data from birth registers at three facilities. BMC Public Health 2017. 17(Suppl 3): 443. DOI 10.1186/s12889-017-4347-z

Magobo ReE, Naicker SD, Wadula J, Nchabeleng M, Coovadia Y, Hoosen A; et al; Detection of neonatal unit clusters of Candida parapsilosis fungemia by microsatellite genotyping: Results from laboratory-based sentinel surveillance, South Africa, 2009-2010. Mycoses. 2017. DOI:10.1111/myc.12596

Negia N, Ahmad A; Current updates on fungal endocarditis. Fungal Biology Reviews. 2018 March; 32, 1-9. Doi: https://doi.org/10.1016/j.fbr.2017.11.001 Dr Aijaz Ahmad is a corresponding author

Keddy KH, Musekiwa A, Sooka A, Karstaedt A, Nana T, Seetharam S, Nchabaleng M, Lekalakala R, Angulo FJ and Klugman KP for GERMS-SA; Clinical and microbiological features of invasive nontyphoidal Salmonella associated with HIV-infected patients, Gauteng Province, South Africa. Medicine. 2017; 96(13)

Perovic O, Singh-Moodley A, Govender NP, Kularatne R, Whitelaw A, Chibabhai V, Naicker P, Mbelle N, Lekalakala R, Quan V, Samuel C, Van Schalkwyk E for GERMS-SA; A small proportion of community-associated methicillin-resistant Staphylococcus aureusbacteraemia, compared to healthcare-associated cases, in two South African provinces. Eur J Clin Microbiol Infect Dis. 2017 Dec;36(12):2519-2532. doi: 10.1007/s10096-017-3096-3. Epub 2017 Aug 28

Prudden HJ, Hamilton M, Foss AM, Adams ND, Stockton M, Black V, Nyblade L; Can mother-to-child transmission of HIV be eliminated without addressing the issue of stigma? Modeling the case for a setting in South Africa. PloS One. 2017 Dec 8;12(12):e0189079. DOI: 10.1371/journal.pone.0189079. eCollection 2017

Stevens T, Schwartz S, Mupawose A, Moonsamy S, Black V; The effects of in utero exposure to antiretroviral therapy (ART) on the language abilities of HIV exposed uninfected infants. Journal of AIDS and HIV Research. 2017;9(8):164-170. DOI:10.5897/JAHR2017.0428

Van Heerden L, Van Aswegen H, Van Vuuren S, Roos R, Duse A; Contamination of nebulisers and surrounding air at the bedside of mechanically ventilated patients. Southern African Journal of Critical Care. 2017, 33 (1) pp. 23 - 27

Wani MY, Ahmad A, Kumar S, Sobral AJ; Flucytosine analogs obtained through Biginelli reaction as efficient combinative antifungal agent. MicrobPathog. 2017 Feb; 9(105):57-62. DOI: 10.1016/j.micpath.2017.02.006. DOI: 10.1039/C7MD00440K. Dr Aijaz Ahmad is a lead and corresponding author

Woollett N, Black V, Cluver L, Brahmbhatt H; Bereavement and incomplete disclosure's impact on understanding vertical transmission: implications for treatment with perinatally infected adolescents in Johannesburg. African Journal of AIDS Research. 2017 Jul:16(2):175-184. DOI: 10.2989/16085906.2017

8.2 Conference presentations

Oral presentations

- A New era in Malaria Diagnosis and Surveillance using Automated Analyzer. E. Pilllay, M. Litshie, T Coetzer. MRC Malaria Conference. 7-9 November 2017, NICD;
- The role of automated malaria as a universal tool in support of malaria elimination initiatives. TL Coetzer, E Pillay, M LIsthie. MIM Conference, 15-20 April 2018. USA;

- Epidemiology of carbapenem-resistant Enterobacteriaceae (CRE) and comparison of the phenotypic versus genotypic screening tests for the detection of carbapenemases at a tertiary level institution in South Africa. Dr T Thomas (invited speaker). PathReD Congress, 23 June 2017; and
- Frequency of rpoB mutations detected in codon 510-513 (WT2) in Mycobacterium tuberculosis (MTB) complex by MTBDRplus v2 in Mycobacteriology Referral Laboratory, Johannesburg. PN Nhleko; M Black; N Moloi. Laboratory Medicine Congress, May 2017, Durban.

Poster presentations

- Epidemiology of carbapenem-resistant Enterobacteriaceae (CRE) and comparison of the phenotypic versus genotypic screening tests for the detection of carbapenemases at a tertiary level institution in South Africa. FIDSSA Congress, October 2017. Dr T Thomas;
- Monitoring and control of Legionella in a private hospital group in South Africa 9th international Conference on Legionella, September 2017. R Stewart;
- Synergistic antifungal effect of newly synthesised cyclicised mono- and bis- chalcone derivatives and fluconazole against Candida albicans. PathReD Congress, 23 June 2017. Dr A Ahmad;
- Validation of an automated real time PCR system (BD MAX) to detect carbapenem-resistant Enterobacteriaceae (CRE). PathReD Congress, 23 June 2017. L Singh;
- Evaluation of a qualitative real time PCR methicillin resistant Staphylococcus aureus detection. PathReD Congres, 23 June 2017. P Makola;
- A two year study of Nocardia isolates in the National Health Laboratory Service (NHLS). FIDSSA, 9 Nov 2017. D Schnugh;
- Evaluation of the BD MAX system for the multiplex detection of MRSA, CRE and other enteric pathogens. FIDSSA, 9 Nov 2017. K Le Roux;
- Friends, microbiologists, clinicians, lend me your auris, Epidemiology of Candida auris at the Charlotte Maxeke Johannesburg Hospital 2014-2017, FIDSSA 2017. V.Chibabhai
- Analysis of the antibiogram from an orthopaedic department at a tertiary hospital in Johannesburg; FIDSSA 2017. T Nana;
- Comparison of manual vs. Rapid automated laboratory methods for the identification of anaerobic bacteria isolated from clinical samples; FIDSSA 2017: T Sibiya and N Bosman;
- Epidemiology of Anaerobic organisms isolated at the CMJAH FIDSSA 2017. N Bosman and O Perovic;
- The camp no-one wants to attend: An interesting case of Campylobacter coli in a Thalassaemia patient; FIDSSA 2017: E Nomlomo; and
- Frequency of rpoB mutations detected in codon 510-513 (WT2) in Mycobacterium tuberculosis (MTB) complex by MTBDRplus v2 in Mycobacteriology Referral Laboratory, Johannesburg.PathCare Conference, August 2017. PN Nhleko; M Black and N Moloi.

Charlotte Maxeke Johannesburg Academic Hospital

The Charlotte Maxeke Microbiology Laboratory is an academic laboratory serving CMJAH which is a quaternary facility, as well as the Nelson Mandela Children's Hospital. In addition, referrals are received from a number of smaller hospitals and clinics in the Southern Gauteng region.

In addition to routine diagnostics, the laboratory offers specialised services including β-d-Glucan (BDG) testing (the only NHLS laboratory offering this assay), and is a referral centre for mycology. As a result of the complex nature of the patient population served, MALDI-TOF MS technology was acquired to allow for cutting-edge rapid diagnostic service.

Consultative infectious diseases and antimicrobial stewardship services are offered in collaboration with the Infectious Diseases Department at CMJAH.

CMJAH Microbiology Laboratory tests and staff compliment

Laboratory	Tests	Staff Complement
CMJAH Microbiology	Bacterial automated ID Fungal ID Breakpoint and MIC-based AST testing for bacteria and fungi Syphilis serology Parasitology ID Bacterial and fungal antigen detection Clostridium difficile toxin testing	Management: 3 Pathologists 1 Laboratory manager Technologists: 13 Technicians: 6 Management: 3 Pathologists 1 Laboratory manager

Table W7: Diagnostic services offered at CMJAH

1. Diagnostic services and new developments

New developments in 2017 include the implementation of the Roche Track for automated sample loading for the Syphilis Total Antibody assay (a treponemal-specific assay for syphilis screening) and a software upgrade to the Vitek 2 to allow for accurate identification of Candida auris isolates.

2. Service delivery and coverage

Outreach was limited to presentations and interactive sessions with clinical staff at Tembisa, Hillbrow and Bertha Gxowa hospitals. Topics covered included appropriate use of the laboratory, fungal sepsis, healthcare-associated infection, antibiotic prophylaxis and antimicrobial stewardship.

2.1 Turnaround times

The average TATS for April 2017 – March 2018 in minutes were as follows:

Table W8: Sample Turnaround times

	AVERAGE SAMPLES PER MONTH	AVERAGE TAT APR 2017-MAR 2018
BDG	1200	2518 mins
CFCC	353	144 mins
MALARIA	102	162 mins
AUROMINE O	211	933 mins
GXP	943	757 mins
TPAB	2265	605 mins
RPR	223	1600 mins

3. Notable achievements

- Accreditation: SANAS accreditation was retained in 2017; and
- Promotions: Lindiwe Sokutu was appointed as laboratory supervisor in 2017.

Technical skills and staffing

Table W9: Technical skills and staffing

Pathologists	Registrars	Technologists
3 Pathologists All FCPath Microbiology T Nana and V Chibabhai MMed	11 Registrars All MBChB as highest qualification Vivian Black has MSc (London School of Tropical Medicine)	14 technologists (includes laboratory manager) Laboratory Manager has MSc 3 have Bachelor Degrees in Medical Technology Remaining 11 have Diplomas in Medical Technology
		6 Technicians All microbiology monospeciality
		1 Laboratory Assistant

4. Skills development

Courses/workshops attended in 2017:

- Mycology Training: Nchabeleng Rankotsana, Esihle Nomlomo, Shalini Pillay, Thulile Sibiya and Sinenhlanhla Ndzabandzaba;
- Writing for Peer Review Workshop (PathReD Congress): Dr. Vindana Chibabhai;
- Q-pulse: Sudeshni Naidoo and Thuli Sibiya;
- How to prepare PowerPoint presentations: Sudeshni Naidoo; Thuli Sibiya; Lorraine Mogatusi and Lindiwe Pule;
- Advanced GXP training: Itumeleng Matete and Modiegi Mokonyane;
- Bacteriology: Dikeledi Masemola;
- FIDSSA Congress: Thuli Sibiya, Trusha Nana, Vindana Chibabhai and Norma Bosman;
- First Aid: Lebogang Nchabeleng;
- Fire Warden: Yola Tatoba, Siyanda Zuma and Lorraine Mogatusi;
- Parasitology: Siyanda Zuma;
- Quality management system: Lorraine Mogatusi; and
- Foundations of laboratory leadership and anagement : Lindiwe Sokutu.

5. Training

5.1 Postgraduate

	Hons	MSc	MMed	PhD
Registered	Nil	Nil	Dr Norma Bosman	Nil

5.2 Other training programmes:

- Mycology training programme run by Dr Vindana Chibabhai; ad
- Wits Students Pathology Society- The laboratory provides workshops to students through the society. A respiratory Sample workshop and an GEMP 1 and 2 examination review workshop were held in 2017.

5.3 Involvement with professional societies

1. All pathologists are members of the South African Society of Microbiologists (SASM);
2. Dr Vindana Chibabhai and Dr Trusha Nana are members of the Microbiology Technology Assessment Committee;
3. Dr Norma Bosman and Dr Vindana Chibabhai were members of the NHLS EUCAST Working Group;
4. Dr Vindana Chibabhai was elected to represent the NHLS on the national C.auris working group for Guideline Development;
5. Dr Trusha Nana was elected chairperson of the National C. difficile Working Group for Guideline Development; and
6. Dr Trusha Nana was a member of the PathReD Congress Organising Committee and Dr Vindana Chibabhai was a member of the PathReD Congress Advisory Committee.

5.4 Stakeholder relations

Local collaboration:

In partnership with the CMJAH Pharmacy and Therapeutics Committee and the Infectious Diseases Department, an antimicrobial stewardship programme for CMJAH was established. In addition, two antimicrobial stewardship train-the-trainer workshops were provided to clinicians from CMJAH, as well as other hospitals and provinces in 2017.

International collaborations

- The pathologists participated in the GLOBAL-PPS study in 2017. The study is conducted in collaboration with the University of Antwerp, Belgium and reports on antimicrobial prescribing practices within hospitals, to assist with compliance to antimicrobial stewardship programmes; and
- We registered with Fungiscope- an online web-based case reporting system, for rare and emerging fungal infections.

6. Ongoing research

Table W9: Research projects

Project title	Researchers	Funding sources: amounts	Duration
DNA sequencing of moulds and thermally-dimorphic fungi causing invasive disease	TG Maphanga, N Govender, V Chibabhai and N Bosman		
Periodic surveillance of antimicrobial susceptibility trends of anaerobic organisms isolated at the CMJAH Microbiology Laboratory	N Bosman and O Perovic	bioMérieux, South Africa (Pty) Ltd (R55 000) and CMID (R27 500)	1 year
An evaluation of the analytical performance of the Dynamiker ® Fungus (1-3)-BDG assay and comparison to the Cape Cod Fungitell ® 1,3 beta-D glucan assay in the diagnosis of invasive fungal infections	S Pillay and V Chibabhai	HTA	1 year
Comparison of Vitek MS Mycobacterium/Nocardia kit and PCR-based hybridisation assays for the identification of mycobacteria in clinical samples	N von Knorring, T Nana and V Chibabhai	CMID	1 year
Disease profile and outcomes of patients with Candida auris infections, compared to other Candida species, at a tertiary South African hospital	Dr A Parak, V Chibabhai and S Stacey	Department of Internal Medicine	18 months
Epidemiology of bacterial bloodstream infections in Neonates at CMJAH	Dr M Mahladisa, V Chibabhai and Prof D Ballot	Department of Paediatrics	18 months
Fosfomycin susceptibility of uropathogens at CMJAH	Dr L Mothibi, T Nana and N Bosman	CMID	1 year

Chris Hani Baragwanath Academic Hospital

The department continues to provide basic laboratory service to the hospital, Bheki Mlangeni District Hospital and 53 clinics in the surrounding areas. As of March 2018, the laboratory took over all microbiology workload processed at Sebokeng Laboratory, which also included work from Kopanong Laboratory.

Table W10: Laboratory services at Cris Hani Baragwanath Hospital

Lab/unit	Total volume tests	Staff compliment
CHB Micro	747,933	39

1. Diagnostic services and new developments

During the period from 1 April 2017 to 31 March 2018, the department processed sample volumes ranging from 59032 to 69764.

2. Service delivery and coverage

As of March 2018, the laboratory workload has increased, due to taking over work from Sebokeng Microbiology Laboratory. The department also delivers excellent service for the NPP.

Table W11: Service delivery and coverage

Month	Apr 17	May 17	Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18
HIV PCR	7167	7143	7008	6291	7041	6948	5841	8306	5193	5343	5885	7403
GXP	5694	5852	5922	4302	5075	5435	5333	4767	3535	4517	4069	4279
TB Micro Scopy	1143	1320	1315	1144	1364	1395	1348	1371	1148	1379	1192	1448

2.1 Turnaround Times (TATs)

Table W12: NPP TAT averages

Month	Apr 17	May 17	Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18
HIV PCR	35.93	34.19	36.99	34.42	37.98	33.35	42.21	53.06	31.90	27.69	32.12	40.95
GXP	10.83	10.18	10.21	11.51	10.43	12.97	10.71	13.51	12.49	10.67	12.37	14.38
TB Microscopy	8.92	8.62	8.38	9.02	8.69	9.27	8.25	21.30	9.31	8.31	10.84	14.95

2.2 Outreach programmes

The department runs a bacteriology workshop to address ongoing training and teaching needs for all NHLS technologists/technicians and registrars. We also added serology to this training. This workshop is conducted by the pathologist, laboratory manager and bench laboratory supervisors.

The pathologists also participate in the regional hospitals and laboratory outreach teaching programmes, that are coordinated through the DoH.

3. Notable achievements

- The department retained its SANAS accreditation status of ISO15189 for 2018; and
- Dr Prenika Jaglal is registered with HPCSA, as a specialist microbiologist.

New laboratories and laboratories upgrading

Our automation laboratory was completed and is running on the new Roche Automation System.

4. Technical skills and staffing

Table W13: Total number of staff per profession and highest qualification

Pathologists	Registrars	PhD Scientists	Technologists	Support
2	0	0	17	20

5. Skills development

A bacteriology workshop is conducted for technologists, technicians and registrars.

6. Training

6.1 Postgraduate

Table W14: Postgraduate training

	Hons	MSc	MMed	PhD
Registered	0	2	1	0
	0	Anthony Onyekwuo Ifeanyi eme	Dr Seetharam - completed 2017 Dr Prenika Jaglal - handed in 2017	0

7. Research

Table W15: Research projects

Project title	Researchers	Funding source/s: amount	Duration
Incidence and etiology of probable serious infection in the first three days of life, Soweto, South Africa. The Sepsis Atiology in Neonates in South Africa (SANISA) study	S Velaphi, M Westercamp, M Moleleki, T Pondo, Z Dangor, N Wolter, A Demirjian, J Winchell, M Diaz, F Nakwa, G Okudo, J Wadula, C Cutland, A von Gottberg, S Schrag and SA Madhi	Centers of Disease Control (CDC) through Global Disease Detection Grant; Partial MRC: RMPRU & DST/ NRF SRAHI	Sent for publication in Lancet Infectious Diseases
A Phase 111, Randomized, double-blind, active comparator-controlled clinical trial to estimate the efficacy and safety of Imipenem/ Cilastatin/ Relebactam (MK-7655A) vs Colistimethate sodium + Imipenem/Cilastatin in subjects with Imipenem-Resistant Bacterial Infection	In collaboration with Main Intensive Care Unit	MSD (Global)	Completed
Post mortem minimally invasive autopsy (MIA) to establish cause of death in under 5 children in a high HIV prevalence setting	Madhi SA, Adam Y, Velaphi S, Nzenze S, Cutland CL, Wadula J and Chawana	DST/NRF Vaccine Preventable Diseases, RMPRU	Ongoing

Mycobacteriology Referral Laboratory, Braamfontein

The laboratory is a biological safety level (BSL) III facility and processes clinical specimens for mycobacteriology culture. It operates on a high-throughput basis and receives specimens from the greater Gauteng area (Ekuhurleni District [Gauteng East], West Rand District [Gauteng West], Sedibeng District [Gauteng South], City of Johannesburg District), selected referring sites from Limpopo Province, selected referring sites from Mpumalanga Province, and selected referring sites from the North West Province, as well as referrals from private mining hospitals.

The scope of testing includes:

i. Direct smear microscopy on specimens;
ii. Microscopy performed on decontaminated and concentrated specimens;
iii. Culturing of mycobacteria using the WHO-recommended automated liquid culturing system (MGIT);
iv. Molecular identification of Mycobacterium species from positive cultures;
v. Molecular drug susceptibility testing from specimens or from positive cultures for isoniazid and rifampicin;
vi. Culture-based drug susceptibility testing for first- and second-line anti-mycobacterial agents;
vii. Molecular drug susceptibility testing from specimens or from positive cultures for the fluoroquinolone and injectable agents; and
viii. Xpert MTB/RIF testing on pulmonary and extra-pulmonary specimens.

As TB is a national priority, an extensive advisory service is offered by the laboratory staff. Clinicians and healthcare workers consult directly with staff or via e-mail. In collaboration with the DoH, teaching activities are executed by the pathologist at healthcare centres throughout Gauteng to guide clinicians and nursing staff on management issues. Periodically, the DoH arranges TB symposia to discuss TB management trends and the pathologist participates from a TB diagnostic perspective.

1. Diagnostic services and new developments

A consultation was held by WHO in April 2017 to review the critical concentrations for the second line and new repurposed TB drugs in the light of MIC distribution data and pharmacokinetic and pharmacodynamics (PK/PD) data. A decision was made to lower the critical concentration of moxifloxacin for phenotypic susceptibility testing from 0.5µg/mL to 0.25µg/ml for low dose moxifloxacin, and from 2µg/ml to 1µg/ml for high dose moxifloxacin. After a validation process, these new critical concentrations were introduced at the referral lab in December 2017.

The new Xpert MTB/RIF Ultra assay was introduced during the last quarter of 2017. Studies demonstrated enhanced performance for the detection of MTB in paediatric specimens, extra-pulmonary specimens and smear-negative culture-positive specimens from HIV positive individuals compared to the previous Xpert MTB/RIF assay (WHO March 2017).

2. Service delivery and coverage

- 07 April 2017: Sizwe DoH DR TB training;
- 08 May 2017: DoH DR TB training: Cullinan;
- 26 May 2017: DoH DR TB training: Yusuf Dadoo Hospital;
- 9 June 2017: DoH meeting, presentation conducted on DR TB Reflex: Helen Joseph Hospital;
- 26 June 2017: DoH DR TB training : Kalafong Hospital;
- 11 July 2017: DoH DR TB training : Ann Latsky Nursing College;
- 18 July 2017: DoH DR TB training: St Georges Hotel, Centurion;
- 25 July 2017: DoH DR TB training: Kopanong Hospital;
- 03 August 2017: DoH DR TB training: Pulse Health, Midrand;
- 06 September 2017: DoH DR TB training: Wits Public School of Health;
- 07 September 2017: DoH TB training: Ann Latsky Nursing College;
- 08 September 2017: nurses training: Kempton Park, Ekurhuleni;
- 15 September 2017: TB diagnostics talk: Yusuf Dadoo Hospital;
- 04 October 2017: Ekurhuleni DoH DR TB training, Alberton;
- 25 October 2017: DoH DR TB training, St. John's Auditorium, Chris Hani Baragwanath Hospital;
- 8 November 2017: TB diagnostics talk: Leratong Hospital;
- 14 November 2017: DoH DR TB training: St Georges Hotel, Centurion;
- 30 January 2018: DTM&H course CMID: TB diagnostics and public health aspects
- 14 February 2018: IPC course for nurses, Wits Medical School; and
- 15 February 2018: Johannesburg Health District basic TB training, Wits Reproductive Health and HIV Institute (WRHI.)

3. Notable achievements

We maintained our SANAS accreditation in 2018.

4. Technical skills and staffing

Table W16: Total number of staff per profession and highest qualification

Pathologist	Registrars	PhD Scientists	Technologists	Technicians	Support
1 (Acting pathologist)	1	0	11	16	3

5. Skills development

Our staff members attended various courses throughout the year.

Table W17: Courses attended by staff throughout the year

Dates	Courses	Number of attendees
April 2017	Advanced GeneXpert course	6
29 May-1 June 2017	Leadership and Laboratory management course	1
11-13 July 2017	QMS workshop	1
23-24 August 2017	Ethics workshop	2
24 August 2017	Safety Representative course	1
September 2017	Foundation of Lab leadership and Management	1
October 2017	Effective communication	3
November 2017	First aid	1
December 2017	Foundation of Lab Leadership and Management	1

5.1 Undergraduate training

Table W18: Undergraduate Training

Course	Staff no.	Status
National Diploma in Biomedical Technology	5	Ongoing

Stakeholder relations

Local collaboration/contributions:

1. IMPAACT P1108 study (paediatric bedaquiline dose finding study) Clinical HIV Research Unit (CHRU), Sizwe Hospital; and
2. Isoniazid monoresistance study, NICD.

Research activities

Table W19: Research projects

Project title	Researchers	Funding source/s; amount	Duration
Evaluation GenoType Mycobacterium CM VER 2	Z Mavimbela		Completed July 2017
Frequency of rpoB mutations detected in codon 510-513 (WT2) in Mycobacterium tuberculosis (MTB) complex by MTBDRplus v2 in Mycobacteriology Referral Laboratory, Johannesburg	PN Nhleko; M Black and N Moloi		Oral presentation at the Laboratory Medicine Congress, May 2017, Durban. Poster at PathCare Conference, August 2017.
Evaluation of the Hain MPT64 antigen platform for detection of Mycobacterium tuberculosis complex off positive cultures	M Black	Health Technology Assessment Unit project	Being finalised.

Project title	Researchers	Funding source/s; amount	Duration
Identification of rifampicin resistance using Xpert MTB/RIF and MTBDRplus v2.0 for greater Gauteng province: Implications for patient care	M Black, P da Silva and L Scott		Master of Medicine project – currently writing up
Comparison of Vitek®MS Mycobacterium/Nocardia kit and PCR-based hybridisation assays for the identification of mycobacteria	N von Knorring, T Nana and V Chibhabai		Master of Medicine project- currently collecting data

Helen Joseph Hospital

Helen Joseph and Rahima Moosa academic hospitals are serviced by a clinical pathology laboratory comprising microbiology, haematology and chemical pathology. The microbiology laboratory has several functions. One of its missions is to provide cost-effective and professional microbiology diagnostic services to the public health catchment area, which comprises several district hospitals, primary healthcare clinics and other state institutions (e.g. prisons). This includes transportation of specimens, on-site diagnostic services, referral of tests to reference laboratories, and timeous delivery of quality results together with the accurate interpretation of those results. The microbiology laboratory provides services to a number of surrounding public healthcare centres, including district hospitals, step-down facilities, as well as primary healthcare clinics.

1. Diagnostic services and new developments

The microbiology laboratory at Helen Joseph Hospital changed the testing algorithm for Clostridium difficile to a two-step algorithm that is in keeping with current recommendations. Diagnosis of C. difficile infection is made, using two tests: the glutamate dehydrogenase and the C. difficile toxin detection. Discordant results are resolved by Gene Xpert C. difficile testing.

2. Service delivery and coverage

The microbiologist holds weekly meetings with the infection control team in Helen Joseph Hospital to monitor the spread of nosocomial infections and formulate control programmes. The microbiologist assists the teams in performing infection control audits and advises on formulation of infection control standard operating procedures (SOPs), for the two hospitals.

Due to skills shortage, the microbiology laboratory at Edenvale Hospital refers specimens for processing to the Helen Joseph Hospital Microbiology Laboratory.

3. Notable achievements

- In August 2017, the Helen Joseph Hospital Microbiology Laboratory passed the pre- SANAS assessment and gained full SANAS accreditation in November 2017; and
- The microbiology laboratory subscribes to several external quality assessment (EQA) schemes. It obtained a PT yearly average of 99.4%.

4. Technical skills and staffing

Table W20: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists			1				
Medical scientists							
Technologists				1	9		10
Technicians						5	5
South Africans							15

4.1 Skills development

Table W21: Skills development

Date	Course completed	Attendee	Designation
17 May 2017	Performance management	Barry Bhaghobhai	Medical technologist
11-13 July 2017	Quality management systems	Nonkululeko Wandlala	Medical technologist
11 October 2017	Gene Xpert utra training	Gisela Kohlmann, Erika Weyers, Barry Bhaghobhai, Thelma Kgoale	Medical technologists and technicians
30 October 2017	Q-pulse course	Nonkululeko Wandlala	Medical technologist
20-23 November 2017	Advanced TrakCare course	Barry Bhaghobhai	Medical technologist

5. Training

Registrars in clinical microbiology receive training on manual and automated diagnostics, interpretation and reporting of results and appropriate use of antibiotics for bacterial and fungal infections.

Infectious diseases sub-specialists fellows at Helen Joseph Hospital and Rahima Moosa Mother and Child Hospital attend laboratory teaching as part of their training programme. Weekly formal didactics, antibiotic stewardship rounds and ICU ward rounds are held in collaboration with the infectious diseases specialists. These ward rounds form part of the clinical training for internal medicine and microbiology registrars as well as infectious diseases sub-speciality fellows. Weekly laboratory didactics in basic microbiology are offered to registrars and medical officers working in the infectious diseases unit. Monthly didactics are executed with the microbiology laboratory staff

6. Research activities

Project title: Procalcitonin-guided antibiotic treatment for suspected and confirmed sepsis in a surgical trauma intensive care unit
Researcher: R. Chomba
Supervisors: W Lowman and S Moeng
Presentations: Presented as an oral presentation at the 7th FIDSSA Congress in November 2017
Duration: Submitted for MMed examination

Department of Science and Technology /National Research Foundation Centre of Excellence for Biomedical TB Research

Head of Department: Prof Bavesh Kana

1. About the department

Research at the DST/NRF Centre of Excellence for Biomedical TB Research (CBTBR) covers identification and validation of novel drug targets for TB, with a particular focus on peptidoglycan, DNA repair and mycobacterial oxidative phosphorylation as tractable areas for the discovery of new drugs. In addition to this, the CBTBR is also focused on the investigation of microbial heterogeneity in TB diseased individuals, prior to the initiation of treatment and during treatment. In this regard, the centre described the prevalence of differentially culturable tubercle bacteria (DCTB) in the sputum of treatment naïve individuals and is in the process of studying how the prevalence of these organisms changes during treatment. The CBTBR furthermore supports the rollout of molecular TB diagnostics in South Africa and almost 20 other countries through the provision of verification and quality assurance reagents. Finally, researchers at the CBTBR were involved in the search for new TB drugs, through screening of compounds/extracts from medicinal plants.

2. Diagnostic services

Due to the threat of bacterial drug resistance, more sensitive, reliable and rapid molecular diagnostic methods are now available for TB diagnosis. For example, the GeneXpert MTB/RIF system is used for simultaneous identification of infection and rifampicin resistant M. tuberculosis. The CBTBR invested substantial effort in the past to streamline the production of verification controls for GeneXpert MTB/RIF, which allowed for the rollout of this diagnostic service to all provinces in South Africa and changed the way TB is diagnosed globally. The method involves the creation of bacteria that mimic those that cause TB disease (this approach is known as bio-mimicry). As an expansion of this approach, the CBTBR undertook a new project that uses the same methodology to create verification standards to detect resistance to other TB drugs in response to the projected rollout of new molecular TB diagnostics that detect composite forms of drug resistance. An environmental microorganism was chosen as a host for biomimetic delivery, as it is known to test negative in the GeneXpert MTB/RIF and the GenoType MTBDRplus diagnostic assays. As an extension of this work, the methodology was tested on the Staphylococcus aureus GeneXpert SA Nasal Complete cartridge which is able to detect the nucleic acid sequence SCCmec present in methicillin resistant strains.

Table 22 Total number of staff per profession and highest qualification

Doctoral	MMed	Masters	Honours	Diploma	All	South Africans	
Pathologists	0	0	0	0	0	0	0
Medical Scientists	6					6	5
Technologists	1		1		1	3	3
Other*							
South Africans	6		1		1	8	8
All							

3. Teaching, training and professional development

3.1 Undergraduate level

At an undergraduate level, lectures are offered as part of the Biomedical Engineering course and the Bachelor of Health Sciences programme.

3.2 Postgraduate Level

At a postgraduate level, students are trained at Hons, Masters and PhD levels. The CBTBR postgraduate training portfolio for 2017 is detailed below:

- **Postdoctoral fellows:** in progress: Dr Julian Peters;
- **PhD students:** in progress:
  - Ms Amanda McIvor (registered January 2014);
  - Ms Nicole Collette Narrandes (registered June 2013);
  - Mr Sibusiso Senzani, Wits (registered June 2013);
  - Ms Andrea Papadopoulos (registered January 2015); and
  - Mr Moagi Shaku (registered March 2017).
- **MSc students:** completed:
  - Mr Moagi Tube Shaku (graduated with distinction);
  - Mr Moeketsi Raymond Moseki;
  - Ms Tebogo Christina Rantsi; and
  - Mr Masethabela Maphatsoe (graduated with distinction).

- **MSc students:** in progress:
  - Ms Nombeko Sikhosana (registered in January 2016); and
  - Ms Poppy Mashilo (registered in January 2016).

- **Honours:** completed:
  - Ms Lisa Campbell; and
  - Ms Kiyasha Padarath

Training visits and workshops attended by members of the wits node

1. Dr. Machowski attended the Wits for the T4 terminal website interface.

Workshops

1. Prof Kana, Drs Ealand, Gordhan, Padyachee and Peters and Ms. Masangana and Sewcharran attended the Good Clinical Practice course at the BEESA Conference Centre, at 5 Sherborne Rd, Parktown, from October – November.
2. Mr Saku represented the Wits node at the DST/NRF CoE annual directors' forum in collaboration with the Nelson Mandela Metropolitan University, Port Elizabeth on 1 September 2017.

3.3 Other

Table 23: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern medical scientists	Honours	All	South Africans
Total number of trainees	5	6			2	13	13
Final year trainees	3	4			2	9	9
Successful completion	0	4			2	6	6

4. Awards

In 2017, members of the Wits node of the CBTBR received the following awards and recognition of its work:

- Prof Bavesh Kana received an award from the Dean of the Faculty of Health Sciences for Excellence in Academic Service. This award was conferred upon him in November 2017, at an event to honour faculty members;
- In July 2017, Prof Kana received Faculty Honours for notable contribution to research;
- Ms Andrea Papadopoulos was renewed for a second year of a Medical Faculty Research Endowment Fund (MFREF) by the Faculty of Health Sciences, Wits, towards research project operating costs;
- Mr Moagi Shaku was appointed as a TB blogger for the online journal, Nature Microbiology Community;
- Mr Moagi Shaku won first prize for the best oral presentation in the Medical Microbiology and Virology track at the 2017 PathReD Congress;
- Dr Machowski was awarded the Claude Leon Foundation (CLF) Merit Award valued at R25 000, through the Wits Research Office;
- Ms Poppy Mashilo was awarded a merit award in 2017 by Wits; and
- Ms Poppy Mashilo won first prize for a poster presentation on the Infectious Disease Tract at the Molecular Biosciences Research Trust Postgraduate Research Day in 2017.

5. Research activities

5.1 Research projects

Project title:	Peptidoglycan remodelling in mycobacteria
Principal investigators:	BD Kana BD (Wits and NHLS)
Co-researchers:	EE Machowski, CS Ealand, AO Papadopoulos, S Senzani, MT Shaku, MM Maphatsoe and L Campbell (all from Wits)
Collaborators:	N Dhar (EPFL), R Guler (UCT) and K Sung Joon (Baylor University)
Funding:	NRF, SAMRC and Howard Hughes Medical Institute
Short description:	Since the discovery of penicillin in 1928, disruption of cell wall biosynthesis with antibiotics has proven to be a clinically successful strategy with bacterial infections for close to a century. However, these benefits have not accrued to TB, due to the refractory nature of Mycobacterium tuberculosis to treatment with conventional penicillin-type antibiotics. This project aims to study cell division in tubercle bacteria with the outlook of identifying and validating potential new drug targets for TB. In an era where new drugs are urgently sought, this approach provides an exciting novel avenue for further TB drug development.
Project start rate:	Jan 2017
Project end date:	Current

Project title:	Detection, quantification and characterization of differentially culturable tubercle bacteria (DCTB) in human TB disease
Principal investigator:	**BD Kana (Wits and NHLS)**
Co-researchers:	JS Peters, A McIvor, AO Papadopolous, T Masangana, BG Gordhan, K Otwombe, Z Waja, N Martinson, M Letuli, F Shahim, S Ramsamy S (All Wits)
Collaborators:	Sterling T, Shepherd B (Vanderbilt University)
Funding:	The Bill and Melinda Gates Foundation, NRF and SAMRC

Short description: During tuberculosis infection, tubercle bacilli adapt to host immunity and drug treatment, by assuming variable growth states as evidenced by the presence of sputum-derived organisms in altered states of culturability. It was proposed that these differentially culturable tubercle bacteria (DCTB) reflect drug tolerant organisms that are difficult to eradicate. This project aimed to describe the kinetics of decline in DCTB in patients with drug sensitive TB disease on standard treatment, to identify putative biomarkers for treatment response and recurrent disease.

Project title: Streamlining production and costing for molecular diagnostics standards

Principal investigator: BD Kana (Wits and NHLS)

Co-researcher: EE Machowski EE

Funding: NRF and Wits Enterprise

Short description: This project was aimed at:

i. Developing new reagents, which can be provided at lower cost for production of dried culture spot (DCS) standards for TB molecular diagnostics; and

ii. Developing new drug resistant variants to respond to a growing clinical need for standards to detect drug resistant TB (III), optimizing the existing production stream to reduce costs and increase efficiency.

iii. DCS is used to perform verification and ongoing quality assurance of the molecular diagnostic test equipment i.e. checking whether the equipment tests accurately.

Project start date:

Project end date:

6. Research output

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6.1 Journal publications

Kamariza M, Shieh P, Ealand CS, Peters JS, Chu B, Rodriguez-Rivera FP, Babu Sait MR, Treuren WV, Martinson N, Kalscheuer R, Kana BD, Bertozzi CR; Rapid detection of Mycobacterium tuberculosis in sputum with a solvatochromic trehalose probe. Sci Transl Med. 2018; 10(430).

Ealand CS, Machowski EE, Kana BD*. beta-lactam resistance; The role of low molecular weight penicillin binding proteins, beta-lactamases and ld-transpeptidases in bacteria associated with respiratory tract infections. IUBMB Life. 2018.

Shah NS, Kim P, Kana BD, Rustomjee R; Getting to Zero New Tuberculosis Infections: Insights From the National Institutes of Health/ US Centers for Disease Control and Prevention/Bill & Melinda Gates Foundation Workshop on Research Needs for Halting Tuberculosis Transmission. J Infect Dis. 2017; 216(suppl_6): S627-S8.

Senzani S, Li D, Bhaskar A, Ealand C, Chang J, Rimal B, Liu C, Joon Kim S, Dhar N, Kana BD*; An Amidase_3 domain-containing N-acetylmuramyl.

McIvor A, Koornhof H, Kana BD*; Relapse, re-infection and mixed infections in tuberculosis disease. Pathog Dis. 2017; 75(3).

Machowski EE, Kana BD*; Genetic Mimetics of Mycobacterium tuberculosis and Methicillin-Resistant Staphylococcus aureus as Verification Standards for Molecular Diagnostics. J Clin Microbiol. 2017; 55(12): 3384-94.

Kistan J, Laher F, Otwombe K, Panchia R, Mawaka N, Lebina L, Diacon A, Kana B, Martinson N; Pulmonary TB: varying radiological presentations in individuals with HIV in Soweto, South Africa. Trans R Soc Trop Med Hyg. 2017; 111(3): 132-6. Citations – none as yet.

Ekengard E, Bergare I, Hansson J, Doverbratt I, Monari M, Gordhan B, Kana B, de Kock C, Smith PJ, Nordlander E; A pyrazine amide – 4-aminoquinoline hybrid and its rhodium and iridium pentamethylcyclopentadienyl complexes; evaluation of anti-mycobacterial and anti-plasmodial activities. J Mex Chem Soc. 2017; 61(2): 158-66.

6.2 Complete books

None.

6.3 Book chapters

Gordhan BG and Kana BD. 2017. Microfluidics for tuberculosis diagnosis: Advances, scalability and challenges.Francesco Piraino and Seila Selimovic (ed.), Diagnostic devices with microfluidics , Chapter 8, Taylor and Francis, CRCPress.

6.4 Conference presentations (Oral, Poster)

6.4.1 Oral presentations

6.4.1.1. International congresses

Kana BD. Can peptidoglycan remodeling reveal novel drug targets and probe for phenotypic complexity in sputum-derived mycobacteria? Center for Emerging and Neglected Diseases Symposium. 31 March 2017. University of California, Berkley, USA. Invited plenary lecture.

Kana BD. Differentially Culturable Tubercle Bacteria: Possible roles in TB transmission. Aerobiology Meeting. Bill and Melinda Gates Foundation. 7 – 8 March 2017. Seattle, USA.

Kana BD. Differentially Culturable Tubercle Bacteria (DCTB): Possible roles in TB transmission. NIH Workshop on Halting TB Transmission in HIV Endemic Settings, 1 -2 June, Vineyard Hotel, Cape Town, South Africa.

Kana BD. Differentially Culturable Tubercle Bacteria (DCTB). 10th International Conference on the Pathogenesis of Mycobacterial Infections. 23 – 26 August. Stockholm, Sweden

Kana BD. Peptidoglycan remodelling reveals novel TB drug targets and phenotypic complexity in sputum-derived mycobacteria. Joint annual SSM meeting, 30 August – 1 September 2017, Congress Centre Basel, Basel, Switzerland.

Kana BD. Chaired Workshop entitled: Key Knowledge Gaps with TB. Joint annual SSM meeting, 30 August 30 – 1 September 2017, Congress Centre Basel, Basel, Switzerland.

Kana BD. States of Wakefulness: Mycobacterial physiology during tuberculosis infection and disease. TB Infection Workshop: Building a framework for eradication. DAIDS, NIAID and HMS workshop: Hyatt Regency Dubai Creek Heights, Dubai, 27-28 September 2017.

Kana BD. Can peptidoglycan remodelling reveal novel drug targets and probe for phenotypic complexity in sputum-derived mycobacteria? Baylor University, Waco, Texas, USA, 2 September 2017.

Kana BD. Can peptidoglycan remodelling reveal novel drug targets and probe for phenotypic complexity in sputum-derived mycobacteria? Université de Genève Médecine, Faculté de Médecine, 4 April 2017.

6.4.1.2. National congresses

2.1. Local congresses (university academic days)

Kana BD. Research Careers in a Time of Uncertainty. 4th Biennial Faculty of Health Sciences Postdoctoral & Carnegie Fellows Symposium, 6 October 2017, Emoyeni Conference Center, Parktown, South Africa.

Papadopoulos AO and Kana BD. The in's and out's of mycobacterial lytM endopeptidases. CPD-accredited seminar presented at the Molecular Medicine and Haematology Wednesday seminar series, School of Pathology, Faculty of Health Sciences, Wits. 6 September 2017.

Shaku TM, Chengalroyen MD and Kana BD. Characterization of LytM-domain containing proteins in Mycobacterium smegmatis. CPD-accredited seminar presented at the Molecular Medicine and Haematology, School of Pathology, Faculty of Health Sciences, Wits. 31 July 2017

Cardoso N and Kana BD. The mycobacterial electron transport chain: How does TB breathe? Oral presentation at the NHLS PathReD Congress, 22- 24 June 2017. Received an honorable mention for the presentation in the Microbiology and Virology Track.

Sikhosana N, Chengalroyen M and Kana BD. Mycobacterium amidases: Biological function and putative role in cell wall remodelling. Oral presentation at the 8th Cross Faculty Graduate Symposium. 25 October 2017.

Shaku TM, Chengalroyen M and Kana BD. Characterization of LytM-domain containing proteins in Mycobacterium smegmatis. Oral presentation at the NHLS PathReD Congress, Johannesburg, South Africa. 22-24 June 2017. Received an honourable mention for the presentation by the adjudication panel. Won first prize for the presentation.

Cardoso N and Kana B. The mycobacterial electron transport chain: How does TB breathe? Oral presentation at the NHLS PathReD Congress. 22- 24 June 2017.

6.4.1.3. Poster presentations

1. International congresses

Chengalroyen MD, Beukes GM, Gordhan BG, Streicher EM, Churchyard G, Hafner R, Warren, R, Otwombe K, Martinson N and Kana BD. Detection and quantification of differentially culturable tubercle bacteria in sputum from tuberculosis patients. Gordon Research Conference on Tuberculosis Drug Development, Il Ciocco Hotel and Resort, Lucca (Barga), Italy, 25-30 June 2017.

Gordhan BG, Rantsi T, Padarath K, Moolla N, Goosens V and Kana BD. Targeting the base excision repair pathway to limit the emergence of drug resistant tuberculosis disease. Poster presentation at the Keystone Symposia, Antimicrobials and Resistance: Opportunities and Challenges, Santa Fe, New Mexico, USA. 30 October 2017.

2. National congresses

Local Congresses (university academic days)

McIvor A, Gordhan B, Martinson N and Kana. B. The use of culture filtrate enhances diagnosis of HIV-infected, sputum smear negative individuals. Poster presentation at the Molecular Biosciences Research Thrust Postgraduate Research Day, Wits. 30 November 2017.

Papadopoulos AO and Kana BD. LytM endopeptidases contrast cell division regulation between slow-growing M. tuberculosis and rapidly-growing model organisms. Poster presentation at the Molecular Biosciences Research Thrust Postgraduate Research Day, Wits. 30 November 2017.

Sikhosana N, Chengalroyen M and Kana BD. Mycobacterium amidases: Biological function and putative role in cell wall remodelling. Poster presentation at the Molecular Bioscience Research Thrust Postgraduate Research Day, Wits. 30 November 2017.

Mashilo P and Kana BD. Characterization of mycobacterial D,D-carboxypeptidases: protein interaction and genetic knockout. Molecular Biosciences Research Thrust Postgraduate Research Day, Wits. 30 November 2017. Won first prize for best poster presentation.

7. Research translations

7.1 Research translated to policy

None.

7.2 Research translated to service

To address the growing TB burden globally, many TB endemic countries, including South Africa, opted to roll out a new molecular diagnostic test, the GeneXpert, which promises to deliver a diagnostic result in 2-3 hours as opposed to 4-6 weeks. For verification of this instrument, the CBTBR developed inactivated pathogenic tubercle bacteria for use as standards in the form of DCS. This product was rolled out to many countries and was endorsed by the WHO. However, a key barrier to developing the product for further global uptake is the high cost of production. To address this, the CBTBR undertook to further develop new reagents that can be used as verification and quality assurance standards, but that are easer to produce and provide a more tractable framework to create drug resistant variants that reflect the clinical spectrum of drug resistant TB.

Human Genetics

Head of Department: Associate Prof Amanda Krause

1. About the division

The Division of Human Genetics, NHLS and Wits continued to achieve over the last year. The division's capacity to conduct research and development projects, and to validate new diagnostic tests is improved, due to the presence of senior scientists. Sample numbers continued to increase, particularly in the DNA profiling laboratory, placing the diagnostic laboratory staff and equipment under pressure. The laboratories continue to offer a high level of service. The division made significant strides towards accreditation in the last year. New equipment is urgently required though, to continue to develop and offer state-of-the-art testing.

The division continues to provide medical genetic laboratory and clinical services and its staff continue to train and teach at undergraduate and postgraduate level. The division continued to produce significant volumes of research output. A number of new research projects were initiated and our number of postgraduate students in all courses increased significantly in 2017. Three staff members registered for higher degrees in 2017, and one staff member submitted an MSc dissertation.

Dedicated staff members continue to be the driving force behind the functioning and success of the division.

Table W24: Total number of staff per profession and highest qualification

	Pathologists (medical geneticists)	PhD scientists	MSc Scientists and counsellors	BSc (Hons)	Technologists and technicians	Support	South African	All
Total	4	4	15	8	6	7	42	44

2. Diagnostic services

Diagnostic services are divided into laboratory services and clinical genetic services. There are four sections in the laboratory: Molecular Genetics; Cytogenetics; DNA Profiling Laboratory and Biochemistry; Ancestry and Clinical Genetic Services.

2.1. Services rendered

Table W25: Tests/patient appraisals

Laboratory	2016/17	2017/18	% Change
Molecular genetics	6508	6209	-7.6%
Cytogenetics	2671	2438	-9%
DNA profiling & biochemistry	~12395 DPL=~11538,Biochem=892)	14290 (DPL=13382, Biochem=908)	+7.5%
Ancestry	473	365	-22.8%
Clinical genetic services	1974	2022	2.4%

Molecular genetics

The Molecular Diagnostic Laboratory remains the largest molecular genetics diagnostic laboratory in the country. The laboratory performs testing for more than 40 genetic conditions, offering its service to the public and private sectors. In addition, the laboratory is actively involved in research and development of new tests. The laboratory participated in the 2017 EQA schemes, through the EMQN.

The laboratory expanded its scope of testing to include extended screening for Rett syndrome using MLPA analysis. New tests using MLPA were introduced for Beckwith-Wiedemann/Silver-Russel syndrome and Di-George syndrome. Improved detection methods for Fanconi anaemia (FA) and Huntington Disease (HD and HDL2) were successfully implemented. Additionally, the laboratory was involved with the validation and implementation of comparative genomic hybridization (CGH) arrays. We furthermore evaluated a new testing approach for cystic fibrosis, using NGS technology. An automated DNA extraction platform was also evaluated. Seven intern medical scientist interns were trained during this period.

Cytogenetics

The Cytogenetics Laboratory continues to provide a pre- and post-natal laboratory service nationally for five provinces (Gauteng, Eastern Cape, Limpopo, North West and Mpumalanga) and internationally (Namibia, Zambia, Zimbabwe and Botswana). For FISH studies, services are also provided for KwaZulu-Natal and some private laboratories. Many FISH tests are being replaced by MLPA tests, which are less expensive and provide improved diagnostic capability. The laboratory continues to obtain good results from the proficiency testing through the College of American Pathologists (CAP).

DNA Profiling Laboratory (previously Applied Polymorphisms Llaboratory) and Biochemistry

The main activities include parentage testing and QF-PCR for the detection of specific chromosomal aneuploidies. Mitochondrial DNA (mtDNA) and Y-chromosome testing (currently performed by the Human Genomic Diversity and Disease Research Laboratory (HGDDRL), are now offered as part of the kinship testing repertoire to resolve complex kinship outcomes. Test numbers increased by approximately 7.5% overall since 2016/2017, largely due to the NHLS providing services to the Department of Home Affairs for identity testing. Proficiency testing was done for paternity testing through CAP, and Aneuploidy screening through Cytogenomics External Quality Assessment Service (CEQAS). Excellent results were obtained for both tests.

Genetic Ancestry Testing

The HGDDRL offers genetic ancestry testing to all individuals interested in tracing their genetic ancestry. A partnership with the Origins Centre at Wits continues at a steady pace. This activity contributes to the broader mandate of public engagement and education of science.

Clinical Genetic Services

The medical geneticists and genetic counsellors of the section continue to see patients in both the State and private hospital sector. Genetic clinics are run at, Chris Hani Baragwanath Hospital, Rahima Moosa Mother and Child Hospital, Helen Joseph Hospital and the Donald Gordon Medical Centre. A new fetal medicine clinic was initiated in 2017. Patients and their families with a wide variety of genetic conditions are seen through these clinics. In addition to patient care and management, other important roles of the staff members of the Clinical Section include teaching, supervising and training of medical students, MSc (Genetic Counselling) students and medical genetics registrars.

3. Teaching, training and professional development

The Division of Human Genetics contributes to both undergraduate and postgraduate teaching at the Faculty of Health Sciences, Wits. Prof JGR Kromberg, a visiting associate professor in the division, continues to assist on a voluntary basis with research supervision and mentoring of staff who have limited research experience. Monthly writing days are hosted to encourage staff to develop their research protocols and prepare manuscripts for publication. Members of staff serve on the Undergraduate Committee. The Faculty Graduate Studies Committee and the Transformation Committee of Wits, as well as members of the Clinical Section of the division serve on the Council of the College of Medical Genetics of South Africa (CMGSA), with Prof Amanda Krause serving as President of the college. She was re-elected in 2017 for another triennium. Dr Anneline Lochan was elected as the Senator of the CMGSA. Prof. Amanda Krause has also served as chair of the Genetics Expert Committee of the NHLS, since July 2015. Prof Himla Soodyall was reappointed to the ASSAf council for the period from 2016-2020 and was also appointed to the sub-committee of the Inter Academy Partnership for 2016-2019.

3.1. Undergraduates

In the MBChB/BHSc courses, undergraduate teaching is provided to students in the course Molecular Medicine II. Genetics teaching to medical undergraduates also takes place in GEMP 1, 2 and 3. GEMP3 students rotate through the genetic counselling clinics held in the academic teaching hospitals of the Wits system. The division presents human and medical genetics lectures to undergraduates in dentistry, physiotherapy, speech therapy, pharmacy and occupational therapy.

3.2. Postgraduates

The division continues to offer the BHSc (Hons) Human Genetics degree. Twelve students graduated at the end of 2017 and 10 students were registered in 2018. Three students graduated with an MSc(Med) Genetic Counselling Degree in 2017, and three new students registered in 2018. The division currently has 17 students registered for an MSc (Med) by research and 11 for PhD degrees. There are currently three medical genetics registrars. The division has had the highest number of postgraduate students registered for many years. Members of the division are involved in teaching in several other postgraduate courses at Wits.

Table W26: Total number of trainees per qualification category and rates of successful completions/pass rates

		Hons		MSc (Med)		MSC (Med) GC		PhD		MMed	
2017	Registered	12	100%	15	13%	3	100%	13	23%	3	0%
	Graduated	12		2		3		3		0	
2018	Registered	10	0%	4	0%	3	0%	1	0%	3	0%
	Graduated	0		0		0		0		0	

3.3. Professional development

The division has one post-doctoral fellow. Three staff members are enrolled for higher degrees, one PhD and two MSc. Three genetic counsellor interns and four medical scientist interns started their training in February 2018.

4. Research sctivities

The research and development team has the important task of remaining abreast of the fast-paced field of genetic diagnostics and investigating new technologies that can improve the service that the Division of Human Genetics delivers. Two next-generation technologies (microarrays and NGS) are currently being investigated, to establish the implementation of these techniques into the routine diagnostic operations of the division.

Microarrays enable high-resolution genome analysis and allow the detection of submicroscopic chromosomal imbalances across the entire genome in a single experiment. It is a powerful method for detecting chromosomal alterations, and has been the gold standard for pre- and postnatal diagnosis globally, for several years. The team evaluated several microarray platforms to assess the best suited approach to our local capacity. The team is aiming for a fully operational implementation of microarrays in 2018.

NGS allows for substantial parallel analyses to be performed. The research and development team focused on the evaluation of an assortment of diagnostically relevant targeted gene sequencing panels, including those for breast cancer, neurodegenerative disorders and developmental disorders. Sequencing is currently performed at the NICD central sequencing facility (NHLS Sandringham), a partnership that has proven very successful in this endeavor.

A number of well-established research projects in the division have continued and expanded in 2017/2018, including those aimed at understanding FA, developmental delay, inherited breast cancer and HD in Africa, as well as the genomic diversity in Africa.

The division also embarked on a significant new project, that aims to characterise the genetic aspects of developmental disorders in Africa, a research area which is extremely poorly understood. The project will embrace clinical, genetic counselling and laboratory aspects of developmental disorders, with the hope of making notable impact on the services offered to patients. This project received a major grant from the NIH in 2017, as well as smaller grants from the NRF and the NHLS Research Trust.

4.1. Research projects

4.1.1 New research Initiatives - project titles

Project title: Association of the monoamine oxidase A (MAOA) variable number of tandem repeats (VNTR) with aggression and sensory processing sensitivity in the Birth to Twenty+ cohort
Researchers: S Wessels, A May and S Macaulay
Collaborators: L Richter (CoE Human Development) and S Norris (DPHRU, Wits)
Funding: CoE Human Development Opportunities Grant, NHLS Research Trust Grant and a Health and Welfare Sector Education and Training Authority (HWSETA) Postgraduate Bursary

Project title: Gene expression patterns in OCA2 patients of African descent with and without ephelides
Researchers: T Ngcungcu and M Ramsay
Collaborators: A Vlasova and RG Serra
Funding: Centre for Genomic Regulation (CRG) – Novartis – Africa Mobility Programme

Project title: The OCA2 gene control region and its possible role in the aetiology of Brown Oculocutaneous Albinism (BOCA) in black South Africans
Researchers: M Eisenberg, R Kerr and T Ngcungcu

Project title: Identifying disease-associated genetic changes in the PXDN gene
Researcher: N Carstens
Collaborator: D Mavri-Damelin
Funding: NRF funding for unrated researchers

Project title: Deciphering Developmental Disorders in Africa (DDD-Africa) - Evaluating Clinical Exome Sequencing in an African Setting
Researchers: Z Lombard, A Krause, N Carstens, F Baine-Savanhu, S Macaulay, R Kerr and C Feben
Collaborators: M Hurles, H Firth, A Middleton (Wellcome Trust Sanger Institute, UK); P Lukusa and A Lumaka (National Institute for Biomedical Research, Democratic Republic of Congo)
Funding: NIH

Project title: Establishing a Baseline for Developmental Disorder Diagnosis by Evaluating Current Processes and Mapping Common Benign Copy Number Variation in Africa
Researchers: E Wiener, Z Lombard and Amanda Krause
Collaborators: S Hazelhurst and S Aron
Funding: NIH

4.1.2 Ongoing research projects

Project title: An investigation into the spectrum of Huntington disease phenocopies in the South African population
Researchers: F Baine and A Krause
Funding: NHLS Research Trust

Project title: Investigating allele sequence diversity at the Huntington disease loci HTT and JPH3 in the South African population
Researchers: J Levesley, F Baine and A Krause
Collaborator: D Monckton (University of Glasgow)
Funding: MRC, University of Glasgow and NHLS Research Trust

Project title: The mutation spectrum of Rett Syndrome in South Africa
Researchers: E Vorster, F Essop and Amanda Krause
Funding: NHLS Research Trust Grant

Project title: A six-year review (2009–2014) of MLPA testing performed in patients with developmental delay at the Division of Human Genetics, NHLS, Johannesburg
Researchers: Q Goodyear, F Essop and A Krause

Project title: Evaluating the performance of the TruSight Multiplicom's One Sequencing Panel (Illumina Inc.) for diagnostic use in the Division of Human Genetics, NHLS, Johannesburg
Researcher: F Essop
Funding: NHLS Research Trust Grant

Project title: Development of a multi-disease targeted next generation sequencing panel to study genetic aetiology of RASopathies.
Researchers: M Mudau, N Carstens and A Krause
Funding: NRF Thuthuka Grant and NHLS Research Trust

Project title: Using a targeted next-generation sequencing (NGS) panel to examine the genetics of cohesinopathies in South African patients
Researchers: H Seymour, N Carstens, C Feben and Zane Lombard
Funding: NRF Thuthuka Grant and NHLS Research Trust

Project title: nvestigating the genetic aetiology of three facial dysostoses in South Africa
Researchers: P Nevondwe, N Carstens, R Kerr and C Spencer
Funding: NRF Thuthuka Grant

Project title: Developing focus to genetic diagnostic approaches for developmental delay in South Africa
Researchers: N Carstens, M Mudau, H Seymour, P Nevondwe, R Kerr, C Spencer, C Feben, Z Lombard and A Krause
Collaborator: E Honey (UP)
Funding: NRF Thuthuka Grant

Project title: Determining the RNA expression levels of SMN protein in the black South African non-SMN1 deletion patients clinically affected with spinal muscular atrophy
Researchers: O Tabane, E Vorster and A Krause
Collaborator: J Rodda (Paediatrics, Chris Hani Baragwanath Academic Hospital CHBAH)
Funding: NHLS Research Trust

Project title: Evaluation of the PowerPlex® Fusion kit to resolve complex kinship disputes in a South African setting
Researchers: M Moremi, V Sahibdeen and Himla Soodyall
Funding: NHLS Resaerch Trust

Project title: Exploring the psychology and genetics of sensory processing sensitivity in multicultural South Africa
Researchers: A May, M Pitman and Zane Lombard
Collaborators: L Richter (CoE Human Development) and S Norris (DPHRU, Wits)
Funding: CoE Human Development Opportunities Grant, NHLS Research Trust Grant and a HWSETA Postgraduate Bursary

Project title: Genetic risk factors for gestational diabetes in a black South African population
Researchers: N Botha, S Macaulay and Z Lombard
Funding: NRF Thuthuka Grant

Project title: The H19/IGF2 imprinted gene cluster and its role in birth weight in black South African individuals
Researchers: B Bailey, Z Lombard and S Macaulay
Collaborators: SA Norris (MRC/WITS Developmental Pathways for Health Research Unit)
Funding: NRF Thuthuka Grant

Project title:	nvestigating signatures of selection in Southern African populations
Researchers:	M Willemse, S Aron, A Choudhury and Z Lombard
Funding:	NRF
Project title:	Breastfeeding and the gut microbiome: impact on infant growth and -development in South Africa
Researchers:	V Sahibdeen and Z Lombard
Funding:	NRF Centre of Excellence in Human Development
Project title:	The effect of genetic variants, anthropometry and the environment on lipid profile in adults in Northern Ghana
Researchers:	G Agongo, A Oduro, N Crowther and M Ramsay
Funding:	NIH (USA) through the AWI-Gen project (grant number: 1U54HG006938-01) and the Forgarty International Centre Grant (grant number: ID43TW008330) under the umbrella of the Wits Non-Communcable Disease Research Leadership Programme
Project title:	Lactase persistence alleles reveal partial East African ancestry of southern African Khoe pastoralists
Researcher:	H Soodyall
Collaborators:	C Schlebusch and M Jakobsson (Uppsala University, Sweden)
Funding:	MRC and NHLS
Project title:	Natural selection for the Duffy-null allele in the recently admixed people of Madagascar
Researcher:	H Soodyall
Collaborator:	M Shriver (Penn State University, USA)
Funding:	MRC and NHLS
Project title:	A genomic portrait of haplotype diversity and signatures of selection in indigenous Southern African populations
Researcher:	H Soodyall
Collaborator:	R Ramesar (UCT, South Africa)
Funding:	MRC and other sources (NRF and NHLS for field work) and the Research Fund (Wits, Medical School)
Project title:	Endocrine profiling in black South African Fanconi anaemia patients, homozygous for a FANCG founder mutation
Researchers:	B Dillon, C Feben, A Krause and David Segal.
Collaborator:	R Wainwright
Funding:	Phyllis Knocker Bradlow Award and NHLS Research Trust
Project title:	An assessment of genetic predisposition in idiopathic dilated cardiomyopathy (IDCM) in Johannesburg.
Researchers:	C Bailly, A Krause, S Henriques and N Tsabedze
Project title:	The clinical and genetic profile of Huntington disease-Like 2 (HDL2) in South Africa
Researchers:	D Anderson, A Ferreira-Correia, F Baine and A Krause
Collaborators:	R Margolis (Johns Hopkins University, Baltimore, USA) and J Carr (Stellenbosch University)
Funding:	MRC Self-initiated Grant and NHLS Research Trust
Project title:	Black South African women's perspectives on the impact of having a child with a genetic disorder in their spousal relationship
Researcher:	T Haw
Collaborator:	S Henriques
Project title:	Genetic susceptibility to Atherosclerosis in Sub-Saharan African: The role of oxidative stress in the pathogenesis
Researchers:	R Boua, M Ramsay, A Choudhury and C Mathew
Funding:	The NIH (USA) through the AWI-Gen project (grant number: 1U54HG006938-01)

Project title: The genetic aetiology of oesophageal cancer in the South African black populations
Researchers: W Chen, C Mathew, R Kerr and CB de Villiers
Funding: CANSA Type A Grant, UKMRC/SAMRC Newton Fund for the ERICA-SA study: NRF Thuthuka grant

Project title: A systematic assessment of the SNV/CNV landscape in ADME genes in Southern African populations
Researchers: L Cottino and Venesa Sahibdeen
Collaborator: S Hazelhurst (Wits)
Funding: GSK

Project title: Investigating APOL1 risk ariants in related potential living kidney donors in South African Population
Researchers: M Govender, M Ramsay and J Fabian
Funding: NRF SARChI

Project title: Genetic Variants in Four Genes Associated with Lipid Levels: A Study in African Populations
Researchers: M Hayat, M Ramsay and R Kerr
Collaborator: D Raal
Funding: NRF SARChI

Project title: Differential gene expression in exfoliation syndrome and exfoliation glaucoma in the conjunctiva of black South Africans
Researchers: M Hulley, M Ramsay, T Ngcungcu and S Williams
Funding: MRC Self-Initiated Grant

Project title: Methylenetetrahydrofolate reductase gene polymorphisms and outcomes of methotrexate treatment in Black South Africans with rheumatoid arthritis
Researchers: E Mathabula, M Ramsay, N Govind and M Tikly
Funding: NRF SARChI

Project title: eQTLs for Pharmacogenes
Researchers: J Mathew, M Ramsay and D Mavri-Damelin
Funding: NRF SARChI

Project title: Bioinformatic analyses of transcriptome and genetic variation in black South Africans with systemic sclerosis
Researchers: P Mpangase, M Ramsay and S Hazelhurst
Funding: NRF SARChI and NRF Thuthuka Grant

Project title: Genetic and environmental factors associated with cognitive decline and the dementia spectrum in an ageing South African population
Researchers: C Soo, M Ramsay and Stephen Tollman
Funding: NIH (USA) and NRF Thuthuka Grant

4.2 Research awards and recognitions

Table 4: Research awards and recognitions received in 2017/2018

Name	Details
Dr Fiona Baine	African Cancer Leaders Institute (ACLI) class of 2017
Ms Bianca Carzis	Prestigious Masters Degree Award: research work and coursework
Dr Nadia Carstens	Elected to the SASHG committee at the August 2017 SASHG congress
Prof Amanda Krause	Re-elected President of CMGSA for 2017-2020
Dr Anneline Lochan	Elected Senator of CMGSA for 2017-2020
Zané Lombard	Elected to the SASHG committee at the August 2017 SASHG congress.
Dr Thandiswa Ngcungcu	Certificate of commendation for outstanding quality of PhD
Prof Himla Soodyall	Reappointed as Chairperson of the Research Development Committee (RDC) and on the Research and Innovation Committee (RIC) at NHLS
Prof Himla Soodyall	Reappointed to the Council of the ASSAf for 2016-2020
Prof Himla Soodyall	Reappointed as General Secretary of the ASSAf for 2016-2020
Prof Himla Soodyall	Appointed to the sub-committee of the InterAcademy Partnership, "Harnessing Science, Engineering, and Health to address challenges in Africa" for 2016-2019
Dr Careni Spencer	Elected to the SASHG Committee at the August 2017 SASHG congress

4.3 Grant funding

Table W27: Grant funding

Name of grant holder	Title of research project	Awarded by	Period	Amount
Dr Nadia Carstens	Developing focus to genetic diagnostic approaches for developmental delay in South Africa	NRF Thuthuka Grant Award	2017-2019	~R400 000 per year
Dr Nadia Carstens	Mutation screening in SA patients with DD, using a targeted NGS-panel	NHLS Research Trust Development Award	2017-2019	R96 000
Dr Nadia Carstens	Using a targeted next-generation sequencing (NGS) panel to examine the genetics of cohesinopathies in South African patients	NHLS Research Trust Development Award	2017-2019	R99 000
Prof Amanda Krause	Investigating allele sequence diversity at the Huntington disease loci HTT and JPH3 in the South African population	NHLS Research Trust Development Award	2017-2019	R93 500
Prof Amanda Krause	The contribution of de novo mutations to developmental disorders in Africa	NHLS Research Trust Development Award	2017-2019	R497 238.00
Dr Zané Lombard, Prof Amanda Krause, Dr Nadia Carstens	Deciphering Developmental Disorders in Africa (DDD-Africa) - Evaluating Clinical Exome Sequencing in an African Setting	NIH	2017-2022	R15,271,224.00

Name of grant holder	Title of research project	Awarded by	Period	Amount
Mr Andrew May	Exploring the psychology and genetics of sensory processing sensitivity in multicultural South Africa	NHLS Research Trust Development Award	2016 – 2018	R100 000.00
Ms MM Moremi	Evaluation of the PowerPlex® Fusion kit to resolve complex kinship disputes in a South African setting	NHLS Research Trust Development Grant	2017-2019	R100 000.00
Mr Phelelani Mpangase	Bioinformatic analyses of transcriptome and genetic variation in black South Africans with systemic sclerosis	NRF Thuthuka Funding Instrument	2016 –18	R 161 860.00
Dr Venesa Sahibdeen	Infant Feeding Practices and the Gut Microbiome: Impact on Infant Growth and Development in South Africa	NRF Thuthuka Grant	2019-2020	R~300 000 pa
Dr Venesa Sahibdeen	Infant Feeding Practices and the Gut Microbiome: Impact on Infant Growth and Development in South Africa	Wits FRC funding	2017	R10 000

5. Research output

5.1. Journal articles

Acuna-Hidalgo R, Deriziotis P, Steehouwer M, Gilissen C, Graham SA, van Dam S, Hoover-Fong J, Telegrafi AB, Destree A, Smigiel R, Lambie LA, Kayserili H, Altunoglu U, Lapi E, Uzielli ML, Aracena M, Nur BG, Mihci E, Moreira LM, Borges Ferreira V, Horovitz DD, da Rocha KM, Jezela-Stanek A, Brooks AS, Reutter H, Cohen JS, Fatemi A, Smitka M, Grebe TA, Di Donato N, Deshpande C, Vandersteen A, Marques Lourenço C, Dufke A, Rossier E, Andre G, Baumer A, Spencer C, McGaughran J, Franke L, Veltman JA, De Vries BB, Schinzel A, Fisher SE, Hoischen A, van Bon BW; Overlapping SETBP1 gain-of-function mutations in Schinzel-Giedion syndrome and hematologic malignancies PLoS Genet. 2017.Mar 27;13(3):e1006683

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Macaulay S, Goodyear QC, Kruger M, Chen W, Essop F, Krause A; The first two confirmed sub-Saharan African families with germline TP53 mutations causing Li-Fraumeni syndrome. Familial Cancer. 2018. DOI: org/10.1007/s10689-018-0075-5

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5.2. Complete books

- Kromberg J, Manga P (Editors) "Albinism in Africa". Elsevier Academic Press, San Diego 2018. [See section 5.3 below for book chapters authored by staff members]

5.3 Book chapters

- Kromberg JGR. Chapter 1. Introduction and Historical Background. pp 1-25
- Kromberg JGR. Chapter 2. Clinical Features, Types of Albinism and Natural History. pp 27-55
- Kromberg JGR. Chapter 3. Epidemiology of Albinism. pp 57-79.
- Manga P. Chapter 5. Molecular Biology of Albinism. pp 99-119
- Kromberg JGR. Chapter 9. Psychosocial and Cultural Aspects of Albinism. Pp 172-201.
- Kromberg JGR. Chapter 10. Genetic Counseling and Albinism. pp 203-233
- Kerr R, Kromberg JGR. Chapter 11. Genetic Testing, Postnatal and Prenatal Diagnosis for Albinism. pp 235-256.
- Kromberg JGR. Chapter 13. Interventions: Preventive Management. Empowerment, Advocacy and Support Services. Pp 272-293.
- Mazibuko NG, Kromberg JGR. Chapter 14. A Personal Perspective: Living with Albinism. Pp 295-307
- Kromberg JGR, Manga P. Chapter 15. Summary and Conclusion. pp 310-325.
- Soodyall H and Reagon F (2017). Human Variation: What can we learn from Genetics? In Living Together, Living Apart: Social Cohesion in a Future South Africa. Edited by Ballantine, M Chapman, K Erwin and G Mare, UKZN Press: Durban, pp. 16-28

5.4 Conference presentations

Table W28: Number of conference presentations

	International congresses	National congresses	Local congresses
Number of presentations by Human Genetics staff and students	5	7	15

Molecular Medicine and Haematology

Head of Department: Prof Wendy Stevens

1. About the Department

The Department of Molecular Medicine and Haematology comprises a number of divisions which continue to support the triple mandate of service delivery, teaching and training and research. Excellence in all three components is a function of the diversity of skills and commitment from staff members in a background of innovation. The department hosts the NNP, which supports the NDoH and is considered a global leader in implementation sciences. The haematology division is the largest single training unit and is an acknowledged leader in undergraduate and postgraduate education. Several research units are associated with the department and include the HIV Pathogenesis Unit, the Antiviral Gene Therapy Research Unit and the Red Cell Membrane Unit. The department thus produces cutting-edge research as evidenced by the number of peer-reviewed publications, conference presentations and the contributions to policy, both locally and globally.

2. Diagnostic services

The department continues to focus on implementing world-class diagnostic technology in the fields of haematology, molecular medicine and for the NPP. The department is responsible for maintaining academic activities at CMJAH, Chris Hani Baragwanath Academic Hospital and Helen Joseph Hospital. Another focus area of the department is the scaled implementation of novel molecular diagnostics for both cancer and infectious diseases. We also prioritised and invested in total laboratory automation, across divisions. Under the NPP umbrella, numerous programmes are managed, which includes national HIV and TB laboratory programmes.

The following are subdivisions of the Department of Molecular Medicine and Haematology:

- Haematology Division
  Prof Johnny Mahlangu. Laboratory Manager: Tuis Mogoregi
  - Automated Haematology – Dr Elise Schapkaitz
  - Morphology – Dr Sharon Officer
  - Coagulation – Dr Susan Louw
  - Haematinics – Professor Nazeer Alli
- Somatic cell Genetics Unit
  - Dr Pascale Willem
- Flow Cytometry and CD4 Division
  - Professor Deborah Glencross, Laboratory Manager: Denise Lawrie
- Molecular Diagnostics
  - Dr Sergio Carmona, Laboratory Managers: Drs Kim Steegen, Perry Hlalele and Irene Ketseoglou
- Immunohaematology
  - Dr Elizabeth Mayne
- Clinical Haematology
  - Prof Barry Jacobsen
- Chris Hani Baragwanath Academic Hospital, Haematology
  - Prof Nazeer Alli
- Helen Joseph Hosptital Haematology
  - Dr Sarolta Kerestes

Table Wits 29: Total number of staff per profession

Pathologists	Registrars	Scientists	Technologists	Technicians	Lab assistants
1	0	2	6	3	0
2	0	9	10	3	1
8	17	0	15	5	0
3	0	4	8	4	4
1		2			
15	18	17	39	15	5

More recently, due to national staff shortages, the morphology unit has supported work from five hospitals in KZN.

3. Teaching, training and professional development

Each unit within the department contributes to teaching output at various levels, at both the NHLS and Wits.

3.1 Undergraduate level

Dr Penelope Keene, Dr Natalie Whalley, Dr Kumaran Chetty and Dr Elizabeth Mayne.
The Department of Molecular Medicine remains committed to undergraduate education. As such, we are significantly involved in undergraduate teaching in the Faculty of Health Sciences at Wits. The department (Dr P Keene, Dr N Whalley and Prof K Chetty), coordinates Molecular Medicine II, a full course for MBChB II and BHSc II students, and additional teaching is offered by the departments of human genetics and infectious diseases.

The student numbers are steadily increasing and there is currently e over 370 students registered. In 2017 there were 333 students with a pass rate of 85.3%. This innovative course is an early introduction to the molecular aspects of the pathophysiology of cancer, genetics and infectious diseases and also provides a foundation in immunology, one of the most important basic sciences in medicine today. The popularity of this course encourages BHSc students to apply for Molecular Medicine III and this latter course is thriving under the leadership of Dr Betty Mowa.

In 2017, there were eight students with a 100% pass rate and in 2018 the number has increased to 12. Molecular Medicine for biomedical engineers {BEngSc (BME)}) is a half course coordinated by Dr Gavin Owen and Ms Thuli Khanyile. There were 46 students in 2017 and the pass rate was 72%. The Hons course is run by Dr Natalie Whalley. In 2017 there were 11 students with a 100% pass rate. In 2018 there are nine students. Haematology teaching is provided mainly for MBBCh III/GEMP 1 students. This is delivered as a six-week block, coordinated by Dr P Keene.

The department actively participates in undergraduate teaching committees and continues to provide input into the curriculum development. We furthermore commit to a 360-degree evaluation, which reflects in the undergraduate performance (table 2). The department received a number of awards for undergraduate teaching, including the award for the Best Department and the Most Inspiring Lecturer (Dr Penny Keene). There is a steady increase in candidates as illustrated in the table below:

Table W 30: Undergraduate courses and student teaching numbers

	2016		2017		2018
	Student numbers	Student pass rates	Student numbers	Student pass rates	Student enrolments
Graduate entry medical programme 1	346	93.6%	348	89.7%	382
Biomedical engineering	34	79%	46	72%	55
Molecular Medicine 2	329	80.5%	333	85.3%	376
Molecular Medicine 3	17	100%	8	100%	12

3.2 Postgraduate level

The department facilitates training for a number of postgraduate students (BSc Honours, Mmed (Haem), MSc, PhD and post-doctoral fellows.

3.3 Other

Table Wits 31: Total number of trainees and successful completion per qualification/profession

	PhD thesis Haem 900	MSc (Med) Haem 8006	Registrars MMed(Haem)	Intern medical scientists	Honours	All	South Africans
Total number of trainees	9	9	18	6	12	54	38
Final year trainees	4	1	2	2	12	18	18
Successful completion	2	5	2	Pending	12	14	14

4. Awards and recognitions

- Professor Mahlangu was elected President of the College of Pathologists of South Africa (C PATH);
- Professor Mahlangu was appointed to the Ministerial Advisory Board on Cancer; and
- Professor Stevens was appointed to National HIV and TB think tanks.

5. Research activities

5.1 Research projects

There are approximately 78 grants located within the department of varying sizes across different donors.

Project title: Establishment of an African Laboratory Innovation Hub
Principal investigator: Prof W Stevens (Wits, NHLS)
Co-researcher: Prof L Scott
Funding: Bill an d Melinda Gates Foundation
Short description: Formation of an Innovation Hub for novel diagnostics and implementation
Project start date: August 2017
Project end date: December 2020

Project title: Supported Systems for rapid impact on TB control
Principal investigator: Prof W Stevens (Wits, NHLS)
Co-researcher: Prof Lesley Scott
Funding: Newton Fund/MRC
Short description: TB Diagnostics
Project start date: 2015
Project end date: Current

Project title: Affordable: diagnostics for HIV and TB for implementation into an ARV treatment programme in South Africa
Principal investigator: Prof W Stevens (Wits, NHLS)
Co-researcher: Prof L Scott
Funding: USAID/PEPFAR
Project start date: 2006
Project end date: Current

Project title: HIV drug resistance testing capacity, expansion of GeneXpert TB programme
Principal investigator: Prof W Stevens (Wits, NHLS)
Co-researcher: Prof L Scott
Funding: Global Fund
Short description: TB and HIV Diagnostics
Project start date: August 2016
Project end date: December 2019

Project title: Establishment of Biorepository (H3Africa)
Principal investigator: Dr E Mayne
Collaborators: A Abimiku [Institute of Human Virology Nigeria H3Africa Biorepository (I-HAB)]. and M Joloba (Makerere University)
Funding: NIH
Short description: Establishment of a biorepository
Project start date: August 2014
Project end date: June 2019

Project title: Comparison of Local Paediatric immune reference ranges
Principal investigators: Prof D Glencross and Dr D Lawrie
Funding: Wellcome Trust
Short description:
Project start date:
Project end date:

Project title: Implementation of screening for early Cryptococcal disease in severely immunosuppressed HIV positive patients with CD4 counts < 100 cells/ul, as a reflexed test in NHLS CD4 labs. CAST-NET: Cryptococcal Antigen Screen-and-Treat National Evaluation Team
Principal investigators: Prof D Glencross and Dr L Coetzee (Wits, NHLS)
Co-researcher: Prof N Govender
Funding: CDC
Short description: Cryptococcal disease detection

Project title: To provide technical assistance to USAID Missions, Ministries of Health and in-country partners in Malawi, Mozambique and Zambia with the overall objective of strengthening the central viral load progam (Equip)

Principal investigator: Prof W Stevens (Wits, NHLS)
Co-researcher: Prof I Sanne
Funding: USAID
Short description: Laboratory strengthening
Project start date: 2016
Project end date: December 2021

Project title: Combining Xpert and GIS to identify areas of high tuberculosis transmission
Principal investigators: Prof W Stevens and Prof L Scott
Funding: NIH
Short description: Tuberculosis diagnostics
Project start date: 2016
Project end date: December 2021

Project title: Implementing a programme of laboratory services to strengthen the Department of Correctional Services (DCS)' HIV and TB care and treatment services
Principal investigator: Prof W Stevens
Funding: CDC
Short description: Tuberculosis and HIV diagnostics
Funding: Global Fund
Project start date: 2014
Project end date: March 2019

Project title: Analysis of the Methylome in South African Oesophageal Squamous Cell Carcinoma
Principal investigators: P Willem (NHLS, Wits) and M Moodley (NHLS, Wits)
Co-researchers: Prof CG Mathews (Sydney Brenner Institute for Molecular Bioscience, Wits, the Department of Medical and Molecular Genetics and King's College London, UK)

Collaborators:	Prof MI Parker (ICGEB) and Medical Biochemistry, UCT
Funding:	NRF Newton Grant
Short description:	The aim of this project is to analyze the methylation profiles in oesophageal squamous cell carcinoma (OSCC) of South African patients.
Project start date:	March 2018
Project end date:	December 2020
Project title:	Genomic Characterization of HIV-associated Burkitt Lymphoma to Improve Treatment strategies
Principal investigators:	H Van Zijl (NHLS) and P Willem (NHLS)
Collaborators:	Y Perner (NHLS), E McAlpine (NHLS) and S Meer (NHLS)
Funding:	NHLS Research Trust
Short description:	To identify genomic aberrations, including single nucleotide mutations, insertions/deletions and fusion transcripts in the coding genome of a cohort of well-characterized HIV-associated BL.
Project start date:	December 2019
Project end date:	January 2017

Project title:	The coding genome of HIV-associated plasmablastic lymphomas in South Africa
Principal investigator:	P Willem (Department of Haematology and Molecular Medicine, NHLS and Wits)
Co-researchers:	L Pasqualucci (Institute for Cancer Genetics, Columbia University, New York, United States) and R Rabadan (Departments of Systems Biology and Biomedical Informatics, Columbia University, New York, NY, United States)
Collaborators:	Zi Liu (Departments of Systems Biology and Biomedical Informatics, Columbia University, New York, NY, United States), Y Perner (Department of Anatomical Pathology, NHLS and Wits), S Meer (Department of Anatomical Pathology, NHLS and Wits), P Patel (Department of Haematology and Molecular Medicine, NHLS and Wits) and D Engelbrecht (Department of Haematology and Molecular Medicine, NHLS and Wits)
Funding:	NIH R21CA192854-02
Short description:	To dissect the genetic profile of PBL by integrating genome-wide copy number analysis, whole exome sequencing (WES) and RNA-sequencing in a well-annotated panel of tumors.
Project start date:	1 May 2015
Project end date:	30 April 2018

Project title:	Genetic studies of HIV-associated cervical cancer
Principal investigator:	P Willem (NHLS, Wits)
Co-researchers:	GL Cook, (Somatic Cell Genetics Unit, NHLS) and D Engelbrecht (Somatic Cell Genetics Unit, NHLS)
Collaborators:	T Omar (Histopathology, NHLS), C Firnhaber, (Histopathology, NHLS, SA Clinical Society; Right to Care, Clinical Division, Themba Lethu Clinic, Helen Joseph Hospital.
Funding:	NHLS Research Trust
Short description:	Genetic aberrations in HIV-associated cervical cancer specimens.
Project start date:	1 December 2014
Project end date:	31 December 2017 (final data analysis and reporting currently underway)

6. Research output

6.1 Journal publications

Meintjes G, Moorhouse MA, Carmona S, Davies N, Dlamini S, van Vuuren C, et al; Adult antiretroviral therapy guidelines. South Afr J HIV Med. 2017;18(1):776

Coetzee LM, Cassim N, Glencross DK; Analysis of HIV disease burden by calculating the percentages of patients with CD4 counts <100 cells/microL across 52 districts reveals hot spots for intensified commitment to programmatic support. S Afr Med J. 2017;107(6):507-13

Singh K, Okombo J, Brunschwig C, Ndubi F, Barnard L, Wilkinson C, et al; Antimalarial Pyrido[1,2-a]benzimidazoles: Lead Optimization, Parasite Life Cycle Stage Profile, Mechanistic Evaluation, Killing Kinetics, and in Vivo Oral Efficacy in a Mouse Model. J Med Chem. 2017;60(4):1432-48

Alli N, Vaughan J, Patel M. An approach to anaemia diagnosis - concerns in primary care. S Afr Med J. 2017;107(11):12116
Saragas NP, Ferrao PN, Jacobson BF, Saragas E, Strydom A; The benefit of pharmacological venous thromboprophylaxis in foot and ankle surgery. S Afr Med J. 2017;107(4):327-30

Schapkaitz E, Mezgebe MH; The Clinical Significance of Schistocytes: A Prospective Evaluation of the International Council for Standardization in Hematology Schistocyte Guidelines. Turk J Haematol. 2017; 34(1):59-63

Cobb B, Simon CO, Stramer SL, Body B, Mitchell PS, Reisch N, et al; The cobas(R) 6800/8800 System: a new era of automation in molecular diagnostics. Expert Rev Mol Diagn. 2017; 17(2):167-80

Paredes R, Tzou PL, van Zyl G, Barrow G, Camacho R, Carmona S, et al; Collaborative update of a rule-based expert system for HIV-1 genotypic resistance test interpretation. PLoS One. 2017;12(7):e0181357

Hodkinson KE, Mahlangu JN. Deep-vein thrombosis in the era of high HIV and tuberculosis prevalence: A prospective review of its diagnosis and treatment in a quaternary centre. S Afr Med J. 2017;107(10):859-63

Cox H, Dickson-Hall L, Ndjeka N, Van't Hoog A, Grant A, Cobelens F, et al; Delays and loss to follow-up before treatment of drug-resistant tuberculosis following implementation of Xpert MTB/RIF in South Africa: A retrospective cohort study. PLoS Med. 2017;14(2):e1002238

Heritier L, Verneau O, Smith KG, Coetzer C, Du Preez LH; Demonstrating the value and importance of combining DNA barcodes and discriminant morphological characters for polystome taxonomy (Platyhelminthes, Monogenea). Parasitol Int. 2018;67(1):38-46

Venter WD, Ford N, Vitoria M, Stevens W; Diagnosis and monitoring of HIV programmes to support treatment initiation and follow up and improve programme quality. Curr Opin HIV AIDS. 2017;12(2):117-22

Scott L, da Silva P, Boehme CC, Stevens W, Gilpin CM; Diagnosis of opportunistic infections: HIV co-infections - tuberculosis. Curr Opin HIV AIDS. 2017;12(2):129-38

Schapkaitz E, Schickerling TM; The Diagnostic Challenge of Acquired Thrombotic Thrombocytopenic Purpura in Children: Case Report and Review of the Literature. Lab Med. 2018

Peter T, Ellenberger D, Kim AA, Boeras D, Messele T, Roberts T, et al; Early antiretroviral therapy initiation: access and equity of viral load testing for HIV treatment monitoring. Lancet Infect Dis. 2017;17(1):e26-e9

Hermans LE, Moorhouse M, Carmona S, Grobbee DE, Hofstra LM, Richman DD, et al; Effect of HIV-1 low-level viraemia during antiretroviral therapy on treatment outcomes in WHO-guided South African treatment programmes: a multicentre cohort study. Lancet Infect Dis. 2018;18(2):188-97

Oldenburg J, Mahlangu JN, Kim B, Schmitt C, Callaghan MU, Young G, et al; Emicizumab Prophylaxis in Hemophilia A with Inhibitors. N Engl J Med. 2017;377(9):809-18

Cassim N, Schnippel K, Coetzee LM, Glencross DK; Establishing a cost-per-result of laboratory-based, reflex Cryptococcal antigenaemia screening (CrAg) in HIV+ patients with CD4 counts less than 100 cells/mul using a Lateral Flow Assay (LFA) at a typical busy CD4 laboratory in South Africa. PLoS One. 2017;12(2):e0171675

Cassim N, Coetzee LM, Schnippel K, Glencross DK; Estimating the cost-per-result of a national reflexed Cryptococcal antigenaemia screening program: Forecasting the impact of potential HIV guideline changes and treatment goals. PLoS One. 2017;12(8):e0182154

Louw SJ, Mayne ALH, Mayne ES. Evaluation of the diagnostic utility of individual parameters in the disseminated intravascular coagulation (DIC) panel for use in underresourced settings. Int J Lab Hematol. 2018

Schapkaitz E, RabuRabu S; Evaluation of the InteRRliner automated erythrocyte sedimentation rate analyzer for a large academic laboratory. Int J Lab Hematol. 2017;39(3):e66-e9
Young JE, Grabell J, Tuttle A, Bowman M, Hopman WM, Good D, et al; Evaluation of the self-administered bleeding assessment tool (Self-

BAT) in haemophilia carriers and correlations with quality of life. Haemophilia. 2017;23(6):e536-e8
Murray TY, Sherman GG, Nakwa F, MacLeod WB, Sipambo N, Velaphi S, et al; Field Evaluation of Performance of Alere and Cepheid Qualitative HIV Assays for Pediatric Point-of-Care Testing in an Academic Hospital in Soweto, South Africa. J Clin Microbiol. 2017;55(11):3227-35

Mayne ES CT, Abimiku A, Joloba M, Kyobe S, Beiswanger CM, Wideroff L, Guyer, Troyer J, Kader M; and H3Africa Biorepository Working Group; Genes for Life: Biobanking for genetic research in Africa. Biopreservation and Biobanking. 2017;15(2):83

Abimiku AME, Joloba M, Beiswanger CM, Troyer J, Wideroff L and the H3Africa Biorepository Working Group; H3Africa Biorepository Program : Supporting Genomics Research on AfricanPopulations by Sharing High-Quality Biospecimens. Biopreservation and Biobanking. 2017;15(2)

Steegen K, Bronze M, Papathanasopoulos MA, van Zyl G, Goedhals D, Variava E, et al; HIV-1 antiretroviral drug resistance patterns in patients failing NNRTI-based treatment: results from a national survey in South Africa. J Antimicrob Chemother. 2017;72(1):210-9

Coetzee J, Hunt G, Jaffer M, Otwombe K, Scott L, Bongwe A, et al; HIV-1 viraemia and drug resistance amongst female sex workers in Soweto, South Africa: A cross sectional study. PLoS One. 2017;12(12):e0188606

Carmona S, Peter T, Berrie L. HIV viral load scale-up: multiple interventions to meet the HIV treatment cascade. Curr Opin HIV AIDS. 2017;12(2):157-64

Jordan MR, Penazzato M, Cournil A, Vubil A, Jani I, Hunt G, et al; Human Immunodeficiency Virus (HIV) Drug Resistance in African Infants and Young Children Newly Diagnosed With HIV: A Multicountry Analysis. Clin Infect Dis. 2017;65(12):2018-25

Stevens WS, Scott L, Noble L, Gous N, Dheda K. Impact of the GeneXpert MTB/RIF Technology on Tuberculosis Control. Microbiol Spectr. 2017;5(1)

Jacobson KR, Barnard M, Kleinman MB, Streicher EM, Ragan EJ, White LF, et al; Implications of Failure to Routinely Diagnose Resistance to Second-Line Drugs in Patients With Rifampicin-Resistant Tuberculosis on Xpert MTB/RIF: A Multisite Observational Study. Clin Infect Dis. 2017;64(11):1502-8

Oldenburg J, Kulkarni R, Srivastava A, Mahlangu JN, Blanchette VS, Tsao E, et al; Improved joint health in subjects with severe haemophilia A treated prophylactically with recombinant factor VIII Fc fusion protein. Haemophilia. 2018;24(1):77-84

Technau KG, Kuhn L, Coovadia A, Carmona S, Sherman G; Improving early identification of HIV-infected neonates with birth PCR testing in a large urban hospital in Johannesburg, South Africa: successes and challenges. J Int AIDS Soc. 2017;20(1):21436

Maskew M, Bor J, Hendrickson C, MacLeod W, Barnighausen T, Pillay D, et al; Imputing HIV treatment start dates from routine laboratory data in South Africa: a validation study. BMC Health Serv Res. 2017;17(1):41

Croxton T SC, Musinguzi H, Kader M, Ozumba P, Pillay A, Syed R, Swartz G, Kyobe S, Lwanga N, Katabazi F, Edgar K, Ndidi A, Jonathan E, Onyemata E, Isaacs S, Mayne ES, Joloba M, Jentsch U, Abayomi A, Abimiku A, Troyer J, Penno S and H3Africa Biorepository PI Committee; Lessons Learned from Biospecimen Shipping Among the Human Heredity and Health in Africa Biorepositories. Biopreservation and Biobanking. 2017;15(2)

Pasi KJ, Fischer K, Ragni M, Nolan B, Perry DJ, Kulkarni R, et al; Long-term safety and efficacy of extended-interval prophylaxis with recombinant factor IX Fc fusion protein (rFIXFc) in subjects with haemophilia B. Thromb Haemost. 2017;117(3):508-18

Escobar MA, Tehranchi R, Karim FA, Caliskan U, Chowdary P, Colberg T, et al; Low-factor consumption for major surgery in haemophilia B with long-acting recombinant glycoPEGylated factor IX. Haemophilia. 2017;23(1):67-76

Clouse K, Vermund SH, Maskew M, Lurie MN, MacLeod W, Malete G, et al; Mobility and Clinic Switching Among Postpartum Women Considered Lost to HIV Care in South Africa. J Acquir Immune Defic Syndr. 2017;74(4):383-9
Chikaonda T, Ketseoglou I, Nguluwe N, Krysiak R, Thengolose I, Nyakwawa F, et al; Molecular characterisation of rifampicin-resistant Mycobacterium tuberculosis strains from Malawi. Afr J Lab Med. 2017;6(2):463

Stevens WS, Gous NM, MacLeod WB, Long LC, Variava E, Martinson NA, et al; Multidisciplinary Point-of-Care Testing in South African Primary Health Care Clinics Accelerates HIV ART Initiation but Does Not Alter Retention in Care. J Acquir Immune Defic Syndr. 2017;76(1):65-73

Rhee SY, Varghese V, Holmes SP, Van Zyl GU, Steegen K, Boyd MA, et al; Mutational Correlates of Virological Failure in Individuals Receiving a WHO-Recommended Tenofovir-Containing First-Line Regimen: An International Collaboration. EBioMedicine. 2017;18:225-35

Schapkaitz E, Moyake B; Participation in the national external quality assessment scheme as a tool to evaluate quality improvement in a South African laboratory. Int J Lab Hematol. 2017;39(3):e80-e3

Mayne ES, Mayne ALH, Louw SJ. Pathogenic factors associated with development of disseminated intravascular coagulopathy (DIC) in a tertiary academic hospital in South Africa. PLoS One. 2018;13(4):e0195793

Schapkaitz E, Raburabu S; Performance evaluation of the new measurement channels on the automated Sysmex XN-9000 hematology analyzer. Clin Biochem. 2018;53:132-8

Schapkaitz E, Khoza P; Performance evaluation of the white cell precursor channel on the Sysmex XN hematology analyzer in HIV specimens. J Clin Lab Anal. 2017

Scott L, David A, Noble L, Nduna M, Da Silva P, Black A, et al; Performance of the Abbott RealTime MTB and MTB RIF/INH Assays in a Setting of High Tuberculosis and HIV Coinfection in South Africa. J Clin Microbiol. 2017;55(8):2491-501

Chikaonda T, Nguluwe N, Barnett B, Gokhale RH, Krysiak R, Thengolose I, et al; Performance of Xpert((R)) MTB/RIF among tuberculosis outpatients in Lilongwe, Malawi. Afr J Lab Med. 2017;6(2):464

Coetzee LM, Glencross DK; Performance verification of the new fully automated Aquios flow cytometer PanLeucogate (PLG) platform for CD4-T-lymphocyte enumeration in South Africa. PLoS One. 2017;12(11):e0187456

Carmona S, Bor J, Nattey C, Maughan-Brown B, Maskew M, Fox MP, et al; Persistent High Burden of Advanced HIV Disease Among Patients Seeking Care in South Africa's National HIV Program: Data From a Nationwide Laboratory Cohort. Clin Infect Dis. 2018;66(suppl_2):S111-S7

van der Watt ME, Reader J, Churchyard A, Nondaba SH, Lauterbach SB, Niemand J, et al; Potent Plasmodium falciparum gametocytocidal compounds identified by exploring the kinase inhibitor chemical space for dual active antimalarials. J Antimicrob Chemother. 2018.

Lentz SR, Rangarajan S, Karim FA, Andersen PD, Arkhammar P, Rosu G, et al; The potential correlation between patient-reported symptoms and the use of additional haemostatic medication for joint bleeding in haemophilia patients with inhibitors: a post hoc exploratory analysis of recombinant activated factor VII data from the ADEPT2 trial. Blood Coagul Fibrinolysis. 2017;28(3):224-9

Schapkaitz E, Sithole J; Predictors of warfarin dose requirements in South African patients attending an anticoagulation clinic. J Vasc Nurs. 2017;35(1):27-30

Vaughan JL, Wiggill TM, Alli N, Hodkinson K; The prevalence of HIV seropositivity and associated cytopenias in full blood counts processed at an academic laboratory in Soweto, South Africa. S Afr Med J. 2017;107(3):264-9

Cassim N, Smith H, Coetzee LM, Glencross DK; Programmatic implications of implementing the relational algebraic capacitated location (RACL) algorithm outcomes on the allocation of laboratory sites, test volumes, platform distribution and space requirements. Afr J Lab Med. 2017;6(1):545.

Mahlangu JN, Andreeva TA, Macfarlane DE, Walsh C, Key NS; Recombinant B-domain-deleted porcine sequence factor VIII (r-pFVIII) for the treatment of bleeding in patients with congenital haemophilia A and inhibitors. Haemophilia. 2017;23(1):33-41
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Essajee S, Bhairavabhotla R, Penazzato M, Kiragu K, Jani I, Carmona S, et al; Scale-up of Early Infant HIV Diagnosis and Improving Access to Pediatric HIV Care in Global Plan Countries: Past and Future Perspectives. J Acquir Immune Defic Syndr. 2017;75 Suppl 1:S51-S8

Kyobe S MH, Lwanga N, Kezimbira D, Kigozi E, Katabazi FA, Wayengera M, Joloba M, Abayomi EA, Swanepoel C, Abimiku A, Croxton T, Ozumba P, Thankgod A, Cristoffels A, Van Zyl L, Mayne ES, Kader M and Swartz, G and the H3Africa Biorepository PI Working Group; Selecting a Laboratory Information Management System for Biorepositories in Low- and Middle-Income Countries: The H3Africa Experience and Lessons Learned. Biopreservation and Biobanking. 2017;15(2)

Schapkaitz E. Stability of New Erythrocyte and Reticulocyte Parameters in Testing for Anemia on the Sysmex XN 9000. Lab Med. 2018

Shapiro AD, Mahlangu JN, Perry D, Pasi J, Quon DV, Chowdary P, et al; Treatment of bleeding episodes with recombinant factor VIII Fc fusion protein in A-LONG study subjects with severe haemophilia A. Haemophilia. 2017;23(3):392-9

6.2 Conference presentations (oral, poster)

Table Wits 32: Conference attendance

Name	Title of presentation	Oral/poster	Name of congress	Local or international
Bailly J, Louw S	Safety and efficacy of adjusted dose enoxaparin in pregnant patients with a perceived risk of venous thromboembolism (VTE)	Oral	SASTH, Johannesburg, October 2017.	Local
Baker G, Khammissa R, Willem P, Meer S and Altini M	KIT gene mutations and expression in South African oral mucosal melanoma	Poster	PathReD Congress, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017.	Local
Benade E	Surface light chain expression in B-cell acute lymphoblastic leukaemia with translocation t(1;19) (q23;p13.3) E2A-PBX1: A case series	Poster	XIV International Congress of Paediatric Laboratory Medicine; 20-22 October 2017.	International
Brown J, Willem P.	Cytoscan™ HD Validation for detection of copy number aberrations in CLL		PathReD Congress, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017.*	Local
Cassim N, Coetzee LM, Tepper M, Bahule M, Glencross DK	TAT as a risk model for operational services	Invited oral	PathReD Congress, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017.	Local
Coetzee LM, Cassim N, Glencross DK	Rapid scale up of reflexed Cryptococcal antigen (CrAg) screening across a CD4 laboratory network in South Africa	Poster:MOPED1129	IAS Conference 2017, Paris, France, 23-26 July 2017	International
Coetzee LM, Cassim N, Glencross DK	Cryptococcal Antigen (CrAg) positivity rates reported from a national CD4-reflexed screening programme identify high-risk regions of co-existent HIV/Cryptococcal disease, requiring urgent programmatic focus into care	Invited oral	11th Interest Workshop, Lilongwe, Malawi, 16-19 May 2017.	International

Name	Title of presentation	Oral/poster	Name of congress	Local or international
Coetzee LM, Cassim N, Glencross DK	Cryyptococcal Antigen (CrAg) positivity rates reported from a national CD4-reflexed screening programme identifies high-risk regions of co-existent HIV/Cryptococcal disease	Invited oral	PathReD Congress, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017.	Local
Coetzee LM, Cassim N, Glencross DK	District and sub district analyses of CD4 counts <100cells/µl identify areas with higher rate of late presentation for ART initiation and risk for opportunistic infections	Poster: PRC15-121 (Honourable mention from Chairman)	PathReD Congress, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017.	Local
Coetzee LM, Durry S, Glencross DK	Comparison of the new fully automated volumetric Aquios flow cytometer PanLeucogate (PLG) platform for CD4-T lymphocyte enumeration to existing predicate PLG technology in South Africa	Poster: PRC 15-120	PathReD Congress, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017	Local
Essop Z, Bouwer N, Willem P	Translocation t(5;16) (q33;q22), A rare finding in an AML patient – A case study.		Olive Convention Centre, Durban, South Africa. 19-21 May 2017.	Local
Hodkinson K	Deep Vein Thrombosis in the era of high HIV and TB prevalence	Oral	PathReD Congress, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017*	Local
Hodkinson K	A Prospective Review of its Diagnosis and Treatment in a Quaternary Care Centre	Oral	PathReD, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017.	Local
Louw S	Direct oral anticoagulants (DOACs): To test, or not to test.		PathReD Congress, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017.	Local
Louw S	Peri-operative management of patients with acquired and hereditary bleeding diatheses	Oral	SASTH Conference, Johannesburg. October 2017.	Local
Louw S	International normalized ratio (INR) point-of-care test (POCT): Time is brain	Oral	SASTH Conference, Johannesburg. October 2017.	Local
Louw S, Mayne E	Evaluation of the diagnostic utility of individual parameters in the disseminated intravascular coagulation panel for use in under-resourced settings.		ISTH Conference, Berlin, July 2017.	International
Louw S, Mayne E	Epidemiological evaluation of patients presenting with disseminated intravascular coagulation (DIC) at an academic hospital in an African middle-income country		ISTH Conference, Berlin, July 2017.	International

Name	Title of presentation	Oral/poster	Name of congress	Local or international
Louw S, Mayne E	A comparison of Disseminated Intravascular Coagulation (DIC) screening parameters with and without human immunodeficiency virus infection in an African Academic Hospital setting		ISTH Conference, Berlin, July 2017.	International
Mojalefa S, Mokone G, Coetzee L, Glencross DK	The national priority programmes (NPP) on-site training alone does not meet national training needs in CD4 testing laboratories within the National Health Laboratory Service (NHLS)	Poster (R500 prize won)	SMLTSA Conference, Durban, South Africa. 19-21 May 2017.	Local
Mokone G, Mojalefa S, Coetzee L, Glencross DK	Replacing the outmoded XL flow cytometer with the Beckman Coulter Aquios PLG/CD4 cytometer across a national CD4 network	Poster (R500 prize won)	SMLTSA Conference, Durban, South Africa. 19-21 May 2017.	Local
Mokone G, Mojalefa S, Coetzee L, Glencross DK	Implementation of a National Cryptococcal Antigen (CrAg) reflexed screening programme in South Africa	Poster: PRC15-122	PathReD Congress, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017.	Local
Mokone G, Mojalefa S, Coetzee L, Glencross DK	Replacing the outmoded XL flow cytometer with the Beckman Coulter Aquios PLG/CD4 cytometer across a national CD4 network	Poster : PRC15-123	PathReD Congress, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017	Local
Noble L, Scott L, Stevens W	Plasma Xpert® HIV-1 Viral Load: Preliminary Findings on Fingerstick WB & DBS Testing	Oral	SA AIDS Conference, Cepheid Satellite Session, Durban, South Africa. 13-15 June 2017.	Local
Noble L, Stevens W, Scott L.	Xpert HIV-1 Viral Load: Beyond	Oral	IAS 2017 Conference Cepheid Satellite Session: Integrating Diagnostic Services at Point-of-Care. Paris, France. 23-26 July 2017.	International
Noble L, Stevens W, Scott L.	Laboratory Evaluation of the Xpert HIV-1 Viral Load assay using low volume plasma specimens	Poster	11th Interest Meeting, Lilongwe, Malawi. 15-19 May 2017.	International
Noble L, Stevens W, Scott L.	Laboratory Evaluation of the Beckman Coulter VERIS HIV-1 Assay	Poster	11th Interest Meeting, Lilongwe, Malawi. 15-19 May 2017.	International
Pienaar N, Louw S	Loss of technical skills in the automated coagulation laboratory		PathReD Congres, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017.	Local
Scott L, Van Rie A, Stevens W, Emch M, Musenge E, Ncayiyana J.	Combining Xpert and GIS to identify areas of high tuberculosis transmission.	Oral	US-South Africa Program for Collaborative Biomedical Research: Scientific Research Workshop, Durban, South Africa. 12 June 2017.	International

Name	Title of presentation	Oral/poster	Name of congress	Local or international
Walton A, Willem P	DNMT3A mutations in South African Cytogenetically-Normal Acute Myeloid Leukaemia	Poster	PathReD Congress, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017.	Local
Wiggill T	Reactive florid B-lineage lymphoid proliferations in HIV may mimic lymphoma	Poster	22nd congress of the European Haematology Association, Madrid Spain, 2017.	International
YO Wan	Analytical performance of the Nijmegen assay using different buffered reagents		PathRed Congress, Emperors Palace, Johannesburg, South Africa. 23-24 June 2017.	Local
YO Wan	The validation of the Nijmegen modification of the Bethesda assay in a quaternary care centre		MASAC Education Symposium 2017.	Local

7. Research translations

7.1 Research translated to policy

- **Implementation of the Aquios PLG CD4+ T testing**
  SOP:GPL4200 (Generic protocol for PLG CD4 testing using Beckman Coulter Aquios CL flow cytometry system). Activated 08/09/2017.

  Paper: Published 3 November 2017: Coetzee L-M, Glencross DK, 2017. Performance verification of the new fully automated Aquios flow cytometer PanLeucogate (PLG) platform for CD4-T-lymphocyte enumeration in South Africa. 12 (11)e0187456. https://doi.org/10.1371/journal.pone.0187456

- **Implementation of the GeneXpert MTB/RIF Ultra**
  SOP: GPL4284: Transitioning from GeneXpert MTB/RIF G4 to GeneXpert MTB/RIF Ultra.
  Paper: Stevens WS, Scott L, Noble L, Gous N, Dheda K. Impact of the GeneXpert MTB/RIF Technology on Tuberculosis Control. Microbiol Spectr. 2017;5(1). Scott L, David A, Noble L, Nduna M, Da Silva P, Black A, et al. Performance of the Abbott Real Time MTB and MTB RIF/INH Assays in a Setting of High Tuberculosis and HIV Coinfection in South Africa. J Clin Microbiol. 2017;55(8):2491-501

WALTER SISULU UNIVERSITY

Medical Virology

Acting Head of School:
Prof E.Blanco-Blanco

Who we are

The Faculty of Health Sciences at Walter Sisulu University (WSU) houses the only medical school in the Eastern Cape Province. We are an established faculty that has made its mark not only locally, but also nationally and globally.

The faculty's area of strength is problem-based learning and community-based education. In community-based education, we focus on the health needs of the people we serve, especially the disadvantaged. As a result of this community work, we have become globally renowned as one of the leading faculties in socially accountable health profession education.
The Department of Laboratory Medicine and Pathology at WSU unifies the different pathology divisions at the University and the NHLS in a structure equivalent to the School of Pathology. Itcomprises five divisions: Anatomical Pathology, Chemical Pathology, Haematopathology, Medical Microbiology and Forensic Pathology. The department is based at the Nelson Mandela Academic Hospital Complex in Sisson Street, Fort Gale, in Mthatha (Mthatha NHLS).

What we do

The diagnostic divisions of Anatomical Pathology, Chemical Pathology, Haemato-pathology, and Medical Microbiology, provide their diagnostic services on the NHLS platform in alignment with the WSU-NHLS bilateral agreement that was concluded in December 2014. The division of Forensic Pathology does not provide any services as part of the NHLS, but it forms part of the service offering of the Mthatha Regional Hospital and the Mthatha State Mortuary.

The department is responsible for diagnostic services, as well as the research and teaching in pathology. The department is housed in the 600-bed Nelson Mandela Academic Hospital where it provides SANAS-accredited diagnostic services. The department also serves the other two large hospitals in the academic complex; namely the Mthatha Regional Hospital and the Bedford Orthopaedic Hospital. The Mthatha NHLS is also a referral centre for a series of district hospitals and healthcare centres in a radius of about 200 km around Mthatha.

Highlights

Excellence in integrated problem-based training for MBChB.
WSU is the flagship facilty for problem-based learning and community-based education in South Africa and also in Africa. In line with the faculty's mission and vision, the department actively participates in the medical undergraduate training through problem-based learning. It entails case selection, facilitation, supporting lectures, tutorials, practical classes and examinations. A comprehensive course is offered during the whole third year of the MBChB curriculum, which fully integrates Anatomical Pathology, Chemical Pathology, Microbiology and Pharmacology. The course is structured in four consecutive modules throughout the year. The main teaching activity for this programme is the small-group tutorial with two sessions of three hours per week, as well as a planning and feedback session on a weekly basis. All pathologists in the department are engaged as small-group tutors along the academic year. Weekly sessions, for this programme only, account for more than 25% of the working hours. During the 2017 year, a total of 108 students were registered in this course, with a pass rate of 98%.

In 2017, the department also provided academic support to the WSU MBChB programme by tutoring three groups of ~20 students in the module of Community Based Education and Service (COBES) for MBChB III. This included regular activities for a full afternoon every week throughout the year, in various primary healthcare centres located in the outskirts of Mthatha.

Figure WSU 1: Walter Sisulu University

Anatomical Pathology and Cytology

Acting Head of Department: Prof C Mzileni

1. About the division

The academic division comprises two pathologists. The pathologists are contracted on the basis of a joint appointment with WSU. The division provided histopathological cytological diagnostic services to the Nelson Mandela Academic Complex in Mthatha, which includes tertiary services at Nelson Mandela Academic Hospital and Bedford Orthopaedic Hospital, as well as secondary level education provided by the Mthatha General Hospital. The division also offers diagnostic services as the main referral centre for a large number of peripheral hospital and primary healthcare facilities in a radius of ~200km around Mthatha (Region D of the Eastern Cape).

2. Diagnostic services

Despite being severely understaffed in terms of pathologists, with a substantial teaching load, the division managed to regularly provide consultancy support as part of the NHLS services at Nelson Mandela Tertiary Laboratory in Mthatha. The division was able to maintain the standard of pathology services at Nelson Mandela Academic Complex and retained its SANAS accreditation.

The average number of histopathology specimens in 2017 increased by 14%, from the previous year. The volume of cytology services for both gynaecological and non-gynaecological specimens, as well as FNAs, has also been increasing considerably since the previous years.

The division offers systematic academic consultancy support to special clinical services such as the Dermatology Clinic and Gynaecological Oncology, via regular diagnostic meetings. Supportive interaction with clinical departments is maintained on a regular basis for follow up of critical diagnoses.

Table WSU 1: Total number of staff per profession and highest qualification

Doctoral	MMed	Masters	Honours	Diploma	All	South Africans	
Pathologists		2					1
Medical scientists							
Technologists							
Other*							
South Africans		1					
All		2					1

3. Teaching, training and professional development

Professional development activities include activities under EQA subscription to the Australian programme

3.1 Undergraduate level

Over and above the usual MBChB integrated programme, the division also supports undergraduate teaching that is vertically integrated with the preclinical and clinicawzl years of the medical career through regular sessions and final assessments shared with the main clinical services throughout the year.

Supportive teaching is also provided to the WSU second- and third-year students in the f Bachelor in Clinical Medical Practice programme, with regular sessions under the curricular module of Pathology. The module runs during the first ten weeks of the academic year with an average of 10 hrs of pathology sessions per week.

Supportive teaching was also provided on a weekly basis to the medical technology students during their training in the NMTL.

3.2 Postgraduate level

The division received HPCSA accreditation for two posts of registrar training in 2014. A registrar was appointed early in 2017, but he resigned during the probation period. A new intake is planned for January 2018.

4. Awards

None.

5. Research activities

Commitment to research projects is extremely challenging, due to the critical understaffing, substantial work load and resource instability of the division, because of extended one-year contracts with pathologists only. The divisional pathologists however serve as reviewers for the faculty science committee and also for external requestors such as the International Association of Medical Science Educators (IAMSE).

5.1. Research Projects

Not registered.

6. Research Outputs

None.

Chemical Pathology

Head of Department: Prof E Blanco-Blanco

1. About the division

The division comprises one technical support staff member, one non-medical lecturer and two pathologists. Only the pathologists are contracted on a basis of joint appointment with WSU and NHLS. One of the pathologists joined the division late in 2016 and received educational training/support during 2017 as per institutional requirements. In 2017, the department also started the registrar training with one appointment.

In addition to the regular teaching support to the faculty, Prof E Blanco-Blanco also served as Chairperson for the Curriculum Development and Academic Planning Committees of the faculty and the Institutional Senate, and he was the Representative of Pathologists for the WSU Academic Pathology Committee. He also served as reviewer for the Faculty Science Committee and Chair to the faculty. During 2017, due to the lack of a dean at the faculty, Prof Blanco also served as member of the Faculty Advisory Committee that led the faculty until February 2018.

2. Diagnostic services

The division offers a 24-hour SANAS-accredited diagnostic service that comprises routine chemical pathology assays and a basic repertoire of endocrine assays.

The division successfully introduced a new set of tests, justified by the increased number of requests from the local and peripheral hospitals. These included insulin, cortisol high sensitive Troponin T and the re-insertion of the protein electrophoresis.

Special support is provided by the division in the administration and maintenance of routine POC services for blood gases and ancillary tests at three different intensive care units at Nelson Mandela Academic Hospital.

The division offers systematic consultancy support to special clinical services such as the Endocrine Clinic and the Intensive Care Unit. Supportive interaction with clinical departments is maintained on a regular basis, for follow up of abnormal results.

Table WSU 2: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists		2					1
Medical scientists							
Technologists				1			1
Other*			1				1
South Africans		1	1	1			3
All		2	1	1			4

*Lecturer

3. Teaching, training and professional development

3.1 Undergraduate level

The division actively participates in the medical undergraduate training through problem-based learning, by being involved in the case selection, facilitation, supporting of lectures, tutorials, practicals and examinations. A comprehensive course is offered during the whole third year of the MBChB curriculum, which fully integrates Anatomical Pathology, Chemical Pathology, Microbiology and Pharmacology. The course is structured in six consecutive modules throughout the year.

The division also supports undergraduate teaching that is vertically integrated with the preclinical and clinical years of the medical career, through regular sessions and final assessments shared with the main clinical services throughout the year.

Supportive teaching is also provided to the WSU second- and third-year students in the Bachelor in Clinical Medical Practice programme, with regular sessions under the curricular module of Pathology. The module runs during the first ten weeks of the academic year.

An elective module in Chemical Pathology for MBChB final year students is also offered. The module has a duration of four weeks, in which students are integrated with pathologists in all regular activities of the division.

In addition, during 2017, the division provided academic support to the WSU MBChB programme by tutoring a group of ~20 students in the module of COBES for MBChB III. This included regular activities for a full afternoon every week throughout the year in a primary healthcare centre, in the outskirts of Mthatha.

Supportive teaching was also given on a weekly basis, to the medical technology students during their training in the Nelson Mandela Academic Lab.

3.2 Postgraduate level

Postgraduate courses offered include a Postgraduate Diploma in Chem Path (NQF level 8), and the MSc in Chemical Pathology (NQF 9)

3.3. Other

Table WSU 3: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern Medical Scientist	Honours (PGD)	All	South Africans
Total number of trainees		4	1		2		7
Final year trainees		1	0		2		3
Successful completion		1	0		2		3

4. Awards

None.

5. Research activities

5.1 Research projects

There are currently no personal research projects registered by staff. Supervision is however offered to research projects towards MSc in Chemical Pathology. In 2017, the following project was successfully completed: Correlation between leptin and thyroid function test in neonates at Nelson Mandela Academic Hospital-Mthatha. Project by P. Ndibangwi (WSU-NRF funded).

6. Research output

The divisional pathologists serve as reviewers for the faculty science committee for MSc and MMed, as well as for external sources on request (NRF)

6.1 Journal publications

Nilubol N, Soldin SJ, Patel D, Rwenji M, Gu J, Masika LS, Chang R, Stratakis CA, Kebebew E; 11-Deoxycortisol may be superior to cortisol in confirming a successful adrenal vein catheterization without cosyntropin: a pilot study. Int J Endocr Oncol. 2017 May;4(2):75-83. doi: 10.2217/ije-2016-0020. Epub 2017 Apr 27

Haematology

Head of Department: Prof BA Ogunsanwo

1. About the Division

The department comprises only one pathologist employed on the basis of an extended one-year contract. He provides diagnostic services and clinical support and actively particpates in the school's undergraduate academic programmes. In spite of numerous vacancy advertisements, there were no successful responses for recruitment.

2. Diagnostic service

The division offers comprehensive laboratory services to the Nelson Mandela Academic Hospital, Mthatha General Hospital and Bedford Orthopaedic Hospital, as well as to various secondary hospitals and clinics in the region. The division offers a 24-hour diagnostic service comprising routine and specialised haematology tests with more than 300 specimens processed daily.

The division also offers both in-patient and out-patient clinical services to the Nelson Mandela Academic Hospital as part of the Department of Internal Medicine, as all our patients are admitted in the four medical wards, and are jointly managed with the assistance of their interns and medical officers.

We also offer expert opinions and care for patients with haemophilia at the Haemophilia Clinic of the Nelson Mandela Academic Hospital. This includes the treatment of all haemophiliacs within a 200 kilometre radius.

Telephonic consultations on haematology matters are routinely conducted with medical officers throughout our catchment area of the region. We receive an average of three to five such requests for consultations, daily. It is through this process that patients are booked to attend our clinic in the MOPD of the Nelson Mandela Academic Hospital.

Table WSU 4: Total number of staff per profession and highest qualification

Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists		1				0
Medical scientists						
Technologists		2				2
Other*						
South Africans						
All		3				2

3. Teaching and training

3.1 Undergraduate level

The division actively participates in the medical undergraduate training through problem-based learning, by being involved in the case selection, facilitation, and supporting of lectures, tutorials, practicals and examinations.

Haematology lectures are offered to the MBChB II students during the Cardio-Respiratory block.

With regards to the MBChB III programme, members of the division are engaged in problem-based learning and the COBES curriculum. This entails the identification of core material; student facilitation; lectures; and assessment of student performance.

For the MBChB IV and V programmes, an integrated approach is taken to the Internal Medicine Programme. This involves regular lectures and tutorials; end-of-block assessments and final exams in Internal Medicine. The students are divided into six groups and all lectures and tutorials are recycled six-weekly, throughout the whole academic year.

3.2 Postgraduate level

None.

4. Awards

None.

5. Research activities

Due to understaffing and work overload the division does not have any registered research projects. There is however an ongoing collection of database related to the laboratory and clinical management of patients seen by the department, with the purpose of prospective write up of findings in collaboration with the Department of Internal Medicine. This pertains to topics such as:

- Prevalence of Deep Vein Thrombosis in patients with HIV/AIDS;
- Prolonged remission in CML patients treated with a tyrosine kinase inhibitor;
- Retroviral induced Aplastic Anaemia and other Cytopaenias in Mthatha;
- Factor VIII inhibitors in patients with Haemophilia A in the Transkei region; and
- ITP in patients with AIDS: prevalence and response to standard therapy.

5.1 Research projects

None registered.

6. Research output

None.

Medical Microbiology

Head of Department: Prof SD Vasaikar

1. About the division

The division comprises ten staff members and two pathologists. The pathologists are contracted on the basis of joint appointment with WSU and the NHLS, and the rest of the staff constitutes technical support appointed by WSU. The division maintained a considerable level of research output.

In addition to the regular teaching support to the faculty, Dr Apalata also served as coordinator of the COBES course for MBChB 3 in 2017. Prof Vasaikar is a member of Curriculum Development, Staff Development and Quality Assurance Committees to the faculty. Dr Apalata and Prof Vasaikar also served as reviewers for the Faculty Science Committee. Dr Apalata is also the Chairman of the Faculty Research and Ethics Committee where Prof Vasaikar is also a member. In addition, Prof Vasaikar is a member of the Faculty Higher Degrees Committee. They are both furthermore appointed members of the EC DR TB Clinical Review Committee and ECP Antimicrobial Stewardship Committee.

2. Diagnostic and clinical services

The division offers a 24-hour diagnostic service comprising routine medical microbiology tests and a basic TB culture and sensitivity service. During 2017, the lab workload increased drastically, mostly due to processing of samples from special national programmes such as the ARV rollout.

The microbiology service section established the LPA-TB laboratory, and also introduced virology tests such as the Respiratory Syncytial Virus (RSV) and Toxoplasma IgM and IgG.

The division provides regular bacteriological testing for an average of 300 specimens per day and also supports the NNP with TB GeneExpert PCR and HIV-PCR for the Academic Hospital Complex and peripheral referring laboratories.

Special support is provided by the division in the infection control units at Nelson Mandela Academic Hospital and on the Eastern Cape Provincial Infections and Antimicrobial Stewardship Committees.

Supportive interaction with clinical departments is maintained on regular basis, for follow up of abnormal results and for advice on the use of antimicrobials.

Table WSU 6: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	2					2	0
Medical scientists							
Technologists			1	1	5	7	7
Other*							
South Africans	0		1	1	5	7	7
All	2					9	9

3. Teaching, training and professional development

3.1 Undergraduate level

The Division actively participates in the medical undergraduate training through problem-based learning, by being involved in the case selection, facilitation, and supporting of lectures, tutorials, practicals and examinations.

The division also supports undergraduate teaching that is vertically integrated with the preclinical and clinical years of the medical career through regular sessions and final assessments shared with the main clinical services, throughout the year.

Supportive teaching is also provided to the WSU second- and third-year students in the Bachelor in Clinical Medical Practice programme, with regular sessions under the curricular module of Pathology. The module runs during the first ten weeks of the academic year. Our academic engagement also includes support to the Microbiology course for the Bachelor in Nursing Sciences students.

An elective six-week duration module on Medical Microbiology is offered to the WSU BSc in Biochemistry and Physiology. Six students completed it in 2017.

During 2017, the division also provided academic support to the WSU MBChB programme by tutoring three groups of ~20 students in the module of COBES for MBChB III. This included regular activities for a full afternoon every week throughout the year in primary healthcare centres in three communities in the outskirts of Mthatha.

Supportive teaching was also provided on a weekly basis to the medical technology students during their training in the NMTL.

3.2 Postgraduate level

Postgraduate courses offered include BSc Honours in Medical Microbiology (NQF level 8), and the MSc in Medical Microbiology Pathology (NQF 9). These students successfully progressed to their second and third years and are currently engaged in their research projects. In 2017, one student completed his programme and obtained his MSc in Medical Microbiology.

3.3 Other

Table WSU 7: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern medical scientists	Honours	All	South Africans
Total number of trainees	4	6	-	-	7	17	
Final year trainees	1	1	-	-	3	5	
Successful completion	0	1	-	-	0	1	

4. Awards

None.

5. Research activities

The division is mostly engaged in collaborative research projects with the clinical departments in the WSU Faculty of Health Sciences. Divisional research is mainly promoted via support and supervision to the projects of PhD:

1. "Molecular Characterization, Antibiograms and Activities of Medicinal plants Against Haemophilus influenzae and Streptococcus pneumoniae isolates from clinical samples of patients in ECP";
2. "Phenotypic, molecular characterization and activity of selected medicinal plants against local isolates of selected coagulase positive and negative staphylococci in the Eastern Cape province";
3. "Genes encoding antibiotic resistance, pathogenicity and phylogenetic profiles of local isolates of Klebsiella species"; MSc;
4. "Immune response to specific Mycobacterium tuberculosis antigens among parasite infected school children in Mthatha: Role of Vitamin D and deworming";
5. "Molecular characterization of Acinetobacter baumanii and Salmonella species from different sources in Mthatha, South Africa";
6. "Antigonococcal activity and cytotoxicity of selected medicinal plants from rural Eastern Cape, SA.";
7. "Antibiotic susceptibility testing and molecular mechanisms of azole resistance in Candida species isolated from women infected with vulvovaginitis."

The division also supports the research projects of BSc Hons students which are funded by WSU and NRF. We also engage in interdepartmental collaborative research projects in the area of STI, Photodynamic therapy and antibiotic resistance, as well as research supervision for MMeds in Clinical Disciplines.

5.1 Research projects

MSc Medical Microbiology graduated. Student name: Tshepo Kwena Charles Mabotja. Student number 200522333. Dissertation title: "Phenotypic Identification, Antimicrobial Susceptibility Patterns and Genes encoding for resistance of Acinetobacter species isolated from Clinical Specimens in Mthatha, Eastern Cape".

MMed Supervision:

- MMed Paediatrics. Supervisor-Prof Vasaikar. Candidate Name: Oyemwimina Osarenren Andrew. Research title: Prevalence of HIV infection among paediatric patients admitted to Nelson Mandela Academic Hospital.
- MMed Dermatology. Co-supervisor- Prof Vasaikar. Candidate Name: Fungiwe Hlubikazi Gxolo. Research title: "The Clinico-Mycological spectrum of patients with Pityriasis Versicolor at Nelson Mandela Academic Hospital in the Eastern Cape".
- MMed Ophthalmology. Co-supervisor- Prof Vasaikar. Candidate Name: Ntando Ncetani. Research title: "Antimicrobial drug sensitivity and resistance patterns in patients with Bacterial Keratitis.

5.2 Grant-funded projects

Project title:	Genes responsible for Carbapenem-Resistant Enterobacteriaceae (CRE) in Mthatha and its correlation with predisposing factors
Principal investigator:	Prof S Vasaikar (Medical Microbiology, Department of Laboratory Medicine and Pathology)
Co-researcher:	N Ngoni (MSc student, Medical Microbiology, Department of Laboratory Medicine and Pathology)
Funding:	SAMRC WSU pilot grant from 2018-2020.
Short description:	Carbapenem-resistant Enterobacteriaceae (CRE) has become our 'worst nightmare', locally and internationally, and poses a major threat to the viability of all currently available antibiotics. These multidrug-resistant organisms cause infections associated with high mortality and limited treatment options. The aim of this study is to determine the genes coding for CRE and to determine its predisposing factors. First stage - Collection of CRE isolates and respective predisposing factors. Second stage - species confirmation and MIC determination by Vitek 2 and by B&D Microscan. Third stage - Real-time PCR genes blaOXA, blaKPC, blaNDM, blaVIM, blaGES using LightCycler 2.0. A prospective, descriptive study based on laboratory investigations. From analysis of CRE predisposing factors, infection control measures can be advised to the Infection Control Team in Mthatha.
Project start date:	1 August 2018
Project end date:	31 July 2020

Project title:	The Management and building of Bridges for Selected Non Communicable Diseases and HIV Risk Factors, Morbidity, and Mortality in the Eastern Cape Province: A Population-, hospital-, Laboratory and Community Study
Principal investigator:	Dr. T Apalata (Division of Medical Microbiology, Department of Laboratory Medicine and Pathology, Faculty of Health Sciences, WSU and NHLS).
Co-researchers:	S Nomatshila (Health Promotion, WSU), S Mabunda (Public Health, WSU), C Sewani-Rusike (Human Biology, WSU), Y Yako (Human Biology, WSU), P Mda (Family Medicine, WSU), Z Vundle (Public Health, WSU), MJ Ntsaba (Nursing Sciences, WSU), G George (Human Biology, WSU) and EJ Ndebia (Human Biology, WSU)
Funding:	SAMRC
Short description:	Chronic diseases account for the greatest share of early death and disability worldwide. Over the next few decades this burden is projected to rise particularly faster in the developing countries such as South Africa. The disease burden in South Africa is shifting, and approximately two out of five deaths in South Africa in 2008, were attributable to NCDs, including cardiovascular diseases, cancers, chronic respiratory conditions, and diabetes. HIV is a pandemic with challenges in general and in Sub-Saharan Africa in particular. HIV infection itself and treatment with combination anti-retroviral therapy (cART) are established as risk factors of NCDs. The lack of micro research, particularly in Eastern Cape, on the implications of chronic disease contrasts with the available knowledge on the epidemiological burden of the problem.

Project start date:	2017
Project end date:	2021
Project title:	Evolution of HIV-infected patients receiving HAART and quality HIV/AIDS care initiated by nurses at primary healthcare level in OR Tambo
Principal investigator:	Dr T Apalata (Division of Medical Microbiology, Department of Laboratory Medicine and Pathology, Faculty of Health Sciences, WSU and NHLS)
Co-researchers:	CD Mwesigwa-Kayongo (Internal Medicine, WSU) and N Katende-Kyenda (Pharmacology, WSU)
Collaborators:	B Longo-Mbenza (Internal Medicine, University of Kinshasa) and N Dlatu (Nursing Sciences, UKZN)
Funding:	SAMRC
Short description:	The study plans to provide a particular insight of the impact of task shifting for HIV care on immunological, virological, and clinical outputs in HIV-infected patients on HAART, attending healthcare facilities in OR Tambo district, Eastern Cape. In an effort to better understand factors associated with ART non-suppressed cases and ART-suppressed non-controllers, the study plans to measure the adherence index as recommended by the Centre for Adherence Support Evaluation (CASE).
Project start date:	2017
Project end date:	2021

6. Research output

6.1. Journal publications

Vasaikar S, Obi L, Morobe I and Bisi-Johnson M; Molecular characteristics and antibiotic resistance profiles of Klebsiella isolates from clinical samples of patients in Mthatha, Eastern Cape Province, South Africa. International Journal of Microbiology. 2017

Mnge P, Okeleye BI, Vasaikar SD and Apalata T; Species distribution and antifungal susceptibility patterns of Candida isolates from a public tertiary teaching hospital in the Eastern Cape Province, South Africa. Brazilian Journal of Medical and Biological Research. 2017. 50(6)

Katende-Kyenda NL, Sam E and Apalata T; Determinants of Adherence to Highly Active Antiretroviral Therapy among people attending a Public HIV Clinic in Ghana. Global Journal for Research Analysis. Volume 6, Issue-4, April 2017, ISSN No 2277-8160

Carine B, Fotso, Sandeep D, Vasaikar and Teke Apalata; Outcomes and Risk Factors associated with Drug Resistant Tuberculosis in Rural Eastern Cape, South Africa. American Journal of Infectious Diseases. 2018 – Accepted Manuscript Number # 518-AJID (In Press)

6.2. Complete books

None.

6.3 Book chapters

Magula NP, Perumal R and Apalata T; Antiretroviral treatment. In The ESC Textbook of Cardiovascular Medicine, 3rd edition, SBN: 9780198784906. Oxford University Press (UK) 2018 (In Press).

6.4 Conference presentations

6.4.1 Oral presentations

None.

6.4.2 Poster presentations

International congresses

Multilocus sequence typing (MLST) of Klebsiella oxytoca from clinical specimens from Mthatha, South Africa. The 18th International Congress on Infectious Diseases (ICID), Buenos Aires, Argentina. February 2018.

National Congresses

Vasaikar SD, Obi L. "Specific detection of laboratory misidentified Klebsiella variicola by Sanger Sequencing from knee effusion". 7th FIDSSA Congress. September 2017.

7. Research Translations

None.

STELLENBOSCH UNIVERSITY

Foreword

Prof Andrew Whitelaw, Head of School

Who We Are

The Department of Pathology at Stellenbosch University (SU) Faculty of Medicine and Health Sciences consists of 6 divisions. Clinical Microbiology, Chemical Pathology, Medical Virology, Haematopathology and Anatomical Pathology are jointly managed by NHLS-SU, with Forensic Pathology part of the PGWC-SU platform. The Department of Oral Pathology at the University of the Western Cape (UWC) also forms part of the NHLS-Tygerberg Hospital business unit. The Immunology Unit is housed within the Division of Medical Microbiology, although offers a separate and distinct diagnostic service.

The Division of Medical Virology is located within the Faculty buildings, while all other divisions are located in Tygerberg Hospital. 2017 saw the beginnings of a move to incorporate the diagnostic virology service within Tygerberg Hospital. This will obviously create challenges, but also opportunities to better integrate services and streamline specimen handling.

What We Do

The laboratories are all SANAS-accredited, and offer both laboratory diagnostic service and consultative services to Tygerberg Hospital and its referring hospitals, including parts of the Western Cape as well as Northern Cape. We have been involved in national coverage activities, providing support to, among others, Port Elizabeth and Kimberley.

The department is actively involved in undergraduate teaching in many of the programmes offered by the faculty, and is participating in the curriculum renewal programme initiated by the faculty in 2017. We have an active postgraduate training programme, including BSc (Hons), MSc and PhD, and of course MMed. In addition to training registrars in the pathology disciplines, we provide training support for subspecialist trainees in clinical disciplines, such as clinical haematology, infectious diseases and rheumatology. While there is no separate division of Clinical Pathology, we do train clinical pathology registrars.

All divisions have active research programmes, although the need to focus on service delivery creates challenges in maintaining research activities. Focus areas are aligned to key national priorities, including malignancies, HIV, TB, diabetes and antimicrobial resistance. The department has developed significant expertise in biobanking (led by Profs Schneider and Abayomi) and point-of-care testing (led by Prof Erasmus).

Highlights

2017 saw the introduction of an automated specimen handling system in the pre-analytic section of the laboratory. This was a huge effort from all involved, but promises to streamline the pre-analytic services and improve service delivery.

The laboratory management course, co-ordinated by the division of Chemical Pathology, but including all divisions, is becoming increasingly recognized and used as a national training resource, with registrars, laboratory managers and pathologists from other regions of South Africa as well as Africa attending.
A unique pathology-supported genetic testing concept was implemented at the divisions of Anatomical and Chemical Pathology over the last five years, and resulted in Prof Maritha Kotze being awarded an international grant for development of a rapid point-of-care test

kit under the South Africa-UK Newton Collaborative Research Development Programme in Precision Medicine. This was featured in the Newton Fund Newsletter (https://t.co/GKlx55ypHs) focused on women in science. The new assay will incorporate both distinct genetic risk factors and key disease pathways shared by non-communicable diseases through gene-environment interaction (epigenetics).

The division of Medical Virology has been registered as a World Health Organization (WHO) Prequalification Evaluating Laboratory under the WHO's Prequalification Alternative Performance Evaluation Mechanism (cf. http://www.who.int/diagnostics_laboratory/evaluations/alternative/en/). Dr Corena de Beer was appointed by the National Minister of Health as a member and since February 2018 the chair of the National Authority for Containment on Poliovirus Eradication as part of the Global Action Plan III of the World Health Organization.

Anatomical Pathology

Head of Division: Prof. JW Schneider

1. About the Department

The division provides a comprehensive diagnostic service, including surgical- and cytopathology and autopsies, to Tygerberg Hospital (TBH) and the Western Cape public health sector. It operates the AIDS Malignancy Consortium (AMC) and AIDS and Cancer Specimen Resource (ACSR) Sub-Saharan Africa Regional Biospecimen Repository (SSA RBR), funded by the USA National Institutes of Health/National Cancer Institute.

The division is involved in several national and international collaborative research projects, including the Vreije University, Amsterdam and the Lineberger Comprehensive Cancer Center, University of North Carolina, USA. Staff members contributed twelve articles to professional journals and presented several papers or posters at national and international congresses. There are six new approved research projects. The division offers specialist training in Anatomical Pathology (MMed), as well as BSc (Hons) (Pathology), M (Pathology), PhD (Anatomical Pathology), and MSc (Cytopathology).

2. Diagnostic Services

The division provides a diagnostic service to TBH and approximately half of the Western Cape's public health sector. Consultation services are offered to the private sector and NHLS laboratories in the Eastern Cape, especially in dermatopathology, electron microscopy, neuropathology, nephropathology, lymphomas, perinatal pathology and cytopathology. Expert services include an FNA clinic, rapid on-site cytology diagnostic services, and the application of flow cytometry and cellblocks using material obtained from FNA of lymph nodes and other selected tissues.

During the reporting period, the Surgical Pathology Laboratory processed 30278, a 1% decrease on the previous year. The Electron Microscopy Laboratory processed 538 cases (12% decrease), and the Immunohistochemistry Laboratory performed 24052 immunohistochemical stains (1% increase) and 1 330 direct immunofluorescence stains (2.5% increase). Staff conducted 44 adult and 74 paediatric autopsies.

The Cytopathology Unit processed 65 451 gynaecological cases (0.8% decrease from previous year), 3758 non-gynaecological cases (18.6% decrease) and 9 150 FNAs (4.3% decrease), including the performance of 4212 on-site FNAs on patients in the FNA clinic (5.3% increase) and on 369 patients in theatre (8.1% increase). The overall year-on-year workload for Cytology decreased by 2%. Both the Cytopathology and Histopathology laboratories retained SANAS accreditation.

The Pathology Research Facility offers diagnostic molecular pathology tests through national and international collaboration. In addition to supporting clinical geneticists, selected molecular tests are offered for the diagnosis, prognosis and therapeutic interventions of various haematological malignancies, colorectal carcinoma and carcinoma of the breast, including MammaPrint that can be performed on formalin-fixed and paraffin-embedded tissue samples.

Table SU 1: Total number of staff per profession and highest qualification

	Doctoral	MMed and / or FCPath	Masters	Honours	Diploma	All	South Africans
Pathologists		10				11	11
Medical Scientists			1			1	1
Technologists			3	8 BTech	13	24	24
All		10	4	8	13	36	36

3. Teaching and Training

3.1 Undergraduate

Dr D de Wet co-ordinates and oversees undergraduate teaching in anatomical pathology. All the pathologists are responsible for delivering the undergraduate teaching program. The anatomical pathology curriculum for medical students comprises a five-week module covering the essentials of disease processes (phase I), systemic pathology lectures as part of an integrated systems curriculum (phase II), and a longitudinal online module using blended learning approaches during the clinical rotations. The allied health science curriculum for Occupational Therapy (3rd year) and Physiotherapy (2nd year) students comprises 10 lectures covering the relevant basic principles of disease processes.

The medical curriculum is currently involved in a renewal process as part of a University wide initiative aimed at delivering a new curriculum in 2020. Dr de Wet represents the Division on the core curriculum renewal team.

3.2 Postgraduate

There are eleven anatomical pathology registrars in the division, and a further two junior and two senior registrars in oral pathology (UWC). In addition, two registrars in forensic medicine rotate for one year of training in anatomical pathology. Postgraduate students include one PhD, six MSc (Cytopathology), four M (Pathology) and one BSc (Hons) student.

Other postgraduate teaching activities include lectures to BSc (Hons) (Reproductive Biology) students; teaching MMed students in family medicine on how to perform FNAB; and teaching anatomical pathology and histology to registrars from clinical disciplines to prepare them for the CMSA examinations. The structured MSc (Cytopathology) programme remains the only cytopathology degree programme in Africa and runs over a minimum of two years. The programme has a modular design, includes a research component and is offered through distance education. Ongoing national and international moderation of the programme ensures top class quality assurance. Pathologists from the division participated as examiners in CMSA examinations, and as external examiners for MMed research assignments.

3.3 Other

Table SU 2: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern Medical Scientist	Honours	BHSc	All	South Africans
Total Number of Trainees	1	10	11	0	1	3	26	26
Final Year Trainees	0	1	2	0	0	3	6	6
Successful Completion	NA	1	0	0	0	3	4	4

The short course in FNAB for Professional Nurses is run in collaboration with the Division of Nursing Sciences as a distance-mediated programme. The theoretical component is offered via DVD and assessment is undertaken at a local NHLS laboratory, followed by the performance of at least 100 FNABs under supervision at a NHLS FNA Clinic. The results are assessed to ensure competence of the trainees. Pathologists from the division continued to train clinicians in the correct technique for FNAB. Dr P Schubert served as external moderator for the MBChB pathology module at University of Namibia.

The division provides academic support to clinicians and pathologists in the Eastern Cape, including consultations, sharing of training material and reciprocal site visits. Support for the MMed training programme at WSU continues.

Staff trained clinicians to perform FNAB as part of the maintenance of competence initiative by the Western Cape Department of Health, and organised and participated in outreach projects in Worcester, Hermanus, Port Elizabeth and East London. The aim is to train clinicians and nursing sisters in the optimal FNAB technique to ensure that better quality specimens reach the Cytology Laboratories.

Pathologists, registrars and the nursing sister from the division offered an FNAB training session at the XI th International Child TB Training Course that was held at Goudini from 10-15 September 2017.

The 3rd Annual Biobank Seminar titled Current issues in biobanking, was held on 18 August 2017 at the South African Medical Research Council, Parow, Cape Town, South Africa. Invited local and international speakers participated in the programme.

Four pathologists in the division successfully completed the PREDAC programme, which is annually presented by SU's Centre for Teaching and Learning (CTL) to newly appointed lecturers to meet, work and reflect on learning and teaching issues at SU, as well as frameworks which direct Higher Education in South Africa.

4. Awards

- Dr L Coetzee successfully completed the International Society of Nephrology-ANIO Clinical Nephropathology Certificate Program;
- Prof CA Wright has been invited to present at the International Congress of Cytology to be held 5 to 10 May 2019 in Sydney, Australia;
- Dr SD Zaharie successfully attended and received a certificate: The African Doctoral Academy (ADA), Stellenbosch 8-12 Jan 2018, SPSS statistical analysis; and
- Dr P Schubert graduated as a fellow of the Pediatric Pathology Association at the International Paediatric Pathology Association, XXXVII Advanced Course in Paediatric Pathology, Island of San Servolo, Venice, Italy: 30th September to 5 October 2017.

5. Research Activities

The SSA RBR continues to expand collaboration with South African and African institutions and researchers to establish a central biorepository site for sub-Saharan Africa that is fully integrated within the AIDS Cancer Specimen Repository (ACSR). The SSA RBR inventory includes a large and growing collection of proactively obtained biospecimens and data for coordinated research on HIV-related malignancies. Biospecimens and data that have been obtained with informed consent and processed under best practices are available at no cost to African researchers with approved research projects. The SSA RBR furthermore supports AMC clinical trials in sub-Saharan Africa, collaborates closely with the African Cancer Institute at Stellenbosch University, and supports several cancer-related research projects. Prof Schneider is the principal investigator / director of the SSA RBR as well as, with dr M Sanderson (PhD) from the SSA RBR, a member of the ACSR Executive Committee. https://acsr.ucsf.edu

5.1 New Research Projects

Project Title:	HPV strain prevalence and HPV-related biomarker expression in vulvar carcinoma at Tygerberg academic hospital.
Researchers:	Petersen N, Razack R, Sanderson M.
Funding:	Harry Crossley Foundation
Short Description:	The aim of this retrospective study is to determine the HPV subtype prevalence and HPV-related biomarker expression in patients with vulvar intraepithelial neoplasia (VIN) and vulvar squamous cell carcinoma (VSCC) at Tygerberg Academic Hospital (TAH). DNA extracted from FFPE specimens will be used for HPV detection and subtyping. FFPE RNA will be used for expression analysis of HPV E6/E7 mRNA transcripts using quantitative real time PCR (qRT-PCR). p16 and Ki67 expression, on full section and constructed tissue microarrays slides, will be assessed using immunohistochemistry (IHC). miRNA-590-5p expression will be determined utilizing in situ hybridization (ISH) and confirmed with qRT-PCR. Results will be correlated to clinical data including HIV status.
Project Start Date:	3 Oct 2017
Project End Date:	3 Oct 2019

Project Title:	The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) – a retrospective reappraisal with histological correlation: A South African single institutional perspective.
Researchers:	Razack R, De Wet D, Kootbodien T
Funding:	Pending
Short Description:	The aim of this study is to reclassify thyroid diagnosis into TBSRTC categories prior to implementing TBSRTC to determine the diagnostic accuracy of preoperative thyroid FNAB diagnosis.
Project Start Date:	14 Nov 2017
Project End Date:	14 Nov 2019

Project Title:	Optimization of proteomics techniques using archival tumour blocks of a South African cohort of colorectal cancer (CRC).
Researchers:	Rossouw SC, Rigby J, Christoffels A.
Funding:	External
Short Description:	This study proposes to identify, clarify and compare the molecular changes at the protein level in CRC (sporadic and/or hereditary) FFPE biopsy tissues of patients from South Africa, using mass spectrometry analysis with extensive bioinformatics analysis. The identification of these disease-associated proteins may allow for the identification of unique biomarkers in a South African population to indicate/diagnose the presence of CRC in biopsy tissue, as well as the tumour grade.
Project Start Date:	25 Aug 2017
Project End Date:	25 Aug 2020

Project Title:	The utility of transthoracic fine needle aspiration in the diagnosis of plasmacytoma.
Researchers:	Benbarka SS, Schubert PT, Koegelenberg CFN.
Funding:	None
Short Description:	Investigating the utility of TTNA investigation in the diagnosis of thoracic myeloma diagnosis. Describing the presentation of thoracic myeloma pathology.
Project Start Date:	2 May 2017
Project End Date:	2 May 2019

Project Title:	Tumour and Tumour-Immunology Differences in HIV+ versus HIV- Non-small cell lung carcinoma.
Researchers:	Bouic P, J Divine, Schubert PT, Koegelenberg CFN, Schneider JW.
Funding:	External
Short Description:	The study will seek to determine what differences exist in the cancer and cancer-associated immune response in non-small cell lung cancer (NSCLC) tumour tissue from HIV+ versus HIV- negative individuals.
Project Start Date:	23 Nov 2017
Project End Date:	23 Nov 2020

Project Title:	The occurrence of Epstein-Barr virus in plasma cell neoplasms: a retrospective review.
Researchers:	Penzhorn IH, Sher-Locketz C, Schneider JW.
Funding:	Pending
Short Description:	The purpose of this study is to determine the occurrence of Epstein-Barr virus (EBV) in plasma cell neoplasms (multiple myeloma and plasmacytoma). Although EBV is associated with a multitude of clinical entities, including many haematolymphoid malignancies, plasma cell neoplasm (PCN) is currently not recognised as an EBV-associated malignancy. The prevalence of EBV in PCN is historically so rare that mainly single or low number cases are reported in the literature. A potentially significant association of EBV in PCN-specimens may be present especially in HIV-positive individuals.
Project Start Date:	7 May 2018
Project End Date:	7 May 2020

Project Title:	Investigating the presence of a bacterial component in colorectal adenocarcinoma tumour sections and blood samples.
Researchers:	de Waal GM, Pretorius V, Rigby J, Davis T.

Funding:	External
Short Description:	The purpose of this study is to determine whether Escherichia coli and H. pylori are present inside colorectal adenocarcinoma tumour sections and the demonstration of bacterial inflammagens like lipopolysaccharide (LPS), resulting in an increase in inflammatory molecules like cytokines and other acute-phase proteins, such as serum amyloid inside these tumours.
Project Start Date:	31 Oct 2018
Project End Date:	31 Oct 2020

Project Title:	Utility of TTF1, NapsinA, CK5 and p63 staining on FNAB, cellblocks and core needle biopsies.
Researchers:	van Zyl A, Schubert PT, Koegelenberg CFN
Funding:	None
Short Description:	Determine and compare specificity and sensitivity of TTF1, NapsinA, p63 and CK5 on FNAB, cellblocks and biopsy specimens.
Project Start Date:	14 Nov 2017
Project End Date:	14 Nov 2018

6. Research Output

6.1 Publications

Bennji SM, Du Preez LJ, Griffith-Richards SB, Smit DP, Rigby JM, Koegelenberg CFN, Irusen EM, Allwood BW. Recurrent Pulmonary Aneurysms Hughes-Stovin Syndrome on the Spectrum on the Spectrum of Behcet Disease. Chest 2017; 152(5):99-103

Brijlal U, Bates WD, Moosa MR. Lupus nephritis in the Western Cape, a high prevalence area: an experience over three decades. Lupus 2017; 26:1228-1234

Bruce-Brand C, Mohamed N, Botes S, Bates WD. Concurrent Diffuse Large B-Cell Lymphoma and Epstein-Barr Virus-Associated Smooth Muscle Tumour in the Small Bowel of an HIV-Positive Adult—a Case Report and Review of the Literature. Journal of Gastrointestinal Cancer, doi.org/10.1007/s12029-017-0046-3

Geldenhuys E, Coldrey JA, Wright CA, Nel DG, Roberts DJ, Boyd T, Odendaal HJ. Fetal foot length at delivery as a tool for determining gestation length in non-macerated stillbirths. International Journal of Gynecology and Obstetrics 2017; 138:107-112

Gie AG, Morrison J, Gie RP, Schubert P, Janson JT, Kling S, Goussard P. Diagnosing diffuse lung disease in children in a middle-income country: the role of open lung biopsy. International Journal of Tuberculosis and Lung Disease 2017; 21(8):869-874

Grewal R, Irimie A, Naidoo N, Mohamed N, Petrushev B, Chetty M, Tomuleasa C, Abayomi EA. Hodgkin's lymphoma and its association with EBV and HIV infection. Critical Reviews in Clinical Laboratory Sciences, DOI: 10.1080/10408363.2017.1422692

Hamunyela KS, Banieghbal B, Sidler D, Ihuhua P, Schubert P. Pediatric Nodular Fasciitis: Case Series Report . Clinics in Surgery 2017; 2:1745, 2 pages

John TJ, Pellizzon AS, Bates WD, Chothia M. IgG4-related kidney disease: a rare cause of tubulointerstitial nephritis. African Journal of Nephrology 2017; 20(1):18-20.

Koegelenberg CFN, Bennji SM, Boer E, Schubert PT, Shaw JA, Allwood BW, Irusen EM. The current aetiology of malignant pleural effusion in the Western Cape Province, South Africa. S Afr Med J. 2018 Mar 28;108(4):275-277. doi:10.7196/SAMJ.2017.v108i4.12936. PubMed PMID: 29629675

Schwartz IS, Kenyon C, Lehloenya R, Claasens S, Spengane Z, Prozesky HW, Burton R, Parker A, Wasserman S, Meintjes G, Mendelson M, Taljaard JJ, Schneider JW, Beylis N, Maloba M, Govender NP, Colebunders R, Dlamini S. AIDS-related Endemic Mycoses in Western Cape, South Africa, and clinical mimics: A cross-sectional study of adults with advanced HIV and recent onset, widespread skin lesions. Open Forum Infectious Diseases 2017; 0:1-7

Sher-Locketz C, Schubert P, Moore SW, Wright CA. Successful introduction of fine needle aspiration biopsy for diagnosis of pediatric lymphadenopathy. Pediatric Infectious Disease Journal 2017; 36(8):811-814
Tannor EK, Bates WD, Moosa MR. The clinical relevance of repeat renal biopsies in the management of lupus nephritis: a South African experience. Lupus 2017; 0:1-11

Van Wyk AC, Van Zyl H, Rigby J. Colonic perineurioma (benign fibroblastic polyp): case report and review of the literature. Diagnostic Pathology (2018) 13:16. doi.org/10.1186/s13000-018-0694-z

6. 1 Conference Presentations (Oral, Poster)

6.2.1 Oral Presentations

National Congresses

Schubert PT. Fine needle Aspiration, Effusion and Gynaecological Cytology Tutorial; Fine Needle Aspiration, Effusion and Gynaecological Cytology Tutorial; University of the Witwatersrand, Education Campus, York Road Parktown, Johannesburg; Thursday 4th - Sunday 7th January 2018

Schubert PT. Invited speaker. Diagnostic work up of surfactant biopsies; Here be Lungs - Pulmonology Congress, held at Lanserac Hotel, Stellenbosch, South Africa; 16-17March 2017

Van Zyl A. Young Pathologists Slide Seminar: Ossifying fibromyxoid tumour; 2nd Pathology Research And Development Congress, Emperors Palace, Johannesburg, South Africa from Friday, 23 June to Saturday, 24 June 2017 (PathReD) 2017

Zaharie SD. Invited speaker at the SASOP (South African Society of Psychiatry) conference, Zimbali, 12-13 Aug 2017

Zaharie SD. Co-organiser together with the Chief Medical Examiner Office, New York and invited speaker: Forensic Pathology Road Show,

Faculty of Medicine and Health Science, Stellenbosch University, 28 Feb-2 March 2018

6.2.2 Poster Presentations

National Congresses

Local Congresses (university academic days)
Van Wyk A. Multifocal juxtaglomerular cell tumour: unusual presentation of a rare tumour, 2nd Pathology Research and Development Congress (PathReD), Emperors Palace, Johannesburg, South Africa from Friday, 23 June to Saturday, 24 June 2017.

Van Zyl A, Schneider JW. Histological and immunohistochemical evaluation of sentinel lymph nodes in breast cancer at a tertiary hospital in the Western Cape, South Africa; 2nd Pathology Research and Development Congress (PathReD), Emperors Palace, Johannesburg, South Africa from Friday, 23 June to Saturday, 24 June 2017.

Local Congresses (university academic days)
Petersen N, Cloete M, Schneider JW and Sanderson M. Secondary utility of archived pathology FFPE tissue blocks: DNA quality assessment for the purpose of downstream molecular analysis. Stellenbosch University, Faculty of Medicine and Health Sciences, Annual Academic Year Day, 2017.

Chemical Pathology

Head of Department: Prof RT Erasmus

1. About the Department

The Chemical Pathology division is SANAS-accredited and provides a 24-hour service to TBH and some of the clinics and secondary hospitals in the Western Cape. This service was expanded in April 2011 to include Eerste River Hospital and more peripheral clinics.

It is involved in numerous research projects, ranging from diabetes to multiple sclerosis and HIV, and collaborates with other pathology divisions as well as other institutions. It also actively fosters international collaborations.

The division is involved in undergraduate and postgraduate training of medical students, registrars, BSc graduates, masters, doctoral students and technologists, and regularly organises training programmes in laboratory management.

2. Diagnostic Services

As mentioned above, the division provides a comprehensive 24-hour service to TBH and some of the clinics and secondary hospitals in the Western Cape region, as well as Eerste River Hospital and more peripheral clinics. It is one of the referral centres for samples from the Eastern Cape, particularly the Nelson Mandela, Livingstone and East London hospitals. Work from the Northern Cape is being referred to the division since 2014. At present, the Tygerberg Business Unit services clients from more than 800 locations. The diagnostic service provides a testing platform for various trials which are incorporated into the daily routine service.

In 2017 the division retained its SANAS accreditation status and also had a successful Health and Safety audit and satisfactory EQA results.

Renovations to the Core Laboratory occurred during the past 2 years with Chemistry being particularly affected. Operations were maintained within the renovated area and staff had to endure dust, noise pollution and operating analysers under dust covers. During this period changes to Chemistry workflow areas were made necessitating moving and consolidating various work areas. Consolidation improved logistics of the workstations and this is particularly noted during times of staff shortages. Following the consolidation of multiple work areas and the introduction of a new analytical instrument, the pre-analytic automation system was introduced last year and is hoped to improve TAT.

Staff shortages continue to affect the division and this has now extended to the consultant staff affecting teaching, training and research. 2 new registrars joined the division further compounding the staff shortage.

Collaborations and communications with the Virology, Immunology, Haematology and Microbiology laboratories continued and assisted in improving workflow in order to improve laboratory performance. This has also being demonstrated with regards to the TBH Pharmacology Department.

Table SU 3: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists	1	2				3	3
Medical Scientists	2					2	2
Technologists			2		10	12	12
Other*					1	1	1
South Africans	3	2	2		11	18	18
All	3	2	2		11	18	18

3. Teaching, Training and Professional Development

3.1 Undergraduate Level

Teaching and training of undergraduate medical students continues to be a priority. The Essentials of Disease Processes Module was chaired by Dr Rensburg, with Dr Hoffman as secundus. This module is presented to MBChB I students and forms the basis of Pathology teaching. Dr Rensburg was appointed as the 2017 MBCH I Phase I chair for the second semester and Dr Hoffmann will continue her duties as secundus to the Essentials of Disease processes module. Prof. Zemlin is involved in MBChB II lectures (Respiratory and Cardiovascular modules) and Middle Clinical Rotation (MBChB V). Dr Hoffmann gives two lectures for the MBChB II Gastro-intestinal module and is also the co-ordinator of TUTs to the departments of Gynaecology and Paediatrics as well as co-ordinating the weekly student intern tutorials . lectures (Respiratory, Cardiovascular and Endocrine) continue to be given by consultant staff to MBCHB 1, II, V and the Endocrinology GIT divisional modules and also part of the Organizing Committee, Middle Clinical Rotation (MBCHB V)

The MBChB IV and V students continue to visit the laboratory as part of their middle clinical rotation. This rotation involves a more intimate teaching environment and exposes the students to the laboratory as well as haematology case studies. The registrars in the division actively participate in this programme which runs throughout the academic year. All staff participate in the small groups discussions for the Enodcrine Module (MBChB II).

3.2 Postgraduate Level

The division is involved in co-ordinating the Laboratory Management Postgraduate Module chaired by Prof. Zemlin and Prof Erasmus. All consultants participate with contribution from other divisions currently at 5% This is expected to increase to 20 % in the next course . The division continues to take part in organising the Diagnosis and Screening Module of the Masters Degree in Clinical Epidemiology organised by the Centre for Evidence-based Health Research (Prof. Erasmus). Dr Rensburg supervises practical laboratory sessions which are given to all registrars and technologist students.

The division was involved in supervising three masters, five MMed (including two clinical pathologists) and four doctoral and postdoctoral students/fellows. Dr Rensburg is co-supervising MMeds in Internal Medicine and Family Medicine.

Prof M Kotze gives training on genomics and personalised medicine towards the development of a pathology –supported genetic testing service for comparative effectiveness studies at the interface between the laboratory and clinic.

Prof Erasmus and Prof Zemlin, together with the programme committee, were involved in the revision of the Laboratory Management Module. The division continues to attract senior technologists and pathologists from across the continent to its training programme on Laboratory Management. Unlike previous due to extreme staff shortages no postgraduate students from African and other countries were taken for laboratory management training. The division also declined a number of doctoral and masters applications for the same reasons
A number of postgraduate students were supervised and consultant staff were involved in weekly updates, TUTs, and journal club academic meeting. This included the assessment of weekly short cases and 6 monthly evaluation of long cases. A formal postgraduate Committee was formed which resulted in considerable involvement by both the consultant and scientific staff

Research in the division was considerably subdued due to the on-going staff shortage. However the Division staff continued to focus on Point of care testing and Personalised Medicine established in 2016. Members of the division continue to serve on several national (NHLS Expert Committee) and international committees (International Federation of Clinical Chemistry).

Specialists, postgraduate students, and medical technologists from the division attended several courses during 2017 as part of continuous professional and skills development. Both scientific and consultant staff were external examiners at various levels ranging from masters to doctoral levels in 8 exams and internal examiners in 4 exams. Prof Zemlin was appointed to the Chair C-EBLM and gave talks related to the talks on IFCC eAcademy. Prof Erasmus was the Conference Chair for the IFCC World Lab International Congress which took place in Durban from 22-25th October which attracted nearly 8-00 delegates. In addition, Prof Erasmus assisted in organizing 3 satellite meetings in Cape Town (Biomarkers for Diabetes) and Durban (Point of Care and Quality Management)

3.3 Other

Outreach and Community Interaction
Unlike the pevious this was put on hold due to staff shortages

Professional Development

Members of the division were involved as external examiners at the University of Zimbabwe, WSU, UCT, and UL. Over 20 manuscripts were reviewed for J Clinical Pathology, Acta Clinica Chimica, Journal of Clinical Chemistry and Laboratory Medicine, South African Journal of Medicine, Metabolic Brain Disease and Schizophrenia Research, Polish Archives of Internal Medicine, Indian Heart Journal, Nigerian Journal of Basic and Clinical Sciences, and Medical Principles and Practices.

Members of the division are actively involved in the SAACB, the International Federation of Clinical Chemistry and Laboratory Medicine, Federation of South African Societies of Pathology, College of Pathologists of East, Central and Southern Africa, IBRO, the SANS and the Multiple Sclerosis Care Trust.

Table SU 4: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern Medical Scientist	Honours	All	South Africans
Total Number of Trainees	3	3	5	1		12	12
Final Year Trainees		2	2			4	4
Successful Completion		1					1

4. Awards

Prof Zemlin was appointed as the chair of the Evidenced Based Committee on Laboratory Medicine by the International Federation of Clinical Chemistry (IFCC)

5. Research Activities

The division has developed various research themes which have evolved over the past four years:

- The clinical audit and laboratory management team is led by Prof. Zemlin. Various audits were written up and submitted for publication;
- Dr Hoffman continues to lead the team on Reference Range Values, which is a collaborative study with a private pathology laboratory, Nigeria, Kenya and Japan;
- Dr Rensburg continued with her involvement on POC testing. The group is currently collaborating with the Nephrology department at Tygerberg evaluating the use of POCT in renal disease. Dr Jalavu, senior registrar recently joined this group and performing an audit of POCT in Tygerberg Hospital;
- Dr Ali is studying the pathophysiology of fat accumulation in various disease states in collaboration with the Department of Bio chemistry and now has extended his interest to ovarian and breast cancers;
- Prof Kotze developed a genomics database for research translation at the intersection between the laboratory and clinic to facilitate the implementation of personalized medicine. A new focus area on breast cancer and Point of Care Testing related to genomics has now emerged and is attracting both national and international attention; and
- Prof Erasmus continues to be involved with many of these groups, but is also extensively involved in a study on diabetes and associated cardiovascular risk factors in the mixed ancestry population of the Western Cape. The latter is a research project in collaboration with CPUT (Prof. T Matsha) and MRC (Prof. A Kengne).

Many of these research groups have external collaborators and with private laboratories.

4.1 Research Units/Study Groups Linked to the Department

- Reference Range Project: Prof Erasmus and Dr Hoffmann, in collaboration with Prof Ichihara from Japan and Pathcare;
- Bellville South Study: Professors Erasmus, Zemlin and others in collaboration CPUT (Prof. Matsha) and SAMRC (Prof. Kengne);
- Epigenetics of Diabetes in Mixed-ancestry subjects: Prof Erasmus in collaboration with Prof Matsha and Kengne from CPUT and SAMRC;
- EBLM Case Bank Development in multiple myeloma and SLE: Prof Erasmus and Prof Zemlin, in collaboration with Prof Esser from Immunology and UCT and Prof Ichihara from Japan;
- Point of Care Group: Prof Erasmus and Dr Rensburg;
- The Audit and Laboratory Management Group: Professors Zemlin and Erasmus, in collaboration with other divisions and African countries (UK, Nigeria, Kenya and Zimbabwe);
- Multiple Sclerosis and Schizophrenia Group: Profs Janse van Rensburg, Erasmus and Kotze, and Dr Van Toorn, Department of Paediatrics and Child Health; and
- Personalised Medicine Group: Professors Kotze, Erasmus, Schneider and Janse van Rensburg and the SAMRC (Dr T Bunn), Dr Ali, Dr Torrorey.

4.2 Research projects

Project Title:	Prolactin testing: Is the rationale for current practice justified?
Principal Investigators:	Dreyer, R (SU, Department of Medicine), Coetzee A (SU, Division of Endocrinology)
Co-researchers:	Hoffmann, M (NHLS and SU)
Collaborators:	Meyer, WP (PathCare Laboratories)
Funding:	Roche sponsored reagents, divisional sponsored consumables
Total Funding for the entire project:	R2450
Short Description:	Prolactin is a hormone commonly tested during theinvestigation of infertility, galactorrhoea, menstrual irregularities in woman, and investigation of infertility, galactorrhoea, menstrual irregularities in woman, andhypogonadism in men. Elevated levels are then futher investigated with expensive imaging. The stress of phlebotomy can however increase prolactin leves, and can result in unnecessary further testing. The aim of this study is to examine the effect of specimen collection at different time-points, to determine the optimal period of rest needed for reliable prolactin determination. Healthy volunteers will be recruited, and samples collected at baseline, and after 20 min, 40 min and 60 min of rest.
Project Start Date:	2017
Project End Date:	August 2018
Project Title:	Evidence for the utility of antenatal HbA1c to predict early postpartum diabetes after gestational diabetes in South Africa.
Principal Investigators:	Coetzee, A (Department of Medicine, Division of Endocrinology Stellenbosch University and Tygerberg Hospital)
Co-researchers:	Mason, D Surname & Initials (Department of Obstetrics & Gynecology, SU and Tygerberg Hospital), Hall, D (Department of Obstetrics & Gynecology, SU and Tygerberg Hospital); Hoffmann, M (NHLS and SU), Conradie, M (Department of Medicine, Division of Endocrinology, SU and Tygerberg Hospital)
Fundeing:	Not funded (part of routine patient care)
Total Funding for the entire project:	R0
Short Description:	Aim To evaluate antenatal HbA1c at diagnosis and in the 4 weeks preceding delivery to predict early postpartum diabetes mellitus (DM) in women with Gestational Diabetes Mellitus (GDM).
Project Title:	An audit on thyroid function testing in acutely ill patients admitted to Tygerberg Hospital.
Principal Investigators:	Kruger, E (NHLS and the SU)
Co-researchers:	Hoffmann, M (NHLS and SU)
Collaborators:	Coetzee, A (Department of Medicine, Division of Endocrinology SU and Tygerberg Hospital), Conradie, M(Department of Medicine, Division of Endocrinology SU and Tygerberg Hospital)
Funding:	Audit. Not funded

Total Funding for the entire project:	R0
Short Description:	Non-thyroidal illness syndrome is an abnormal thyroid hormone profile due to extra-thyroidal pathology. This syndrome is often seen in patients who either present to the Emergency Department or is admitted to an Intensive Care Unit. TSH that is requested in these patients is not necessarily a true reflection of the thyroid function. The objectives of this audit is to identify how many TSH requests were received from patients presenting to the ED at Tygerberg Hospital, as well as from patients admitted to the medical and surgical ICU's and to determine how many required no follow-up, treatment, or repeat testing in 6 – 8 weeks time.
Project Start Date:	June 2017
Project Start Date:	June 2018

Project Title:	Hyperferritinaemia and the causes thereof at a tertiary level hospital in Cape Town, South Africa
Principal Investigators:	Kariem, R (NHLS and SU) Co-Researchers: Jafta, A (NHLS and the University of Stellenbosch), N Naidoo (NHLS and SU), Erasmus, RT (NHLS and SU)
Funded by:	Audit (Not funded)
Total Funding for the entire project:	R0
Short Description:	Serum ferritin can be used as an indicator of body iron stores. Hyperferritinaemia occurs not only in iron overload but also a number of clinical settings including malignancy, liver disease, renal disease and inflammation, limiting its use to assess iron stores. The aim of this audit was to determine the most frequent causes of hyperferritinaemia in adults attending Tygerberg Hospital
Project Start Date:	2015
Project End Date:	January 2018

Project Title:	Glycated albumin: a biomarker for screening of diabetes and prediabetes in a high risk South African population
Student:	Dr M Barkhuizen (MMed) (NHLS and SU)
Role AEZ:	Principal Investigator and Supervisor
Co-supervisors:	Prof RT Erasmus (NHLS and SU) and Prof TE Matsha (CPUT)
Funding:	MRC Fund for Belville South Study; kits donated by Werfen
Total Funding for the entire project:	R200,000
Short Description:	Glycated albumin, an intermediate marker of glycaemic control, has been proposed as a screening tool for diabetes and prediabetes, especially in populations where the use of HbA1c may be unreliable. The aims of this study are to validate the methodology, determine local reference intervals and determine cut-offs for the screening of diabetes and prediabetes in our population.
Project Start Date:	2017
Project End Date:	2019

Project Title:	Development of a Clinical Case Bank for Promoting the Practice of Evidence Based Laboratory Medicine – Retrospective epidemiological study of patients with Multiple Myeloma and Systemic Lupus Erythematosus through retrieval and analyses of clinical records obtained from daily clinical practice at Tygerberg Hospital
Student:	Dr T Jalavu (MMed) (NHLS and SU)
Role AEZ:	Principal Investigator and Supervisor
Co-supervisors:	Prof RT Erasmus (NHLS and SU) and Prof K Ichihara (Japan)
Funding:	Applied unsuccessfully SA-Japan grant; Applied NHLS R500 000 grant
Total Funding for the entire project:	
Short Description:	The aims of this study are to create a web-based environment for the practice of EBLM through: (1) Development of a well-defined international clinical case bank by standardized / harmonized recording of laboratory data together with clinical findings for MM and SLE cases. (2) Development of information techniques and statistical methodologies for exploration and best utilizationof the database for laboratory diagnosis.

Project Start Date:	2017
Project End Date:	2020
Project Title:	Retrospective Audit of Serum and Urine Ketone Tests Performed at NHLS Tygerberg Hospital
Student:	Dr M Bezuidenhout (MMED) (NHLS and SU)
Role AEZ:	Principal Investigator and Supervisor
Co-supervisors:	Prof RT Erasmus (NHLS and SU)
Funding:	Audit – no funding needed
Total Funding for the entire project:	Not known
Short Description:	The aim of this retrospective audit is to examine the amount of serum and urine ketone tests performed at Tygerberg Hospital over a 6 month period. The results of this study will be used to motivate for the introduction of the manual ketone test and we will then collaborate with Nova and evaluate a ketone POCT test (2 further future studies)
Project Start Date:	January 2018
Project End Date:	Dec 2018
Project Title:	Urinary albumin assay comparison: NHLS Tygerberg Roche Cobas Tina-quant ® Albumin Gen 2 vs. Sysmex Corporation urine chemistry analyser-1000
Student:	Dr M Bezuidenhout NHLS and SU)
Role AEZ:	Principal Investigator and Supervisor
Co-supervisors:	Prof RT Erasmus (NHLS and SU) and Prof deLanghe (Ghent)
Funding:	Audit – no funding needed
Short Description:	The aim of this study is to establish whether the Sysmex Corporation UC-1000 can be used as an improved and cost-effective method for the determination of albuminuria in the Bellville-South study.
Project Start Date:	January 2018
Project End Date:	2019
Project Title:	The impact of training workshops and locally adopted international standardized guidelines on coagulation specimen rejection rates
Student:	Dr M du Toit (MMED Haem) (NHLS and SU)
Role AEZ:	Co-supervisor
Main supervisor:	Dr A Jafta
Funded by:	Audit – no funding needed
Short Description:	A retrospective audit will be performed to determine the rejection rate of coagulation specimens received at Tygerberg Hospital. A training workshop will be arranged to educate users on the standardized guidelines of coagulation samples. A re-audit will be performed after this to determine the impact of this training on specimen rejection rates.
Project Start Date:	January 2018
Project End Date:	Dec 2018

4.4.3 Grants Awarded

- R 200 000 per year (2015-2017) was awarded by CANSA for establishment of a cancer genomics patient database/registry; R 266 000 per year (2018-2010) for a PhD study on vitamin D in breast cancer patients. (Prof Erasmus –PI);
- R 3.1 million from the South Africa-UK Collaborative Research Development Programme in Precision Medicine from 2018-2020 as part of a R 10 million research commercialisation grant (Prof Kotze-PI);
- R 5 542 800 by the Technology Innovation Agency for the Open Genome Project from 2018-2020 (Prof Kotze-PI);
- R 500 000 by the NHLS for familial hypercholesterolaemia from 2017 to 2019 (Prof Kotze-PI);
- R30,000 NRF Incentive Funding – Prof Zemlin;
- Stellenbosch University Travel Funding R15 000 to attend Abu Dhabi in Dec 2017 (Prof Zemlin);
- R30,000 NRF Incentive Funding- Prof Erasmus;
- R30,000, NRF Incentive Funding- Prof Kotze;

6. Research Output

6.1 Journal Publications

Van der Merwe N, Peeters AV, Pienaar FM, Bezuidenhout J, van Rensburg SJ. Exome sequencing in a family with luminal-type breast cancer underpinned by variation in the methylation pathway. Int J Mol Sci 2017;18(2): E467. doi: 10.3390/ijms18020467.

Baatjes KJ, Conradie M, Apffelstaedt JPA, Kotze MJ. Pharmacogenetics of aromatase inhibitors in endocrine responsive breast cancer: lessons learnt from tamoxifen and CYP2D6 genotyping. Anticancer Agents Med Chem 2017; 17(13): 1805-1813.

Herbert E, Engel-Hills P, Hattingh C, Fouche JP, Kidd M, Lochner C, Kotze MJ, van Rensburg SJ. Fractional anisotropy of white matter, disability and blood iron parameters in multiple sclerosis. Metab Brain Dis 2018, 33(2): 545-557. (published online Feb 2018).

Negasha S, Kengne A, Erasmus RT, Matsha T. Differential prevalence and association of overweight and obesity by gender and population groups among school learners in South Africa: a cross sectional study. DOI:10.1186/S40608-017-0165-1.

Kengne A, Erasmus RT, Matsha T. Alternate indices of glucose homeostasis as biochemical diagnostic tests for abnormal OGTT in an African setting. Primary Diabetes Care, 2017; 11(2):119-131.

Naidoo N, Erasmus RT, Grewal R. Electrophoresis test prevalence, requesting patterns, yield and related bone marrow biopsy findings at a South African tertiary hospital: a 5-year retrospective audit. S Afr Med J 2017;107(3):270-3.

Mariachiara Di Cesare, James Bentham, [...], Julio Zuñiga CisnerosTrends in adult body-mass index in 200 countries from 1975 to 2014: A pooled analysis of 1698 popula...The Lancet 04/2016; 387(10026):1377-1396. DOI:10.1016/S0140-6736(16)30054-X.

Omuse G, Maina D, Hoffman M, Erasmus R. Metabolic syndrome and its predictors in an urban population in Kenya: A cross sectional study. BMC Endocrine Disorders, 2017. Doi:10.1186/S 12902-017-0188-0.

Zemlin AE, Matsha TE, Kengne AP, Hon GM, Erasmus RT. High molecular weight adiponectin levels are neither influenced by adiponectin polymorphisms nor associated with insulin resistance in mixed-ancestry hyperglycemic subjects from South Africa. J Med Biochem 2016;35:1-12.

Davison GM, Nkambule BB, Mkandla Z, Hon GM, Kengne AP, Erasmus RT, Matsha TE. Platelet, monocyte and neutrophil activation and glucose tolerance in South African Mixed Ancestry individuals. Sci Rep. 2017; 7:40329.

Matsha TE, Pheiffer C, Mutize T, Erasmus RT, Kengne AP. Glucose Tolerance, MTHFR C677T and NOS3 G894T Polymorphisms, and Global DNA Methylation in Mixed Ancestry African Individuals. J Diabetes Res. 2016;2016:8738072.

Tanyanyiwa D, MasekomengM, Mpye K, Bhana S, Musarurwa C, Erasmus R. Non-HDL/HDLC ratio is a better marker of dyslipidaemia related cardiovascular risk in African patients with acute coronary syndrome. Cent Afr J Med, 2017, 63(4/6)45-51.

Zemlin AE, Matsha TE, Kengne AP, Hon GM, Erasmus RT. Correlations of E-selectin concentrations with carotid intima-media thickness and cardio-metabolic profile of mixed ancestry South Africans: a cross-sectional study. Ann Clin Biochem 2017;54(1):92-100.

Naidoo N, Erasmus RT, Grewal R. Electrophoresis test prevalence, requesting patterns, yield and related bone marrow biopsy findings at a South African tertiary hospital: a 5-year retrospective audit. S Afr Med J 2017;107(3):270-3 .

Zemlin AE. Errors in the extra-analytical phases of clinical chemistry laboratory testing. Ind J Clin Biochem 2017 (DOI 10.1007/s12291-017-0657-2).

Florkowski C, Don-Wouchope D, Gimenez N, Rodriguez-Capote K, Wils J, Zemlin A. Point-of-care testing (POCT) and evidence-based laboratory medicine (EBLM) – does it leverage any advantage in clinical decision making? Crit Rev Clin Lab Sci 2017;54(7-8):471-94.

Published Journal Congress Abstracts

Peeters AV, van Heerden CJ, Kotze MJ. Whole exome sequencing revealed a novel 1-bp PALB2 deletion mutation (D434fs) in a breast cancer patient with a BRCA1 variant of uncertain clinical significance. Breast 2017; 32 (Suppl 1): S44.

Baatjes KJ, Santhia S, Peeters AV, Mccaul M, Kotze MJ. Clinical Outcomes in South African Breast Cancer Patients on Tamoxifen: A Ten-Year Review following CYP2D6 Genotyping. Breast 2017; 32 (Suppl 1): S22, Abstract P003.

6.2 Conference Presentations (Oral, Poster)

6.2.1 Oral Presentations

International Congresses

Invited Speaker: Epigenetics and diabetes. International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) Worldlab Congress, Durban, 22-25 October 2017.

Invited Speaker: Kotze M. Development of a rapid point-of-care DNA test for selection of patients eligible for next generation sequencing. Kenya Association of Clinical Pathologists, 13-15 November 2017, Nairobi, Kenya.

Invited Speaker: Kotze M. Genomics in pathology: The promise and reality of personalised medicine. 12th Biennial Scientific Conference of the Kenya Association of Clinical Pathologists, 15-17 November 2017, Watamu, Malindi, Kenya.

Invited Speaker: Hoffmann M: Invited lecture: Method validation of Point of Care Devices. Kenya Association of Clinical Pathologists, 13-15 November 2017, Nairobi, Kenya.

Invited Speaker: Zemlin AE. POCT in Africa – the need for a well-designed curriculum. Knowledge Exchange International Workshop: improving the quality of diabetes testing in Ethiopia and other African countries. 27 – 28 January 2017, Cape Town.
Invited Speaker. Zemlin A Invited talk: Glycated albumin: an emerging biomarker for diabetes.

QC workshop:
Invited Speaker. Zemlin A. preventing errors in the pre-analytical testing phase; Relevance of clinical audits and EBLM to improve quality. QA Workshop.

Invited Speaker: Erasmus R. HbA1C: Does one size fit fit all ? Knowledge Exchange International Workshop: improving the quality of diabetes testing in Ethiopia and other African countries. 27 – 28 January 2017, Cape Town.

Invited Speaker: Erasmus R. Glycation Gap. Biomarkers for Diabetes, EFLM, Sounio, Greece, 23rd June, 2017.

Invited Speaker: Erasmus R. Stat us of Laboratory Accreditation in South Africa. IFCC WorldLab, Durban, 22-25th October, 2017.

Invited Speaker. Erasmus R. Development of laboratory leadership and management program for Africa. IFCC WorldLab, Durban, 22-25th, October, 2017.

Invited Speaker. Erasmus R. Can we use HbA1c of 6.5% for the diagnosis of diabetes across all population groups? 44th National Conference of Association of Clinical Biochemists of India (ACBICON), Lucknow, India, 3-6th December, 2017.

Invited Speaker. Erasmus R. Developing National Point of Care Testing Policies, the South African Model. 3RD Point of Care Testing Africa Congress, Nairobi, Kenya, 13-14th November.

Invited Speaker. Erasmus R. Developing a Curriculum for Training of Point of Care Operators in Africa. 3rd Point of Care Testing Africa Congress, Nairobi, Kenya, 13-14th November.
Invited Speaker: 3rd International Conference of Chemical Pathology Department, Medical Research institute, Alexandria, Egypt, 3rd Feb, 2018.

Invited Speaker. Erasmus R. Strategic Planning and Quality: Key to success. Ethiopian Medical Laboratory Association Annual Conference.. Workshop on Improving quality in the laboratory. Bahar Dar, Ethiopia, 15/03/2018.

National Congresses

Kotze MJ, Van der Merwe N, Moremi KE, Van Heerden CJ and Peeters AV. Development of a whole exome sequencing service in South Africa: Identification of a novel PALB2 frameshift mutation during the breast cancer test validation phase. 2nd Pathology Research and Development (PathReD) Congress. 22-24 June 2017, Johannesburg.

Ali AT, Kelebogile ME, Peeters AV, RT Erasmus, Kotze MJ. Vitamin D pathway analysis in a BRCA1/2 mutation-negative patient diagnosed with metastatic ovarian cancer.

South Africa Society of Medical Oncology Congress, Johannesburg, 4-6 August 2017. Myburgh EJ, Langenhoven L, Grant KA, Van der Merwe L, Kotze MJ. Clinical overestimation of HER2 positivity in early estrogen and progesterone receptor-positive breast cancer and the value of molecular subtyping using Blueprnt.

Moremi KE, Kotze MJ, Kidd M, van Toorn R, van Rensburg SJ. Whole exome sequencing and extended screening for the HLA-DRB1*15:01 allele in multiple sclerosis patients evaluated for variation in the iron metabolism pathway. Biological Psychiatry Congress, Somerset-West, 14 – 17 September 2017.

Hattingh C, van Rensburg SJ, Kotze MJ, Engel-Hills P. Quantification of lesion load in clinical MRI in multiple sclerosis.

Kemp M, Isaacs F, Engel-Hills P, Kotze MJ, Kidd M, van Rensburg SJ. Ultrasound investigation of risk factors for extracranial vascular pathology in patients with multiple sclerosis (MS).

Burger A, Kotze MJ, Stein DJ, van Rensburg SJ, Howells F. The relationship between in vivo glutamate and peripheral markers of iron metabolism: A proton magnetic resonance spectroscopy study (1H-MRS) in healthy females and males.

Breast Interest Group of South Africa Conference, Johannesburg, 21 October 2017. Van der Merwe N, Peeters AV, Heslop L, Kotze MJ. Clinical utility of whole exome sequencing in two unrelated South African breast cancer patients evaluated for familial risk and treatment failure.

Sawe RT, Laing N, Mining SK, Kotze MJ. Experience with the informed consent process and family pedigree assessment for BRCA1/2 gene screening in Kenyan breast cancer patients.

Ali AT, Moremi KE, Peeters AV, Erasmus RT, Kotze MJ. Application of personalised medicine in a patient diagnosed with metastatic ovarian cancer. International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) Worldlab Congress, Durban, 22-25 October 2017.

Mampunye L, Moremi KE, van Eeden C, Grant KA, Kotze MJ. Confirmation of a BRCA2 founder mutation detected in tumour DNA in the germline of a breast cancer patient no family history of cancer.

Moremi KE, van Rensburg SJ, Kotze MJ. Co-occurrence of multiple sclerosis and triple-negative breast cancer underpinned by genetic variation in the iron metabolism pathway.

Okunola AO, Moremi KE, Zemlin AE, Baatjes KJ, Erasmus RT, Kotze MJ. Vitamin D levels in estrogen receptor-positive breast cancer patients treated with aromatase inhibitors.

Sawe RT, Kotze MJ, Mining K. High prevalence of triple-negative breast cancer in Kenyan breast cancer patients.
van der Merwe N, Peeters AV, Pienaar FM, Bezuidenhout J, van Rensburg SJ, Kotze MJ. Application of a pathology-supported pharmacogenetic testing approach in selection of BRCA1/2 negative patients for whole exome sequencing.

EMBL Conference: Cancer Genomics. 5-8 November 2017, EMBL Heidelberg, Germany.
Peeters AV, Van Heerden C, Baatjes K and Kotze MJ. Development of a Whole Exome Sequencing Service for Breast Cancer in South Africa.
Ethics-related congress contribution:

Invited as panel member in Session 3 on Genetics, Genomics and Precision Medicine, 6th Annual ARESA Research Ethics Seminar, Vineyard Hotel, Newlands, Cape Town, 11-12 May 2017.

Local Congresses (university academic days)
Zemlin AE. Writing a grant funding proposal: literature review and search engines. PathRed, Johannesburg 2017.

Zemlin AE, Kruger K. Case Presentation: A pain in the back (IgD myeloma). PathRed, Johannesburg 2017.

6.2.2 Poster Presentations
International Congresses
Meyer WP, Hoffmann M, Davids R, HitchcockE, Erasmus RT. Omnipaque™ intravenous contrast interference in capillary zone electrophoresis (EuroMedLab 2017; Athens).

Zemlin AE; Rensburg MA; Esser JH; Matsha TE; Kengne AP; Erasmus RT. Evaluation of a point-of-care instrument for HbA1c in a community at risk of developing diabetes. IFCC Durban Oct 2017.

Zemlin AE; Rensburg MA; Esser JH; Erasmus RT. HbA1c method performance and utilization at public health laboratories in South Africa – a sigmametric evaluation. IFCC Durban Oct 2017.

Zemlin AE; Rensburg MA; Esser JH; Matsha TE; Kengne AP; Erasmus RT. Evaluation of a point-of-care instrument for HbA1c in a community at risk of developing diabetes. IDF Abu Dhabi Dec 2017.

Zemlin AE; Rensburg MA; Esser JH; Erasmus RT. HbA1c method performance and utilization at public health laboratories in South Africa – a sigmametric evaluation. IDF Abu Dhabi Dec 2017.

National Congresses
Zemlin AE; Rensburg MA; Esser JH; Matsha TE; Kengne AP; Erasmus RT. Evaluation of a point-of-care instrument for HbA1c in a community at risk of developing diabetes. PathRed 23-24 June 2017, Johannesburg.

Zemlin AE; Rensburg MA; Esser JH; Erasmus RT. HbA1c method performance and utilization at public health laboratories in South Africa – a sigmametric evaluation. PathRed 23-24 June
2017, Johannesburg

Haematology

Acting Head of Division: Dr ZC Chapanduka

1. About the Department

The Division of Haematological Pathology is part of the Department of Pathology at the Tygerberg Hospital and SU. The main Division is housed on the 9th Floor at Tygerberg Hospital with the Biobank situated on the 10th Floor and the Molecular Laboratory currently located within the Virology Division at SU Tygerberg campus.

The vibrant array of personnel includes Technicians, Technologists, Student Technologists, Scientists, Student Scientists, Intern Scientists, Registrars/Student Pathologists and Pathologists, all from diverse backgrounds. The year under review has been both challenging and rewarding and has injected a new sense of optimism and purpose.

Table SU5: Number of staff per proffession

	Pathologist	Registrars	PhD S cientist	Technologist	Technician	Student Technologist	South African*	All
Black	2	1		6	1	1	10	
Coloured	0	3	1	3		1	5	
Chinese	0	0						
White	0	3		7		1	8	
Indian	1	2		1			2	
South A frican*	3	7	1	17	1	3	22	
Total	3	9	1	17	1	3	22	34

2. Diagnostic Services

The Division of Haematology offers a 24-hour laboratory service for Tygerberg Hospital, secondary hospitals and numerous clinics in the Western Cape Region. The Division serves as a referral centre for some Eastern Cape hospitals, notably Nelson Mandela Hospital for which all bone marrow biopsies are done.

The Haematology Laboratory maintains SANAS-accreditation and strives to be in a permanent state of audit readiness (the PSOAR principle). A successful re-accreditation inspection was held in 2017.

An antenatal blood group serology service is provided to the Tygerberg Hospital and other facilities in the Western Cape, in association with GSH. During the period under review, with the support of the Business Manager and the Area Manager, the division has made significant progress in an exercise to retire the antiquated serological methods and migrate to automated blood group serology.

The FACS Calibur flow cytometer used in diagnostics has reached it end-of service life and will be decommissioned shortly. The 2017 - 2018 period was spent making robust preparation for this eventuality and NHLS Procurement are leading the process with a Cross-Divisional team from both Haematology and Immunology supporting.

The Division experienced extreme academic and operational turbulence which culminated in the resignation of the Head of Department and two Consultants in the period under review. The final quarter brought in some stability with the on-boarding of two permanent Consultants and one sessional one.

The pursuit Inter-divisional collaboration yielded positive results with the acceptance of bone marrow trephine biopsy processing by the Division of Anatomical Pathology. This process improvement solved numerous quality problems.The Bone Marrow Biopsy Clinic was closed and bone marrow biopsies are now performed in the much safer X-block Theatre, a move which has allowed the universal use of midazolam, pre-medication. Procedure-related patient pain has therefore been practically abolished. The cost is the need for technologists to leave the laboratory area, which in turn exacerbated the shortage of technologist staff. In the last 6 months of the period under review, significant improvement was reported by the patients, the Registrars performing the procedure and the Consultants reviewing the quality of the bone marrow specimens obtained.

3. Teaching, Training and Proffesional Development

3.1 Undergraduate

Dr Debbie Jafta took over the Undergraduate teaching programme. She actively advanced our proposal that the 1st Year MBChB Haematology lecture series not be given until the students had completed the physiology of blood cells, bone marrow and lymph nodes. This was proposal was adopted.

Prof Abayomi and Drs Grewal, Jafta and Chapanduka delivered Undergraduate lectures, small group sessions and remedial tutorials as required, and set up examinations. Excellent student feedback was obtained.

3.2 Postgraduate

3.2.1 Pathology Registrars/Students:

Prof Abayomi appointed Dr Chapanduka to lead an exercise to improve Registrar supervision, time utilization and allocation of adequate time for Registrars to execute their various service and academic commitments. Drs Grewal and Jafta participated. The result was a new format Duty Roster which was instituted and refined since April 2017.

Advancement of the Registrars Master of Medicine (MMed) degree research was a major area of focus and resulted in all but one of the Haematopathology Registrars achieving their Ethics Committee approval or exemption. Two Registrars successfully completed their MMed degrees and graduated. The same two Registrars having passed their FCPath(SA) Haematology Part 2 examinations in 2017. The division of Haematology co-supervises its MMed Registrars with colleagues in Chemical Pathology, Paediatric and Adult Clinical Haematology.

The Division assists in the teaching of Registrars in other Divisions, including Paediatrics, Internal Medicine, Clinical Haematology and the other pathology disciplines. Furthermore, it contributes to the teaching of all the other Registrars in all the other academic departments on an ad hoc consultative and pre-determined basis.

One Clinical Pathology Registrar was guided through her MMed Part 1 examination, which she passed well. The Annual Molecular Pathology Course was successfully conducted under the leadership of Dr Carmen Swanepoel and involved Registrars and scientists from other disciplines. Drs Mashigo and Chapanduka delivered lectures and participated in the assessment.

3.2.2 Science students:

Dr C Swanepoel represents and manages the curriculum of all post graduate science students. For 2017, the division had 3 students (2X MSc, 1x Honours), respectively under the supervision/co-supervision of Dr Carmen Swanepoel, Dr Ravnit Grewal, and Prof. Akin Abayomi and Ms Shafieka Isaacs. One completed his studies and received his MSc degree. At present, the Division have 3 Honours and 1 MSc students currently under the supervision of Dr. Swanepoel, Mr Faghri February, Dr Nomusa Mashigo and Dr. Z Chapanduka

Table SU 6: Total number of trainees per qualification category and rates of successful completion/pass rates

	Total Number of trainees	Final year trainees	Successful completion	Percentage of Successful Completions
BSc Med Hons	3	0	0	-
MSc	2	1	1	100%
Registrars	9	4	2	50%
PhD	1	0	0	-
All	15	5	3	
South African	13	3	1	

3.2.3 HPCSA Scientist Internship Program:

Dr. Carmen Swanepoel also participated in the training of the intern scientists as part of the Haematology and Molecular Biology Discipline program. There were no intern scientists for the 2017 period however two new interns have been registered for 2018.

- Ms. Ntando Mthiyane
- Ms Shafieka Isaacs

3.2.4 Graduation 2017:

MSc Degree:
Mr Fungai Musaigwa. Investigating the suitability of Euroflow standardized multicolour flow cytometry panels for the charactherization of chronic lymphocytic leukemia (CLL) in the Tygerberg Academic Hospital, South Africa
Supervisors: Dr. Carmen Swanepoel and Dr. Ravnit Grewal

MMed (Haematological Pathology) Degree: Both candidates graduated in March 2018
Dr Essam Mahroug: The incidence of Castleman disease at Tygerberg Academic Hospital (TAH)
Supervisors: Dr. Ravnit Grewal
Dr Yadhia Maharaj: Clinical Outcomes in Patients with Chronic Lymphocytic Leukaemia at a Tertiary Teaching Hospital in South Africa.
Supervisors: Dr Gerhard Sissolak

3.2.5 Workshops/conferences/congress attendance:

- Specialists, postgraduate students, and medical technologists from the Division attended several training courses/conferences/ congresses during 2016 as part of continuous professional and skills development

- Fungai Musaigwa, Bongani Nkambule, Fatima Bassa, Akin E. Abayomi, Ravnit Grewal, Carmen C Swanepoel (Oral and Poster) Investigating the suitability of standardized Euroflow flow cytometry panels for the characterization and diagnosis of chronic lymphocytic leukemia/ small lymphocytic lymphoma at Tygerberg Academic Hospital (TAH), South Africa Young Investigator Work shop 2017, 9-10 February 2017, The University of Texas, M.D. Anderson Cancer Center, Houston, Texas

- B3Africa Training Workshop. International Agency for Research on Cancer, Lyon France 28 November – 1 December 2017 – Mr Faghri February, Dr. Carmen Swanepoel and Prof Akin Abayomi

- IARC-BCNet Symposium. From Biobank Infrastructure to Research: How BCNet Member Biobanks and Cohorts Are Contributing to Address Public Health Concerns, International Agency for Research on Cancer, Lyon France 27-28 November 2017 – Mr Faghri February, Dr. Carmen Swanepoel and Prof Akin Abayomi

- Prof Abayomi. Freetown Biosecurity Training. 6-11 March 2017
- Biorepositories and Biosecurity Workshop: 2nd Pathology Research and Development Congress (PathReD), Emperor's Palace Convention Centre, Johannesburg on the 23rd to 24th of June 2017 – Prof Abayomi and Dr. C Swanepoel
- Dr. Carmen Swanepoel was invited as an expert member by Economic Community of West African States (ECOWAS) to assess the technical and organizational capacities of a proposed Regional Biobank, the Cote d'Ivoire Biobank (CeReB) in Abidjan, Ivory Coast from 5-10 March 2018

- Drs Debbie Jafta, Ravnit Grewal and Elizabeth Mayne (Wits) collaborated to lead in an excellent Workshop at the PathRed Congress in Gauteng in 2017
- Professor Akin Abayomi co-led a Workshop on Biobanking at the PathRed Congress in Gauteng in 2017 in addition to the above-mentioned Plenary Lecture

3.3 Other Training Information

3.3.1 Outreach and Community Interaction

In collaboration with the Laboratory Manager Ms Fazlin Kolia-Cassiem, Session Pathologist Dr Maureen Stein embarked on an exercise to train technologist staff in order to improve the service they provide to their institutions, improve the quality of referrals and reduce referral-associated problems. The training focused on blood film examination and involved Karl Bremer, Worcester and Paarl Hospitals. Significant improvement was achieved

Dr. Carmen Swanepoel & Ms Jody Bell (MSc student) – Invited speakers at the Cape Town Science Centre for the National Science week, 7th August 2017

Dr. Carmen Swanepoel & Ms Jody Bell (MSc Student) – joined SAWISE members and the Thope Foundation on the 5th October in Khayelitsha and participated in a school holiday programme which popularizes Science, Technology, Engineering, Arts and Maths (STEAM) for school girls learners

An initiative to foster close collaboration with haematological pathologists in the private sector was initiated in the latter part of the period under review and resulted in the cooption of Drs Debbie Jafta (who left the NHLS in November 2017) and Dr Luhan Swart, both of AMPATH, as Extraordinary Lecturers under Stellenbosch University conditions. Furthermore, Dr Vash Mungal-Singh (a former Tygerberg pathologist) agreed to participate in the Division's academic and consultative activities.

The division continues to collaborate closely with Dr Basil Ogunsanwo and other Haematology laboratory colleagues at the Nelson Mandela Hospital in Umtata.

3.4 Professional Development

Table SU 7: Number of postgraduate students

Category	Number of Students
MMed (Haem Path) current	8
FCPath Haem Part 1	2 passed in February 2018
FCPath Haem Part 2	2 passed in May 2017
BSc Hons graduates in Haematology	0
MSc current	1
PhD (current)	0
PhD graduated	0
Intern Scientist	0
MSc graduated	1
Clinical pathology (current)	1
MMED graduate	2
Clinical Haematology (current)	0.

4. Research Activities

4.1 Research Groups

The Division of Haematopathology Research Committee has expanded initiatives over the last year. A number of projects for Hons students, Masters Student, PhD students as well as MMed students have been created, which are on-going or have been completed during this time frame.

4.2 Research Projects [Please include short description, start and end date]

THE TYGERBERG LYMPHOMA STUDY GROUP:

Project title: A multidisciplinary approach to improve the understanding of how HIV is transforming the incidence, pat tern, prognosis of malignant Lymphoma in the Western Cape of South Africa.
Researchers: E. Akin Abayomi, Ravnit Grewal, Carmen Swanepoel, Timothy Reid Fatima Bassa, Noor Mohamed, J Schnei der, Shafieka Isaacs, Fungai Masaigwa, Catherine Roussow (UWC)
Funding: The National Institute of Health (NIH) through the Sub Sahara Africa Lymphoma Study and the AIDS Cancer Specimen Repository (ACSR) as well as CANCA-SA.

Sub studies for degree purposes that forms part of the TLSG:

Project title: The incidence of DLBCL over a 10 year period at Tygerberg Hospital.
Researchers: Lindelwa Mazwi (MMED), Noor Mohamed, Fatima Bassa, Akin Abayomi and Nomusa Mashigo.
Project title: The incidence of Burkitt Lymphoma over a 10 year period at Tygerberg Hospital.
Researchers: Ernest Musekwa (MMED), Fatima Bassa, Prof Kruger and Dr. Zivanai Chapanduka.
Project title: Management of lymphoma in a centre with high HIV and TB prevalence.
Researcher: Dr.F Bassa (PhD)

BIOBANKING

Scale up of NSB, a biobank within the Division to serve as a model for the development of a network of biobanks through harmonization and standardization of biobanking operations according to national and International ethical and legal principles.

This project includes a collaboration of the Division of Haematology and the South African National Bioinformatics Institute (SANBI), University of the Western Cape, the Department of Chemical Physiology, Centre for Regenerative Medicine, The Scripps Research Institute, La Jolla, Ca, USA and RUCDR Infinite Biologics, Rutgers University, Piscataway NJ, USA, H3Africa, B3Africa, BCNET, NHLS NIOH Biobank.

Researchers: PI: Akin Abayomi, Co-investigators: Carmen Swanepoel, Faghri February, Shafieka Isaacs, Jody Bell, Michael Sheldon, Andrew Brooks Ravnit Grewal, Alan Christoffels
Funding: NIH, EU Horizon 2020, NHLS

Sub studies forming part of this initiative

Project title: The B3 Africa project (Bridging Biobanking and Biomedical Research across Europe and Africa): Creating a harmonised ethical and legal framework between European and African partner institutions that will allow sharing bio-resources and data and also consolidate the Africa-EU biobank cooperation.
Researchers: PI: Akin Abayomi, Co-PI: Carmen Swanepoel, Co-investigators: Faghri February, Shafieka Isaacs
Funding: EU Horizon 2020

Project title: Evaluation and validation of room temperature biospecimens transportation and storage technologies as an alternative cost effective solution to cold chain logistics and storage within biobanking and/or diagnostics

Researchers: Dr. Carmen Swanepoel, Ms. Shafieka Isaacs, Dr Ravnit Grewal, Prof Akin Abayomi
Funding: NIH H3Africa, NHLS

Project title: Evaluating the role of long-term urine biobanking on the stability of urine biomarkers in the diagnosis of pre-eclampsia?
Researchers: Ms Jody Bell, Ms Shafieka Isaacs, Prof James Roberts, Dr. Carmen Swanepoel
Funding: SAMRC

PROJECTS RELATED TO CLINICAL AUDIT/DIAGNOSTIC ASSAY DEVELOPMENT AND/OR IMPROVEMENT

Project Title: An audit of molecular testing for suspicion of thrombophilia at Tygerberg Hospital
Researchers: Dr. Wardah Cerfontein, Dr R. Grewal and Dr C Swanepoel

Project Title: An Audit of molecular testing for the diagnosis of myeloproliferative neoplasms
Researchers: Dr S Irusen, Dr. C Swanepoel and Dr R. Grewal

Project Title: The utility of flow cytometry as an ancillary tool for the diagnosis of lymphomas on
Researchers: Dr. C Griesel, Dr. C Swanepoel and Dr R. Grewal

Project Title: An audit of coagulation tests utilised for thrombophilia screening at Tygerberg Hospital
Researchers: Dr I Abdullah, Dr. Z Chapanduka and Dr. Debbie Japhta

Project Title: Investigating the prevalence of HIV-associated lymphomas and impact of antiretroviral therapy thereon at Tygerberg hospital from August 2015 To August 2017
Researchers: Mohau E Mphuthi (Dr N Mashigo -Supervisor)

Project Title: The association between malaria subtypes and the severity of thrombocytopaenia: Tygerberg Hospital ex perience 2015 to 2018
Researchers: Anne-Marie Visser (Dr N Mashigo -Supervisor)

Project Title: The prevalence of thrombotic thrombocytopenic purpura in HIV positive patients I Tygerberg Hospital, Western cape Province South Africa 2015-2017
Researcher: Prayer Nkuna (Dr E Musekwa - Supervisor)

Project Title: Investigating the ESR at Tygerberg against the international guidelines of ESR
Researcher: Aviwe Nompalweni (Fezeka Bam –Supervisor)

Project Title: Comparison of microscopy to the malaria rapid antigen test in the diagnosis of malaria
Researcher: Tlotlo Radebe, (Dr N Mashigo – supervisor)

Project Title: Evaluation of Prothrombin request, molecular testing and prevalence in Hereditary Thrombophilia at Tygerberg Hospital
Researchers: Ms Shareefa Isaacs, Ms Shafieka Isaacs, Dr. Nomusa Mashigo and Dr. Carmen Swanepoel

Project Title: Quantitative assessment of JAK2 and CalR mutations in Myeloproliferative Neoplasms by means Real Time PCR
Researchers: Ms Meagen Cousins, Dr. Z Chapanduka and Mr Faghri February

Grant research funding

- NIH;
- EU HORIZON 2020;
- NHLS;
- SAMRC;
- SU.

5. Research Outputs

5.1 Journal Publications

N Naidoo, RT Erasmus, R Grewal, AE Zemlin. Electrophoresis test prevalence, requesting patterns, yield and related bone marrow biopsy findings at a South African tertiary hospital: A 5-year retrospective audit. S Afr Med J 2017; 107(3):270-273. DOI:10.7196/SAMJ.2017.v107i3.10960.

Talishiea Croxton, Carmen Swanepoel, Henry Musinguzi, Mukthar Kader, Petronilla Ozumba, Azure-Dee Pillay, Raeesa Syed, Garth Swartz, Samuel Kyobe, Newton Lwanga, Fred Ashaba Katabazi, Kigozi Edgar, Agala Ndidi, Emmanuel Jonathan, Enzenwa Onyemata, Shafieka Isaacs, Elizabeth Sarah Mayne, Moses Joloba, Ute Jentsch, Akin Abayomi, Alash'le Abimiku, Jennifer Troyer, Sue Penno; and H3Africa Biorepository PI Committee. Lessons Learned from Biospecimen Shipping Among the Human Heredity and Health in Africa Biorepositories. BIOPRESERVATION AND BIOBANKING Volume 15, Number 2, 2017 DOI: 10.1089/bio.2017.0009.

Samuel Kyobe, Henry Musinguzi, Newton Lwanga, Dafala Kezimbira, Edgar Kigozi, Fred Ashaba Katabazi, Misaki Wayengera, Moses Lutaakome Joloba, Emmanuel Akin Abayomi, Carmen Swanepoel, Alash'le Abimiku, Talishea Croxton, Petronilla Ozumba, Anazodo Thankgod, Alan Christofells, Lizelle van Zyl, Elizabeth Mayne, Mukthar Kader, Garth Swartz; the H3Africa Biorepository PI Working Group*. Selecting a Laboratory Information Management System for Biorepositories in Low- and Middle-Income Countries: The H3Africa Experience and Lessons Learned. Biopreserv Biobank. 2017 April 15(2):1-4.

Hocine Bendou, Lunga Sizani, Tim Reid, Carmen Swanepoel, Toluwaleke Ademuyiwa, Roxana Martinez, Heimo Meuller, Akin Abayomi, and Alan Christoffels. Baobab Laboratory Information Management System: Development of an Open-Source Laboratory Information Management System for Biobanking. Biopreserv Biobank. 2017 April 15(2):116-120. doi: 10.1089/bio.2017.0014. PMID:28375759.

Naidoo, N., Abayomi, A. Locketz, C. Musaigwa, F. and R Grewal (2018) "Incidence of Hodgkin lymphoma in HIV positive and negative patients at a tertiary hospital in South Africa (2005-2016) and comparison with other African countries" S Afr Med J December 2017.

5.2 Conference Presentations

5.2.1 Oral Presentations

Fungai Musaigwa, Bongani Nkambule, Fatima Bassa, Akin E. Abayomi, Ravnit Grewal, Carmen C Swanepoel (Oral and Poster) Investigating the suitability of standardized Euroflow flow cytometry panels for the characterization and diagnosis of chronic lymphocytic leukemia/ small lymphocytic lymphoma at Tygerberg Academic Hospital (TAH), South Africa Young Investigator Workshop 2017, 9-10 February 2017, The University of Texas, M.D. Anderson Cancer Center, Houston, Texas.

TD Reid, R Dusabe, R Grewal, C Swanepoel, S Radelet, B Patterson, MH Botha, EA Abayomi. An alternative strategy for rapid & cost-effectivehuman papillomavirus (hpv)-related cervical cancer screening via flow cytometry: A PILOT STUDY The 31st International Papillomavirus Conference (HPV 2017), Cape Town, South Africa, 28 February - 5 March, 2017.

A Abayomi. Invited Speaker: BBMRI-ERIC's contribution to health research capacity building in Africa. Brussels 5 April 2017.

Shafieka Isaacs, Fatima Abulfathi, TimothyReid, Moeggamat February, Ravnit Grewal, Akin Abayomi, Carmen Swanepoel. Room Temperature storage solutions: An alternative to cold chain management within biobanks and/or diagnostics and research laboratories in Africa. ISBER 2017 Annual Meeting & Exhibits, Toronto, Canada. 9-12 May 2017.

C Swanepoel. International Genomic & Biobanking Initiatives in Africa. 2nd Pathology Research and Development Congress (PathReD), Emperor's Palace Convention Centre, Johannesburg, 23rd to 24th of June 2017.

Z.C. Chapanduka. The business of Pathology 2nd Pathology Research and Development Congress (PathReD), Emperor's Palace Convention Centre, Johannesburg, 23rd to 24th of June 2017.

A.E Abayomi. Biorepositories and Biosecurity. 2nd Pathology Research and Development Congress (PathReD), Emperor's Palace Convention Centre, Johannesburg, 23rd to 24th of June 2017.

Swanepoel C, Isaacs S, Abulfathi F, February M, Bell J, Grewal R, Christoffels A, Abayomi EA. Lessons learned: Challenges experienced by the NHLS/STELLENBOSCH UNIVERSITY BIOBANK (NSB), a South African perspective. Global Biobank Week, Stockholm, Sweden, 13-15th September 2017.

5.2.2 Poster Presentations

Swanepoel C, Isaacs S, Abulfathi F, February M, Bell J, Grewal R, Christoffels A, Abayomi EA. Lessons learned. ISBER 2017 Annual Meeting & Exhibits, Toronto, Canada. 9-12 May 2017.
Shafieka Isaacs, Fatima Abulfathi, TimothyReid, Moeggamat February, Ravnit Grewal, Akin Abayomi, Carmen Swanepoel. Room Temperature storage solutions: An alternative to cold chain management within biobanks and/or diagnostics and research laboratories in Africa. PathRed 2017, Johannesburg.23-24 June 2017.

Jody Lee Bell, Justus Hofmeyer, James Roberts, Shafieka Isaacs, Faghri February, Akin Abayomi, Carmen Swanepoel. Biobanking lessons learned from an urine based preeclampsia study. 61st Annual Academic Day, Faculty of Medicine and Health Sciences, Stellenbosch University. 30 August 2017.

Investigating the use of standardized EuroFlowTM panels for the characterisation and diagnosis of Chronic lymphocytic leukaemia in the Tygerberg Academic Hospital, South Africa. Musaigwa F, Bassa F, Nkambule B, Abayomi A, Grewal R, Swanepoel C.

- NHLS Pathred Congress, Johannesburg, South Africa, 22 - 24 June 2017
- Stellenbosch University 61th Academic Day, Cape Town, 30 August 2017
- AORTIC International cancer conference, Kigali, Rwanda, 7-10 November 2017

M. du Toit and D.Jafta Philadelphia Chromoseme positive CML presenting with non-characteristic morphologic features: A case report. 2nd Pathology Research and Development Congress (PathReD), Emperor's Palace Convention Centre, Johannesburg, 23rd to 24th of June 2017.

5.2.3 Additional Information

Non-peer reviewed article publications:

- Faghri February (2017). The Successful Testing of the Baobab LIMS Open-Source Software in a Use Case Analysis at a Medical School in South Africa. B3 African NEWSLETTER Issue No. 5/2017 pg.7

Medical Microbiology and Immunology

Head of Division: Prof. A Whitelaw

1. About the Department

The SANAS-accredited division of Medical Microbiology and Immunology offers a diagnostic service in microbiology, immunology and serology to Tygerberg Hospital and surrounding regional, district and primary level healthcare facilities which refer patients to Tygerberg Hospital. The immunology unit, headed by Prof Monika Esser, is recognised as a reference centre for primary immunodeficiency, and we are able to offer a national diagnostic and clinical consultative service in this area.

Dr Maloba sadly left the division at the end of 2017 to take up the post of HoD at Universitas Hospital / UFS. However we were very fortunate to be able to appoint Dr Kessendri Reddy, who successfully completed her training in 2017, and was appointed as a consultant pathologist in January 2018.

Table SU 8: Total number of staff per profession and highest qualification

	Doctoral	MMed	Masters	Honours	Diploma	All	South Africans
Pathologists		5				5	5
Medical Scientists	2					2	2
Technologists					5	14*	14
Other**		1				1	1
South Africans	2	6				8	8
All	2	6				8	8

- 7 technologists with BTech; 2 with BHSc
- **paediatrician / rheumatologist leading immunology unit

2. Diagnostic Service

The microbiology and immunology laboratories were successfully re-assessed by SANAS in 2017. One the challenges we are facing as a division is space utilisation. Dr Lourens co-ordinated the process of drawing up plans to renovate the laboratory to improve workflow, however this is an ongoing process as it requires permissions from hospital management and the provincial NDoH.

We continue to offer a consultative service to Tygerberg Hospital as well as all the facilities served by the laboratory. This involves rounds at various hospitals (Karl Bremer, Worcester, Khayelitsha), and Dr Reddy has been actively looking for ways to expand our physical coverage. The Immunology Unit provides a clinical service in immunology in collaboration with the Paediatric and Adult Infectious Diseases Services, as well as a service at the rheumatology clinic at Tygerberg Hospital. Both these services include a weekly outreach clinic, extensive telephone and e-consulting to advise on further investigations.

Members of the division are involved in antibiotic stewardship (AMS) and infection control governance committees at hospital, provincial and national levels, as well as in the NHLS microbiology, immunology and clinical pathology expert committees and subcommittees, and a number of local and regional bodies involved in clinical microbiology, immunology and immunodeficiencies.

We introduced one new test in 2017, the Legionella urinary antigen, and modified our protocol for performing Clostridium difficile testing in line with a national policy agreed by the Microbiology Expert Committee. This latter change is hopefully the start of more standardisation around testing practices nationally. Outbreaks in 2017 created challenges, especially the nationwide Listeria outbreak, as well as a local outbreak of diphtheria in the region which resulted in a large influx of screening samples over a limited time period.

3. Teaching and Training and Professional Development

3.1. Undergraduate

We continue to be involved in undergraduate training for both MBChB students and BSc dietetics students. This includes lectures, as well as tutorials both at Tygerberg and the Rural Clinical School in Worcester. Dr Hoffmann is working closely on the microbiology components of the planned BSc (Nurs) at the faculty. Dr Hoffmann also represents the Department of Pathology on the Undergraduate Programme Committee. The faculty embarked on a curriculum renewal programme in 2017, and both Dr Hoffmann and Dr Pienaar are involved in this, representing microbiology.

3.2. Postgraduate

One registrar successfully completed the CMSA exams and obtained her MMed in 2017; she was appointed into a consultant post in January 2018 at Tygerberg Hospital. Dr Lourens developed a formal induction programme for new registrars which was implemented in 2017, and has received positive feedback. We currently have 5 funded registrar posts, and have budgeted for a 6th post in 2018 to increase our training output. We hosted one adult infectious disease trainee in 2017 and pathology trainees from UCT and Red Cross Children's Hospital rotate through the Immunology Unit. Our intern scientist training programmes (microbiology and immunology) were re-accredited by the HPCSA and we accepted 2 interns in January 2018.

Members of the Division are involved in supervising BSc (Hons), MSc and PhD students, and contribute to the lecture and tutorial programme offered to the BSc (Hons) students. Our intake of BSc (Hons) and MSc students in 2018 was less than expected, due to late withdrawals of applicants who had been unable to secure bursary funding. This issue is likely to continue and we must investigate additional funding sources for postgraduate students.

Table SU 9: Total number of trainees and successful completion per qualification/profession

	Doctoral	Masters	Registrars	Intern Medical Scientist	Honours	All	South Africans
Total Number of Trainees	1	9	5	2	3	19	16
Final Year Trainees	0	4	1	0	3	8	7
Successful Completion		3 (1 pending examiners report)	1		3	7	7

*Footnote: Numbers for Masters and Honours reflect 2017 numbers. New students admitted in 2018 will be reflected in the 2018/19 report.

4. Research Activities

The Division continues to build on well-defined research themes, developing capacity and expertise, and ensuring that the research objectives meet national priorities:

- Laboratory diagnosis of infectious disease, including TB;
- The epidemiology and pathogenesis of staphylococcal infections;
- Diagnosis, epidemiology and impact of antimicrobial resistance;
- Detection and management of primary immunodeficiencies;
- Molecular investigation of genetic susceptibility to tuberculosis and other immune deficits; and
- The human microbiome and its relationship to human health.

4.1. Research Units/Study Groups Linked to the Department

The Primary Immunodeficiency Registry of South Africa
Investigator: M Esser

Burden of Antibiotic Resistance in Neonates from Developing Societies (BARNARDS)
Local Investigators: Ms L Paterson, Prof A Whitelaw, Dr K Hoek, Prof S Mehtar, Mr A Bulabula
Principal Investigator: Prof T Walsh, University of Cardiff

The AFROStrep Study: A surveillance system for group A streptococcal infection in South Africa.
Investigators: Prof B Mayosi (PI), Dr Mark Engel, Mr Dylan Barth, Prof A Whitelaw, Prof M. Nchabeleng

4.2. Research Projects [Please include Principal investigator, funder, short description, start and end date] Projects completed in 2017

Project Title: Investigation of the oral and gut microbiome of patients with metabolic syndrome.
Supervisor: Dr K Hoek, Prof. A Whitelaw | Student: Jade Pekeur (MSc)
Status: Complete, thesis examined and passed.

Project Title: β-lactam resistance mechanisms in Enterobacter spp. isolates from Tygerberg Hospital.
Supervisors: Dr M Newton-Foot; Prof A Whitelaw: Student Ms D Okyere (MSc)
Status: Complete, thesis submitted for examination.

Project Title: A point-prevalence study of adult in-patients to determine colonisation with carbapenemase-producing Enterobacteriaceae in TBH, Western Cape, SA.
Funding: NHLS Research Trust Development grant
Supervisors: R Hoffmann, K Hoek Student: P Nel (MMed)
Status: Lab work complete; report in final stages.

Project Title: The epidemiology and clinical impact of Gram negative bacteraemia at Tygerberg Hospital
Funding: NHLS Research Trust Development grant
Supervisors: Prof A Whitelaw, Dr M Newton-Foot Student: Ms L. Paterson (MSc)
Status: Complete, student graduated 2017; results to be published

Project Title: Evaluation of two molecular methods to rapidly identify Staphylococcus aureus and methicillin resistance from positive blood cultures.
Investigators: Dr K Reddy (MMed student); Prof A Whitelaw, Dr M Newton-Foot; Dr K Hoek.
Status: Complete, Dr Reddy graduated 2017. Manuscript submitted

Projects ongoing in 2017

Project Title: Functional immunological screening of the primary deficiency Mendelian susceptibility to Mycobacterial Disease (MSMD)
Researchers: RH Glashoff (Division of Medical Microbiology & Immunology, NHLS Tygerberg), M Esser, A van Coller (MSc student)
Collaborators: C Kinnear, M. Moller, B Glanzmann, E Hoal, M Urban (DST/NRF Centre of Excellence in Biomedical Tuber culosis Research, SAMRC Centre for Tuberculosis Research, Division of Molecular Biology and Human Genetics)

Project Title: The role of agr type and agr functionality in bacterial physiology and clinical disease in Staphylococcus aureus.
Investigators: Dr M Newton-Foot, Prof A Whitelaw, Dr J Taljaard, Dr H Rabie, Prof R Warren, Ms Amike van Rijswijk (BSc Hons 2016; MSc 2017)

Status: MSc student to complete end 2017

Project Title: Percutaneous Pericardioscopy in Tuberculous (TB) Pericarditis: Improving the Diagnostic yield and Gaining New Insights Into the Pathogenesis of TB Pericarditis.
Investigators: Dr Charles Kyriakakis (PhD student), Prof G Doubell; Prof A Whitelaw; Dr M Newton-Foot; Ms C. Rautenbach
Status: ongoing sample collection

Project Title: Molecular epidemiology of S. aureus in Northern, Central and Southern Africa.
Investigators: Prof A Whitelaw, Prof G Revathi, Dr A AbouElfetouh, Dr M Newton-Foot, Ms K Nel van Zyl, Dr G Omuse, Mr M Al-Seqely
Status: Ongoing; extension requested from NRF. Has fed into a new project with Wurzburg University (see later)
Project Title: Characterization of colistin resistance in Enterobacteriaceae isolates from TBH.
Investigators: Prof A Whitelaw, Dr B Maloba, Dr M Newton-Foot, Ms Y Snyman (BSc Hons 2016; MSc 2017)
Funding: Application to NHLS Research Trust
Status: 1 publication 2017; 2nd in progress. MSc student to complete in 2017

Project Title: Estimating excess mortality risk from antibiotic-resistant Gram negative bacteraemia in hospitalized Afri can patients
Investigators: Dr Alex Aiken (LSHTM); Dr A. Dramowski, Prof A Whitelaw
Funding: Gates Foundation (Grand Challenge Award)
Status: Data collection complete. Genome sequencing on approx. 50% isolates complete. 1 manuscript in preparation. 2nd will follow once WGS complete.

New projects commenced 2017

Project Title: The effect of long term fluoroquinolone prophylaxis on carriage of antimicrobial resistant organisms in children (a TB-CHAMP sub-study)
Investigators: Prof A Whitelaw; Dr M Newton-Foot; Prof A Hesseling (TB-CHAMP PI): Mr R Ocloo (MSc student)
Funding: NHLS, Harry Crossley Foundation
Short Description: Stool samples from children randomised to either 6 months of levofloxacin or 6 months of placebo (Tb CHAMP study) are being collected to assess carriage of resistant organisms, and the effect of antibiotic exposure on carriage of resistance.
Status: Stool samples being collected, aim to complete MSc by end 2018. TB-CHAMP to continue for longer, 2nd student will take study forward

Project Title: The effect of antibiotics on the gut microbiome of children from Cape Town communities (a TB-CHAMP sub study)
Investigators: Prof A Whitelaw; Dr M Newton-Foot; Prof A Hesseling (TB-CHAMP PI): Ms K Nel van Zyl R Ocloo (PhD student).
Funding: NHLS. (EDCTP application pending)
Short Description: Another TB-CHAMP sb study, describing baseline microbiota, the effect of levofloxacin on the microbiota, as well as stability of such effects.
Status: Pilot study to determine optimal collection / storage protocol almost complete. Stool sample collection ongoing.

Project Title: Molecular epidemiology and antimicrobial resistance mechanisms in staphylococci from various geo graphic regions in Africa
Investigators: Prof A Whitelaw; Prof R Gunturu (Nairobi), Dr A Abouelfetouah (Alexandria), Prof W Ziebuhr (PI; Wurzburg)
Funding: DFG
Short Description: Multi centre study to evaluate the links between resistance in commensal and environmental staphylococci and resistance in clinical S. aureus; as well as to describe / characterise novel resistance mechanisms in S. aureus.
Status: Funding approved end 2017; one start up meeting Feb 2018.

Project Title:	Comparison of three different commercial assays for the detection of Clostridium difficile in stools
Investigators:	Dr Maloba, Dr C Pienaar, Dr S Singh (MMed), Dr M. Newton-Foot;
Funding:	Internal divisional funding
Short Description:	Observational study comparing diagnostic accuracy of three different assays for the detection of Clos tridium difficile (C. diff) in stools. Loose stool for routine C.diff testing using Xpert® C. difficile (Cepheid) will be tested with the C. diff Quik Check Complete® (Alere Techlab) and the BD MAX™ C.diff (Becton Dickinson). Stool samples undergo toxigenic culture using the chromID® C. diff agar (bioMérieux,).
Status:	Testing almost complete, research report to be completed in 2018

Project Title:	Rapid detection of Mycobacterium Tuberculosis resistance to second line anti-TB drugs by a dye-based real-time PCR assay at Tygerberg Hospital Investigators: Dr M. Newton-Foot; Prof A Whitelaw; Mr T Mazango (MSc student)
Funding:	Harry Crossley Foundation
Short Description:	development and validation of a real time PCR assay to identify resistance to INH (inhA and katG), fluoro quinolones (gyrA) and injecteables (rrs) using real time PR and melting temperature analysis.
Status:	Assay for all gene targets optimised; evaluating assay ion a collection of characterised resistant M. tubercu losis isolates.

Project Title:	Characterization of the nasopharyngeal microbiome in children with pulmonary tuberculosis
Investigators:	Dr M. Newton-Foot; Dr M van der Zalm, Dr B Kirby (UWC); Ms B Hamman (MSc student))
Funding:	EDCTP (M vd zalm, PI)
Short Description:	This is a sub study of a larger study evaluating Tb diagnosis, and assessment of lung function in children with and without TB. In this sub study, respiratory samples from children with and without TB are compared to describe differences in the microbiota as well as the presence of specific viral and bacterial pathogens, as possible co-infections.
Status:	sample collection complete; pathogen-specific multiplex PCR complete. 16S DNA sequencing in progress. Aim to submit MSc 2017.

Project Title:	Detection, Molecular Characterization and Epidemiology of Fosfomycin Resistance Mechanisms in Entero bacteriaceae from Urinary Isolates at Tygerberg Hospital Investigators: Dr A Lourens; Dr M. Newton-Foot; Ms L Mosimane (BSc Hons student)
Funding:	Divisional funding
Short Description:	Fosfomycin is becoming increasingly used to treat UTIs due to resistant organisms. This study aimed to describe mechanisms of resistance in clinical Enterobacteriaceae with phenotypic fosfomycin resistance
Status:	Study complete 2017; student graduated end 2017.

Project Title:	The Characterisation of Vitek 2-Modified Amikacin-Intermediate Enterobacteriaceae from Tygerberg Hospital
Investigators:	Dr C Pienaar; Dr M. Newton-Foot; Ms L Stein (BSc Hons student)
Funding:	NHLS
Short Description:	The automated Vitek system often reports Enterobacteriaceae as non-susceptible even when MICs are in the susceptible range, due to the predicted presence of an aminoglycoside modifying enzyme. This study aimed to determine the presence of AMEs in these isolates using molecular assays.
Status:	Study complete 2017; student graduated end 2017.

Project Title:	Immunological aspects of HIV-1 infection: cellular role players and biomarkers of immune activation/ex haustion and the impact of long-term antiretroviral therapy and relationship to latent reservoirs
Researchers:	RH Glashoff (Division of Medical Microbiology & Immunology, NHLS Tygerberg), T Maponga (Postdoc), S Naidoo (PhD student), P Olifant (MSc student)
Collaborators:	M Cotton, S Innes and B Laughton (FAMCRU/KIDCRU, Department of Paediatrics, SU/TBH), M Esser (Immu nology Unit, Division of Medical Microbiology, NHLS Tygerberg), A Zemlin (Division of Chemical Pathology, NHLS Tygerberg), LG Bekker (Desmond Tutu HIV Foundation, UCT)
Funding:	PRF, NHLS Research Trust, Hope, NIH

Short Description: Inflammation and Immune activation, as well as the phenomenon of immune exhaustion are characteristic features of chronic HIV infection. ART usually leads to a reduction in these processes, however residual levels are thought to play a role in development of cardiovascular and neurovascular disorders. The current thrust of the research is in ascertaining the how these features of chronic adult infection manifest in MTCT-infected children. This work is also comparing immune status to viral reservoir persistence and to neurovascular and neurocognitive outcomes.

Project Title: Immunological mechanisms underlying liver fibrosis in chronic HBV and HBV/HIV-1 co-infection
Collaborators: T. Maponga, W. Preiser, M. Andersson, P. Matthews (Oxford University)
Funding: NHLS Research Trust, PRF
Short Description: HIV infected individuals usually have a worse prognosis when infected with HBV. Fibrosis is due to chronic HBV infection, which usually manifests in children. Subsequent HIV infection exacerbates the fibrogenic process. In this study we are assessing immune function in mono-infected and co-infected individuals. The current thrust of the research is ascertaining the immune functioning in different patient groups.

4.3. Grant Funding

New grants awarded in 2017

- 2 NHLS Development grants;
- 1 NHLS research award;
- 1 DFG Grant;
- 2 Harry Crossley Foundation awards; and
- 1 Polio Research Foundation.

5. Research Output

5.1. Journal Publications (Subsidised)

Barth D, Mayosi BM, Badri M, Whitelaw AC, Engel ME. Invasive and non-invasive group A ß-haemolytic streptococcal infections in patients attending public sector facilities in South Africa:2003 - 2015. Southern African Journal of Infectious Diseases 2017; 1(1):doi.org/10.1080/23120053.2017.1376546.

Bhigjee A I, Moodley A A, Roos I, Wells C-L, Ramdial P, Esser MM. The neuromyelitis optica presentation and the aquaporin-4 antibody in HIV-seropositive and seronegative patients in KwaZulu-Natal, South Africa. Southern African Journal of HIV Medicine 2017; 18(1):doi.org/10.4102/sajhivmed.v18i1.684.

Boyles TH, Brink A, Calligaro G, Cohen C, Dheda K, Maartens G, Richards GA, Van Zyl Smit R, Smith C, Wasserman S, Whitelaw AC, Feldman C. South African guideline for the management of community-acquired pneumonia in adults. Journal of Thoracic Disease 2017; 6:1469-1502.

De Villiers N, Glanzmann B, Van Helden EG, Schoeman M, Petersen B-S, Franke A, Lau Y-L, Urban MF, Van Helden PD, Esser MM, Moller M, Kinnear CJ. Exome Sequencing Identifies a Novel MAP3K14 Mutation in Recessive Atypical Combined Immunodeficiency. Frontiers in Immunology 2017; 8:doi 10.3389/fimmu.2017.01624.

Dramowski A, Cotton MF, Whitelaw AC. A framework for preventing healthcare-associated infection in neonates and children in South Africa. SA Medical Journal 2017; 107(3):192-195.

Dramowski A, Cotton MF, Whitelaw AC. Surveillance of healthcare-associated infection in hospitalized South African children: Which method performs best?. SA Medical Journal 2017; 107(1):56-63.

Fang Z, Newton-Foot M, SAMPSON SL, Gey Van Pittius NC. Two promoters in the esx-3 gene cluster of Mycobacterium smegmatis respond inversely to different iron concentrations in vitro. BMC Research Notes 2017; 10(426):DOI 10.1186/s13104-017-2752-0

Glanzmann B, De Villiers N, Moller M, Glashoff RH, Nortje R, Petersen B-S, Franke A, Schoeman M, Urban MF, Kinnear CJ, Esser MM. A Primary immunodeficiency diseases odyssey - answer from the exome in a case with immunodeficiency and autoimmunity. Current Allergy and Clinical Immunology 2017; 30(4):278-283.

John TJ, Lalla U, Taljaard JJ, John KG, Slabbert JT, Koegelenberg CFN. An outbreak of community-acquired pseudomonas aeruginosa pneumonia in a setting of high water stress. Quarterly Journal of Medicine 2017; 110(12):855-856.
Kalk E, Schubert P, Bettinger JA, Cotton MF, Esser MM, Slogrove AL, Wright CA. Placental pathology in HIV infection at term: a comparison with HIV-uninfected women. Tropical Medicine and International Health 2017; 22(5):604-613.

Kinnear CJ, Glanzmann B, BANDA E, DE Villiers N, Durrheim GA, Neethling A, Nel Edlr, Schoeman M, Johnson AG, Van Helden PD, Van Helden EG, Esser MM, Urban MF, Moller M. Exome sequencing identifies a novel TTC37 mutation in the first reported case of trichohepatoenteric syndrome (THE-S) in South Africa. BMC Medical Genetics 2017; 18(26):11.

Kumar S, Bouic PJD, Rosenkranz B. Simultaneous HPLC Determination of Efavirenz, 8-Hydroxy Efavirenz, Neostigmine and Comparison of Separation Using a C18 and Biphenyl Column through Pharmacological Evaluation. Indian J of Pharmaceutical Sciences 2017; 3:353-360.

Liebrich W, Esser MM, Urban MF. PID123 A visit to a molecular diagnostic laboratory. Current Allergy and Clinical Immunology 2017; 30(2):114-115.

Newton-Foot M, Snyman Y, Maloba M, Whitelaw AC. Plasmid-mediated mcr-1 colistin resistance in Escherichia coli and Klebsiella spp. clinical isolates from the Western Cape region of South Africa. Antimicrobial Resistance and Infection Control 2017; 6(78):DOI 10.1186/s13756-017-0234-8.

Perovic O, Singh-Moodley A, Govender NP, Kularatne R, Whitelaw AC, Chibabhai V, Naicker P, Mbelle N, LekalakalA R, Quan V, SAmuel C, Van Schalkwyk E. A small proportion of community-associated methicillin-resistant Staphylococcus aureus bacteraemia, compared to healthcare-associated cases, in two South African provinces. European Journal of Clinical Microbiology and Infectious Diseases 2017; 36(2):2519-2532.

Ruhanya V, Jacobs GB, Glashoff RH, Engelbrecht S. Clinical Relevance of Total HIV DNA in Peripheral Blood Mononuclear Cell Compartments as a Biomarker of HIV-Associated Neurocognitive Disorders (HAND). Viruses-Basel 2017; 9(324):doi 10.3390/v9110324.

Schwartz IS, Kenyon C, Lehloenya R, Claasens S, Spengane Z, Prozesky HW, Burton R, Parker A, Wasserman S, Meintjes G, Mendelson M, Taljaard JJ, Schneider JW, BEYLIS N, Maloba M, Govender NP, Colebunders R, Dlamini S. AIDS-related Endemic Mycoses in Western Cape, South Africa, and clinical mimics: A cross-sectional study of adults with advanced HIV and recent onset, widespread skin lesions. Open Forum Infectious Diseases 2017; 0:1-7.

Slogrove AL, Esser MM, Cotton MF, Speert DP, Kollmann TR, Singer J, Bettinger JA. A prospective cohort study of common childhood infections in South African HIV-exposed uninfected and HIV-unexposed infants. Paediatric Infectious Disease Journal 2017; 36(2):e38-e44.

Smith AM, Smouse SL, Tau NP, Bamford CM, Moodley VM, Jacobs C, Mccarthy KM, Lourens A, Keddy KH. Laboratory-acquired infections of Salmonella enterica serotype Typhi in South Africa: phenotypic and genotypic analysis of isolates. BMC Infectious Diseases 2017; 17(656):doi 10.1186/s12879-017-2757-2.

Walters E, Demers A, Van Der Zalm MM, Whitelaw AC, Palmer M, Bosch C, Draper HR, Gie RP, Hesseling AC. Stool Culture for Diagnosis of Pulmonary Tuberculosis in Children. J Clinical Microbiology 2017; 55(12):3355-3365.

Walters E, Van Der Zalm MM, Palmer M, Bosch C, Demers A, Draper HR, Goussard P, Schaaf HS, Friedrich SO, Whitelaw AC, Warren RM, Gie RP, Hesseling AC. Xpert MTB/RIF on Stool is Useful for the Rapid Diagnosis of Tuberculosis in Young Children With Severe Pulmonary Disease. Paediatric Infectious Disease Journal 2017; 36(9):837-843.

5.2. Conference Presentations

5.2.1 Oral Presentations

International

E. Teer, H. Strijdom, N. Driescher, R. Glashoff, M. F. Essop. Evidence of immune activation and coagulation in South African HIV-positive individuals: link to cardiovascular disease onset? IUPS 2017 Congress, Rio de Janiero, Brazil, August 2017.

Shalena Naidoo, Mary-Grace Katusiime, Mark F. Cotton, Gert U. Van Zyl, Richard H. Glashoff. Upregulation of chronic inflammatory cytokines despite early treatment and virological suppression in children: a role in HIV persistence? IAS AIDS Science 2017, Paris, July 2017.
Whitelaw A. Point of Care in Infectious Diseases: Getting ready for Prime Time. Point of Care Africa Conference, Nairobi,Kenya, November 2017; and Kenyan Association of Clinical Pathologists (KACP) meeting; Malindi, Kenya, November 2017.

M Esser Presenter of 3 Talks and Inviter Speaker to CSL Behring Genetics Symposium. ASID Congress, Victoria Falls, Zambia . 1-3 April 2017.

M Esser Invited Speaker 2 presentations IPOPI PID Workshop, Jakarta 7 May 2017.

M Esser Invited Speaker 2 talks. 38th Namibian Medical Conference, Swakopmund.
M Esser: Utility of the clinical case bank for improved clinical diagnosis and management of collagen diseases. IFCC World Lab Conference, Durban October 2017.

M Esser Invited Facilitator and Presenter: A Project - Primary Immunodeficiency Workshop, Pathologists & Forensics Association Mauritius. Mauritius, October 2017.

National

Ansia van Coller, Brigitte Glanzmann, Marlo Möller, Michael Urban, Nikola Schlechter, Craig Kinnear, Monika Esser, Richard Glashoff. Identification of variants associated with the Primary Immunodeficiency Mendelian Susceptibility to Mycobacterial Disease (MSMD) in South Africa. South African Immunology Society (SAIS) Conference, Cape Town, September 2017.

Shalena Naidoo; Michele D. Sobolewski; Taylor Simmons; Joshua C. Cyktor; Melissa A. Tosiano; Mary-Grace Katusiime; Mark F. Cotton; Gert U. Van Zyl; John W. Mellors; Richard H. Glashoff. Characterization of the inflammatory cytokine profile and latent HIV reservoir in early treated and long-term suppressed HIV infected children – the emerging insights into HIV persistence. South African Immunology Society (SAIS) Conference, Cape Town, September 2017.

Tongai G. Maponga, Monique I. Andersson, Jantjie Taljaard, Christo J. Van Rensburg, Wolfgang Preiser, Richard H. Glashoff. HIV/HBV viraemia and not immune dysregulation is associated with liver inflammation in South African patients. South African Immunology Society (SAIS) Conference, Cape Town, September 2017.

Reddy K, Whitelaw A. Can we trust the Xperts? An evaluation of the Xpert MRSA/SA BC system and assessment of potential clinical impact. 7th FIDSSA Congress, Cape Town, November 2017.

M Esser. Primary Immunodeficiency Syndrome and Autoimmunity SARAA Congress 10 February 2017, Johannesburg.

M Esser Presenter of 3 talks and convener of the Immunoglobulin workshop. ALLSA Congress, Port Elizabeth , 14-17 September 2017.

M Esser. A Shotgun Genetic Diagnostic Approach to Primary Immunodeficiencies SAIS Conference, Gordon's Bay 6-8 August 2017.

Kristien Nel Van Zyl. The effect of antibiotics on the microbiome. PathRED Congress. Johannesburg, June 2017.

Local

3 oral presentations (Yolandi Snyman, Amike van Rijswijk, Dora Okyere): Faculty of Medicine and Health Sciences Academic Year Day, July 2017.

1 oral presentation (M Esser), African Doctoral Academy, Stellenbosch University, Jan 2017.

5.4.2 Poster Presentations

International:

Reddy K; Whitelaw A. Management of suspected sepsis and staphylococcal bacteraemia in Cape Town, South Africa. International Congress on Infectious Disease, Buenos Aires, 27 Feb – 2 March 2018.
Okyere D, Whitelaw A, Newton-Foot M. beta-lactam resistance mechanisms in Enterobacter spp. isolates from Tygerberg Hospital. 6th Keystone Symposia Conference on Antimicrobials and Resistance. Santa Fe, New Mexico. October 29 to 1st November, 2017.

Okyere D, Newton-Foot M, Whitelaw, AC. Beta-lactam resistance in Enterobacter species isolates from Tygerberg Hospital. UNESCO Merck Africa Research Summit (MARS). Port Louis, Mauritius. November 2017.

M Esser Identification of a novel WAS mutation in a South African patient presenting with atypical Wiskott-Aldrich Syndrome. ESID Congress, Edinburgh, UK .11-14 September 2017.

National
Paterson L, Whitelaw A, Newton-Foot M. The epidemiology of Gram negative bacteraemia at Tygerberg Hospital.. 7th FIDSSA Congress, Cape Town, November 2017.

Nel P, Hoffmann R. A point-prevalence study of adult in-patients to determine colonisation with carbapenemase producing Enterobacteriaceae in Tygerberg Hospital, Western Cape, South Africa.. 7th FIDSSA Congress, Cape Town, November 2017.

Reddy K, Rabie H. Maloba M, Pienaar C; Gericke S. Will the real pathogen please stand up? A case report report of exudative pharyngitis caused by Corynebacterium pseudodiphtheriticum. . 7th FIDSSA Congress, Cape Town, November 2017.

Hoffmann R, Singh S. Early onset neonatal Streptococcus gallolyticus subsp pasteurianus meningitis and septicaemia. . 7th FIDSSA Congress, Cape Town, November 2017.

Local
3 poster presentations (Bianca Hamman, Jade Pekeur, Lauren Paterson): Faculty of Medicine and Health Sciences Academic Year Day, July 2017.

Medical Virology

Head of Department: Prof. W Preiser

1. About the Department

The Medical Virology Division delivers a comprehensive diagnostic virology service, including virus isolation and an extensive repertoire of serological and molecular assays, with a special focus on antiretroviral drug resistance testing. Staff, postdoctoral fellows and post-graduate students are successfully conducting research on several themes, often with national and international collaborators. While HIV accounts for a major portion of routine diagnostic tests and is the focus of several research areas, a number of additional research activities are being pursued.

Since 2015, the Division has been recognised as the South African Medical Research Council Collaborating Centre for HIV Laboratory Research (TygHIVLab). TygHIVLab pursues three specific research projects, namely the evaluation of novel monitoring approaches for ART success; the study of HIV persistence in patients on long-term antiretroviral therapy; and the characterisation and pathogenesis of HIV-1 in neurocognitive disorder (HAND) in South Africa. The grant has been extended by one more year.

Following a stringent process with a successful outcome, the Division is now registered as a World Health Organization (WHO) Prequalification Evaluating Laboratory under the WHO's Prequalification Alternative Performance Evaluation Mechanism (cf. http://www.who.int/diagnostics_laboratory/evaluations/alternative/en/). Dr Corena de Beer was appointed by the National Minister of Health as a member of the National Authority for Containment on Poliovirus Eradication as part of the Global Action Plan III of the World Health Organization in May 2017 and in February 2018, she was elected and appointed as the chairperson of this committee.

Tygerberg Hospital (TBH) Virologist, Prof. Gert van Zyl, serves on the Western Cape Province's Third-Line Antiretroviral Treatment Committee. He is also a reviewer for the South African Medicines Control Council and several international bodies such as the Clinical Trials Committee, the AIDS Clinical Trials Group (ACTG), the HIV Reservoirs and Viral Eradication Transformative Science Group and serves on the NHLS' HIV Drug Resistance Testing Subcommittee.

Dr Jean Maritz left for the private sector but has been appointed as an Extraordinary Senior Lecturer by the Faculty; as such he will continue to be involved with under- and postgraduate teaching and certain research projects. Dr Nokwazi Nkosi, who trained at Groote Schuur / UCT and excelled in her final CMSA exam, has been appointed as a virologist as from 1st February 2018. After a turbulent first half of 2017, which saw all registrars depart, three new registrars commenced their training during the second half-year and were joined by a supernumerary registrar from Libya in 2018. In addition, two new intern scientists and one NRF intern joined the Division during the first quarter of 2018.

Table SU7: Total number of staff per profession and highest qualification

	Pathologist	Medical Scientist	Technologists	Support	South African	All
Total	3	2	10	4	18	19

2. Diagnostic Services

The Diagnostic Section's workload increased in comparison with the previous year, to a total of 308,582 tests performed. The Diagnostic Section continues to be profitable. As the only NHLS laboratory in the coastal region performing routine cell culture and virus isolation, the Division provides training for registrars and student medical technologists from Groote Schuur, as well as infectious diseases sub-specialist trainees. Virology Tygerberg is also one of few NHLS laboratories to conduct HIV drug resistance testing for routine diagnostic purposes.

Following an in-depth laboratory audit of antibody and antigen as well as nucleic acid testing for HIV, HBV and HCV by the World Health Organization (WHO), the Division is now listed as a WHO Prequalification Evaluating Laboratory for the above markers. It remains challenging to fill vacant technologist and registrar posts, due to a scarcity of suitably qualified applicants and the field and/or the employer being perceived as not attractive.

2. Teaching, Training and Professional Development

2.1. Undergraduate Level

The Division's medical staff have significant teaching commitments in various modules of the faculty's MBChB and Allied Health Sciences programmes. Dr Maritz was, until 2017, chairperson for the MBChB IV Infectious Diseases and Immunology Module, and together with Prof. Wolfgang Preiser is involved in the major process of developing a new MBChB curriculum for SU.

2.2. Postgraduate Level

The postgraduate platform trains registrars (MMed students) in Medical Virology, Medical Microbiology and Clinical Pathology, plus Infectious Diseases (ID) sub-specialty trainees. In addition the diagnostic platform provides training specifically for the assays performed here only for Virology registrars, student medical technologists and ID sub-specialty trainees from Groote Schuur.

A total of sixteen PhD, eleven MSc and four BSc Honours students as well as five MMed (Medical Virology) candidates (registrars) was enrolled during the reporting period. Many of the science students received bursaries from the Poliomyelitis Research Foundation, the NHLS Research Trust, the NRF, the SAMRC, and other funding bodies. In addition, a number of postgraduate students, registered in other divisions, departments and faculties, were co-supervised. Seven students graduated during the reporting period; three BSc Honours (one cum laude), four MSc (one cum laude) and one PhD.

The BSc Hons course was again extensively revised and updated; all theoretical modules are now shared with Medical Microbiology. An application has been submitted to the Faculty of Medicine and Health Sciences to rename the current BSc Hons module and officially combine it with that of Medical Microbiology to form a single degree from 2019, i.e. BSc Hons (Infectious Disease Pathology and Immunology).

Additional teaching and training activities include the South-to-South Partnership for Comprehensive Paediatric HIV Care and Treatment, the SU Postgraduate Diploma in Infection Control, the Immunology Interactive Forum, the HIV Management Diploma course at SU, and several lectures given for the Diploma in Tropical Medicine and Hygiene and other courses at the London School of Hygiene and Tropical Medicine.

The Faculty's new Master of Philosophy (MPhil) in Cancer Science degree course was held for the first time in 2017. Prof. Preiser was appointed as chair of the module "Infections and Cancer". This had to be designed "from scratch" and involved a major effort to develop substantial lecturing and other teaching activities, delivered by several members of the Division and outside colleagues.

The Division again hosted several foreign students, from collaborating institutions in Africa (Yaounde and Mwanza, some partially funded by the SU International Office) and through the German Academic Exchange Service (DAAD) RISE Internship Programme for undergraduate students. These students spent between six weeks and six months experiencing a very active laboratory work programme with all its aspects, mostly joining existing research projects. While this provides exciting opportunities for these students to experience laboratory research 'in action', it also allows the division to pursue small projects that would not fit easily into postgraduate projects, due to being too small, too exploratory or too applied.

Table SU7: Total number of trainees per qualification category and rates of successful completion/pass rates

	Total Number of Trainees	Final Year Trainees	Successful Completion	Percentage of Successful Completions
All	31	12	12	100%

2.3. Professional Development

Four BSc Hons, five MMed, eleven MSc, 16 PhD students and three Postdoctoral Fellows enrolled. Three BSc Honours, four MSc and one PhD students graduated. Several staff of the Division hold NRF ratings.

3. Research Activities

The Division's research areas encompass a number of relevant themes, with special emphasis on, but not limited to, HIV as a major health problem in South Africa and the Southern African region.

3.1. Research Projects in pathology

Project Title: Molecular characterisation and diversity of HIV

Researchers: S Engelbrecht, RH Glashoff, GB Jacobs (NRF Early Career Advancement Fellow), D Njenda, V Ruhanya, AEA Obasa, SG Mikasi, (PhD students), S Kiewietz, O Varathan (MSc students)

Collaborators: S Seedat (Department of Psychiatry, SU/TBH), T de Oliveira and E Wilkinson (Africa Centre for Health and Population Studies, UKZN), J Joska (Department of Psychiatry, UCT), R Paul (Department of Psychology, University of Missouri, St. Louis, USA), A Sönnerborg and U Neogi (Karolinska Institute, Sweden), G Ikomey (Center for the Study and Control of Communicable Diseases, Faculty of Medicine and Biomedical Science, University of Yaoundé I, Cameroon)

Funding: PRF, NHLS Research Trust, SAMRC Collaborating Centre for HIV Laboratory Research, NRF

Short Description: One of the features of HIV-1 is its extreme genetic diversity, which impacts on diagnostic assays, antiretro viral treatment, prevention and vaccine development. Although HIV-1 subtype C strains predominate in South Africa, it is essential to study HIV-1 on an ongoing basis to gain a better understanding of the viruses in circulation. There is a need for more near-full-length genome sequences, as partial HIV-1 sequences may under-represent viral recombinant forms. We are currently investigating more than 200 unique(URF) and also two possible circulating recombinant forms (CRFs) using both Sanger and next-generation sequencing techniques. It is still unclear what role these unique strains will play in terms of antiretroviral treatment in the long term and what challenges they will pose to vaccine development. A number of papers were published during this reporting period.

Recent work on the identification of resistance mechanisms and against newer antiretrovirals in HIV-1 subtype C infected patients, focused on investigating mechanisms of resistance for PIs and INSTIs, and also to describe the in-vitro potency of reverse transcriptase inhibitors (RTI), PIs and INSTIs with a specific emphasis on investigating any HIV-1 subtype-specific differences the different ARVs may have. The conclusions so far is that no significant subtype-specific effect were found amongst all INSTIs. Follow up research is required on the impact of natural occurring polymorphism M50I especially when it co-occurs with R263K. The impact of INSTI accessory mutations (E157Q, T97A and A128T) should also be investigated.The project on analysis of HIV-1 diversity and inflammatory markers in HIV associated neurocognitive disorders (HAND), found that HIV DNA in peripheral blood was significantly higher in people with neurocognitive impairment than normal people. Currently, we are performing computational analyses on the different HIV-1 genes to evaluate how the genetic differences on these genes and their products interfere with neurocognitive function. We have also investigated the PR, RT and IN gene diversity in an Eastern Cape cohort and identified a possible new and novel circulating recombinant form. Near-full-length HIV-1 genome sequencing is currently being done.

Project Title: Immunological aspects of HIV-1 infection: cellular role players and biomarkers of immune activation/exhaustion and the impact of long-term antiretroviral therapy

Researchers: RH Glashoff (Division of Medical Microbiology & Immunology, NHLS Tygerberg), S Engelbrecht, E Vardas (Medical Virology TBH/Lancet Laboratories, Johannesburg), T Maponga (Postdoc), S Naidoo (PhD student), P Olifant (MSc student)

Collaborators: M Cotton, S Innes and B Laughton (FAMCRU/KIDCRU, Department of Paediatrics, SU/TBH), M Esser (Immunology Unit, Division of Medical Microbiology, NHLS Tygerberg), A Zemlin (Division of Chemical Pathology, NHLS Tygerberg), LG Bekker (esmond Tutu HIV Foundation, UCT)

Funding: PRF, NHLS Research Trust, Hope, NIH

Short Description: The impact of chronic immune activation on both B and T cell subsets as well as innate role players is be ing evaluated in several interrelated projects. The current focus is on early antiretroviral treated children (the post-CHER cohort). We are characterizing immune status at time of therapy initiation and assessing the impact of long-term therapy after 7-11 years. We are particularly interested in factors whichpredict ongoing immune activation and exhaustion. Here we are investigating T follicular helper cells (Tfh) and other helper subsets expressing multiple exhaustion markers (PD-1, Tim-3, Lag-3, TIGIT) within a strongly pro-inflammatory environment. The antigen-specific T cell re sponsiveness of HIV-infected infants and the relationship to viral reservoir persistence is also being studied. Recent work has indicated that inflammatory conditions persist in children after around 8 years of continuous therapy. There is a significant elevation of innate and myeloid cell-associat ed markers of inflammation. The persistence of inflammation appears to be related to chronic gut dysbiosis – as evidenced by markers of gut epithelial damage and leakage. These findings have important implications in timing of antiretroviral therapy in children – and for monitoring residual inflammation (and possibly reducing it) in long-term treatment. Ongoing work is investigating Tfh subset distribution in treated children – and also assessing how func tional changes in these cells dictates their relationship to B cells and the resultant anti-HIV anti body response later in life.

Project Title: Investigation of viral respiratory pathogens in cases of sudden unexpected death in infants (SUDI) in the Cape Town Metropole

Researchers: C de Beer, D Matshazi (MSc student, graduated), JE Saayman (MSc student, graduated), D Cupido (PhD stu dent), ML Venter (MSc student), J Ferreira (MSc student), C Evert (HonsBSc student)

Collaborator: J Dempers (Division of Forensic Pathology, SU/TBH, Western Cape Forensic Services)

Funding: PRF, NHLS Research Trust, Harry Crossley Foundation

Short Description: The majority of SUDI cases occur in infants between one and six months of age. Inflammatory changes in the upper and lower respiratory tract are a frequent finding and respiratory tract infection in the dayspreceding death have been documented repeatedly. Further more, viral respiratory in fections have commonly been found in autopsy samples. Collaborative studies on the infectious aetiology of SUDI have been done with the Division of Forensic Pathology (Prof. JJ Dempers) since 2009. Several new approaches towards diagnosis of the cause of death in SUDI cases admitted to the Tygerberg Medico-legal Mortuary have been investigated and are still continuing.

Cases are continuously being collected and investigated for infections of different biological systems. A high percentage of cases showed evidence of respiratory bacterial and/or viral pathogens, which was confirmed with molecular techniques, supported by histological ev- idence in lung tissue. Immunological markers of inflammation/infection were measured and correlated with histology and final cause of death classification assigned by Forensic Pathologists. In addition, the highest number of SUDI cases in this study appeared in the colder months, which is consistent with the literature. However, the Tygerberg cases seem to contradict the literature with regard to gender distribution, as more males are reported in the literature to be affected, which was not the case for the Tygerberg cases.

Ongoing studies include investigating infections of the cardiovascular and gastrointestinal systems.

Project Title: Prevalence and risk factors of respiratory infection by respiratory syncytial virus (RSV) in children at Provincial General Hospital of Bukavu, Democratic Republic of the Congo

Researchers: C de Beer, LK Cihambanya (MSc student, graduated)

Collaborators: Provincial General Hospital of Bukavu, Democratic Republic of the Congo (DRC)

Short Description: RSV is the major pathogen of severe lower respiratory tract infections in children in developed countries with temperate climates, such as the DRC. Early diagnosis is important to allow implementation of measures to limit spread, e.g. in a hospital setting or nursing homes, and early implementation of antiviral therapy, which should increase treatment efficacy. Final diagnosis of RSV infection depends on the laboratory and the gold standard remains isolation of the virus in cell culture. Rapid detection methods are also used routinely and include the detection of viral antigen or nucleic acid in secretions, such as direct immunofluorescent assay (DFA) and enzyme immunoas say (EIA). So far, no investigations have been done on the viral aetiology of acute respiratory infection in the DRC, especially the war-torn East part of the country. This lack of information may lead to incorrect di agnosis and result in abusive antibiotic use which often leads to antimicrobial resistance, such as recently demonstrated in South Kivu, DRC.

Project Title: Human Papillomavirus
Researchers: GB Jacobs (NRF Career Advancement Fellow), S Engelbrecht, Robyn Adams (MPhil Cancer Science student)
Collaborators: H Botha (Gynaecological Oncology Unit, SU/TBH), A de Meyer (University of Antwerpen)
Short Description: The HPV study forms part of a randomized controlled trial aimed at evaluating the efficacy of different cer vical cancer screening tests in a South African context. This sub-study is an analytical study with a cross sec tional study design in which we are examining the prevalence of HPV types in HIV-positive and HIV-negative women testing positive for HPV presence through HPV genotyping using the Roche Linear Array HPV Genotyping Test.

Project Title: The role of cytokines and impact of HIV on the severity and pathogenesis of necrotising enterocolitis
Researchers: C de Beer
Collaborators: S Moore and M Arnold (Paediatric Surgery, TBH/SU)
Funding: PRF, NHLS Research Trust
Short Description: Necrotising enterocolitis (NEC) pathogenesis remains elusive, although the cytokine inflammatory cascade remains important in its pathophysiology. Maternal HIV infection has been identified as an independent risk factor, associated with increased mortality. This may relate to the enhanced endothelial activation and inflammation in HIV infection. Pro-inflammatory interleukin (IL)-12 and IL-18 have been implicated in NEC pathogenesis. IL-10 is a marker of severe NEC, while the anti-inflammatory IL-10 is protective against NEC. These inflammatory and counter-inflammatory proteins are similarly implicated in HIV-related immune modulation. This study aims to evaluate how HIV exposure (as compared to HIV non-exposure) impacts on NEC disease pathogenesis, prevalence and severity. Clinical markers of disease severity and mortality, as well as serum levels of cytokine inflammatory responses, are evaluated in infants with severe NEC referred for surgical evaluation. These cases rarely survive more than 24 hours after birth and are only included in the study if 24- and 48-hour follow up samples are available, but the study is ongoing.

Project Title: Very early diagnosis of HIV infection in infants and HIV persistence in early treated children
Researchers: J Maritz, GU van Zyl, W Preiser, S Engelbrecht, RH Glashoff, JB, Jacobs, MG Katusiime (PhD student), S Naidoo (PhD student), KA Veldsman (MSc student)
Collaborators: M Cotton, H Rabie, S Holgate and L Frigati (Department of Paediatrics, TBH/SU), GB Theron (Department of Obstetrics and Gynaecology, TBH/SU), JW Mellors (University of Pittsburgh), M Kearney (National Cancer Institute, Frederick, Maryland), JB Nachega (Centre for Infectious Diseases, SU), VA Cox and AK Nelson (MSF, Khayelitsha), G van Cutsem (MSF South Africa)
Funding: NHLS Research Trust, National Institutes of Health, National Research Foundation, SAMRC Collaborating Centre for HIV Laboratory Research
Short Description: This project aims to investigate various aspects relating to the early diagnosis of HIV infection in infants in order to improve care. HIV-1 infection remains a major cause of morbidity and mortality in infants globally, despite considerable advances in the prevention of mother-to-child transmission of this infection. HIV-1 can be transmitted transplacentally, during delivery or through breastfeeding. In infants infected with HIV, early initiation of ART and therefore very early diagnosis of the infection in the first few weeks of life significantly reduces HIV-associated morbidity and mortality compared to deferred initiation.

Specific aspects being investigated include the optimal age of diagnosis for the prevention of morbidity, maternal factors constituting a high risk for transmission of the virus to infants, and the impact of a point-of-care (PoC) diagnostic approach on patient treatment and retention.
Linked to this project is the collaborative study of HIV persistence and HIV diversity and integration sites, aiming to quantify and characterise mechanisms of HIV persistence in children from the CHER cohort.

Project Title:	Pooled testing as a bridging technology until point-of-care testing becomes available
Researchers:	W Preiser, GU van Zyl, J Maritz
Collaborators:	A Welte and C van Schalkwyk (DST/NRF Centre of Excellence in Epidemiological Modelling and Analysis (SACEMA), SU)
Funding:	NHLS Research Trust, PRF, SA MRC Collaborating Centre for HIV Laboratory Research (TygHIVLab)
Short Description:	Pooled testing (i.e. mixing several samples together and testing them in one test) has long been used for screening of blood for transfusion. It is predicated on a low prevalence of the condition to be detected and an acceptable sensitivity when testing pools. With the appropriate pool size, most pools will test negative, which means that all samples which they contain will have used just one test between them. Pooling can thus considerably reduce the number of tests needed and costs, even though pooling anddeconvoluting positive pools add to the workload.

While the successes of most prevention of mother-to-child transmission (PMTCT) and ART programmes in sub-Saharan Africa are remarkable, remaining challenges include laboratory support. Access to appropriate tests, especially for infant diagnosis, and monitoring of patients on ART, is vital to allow timely initiation of ART in infected infants and the diagnosis of ART failure before it leads to drug resistance, which through transmission, may endanger the whole programme.

In many African settings, PMTCT and/or ART failure are now low-prevalence conditions and thus amenable to pooled testing. It has been demonstrated that pooled testing can be used for both purposes in African settings. Furthermore, dried blood or plasma spots can be used.
While its reliance on centralised facilities does not help to shorten time to availability of results, pooled testing optimises use of scarce skilled staff and expensive equipment and, most importantly, it can translate into substantial cost savings. This can bring laboratory testing within reach of many more settings, and provide a bridging solution until such time that reliable and affordable POC tests become widely available. To date, scientific outputs from this project include three papers confirming the utility of pooled testing for ART failure monitoring and two conference presentations detailing a cost-effectiveness model for PMTCT failure monitoring. A manuscript for the cost-effectiveness model is currently in preparation.

Project Title:	Antiretroviral drug resistance: epidemiological, clinical and diagnostic aspects
Researchers:	GU van Zyl, W Preiser, S Engelbrecht, GB Jacobs, M Claassen (medical technologist), SG Mikasi, AEA Obasa (PhD students)
Collaborators:	R Shafer (Stanford University), U Neogi and A Sönnerborg (Karolinska Institute, Stockholm, Sweden), C Scheller (University of Würzburg, Germany), K Kasang (Medical Mission Institute, Würzburg, Germany)
Funding:	PRF, NHLS Research Trust, Gilead Germany, SAMRC
Short Description:	An audit of antiretroviral drug resistance in diagnostic samples received at TBH Virology, in collaboration with Stanford University, with the purpose of keeping abreast of any changes in the incidence of such mutations as the ART Programme comes of age, has been published. We continue to monitor drug resistance patterns. As part of the collaboration with Karolinska Institute, viral diversity and HIV protease, reverse transcriptase and integrase inhibitor-associated mutations are investigated.

Project Title:	Potentially emerging zoonotic viral diseases
Researchers:	W Preiser, M Andersson, NL Ithete and T Suliman (postdoctoral fellows), N Sampson, K Poovan, K Malan and B Kleinhans (PhD students), A Kotze (MSc student),T Lopes (MSc student, graduated)

Collaborators: S Matthee (Department Conservation Ecology and Entomology, SU), D Krüger (Institute for Virology, Charité, Humboldt University, Berlin, Germany), JF Drexler and C Drosten (Institute for Virology, Universitätsk linikum Bonn, Germany), C Matthee (Evolutionary Genomics Group, Department of Botany and Zoology, SU), MC Schoeman (School of Life Sciences, UKZN), RI Cable (Western Province Blood Transfusion Service, Cape Town), S Korsman (NHLS Groote Schuur/UCT), L van Helden (Western Cape Veter inary Services, Elsenburg)

Funding: Deutsche Forschungsgemeinschaft (Africa Infectiology Programme), PRF, NHLS Research Trust, Harry Cross ley Foundation

Short Description: This project aims to identify and characterise novel viruses occurring in small mammals, i.e. rodents, shrews and bats, that potentially may be transmitted zoonotically and cause human disease. This project has identified and is in the process of characterising several novel astro-, arena- and coronavirus sequences.

This work is done in close collaboration with bat and rodent specialists who not only contribute animal samples for testing, but also valuable zoological and ecological data that are needed to better understand the relationship between these viruses and their wildlife hosts as the key to determining the magnitude of the risk to humans. Of the multitude of viruses present in wild animals, relatively few have so far crossed the'species barrier' and caused human infections. The question is why this happens, whether it is predictable in any way, and how one could quantify the risk?

The most intriguing discovery to date is a novel beta-coronavirus which turned out to be a close relative of the recently emerged Middle East Respiratory Syndrome (MERS) coronavirus. This work has resulted in two widely read and much-cited papers, seeing that it provides important clues to bats as a possible original source of this ongoing outbreak. In the meantime, additional related viruses have been detected and are being characterised.

Having detected infection with hepatitis E virus (HEV) in several patients in Cape Town and described the prevalence of past and active HEV infection in blood donors, in co-operation with colleagues from the Western Province Blood Transfusion Service, this project is now focusing on the search for serological and molecular evidence of HEV infection in pigs slaughtered locally in co-operation with colleagues from Groote Schuur/UCT and the provincial Veterinary Services in Elsenburg.

Project Title: AIDS and Cancer Specimen Resource (ACSR) and AIDS Malignancy Consortium (AMC) Sub-Saharan Africa Biorepository

Collaborating Researcher: W Preiser

Principal Investigator: JW Schneider (Anatomical Pathology, NHLS Tygerberg/SU)

Funding: NIH ACSR

Short Description: This major project aims to establish a central biorepository site for sub-Saharan Africa that can proactively obtain and make available relevant biospecimens and data for co-ordinated research and studies on HIV-related malignancies.

Project Title: Hepatitis B virus (HBV): Screening and prevention, HIV co-infection, immune activation and hepatocellular carcinoma

Researchers: M Andersson, RH Glashoff, W Preiser, T Maponga (Postdoc), N Chotun and C Tamandjou (PhD students)

Collaborators: S Ijaz and RS Tedder (Public Health England, London, UK), E Nel (Department of Paediatrics, TBH/SU), L Fourie (Department of Oncology, TBH/SU), Dieter Glebe (Universität Giessen / National Reference Laboratory for Hepatitis B Virus, Germany), B Robertson, W Spearman and M Kew (UCT), P Ruff (Wits), P Veersamy and V Fredlund (UKZN), A Neugut, R Santella and J Jacobson (Columbia University, New York)

Funding: PRF, NHLS Research Trust, Gilead Germany

Short Description: The prevalence of HBV infection in infants born to HIV-positive mothers has been studied through a retrospective cohort study using banked samples from an International Maternal Pediatric Adolescent AIDS Clinical Trials Group (IMPAACT) trial. A pilot study has evaluated testing pregnant women for HBV infection using an HBsAg rapid test to identify those at risk of transmitting HBV to their babies and instituting preventative measures, i.e. antiviral treatment for the mother and administering the first dose of HBV vaccine to the newborn at birth. A multi-site study has assessed prevalence, presentation, survival and risk factors of HIV-associated hepatocellular carcinoma. This study will describe the demographics, HIV status, risk factors, including HBV status with characterisation of HBV, aflatoxin adduct testing and patient survival time post diagnosis.

A study investigating the impact of HIV co-infection on fibrosis and markers of immune activation or inhibition in patients with chronic HBV infection has confirmed that the major driver of fibrosis in both mono- and co-infected patients is active viral replication and not gut dysbiosis. The study has also highlighted IP-10 (CXCL10) as a key biomarker for fibrosis in chronic HBV. This study has been important for its use of physical detection of fibrosis by Fibroscan and relating "confirmed fibrosis" to immune factors. This work is being submitted for publication – and will continue in future in planned longitudinal follow-up studies. A particular thrust is in exploring HBV antigen-specific T cell responses and how they relate to the dysregulated cytokine-viral replication-fibrosis axis.

4. Research Outputs

4.1. Journal Publications

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University of the Western Cape

Foreword

Head of Department

Prof Jos Hille

The front view of the Oral Health Centre/ Dental Faculty at Tygerberg Campus

Who we are

The school of Pathology of the University of the Western Cape (UWC) has only one department of Oral & Maxillofacial Pathology since the university does not have a medical school. Oral & Maxillofacial Pathology is the specialty of dentistry and pathology which deals with the nature, identification, and management of diseases affecting the oral and maxillofacial regions. It is a science that investigates the causes, processes and effects of these diseases and is positioned at the interface of Dentistry (in particular the disciplines of Oral Diagnosis, Oral Microbiology, Oral Medicine and Oral Surgery) and Medicine (specifically Anatomical Pathology, Oral and Head & Neck Oncology,Head & Neck Surgery and Dermatology).

Compared to other divisions/departments of Anatomical Pathology of other schools, we are a small department of which its anatomical pathology activities are embedded within the division of Anatomical Pathology of the NHLS Tygerberg laboratories. The staff includes two full-time jointly appointed pathologists and one university-appointed pathologist, 4 registrars of which two are supernumerary registrars (from Ghana and Kenya).

What we do

Our daily diagnostic activity mainly consists of anatomical pathology analysis (histopathology and cytopathology) in conjunction with clinical & radiographic investigations, biochemical, molecular tests and other examinations, and we advise on the management of patients of the departments of Oral Surgery, Oral Medicine, Ear, Nose and Throat Surgery and the combined Head & Neck Oncology Clinics of Tygerberg hospital. The synergy generated by the joint platform with the Division of Anatomical Pathology of the University of Stellenbosch/NHLS Tygerberg allows us to render service in a rational and mutually enriching manner. The diagnostic services and consultations in Oral & Maxillofacial/Head & Neck Pathology extend to pathologists and clinicians throughout the public health services of the Western and Eastern Cape.

This department teaches the courses in general and oral pathology/oral diseases to the dental (2nd to 4th years) and oral hygiene students (1st and 2nd years); the average class sizes are 90 dental students and 40 oral hygiene students. We also teach oral pathology on a postgraduate level to MSc students, and Oral & Maxifacial Pathology on an intermediate level with histopathology to registrars in Oral Medicine and Oral Surgery. The department trains registrars (MChD) in diagnostic Oral & Maxillofacial/Head & Neck pathology. We cross-teach registrars and provide consultations in Anatomical Pathology on the joint platform.

Departmental research mainly focuses on liquid-based Oral Cytology, HPV –related oropharyngeal cancer, thyroid pathology, epidemiology of oral/head & neck cancer in Africa and dental implications of intellectual disabilityin South African children.

Highlights

A chapter on non-odontogenic bone pathology was co-authored by Prof Jos Hille in a new comprehensive text book " Contemporary Oral Medicine". Prof Jos Hille was also invited as an international speaker by the African branch of the International Association of Oral Pathology to address the 2nd IAOP Africa Region Congress in Accra, Ghana in August 2017.

A record number of registrars in Oral Medicine & Periodontology and Maxillofacial & Oral Surgery registrars were taught in Diagnostic Oral & Maxillofacial Pathology.

The department also was consulted by the International Collaboration on Cancer Reporting (ICCR) for the development of a dataset reporting on carcinomas and mucosal melanomas of the nasopharynx and oropharynx.

Oral and Maxillofacial Pathology

Head of Department: Prof. JJ Hille

1. About the Department

The Department of Oral and Maxillofacial Pathology of UWC is a relatively small department located in the NHLS laboratories on the 10th floor at Tygerberg Hospital. It is the sole diagnostically active pathology department within the university, and shares the anatomical pathology laboratory facilities and diagnostic platform with the Division of Anatomical Pathology, SU, in unique and rational ways. This enables the joint appointment staff to provide comprehensive oral and maxillofacial/head and neck clinico-pathological consultation services to the University of the Western Cape's Oral Health Centres located at Tygerberg, Mitchells Plain and GSH and the ENT, Oncology and Dermatology divisions of Tygerberg Hospital and the large regional hospitals in the Eastern Cape. Consultations on thyroid pathology are now also included in the range of diagnostic services.

The Head of Department participates as a full member in the activities of the Anatomical Pathology Expert Committee (APEC) of the NHLS.

The department continues to refine its research in liquid-based cytology diagnostics of (pre) cancers of the mucosal surfaces of the upper aero-digestive tract, and the epidemiology of oral/head and neck cancers in Africa as part of the terms of reference of the WHO Collaboration Centre in Oral Health for sub-Saharan Africa, affiliated to the Faculty of Dentistry of UWC. Furthermore it conducts research in dental abnormalities in intellectually disabled children in the Western Cape and runs various projects in forensic odontology.

The Department has access to the joint NHLS/SU Pathology Research Facility (PRF), which offers various diagnostic molecular pathology tests through national and international collaboration (see description of PRF in the report on the Division of Anatomical Pathology, SU.

The Department, with only two full-time NHLS/WC joint appointment consultants, one full-time UWC consultant and one part-time UWC consultant (Molecular / Oral Pathology), a recently qualified senior registrar and three registrars, bore a heavy undergraduate and postgraduate teaching load at the University of the Western Cape's Faculty of Dentistry.

Table UWC 1: Total number of staff per profession and highest qualification

	Doctoral	MChD/MDent	Masters	Honours	Diploma	All	South Africans
Pathologists		3	1			4	2
Medical Scientists							0
Other*	2						
South Africans	1	2	1			4	4
All	2	3	1			6	4

* Part-time Forensic Oral Pathologist and Part-time Oral Pathology Scientist

2. Diagnostic Services

Through the joint NHLS platform, approximately half of the Western Cape public health sector is reached. Consultation services are offered by Dr A Afrogheh and Prof JJ Hille to the NHLS laboratories in the Eastern Cape to increase registrars' teaching exposure. Second opinions are available to the private sector. Furthermore the shared diagnostic platform with the division of Anatomical Pathology of the SU empowers the department to offer special services and expertise, in particular immunohistochemistry for service and research, and fine needle aspiration and upper aero-digestive tract brushings with rapid on-site cytology diagnostic services. The various adjunct specialised services and case numbers during the reporting period are described in the Division of Anatomical Pathology of the SU report. The overall year on-year workload for both biopsy/surgical pathology and cytology has stabilised and approximates 1500 cases per year. The department also provided consultations (Dr TS Roberts) and second opinion services in oral pathology to the NHLS/UCT Division of Anatomical Pathology at GSH on a minimum basis of twice a week .

The Department continued to offer its oral/head and neck diagnostic support services to pathologists in the Eastern Cape through assistance with excessive routine workloads and diagnostic consultations, where possible. Challenges have been encountered due to the reduced numbers of medical technology staff in the Tygerberg Anatomical Pathology laboratories.

3. Teaching, Training and Professional Development

3.1. Undergraduate Level

The undergraduate dental student classes are large (+ 90 students). The following modules are offered: BCHD II – Basis of Disease Processes; BCHD II – System's Based Pathology; BCHD IV – Oral Pathology. Courses and modules in Basic Pathology and Oral Diseases are offered to Oral Hygiene Students (classes of + 40 students). Furthermore there is significant involvement in the continuous development of the BCHD and BOH programmes, and the general Teaching and Learning Programme of the Faculty of Dentistry.

3.2. Postgraduate Level

Table UWC 2: Total number of trainees per qualification category and rates of successful completion/pass rates

	Doctoral	Masters	Registrars	Intern Medical Scientist	Honours	All	South Africans
Total Number of Trainees	1	4	4				3
Final Year Trainees		1	1				1
Successful Completion		1	1				1

The Department had three registrars (South Africa, Ghana, Kenya) who are undergoing specialist training in Oral and Maxillofacial Pathology (MChD). This part of the training is achieved by functioning and receiving training as registrars in Anatomical Pathology on the joint NHLS diagnostic and training platform with the Division of Anatomical Pathology of the SU. Both Part I registrars attempted the FC PATH (SA) Part I examinations, but were unsuccessful.

Part II of the training takes place on the clinico-pathological training platform of the oral health centres of UWC and the NHLS diagnostic platform in Tygerberg and the Western Cape. The part II registrar (South Africa) passed his university exit examination in April 2017 and remained in the department on contract extension to complete his research.There were no full-time MSc students registered with the department.

Important postgraduate teaching activities further include:

- A postgraduate course in generic Oral Pathology with examinations was offered to 7 MSc/MChD students from other clinical dental departments;
- An intensive postgraduate course in Diagnostic Oral Pathology for MChD in Periodontlogy & Oral Medicine (3 candidates) and Maxillofacial & Oral Surgery (7 candidates) was conducted with examinations;

- Courses in forensicodontology were offered to 5 postgraduate students. Other courses offered include MSc and PDD Forensic Dentistry block training courses, Mass Disaster Dental Identification and Forensic Dentistry for Forensic Medicine, Human Biology post graduates;
- Courses in performing FNAB and oral exfoliative cytology are also offered to oral health staff, undergraduate and postgraduate dental students;
- Participation in, and co-ordination of various examination of the College of Pathologists and the Collage of Maxillofacial and Oral Surgeons are routine activities.

3.3 Specialised courses attended

Prof J Hille:

- Teaching and Learning course and journal clubs offered by the UWC Faculty of Dentistry; and
- Clinical Research Education and Development (CREDE) Good Clinical Practice: Beginners' Course.

3.3 Additional qualifications obtained

Medical technologists and technicians

See report for the Division of Anatomical Pathology, SU.

Table UWC 3: Total number of trainees per qualification category and rates of successful completions/pass rates

	Total Number of Trainees	Final Year Trainees	Successful Completion	Percentage of Successful Completions
All	3	1	No candidates completed	

3.5 Other Training Information

Outreach Programmes

The Department worked in close collaboration with pathologists at WSU and Port Elizabeth, to exchange teaching material and to offer comments on diagnostically challenging oral/head and neck cases. Academic support is offered to pathologists in the Eastern Cape through the joint UWC-SU diagnostic platform to provide specialised pathological tests and consultations on various tissue samples from the NHLS Anatomical Pathology Laboratories in East London and Frere Hospital in Port Elizabeth.

Oral Pathology staff participates in outreach projects organised by the Division of Anatomical Pathology of SU by teaching FNAB technique to clinicians as part of the maintenance of competence initiative by the Western Cape Department of Health and specialised courses.

4. Awards

None

5. Research Activities

5.1. Research Projects in pathology

Project Title:	The epidemiology of Oral Cancer in Africa
Principal Investigators:	Hille J (NHLS/UWC) and Johnson NW (Griffith, AUS)
Funding:	Global Oral Cancer Forum
Total Funding for the entire project:	R 1500-00
Short Description:	To determine the burden of incidence and mortality of oral cancer in Africa using IARC - GLOBO CAN data.
Project Start Date:	December 2015
Project End Date:	June 2017
Project Title:	Application of Liquid-Based Cytology in Screening Oral Mucosal Changes among Khat Chewers in Kenya
Principal Investigators:	Hille J and Ndonga M (NHLS/UWC)
Co-researchers:	Dr A Afrogheh (NHLS/UWC), Prof C A Wright (US)
Funding:	NHLS Research Trust
Total Funding for the entire project:	R 78,000-00
Short Description:	To describe the social and demographic characteristics, the habits, the oral mucosal changes associated with and occurring in Kenyan khat chewers. To describe the cytological changes seen in cells exfoliated in oral mucosal lesions from Khat application sites found in Kenyan Khat chewer
Project Start Date:	March 2018
Project End Date:	June 2020

Project Title:	PDL1 and PDL2 and CD8 expression in conjunctival squamous cell carcinomas.
Principal Investigators:	Amir Afrogheh (NHLS/UWC), Natalie Wolkow (MEEI, Harvard medical school);
Co-researchers:	Dr. William C. Faquin (MGH, HMS), Dr. Frederick Jakobiec (MEEI, HMS).
Funding:	MGH, Harvard Medical School
Total Funding for the entire project:	R 150 000.
Short Description:	To assess the expression patterns of PDL1, PDL2 and CD8 in conjunctival squamous cell carcino mas (overall, stroma, tumour and endothelium) to determine if these cancers can respond to anti-PD1 agents.
Project Start Date:	01 January 2018
Project End Date:	01 July 2018

Project Title:	PDL1 and PDL2 and CD8 expression in periocular sebaceous carcinomas.
Principal Investigators:	Amir Afrogheh (NHLS/UWC), Natalie Wolkow (MEEI, Harvard medical school);
Co-researchers:	Dr. William C. Faquin (MGH, HMS), Dr. Frederick Jakobiec (MEEI, HMS).
Funding:	MGH, Harvard Medical School
Total Funding for the entire project:	R 150 000.
Short Description:	To assess the expression patterns of PDL1, PDL2 and CD8 in sebaceous (overall, stroma, tumour and endothelium) to determine if these cancers can respond to anti-PD1 agents.
Project Start Date:	01 January 2018
Project End Date:	01 July 2018

Project Title:	Incidence of human papillomavirus (HPV) positive oropharyngeal squamous cell carcinoma in Cape Town, South Africa.

Principal Investigators:	Dr. Gloria Dapaah (NHLS), Prof Jos Hille (NHLS); Dr. Amir Afrogheh (NHLS/UWC)
Co-investigators:	Dr. AK Ebrahim (ENT, Tygerberg Hospital), Dr. Komeela Naidoo (Oncology, Tygerberg Hospital)
Funding:	Self funded
Total Funding for t he entire project:	R50,000.
Short Description:	To determine the prevalence of high-risk human papillomavirus positive oropharyngeal squa mous cell carcinoma at Tygerberg Hospital, Cape Town, South Africa.
Project Start Date:	01 January 2016
Project End Date:	01 July 2018

Project Title:	The prevalence of head and neck malignancies at Tygerberg Hospital, Cape Town, South Africa.
Principal Investigators:	Dr. Komeela Naidoo (Oncology, Tygerberg Hospital), Prof J Hille (NHLS), Dr. Amir Afrogheh (NHLS/UWC)
Funding:	Oncology Unit, Tygerberg Hospital.
Total Funding for the entire project:	N/A.
Short Description:	To determine the prevalence of head and neck malignancies at Tygerberg Hospital, Cape Town, South Africa.
Project Start Date:	01 January 2017
Project End Date:	01 July 2018

Project Title:	Dental Implications of Genetic and Congenital Intellectual Disabilities in Cape Town
Principal Investigators:	Roberts, TS (UWC)
Co-researchers:	Beighton, PB (IUCT), Stephen, LXG (UWC);
Collaborators:	none
Funding:	none
Total Funding for the entire project:	none
Short Description:	The dental implications of children with genetic and congenital intellectual disabilites were reported in terms of their umet dental needs and dental management implications. Intellectual and physical challenges as well as socioeconomic barriers to oral health care among these children were comprehensively documented.

Project Title:	Genomic characterization of Hurthle cell tumors of the thyroid gland.
Principal Investigators:	Dr. Sareh Parangi (Harvard Medical School, Massachusetts General Hospital), Peter M. Sadow (HMS, MGH)
Co-researchers:	Amir Afrogheh (NHLS/UWC)
Funding:	BROAD institute (MIT)
Total Funding for the entire project:	The funding will be estimated once the project is complete.
Short Description:	In general, oncocytic (Hurthle) cell tumours of the thyroid gland show a different biologic behaviour than non-oncocytic lesions. The purpose of this project is to identify genetic alterations/rearrangements that characterize these lesions, using whole exome sequencing.
Project Start Date:	01 June 2014
Project End Date:	Ongoing project.

Project Title:	Genomic characterization of poorly differentiated carcinomas of the thyroid gland.
Principal Investigators:	Dr. Sareh Parangi (Harvard Medical School, Massachusetts General Hospital), William C. Faquin (HMS, MGH)
Co-researchers:	Amir Afrogheh (UWC)
Funding:	BROAD institute (MIT)
Total Funding for the entire project:	The funding will be estimated once the project is complete.

Short Description: Most thyroid poorly differentiated malignancies develop from a pre-existing differentiated thy roid malignancy. The purpose of this study is to identify the genetic abnormalities that underlie the process of transformation.

Project Start Date: 01 June 2014

Project End Date: Ongoing project.

Research Units/Study Groups linked to the Department

The newly established African Ameloblastoma Research Network (AARN) is a co-operation programme between USA, Nigeria and the NHLS/UWC Department of Oral and Maxillofacial Pathology (Prof Hille and Dr Adeola)

Dr Afrogheh maintains an international research link with Head and Neck Pathology, Harvard Medical School and Ophthalmic Pathology, Mass Eye and Ear Infirmary (MEEI), Harvard Medical School, mainly on HPV cancer – related , Thyroid pathology, HPV-related Head & Neck Cancers and Adenoid cystic Carcinoma genomics research. Funding: MGH and possibly NHLSRT.

Dr Roberts maintains links with the UCT Faculty of Health Sciences - Human Genetics and Anatomical Departments and established ties with the UKZN department of Education.

5.2. NHLS Trust Grant Funding

None applied for and received.

6. Research Outputs

6.1. Journal Publications

Hille J, Johnson N. The Burden of Oral Cancer in sub-Saharan Africa.- An Estimate as Presented to the Global Oral Cancer Forum, March 2016. Translational Research in Oral Oncology 2017; 2: 1-1.

Arotiba GT, Hille J, Guthua SW , Adeola H , Odhiambo W , Effiom OA, Osundwa T , Kirimi J , Dimba E , Olojede, ACO, Gbotolorun, OM, Adamson O. Ameloblastoma in Black Africans: The Need for Multi-National Collaborative Research. JSM Dent Surg 2017; 2(2): 1014-1020

Chetty M, Roberts T, Stephen LXG, Beighton P. Craniofacial Manifestations in Osteogenesis Imperfecta type III in South Africa. BDJ Open 3, Article number: 17021. doi:10.1038/bdjopen.2017.21

Chetty M, Roberts T, Stephen LXG, Beighton P. Dental Implications of Bisphosphonate Therapy in Osteogenesis imperfecta. SADJ 2017; 72(9):424-428

Chetty M, Roberts T, Stephen LXG, Bertie JD, Beighton P. 2017. Oro-Dental Manifestations and Implications of the Osteolyses. Journal of Dentistry and Oral Care 2017; 3(2):1-5

Mohamed N and Phillips VM. Accuracy of acetate overlays in bite mark comparison: How accurate is an ideal bite pattern? SADJ 2017; 72 (10): 456-461

Sajed DP, Faquin WC, Carey Chris, Severson EA, Afrogheh AH, Johnson C, Blacklow C, Chau G, Lin DT, Krane JF, Vickie JY, Garcia JJ, Sholl LM, Aster JC. Diffuse Staining for Activated NOTCH1 Correlates With NOTCH1 Mutation Status and Is Associated With Worse Outcome in Adenoid Cystic Carcinoma. The American Journal of Surgical Pathology 2017;41(11):1473-1482

Temilola D, Holmes H, Mulder-van Staden S, Afrogheh A. Oral medicine case book 74, Marijuana-induced Oral Leukoplakia. SADJ 2017; 72:224-226

6.2 Book Chapters

Coleman H, Hille JJ, van Heerden W, Boy S and Mahar A. Non-Odontogenic Bone Pathology. In: Contemporary Oral Medicine - A Comprehensive Approach to Clinical Practice. In: Farah CS, Balasubramaniam R, McCullough MJ, Eds. Springer Reference, 2018

Public awereness/Media:

Torres-Holmes M, Hille J et al ."Head and Neck cancers – Why are They More Common and Deadlier than You Realise?" Know Your Cancer, Oncology Buddies - 28 September, 2017 (http://oncologybuddies.com/2017/09/28/head-neck-cancers/)

6.3. Conference Presentations (Oral, Poster)

International Oral Presentations
Hille, J. International Invited speaker : "The Art of Assessing and Reporting Carcinoma of the Oral Cavity and Oropharynx". 2nd IAOP Africa Region Congress, Accra, Ghana, 3 August 2017

6.4. Plenary Talks

National

Phillips, V. Human remains identification – Dept. Forensic Medicine and Toxicology UCT June 2017 and Emergency Medical Services

6.5. Conferences and courses attended

Prof JJ Hille:

- 2nd IAOP Africa Region Congress, Accra, Ghana, 3 August 2017
  All Consultants and registrars:
- Royal College of Pathologist Australia: quality assurance programme in Oral & Maxillofacial Pathology (2 modules)

7. Additional Information

Prof JJ Hille:

- Consultant for the International Collaboration on Cancer Reporting (ICCR) ICCR for the development of a dataset reporting on carcinomas and mucosal melanomas of the nasopharynx and oropharynx
- External examiner: Postgraduate and undergraduateOral Pathology – University of Nairobi – September 2017
- External thesis review and marking: Head and neck cancers amongst HIV positive patients: a 5 year retrospective study – University of the Witwatersrand.

Dr AH Afrogheh:

- Examiner: College of Medicine of South Africa (CMSA), Subject: General Pathology, primary examination for the Fellowship of the College of Oral and Maxillofacial Surgeons (FCMFOS). June/July 2017.
- External Exmaminer: Sefako Makgatho University, November/December 2017. Subject: MChD Oral Pathology exit examination and Oral Pathology examination for postgraduate MChD dental students in Prosthodontics, Orthodontics and Maxillofacial & Oral Surgery.

Prof VM Phillips:

- Supervisor of:
  - PhD Forensic Dentistry (Dr Susan Chandler –registered in 2015)
  - MSc Minitheses in Forensic Dentistry
- Examiner: College of Medicine of South Africa (Primary examinations in General Pathology), April 2017

Notes

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