Laboratory User Handbook

2024

Vision Statement:

"To provide high quality pathology and laboratory services that are clinically efficient and cost-effective"

STANDARD OPERATING PROCEDURE

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LIST OF ABBREVIATIONS

5-HIAA	5-hydroxy-indoleacetic acid
ACD	Acid citrate dextrose
ACE inhibitors	Angiotensin-converting enzyme inhibitors
ACLA	Anti-cardiolipin antibodies
AFB	Acid-fast bacilli
AFP	Acute flaccid paralysis
ALPS	Auto-immune lymphoproliferative syndrome
ANA	Antinuclear antibodies
ANCA	Anti-neutrophil cytoplasmic antibodies
Anti HAV IgM	Hepatitis A virus IgM antibodies
Anti HBc IgM	Hepatitis B virus core IgM
Anti-HBs	Hepatitis B virus surface antibodies
Anti-HCV	Hepatitis C virus antibodies
APCR	Activated Protein C resistance
ARV	Antiretroviral therapy
AST	Aspartate aminotransferase
BAL	Broncho-alveolar lavage
BCG	Bacille Calmette-Guérin
BDG	Beta-D glucan
CCHF	Crimean-Congo haemorrhagic fever
CCMT	Comprehensive Care, Management and Treatment
CD	Cluster of differentiation
CDC	Centers for Disease Control and Prevention
CHB	Chris Hani Baragwanath
CJM	Charles Johnson Memorial
CK	Creatine kinase
CMJ	Charlotte Maxeke Johannesburg
CMV	Cytomegalovirus
COSH	Church of Scotland
CRE	Carbapenem-resistant Enterobacterales
CSF	Cerebrospinal fluid
CT	Computed Tomography
CVID	Common variable immune deficiency
CVS	Chorionic villus sampling
DBS	Dried blood spot
DGM	Dr George Mukhari
DM	Diabetes Mellitus
DNA	Deoxyribonucleic acid
DOH	Department of Health
DPL	DNA Profiling Laboratory
DST	Drug Susceptibility Testing
EBV	Epstein-Barr virus
EDTA	Ethylenediaminetetraacetic acid
EGK	Electronic gate keeping
EHP	Environmental Health Practitioner
ELISA	Enzyme-linked immunosorbent assay
EPI	Exocrine Pancreatic Insufficiency
EPID	Epidemiological Identification
ESR	Erythrocyte sedimentation rate

FBC	Full blood count
FCL	Forensic Chemistry Laboratory
FPS	Forensic Pathology Services
FFPE	Formalin-fixed, paraffin-embedded
FGT	Female Genital Tract
Fig.	Figure
FISH	Fluorescence *in situ* hybridisation
FNA	Fine needle aspiration
GISA	Glycopeptide-Intermediate *Staphylococcus aureus*
HAART	Highly active antiretroviral therapy
HAV	Hepatitis A virus
HBcAg	Hepatitis B core antigen
HBeAb	Hepatitis B virus e-antibody
HBeAg	Hepatitis B virus e-antigen
HBsAg	Hepatitis B surface antigen
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HDV	Hepatitis D virus
HEV	Hepatitis E virus
H&E	Haematoxylin and Eosin
hGISA	Heterogeneously Glycopeptide-Intermediate *Staphylococcus aureus*
HHV-8	Human herpesvirus-8
HIV	Human immunodeficiency virus
HLA	Human leukocyte antigen
HPV	Human papillomavirus
HSV	Herpes simplex viruses
ID	Identity document
IEI	Inborn errors of immunity
Ig	Immunoglobulin
IgG	Immunoglobulin G
IMF	Immunofluorescence
INR	International Normalised Ratio
INSTI	Integrase strand transfer inhibitor
IT	Information Technology
IV	Intravenous
JHB	Johannesburg
K_2EDTA	Dipotassium ethylenediaminetetraacetic acid
LAD	Lamina-associated domain
LBC	Liquid-based cytology
LDH	Lactate dehydrogenase
LIS	Laboratory information system
MAOIs	Monoamine oxidase inhibitors
MC&S	Microscopy, Culture and Sensitivity
MDR	Multidrug-resistant
MERS-CoV	Middle East respiratory syndrome coronavirus
MIC	Minimum Inhibitory Concentration
MLPA	Multiplex ligation-dependent probe amplification
MOG	Myelin oligodendrocyte glycoprotein
MPV	Mean Platelet Volume
MRN	Medical Record Number
MRSA	Methicillin-resistant *Staphylococcus aureus*

MSI	Microsatellite instability
MTB	*Mycobacterium tuberculosis*
N	Normal
Na_2EDTA	Disodium ethylenediaminetetraacetic acid
NaOH	Sodium hydroxide
NCR	National Cancer Registry
NHLS	National Health Laboratory Service
NICD	National Institute for Communicable Diseases
NIOH	National Institute for Occupational Health
NK	Natural killer
NMC	Notifiable Medical Conditions
OGTT	Oral glucose tolerance test
PAS	Periodic Acid-Schiff
PCR	Polymerase chain reaction
PCV	Packed cell volume
PH	Public holidays
PHC	Primary Health Care
PID	Primary immunodeficiency diseases
PJP	*Pneumocystis jiroveci* pneumonia
POC	Point-of-care
PTT	Partial Thromboplastin Time
PTS	Proficiency Testing Scheme
PUO	Pyrexia of Unknown Origin
QF-PCR	Quantitative Fluorescence Polymerase Chain Reaction
RBC	Red blood cell
RL	Regan-Lowe
RSV	Respiratory syncytial virus
SA	South Africa
SAPS	South African Police Service
SARS-CoV	Severe acute respiratory syndrome coronavirus
SG 1	Serogroup 1
STI	Sexually Transmitted Infection
SFA	Senior Forensic Analyst
SMS	Short message service
SOP	Standard operating procedure
SPUR	Serious, persistent, unusual, recurrent
SST	Serum separator tube
T	Tumour
TAD	Tshwane Academic Division
TAT	Turnaround time
TB	Tuberculosis
TPC	Total Plate Count
VHF	Viral haemorrhagic fever
VMA	Vanillylmandelic acid
VTM	Viral transport medium
VRE	Vancomycin-resistant enterococci
VZV	Varicella-zoster virus
WBC	White blood cell
WHO	World Health Organisation
XDR	Extensively drug-resistant

SECTIONS 1.0 – 6.0

1.0 VISION of the NHLS

To provide high quality pathology and laboratory services that are clinically efficient and cost-effective.

2.0 MISSION of the NHLS

To provide pathology and laboratory services through competent professionals and state-of-the-art technology, supported by evidence-based research, training, and innovation to enhance integrated service delivery to meet the needs of the population.

3.0 QUALITY POLICY STATEMENT (As per QPS0001v1)

The management and staff of the NHLS aspire to realise our vision of providing high quality pathology and laboratory services that are clinically efficient and cost-effective. This is done through continuous improvement and good professional practice.

We do this by:

- Developing, implementing, and maintaining a Quality Management System that continually improves the effectiveness of the service to our customers and ensuring that this is applied throughout the NHLS.
- Our Quality Management System is compliant with the requirements of the following:
  - ISO 15189 for Medical laboratories
  - ISO/IEC 17020 for Occupational Hygiene
  - ISO/IEC 17025 for Testing and calibration laboratories
  - ISO/IEC 9001 for production and support service departments
  - ISO/IEC 17043 for Proficiency Testing scheme providers
  - ISO 13485 for manufacturing of medical devices
  - And other regulatory authorities
- Requiring that the objectives that improve the Management System are set and reviewed by management,
- Requiring that all staff comply with the Quality Management System and provide training and support for them to do so,
- Supporting teaching and research to promote the adoption and application of innovative technology,
- Ensuring professional behaviour and ethical standards of business conduct, and
- Ensuring that all staff within the organisation is aware of this quality policy.

The NHLS shall not knowingly enter into an agreement for the provision of services where its impartiality is threatened, self-interest of any of its employees is evident, any potential conflicts can arise from within its own organisation or from the activities of its employees, other persons, bodies, or organisation.

Our laboratories and departments are committed to providing services that are responsive to the needs of our customers and meet their expectations. The full scope of testing and services is documented and available to our customers.

The NHLS goals are set out in the NHLS strategic plan. These and the quality policy are reviewed regularly for continued effectiveness and best practise within the public health service.

4.0 CONFIDENTIALITY STATEMENT

The NHLS and its users/clients are responsible for maintaining confidentiality of patient information. The NHLS ensures protection of personal information by making all employees aware that patient information is confidential. There is a standard operating procedure (SOP) GPQ0061 on confidentiality that all employees are expected to comply with.

Access to electronic information is managed through a formal registration process and password-protected access. Laboratory employees and registered healthcare workers are allocated appropriate access levels depending on their scope of work and/or responsibilities.

Confidential NHLS information may not be disclosed to any third party unless written permission is obtained from senior management, the responsible clinician or relevant customer representative.

When the NHLS is required by law or authorised contractual arrangements to release confidential information, the customer will be informed of the information provided. Patient confidentiality is enshrined in the National Health Act of 2003 and therefore, no patient information may be disclosed to the public.

5.0 INTRODUCTION

This booklet serves as a guide to the services offered by the NHLS. Please contact the laboratory if any additional information is required. Table 7-1 on pages 21−57 shows the contact numbers for laboratories and their hours of operation.

The specialised institutes of the NHLS include the National Institute for Communicable Diseases (NICD) incorporating National Cancer Registry (NCR), the National Institute for Occupational Health (NIOH), Forensic Chemistry Laboratories (FCLs), and the South African Vaccine Producers (SAVP) as subsidiary.

The NHLS has laboratories in all nine provinces. There are four FCLs in South Africa, one each in Cape Town, Durban, Pretoria, and Johannesburg.

6.0 COMPLAINTS and COMPLIMENTS

We welcome any complaints and compliments about our service, please contact your local laboratory at the numbers provided in Table 7-1 on pages 21−57. The laboratory has a complaints procedure number GPQ0059 to follow and address your concerns. Additionally, your acknowledgement of good service is considered valuable feedback. Please take time to forward your written or verbal compliment. Written compliments are encouraged, and these can be forwarded to the relevant laboratory.

SECTION 7.0

CONTACT DETAILS AND HOURS OF OPERATION

7.0 CONTACT DETAILS and HOURS of OPERATION

Table 7-1. Laboratory contact numbers and hours of operation per province and institution

EASTERN CAPE PROVINCE					
AREA / BUSINESS MANAGER		**TELEPHONE**	**MOBILE**		**FAX**
AREA MANAGER		(043) 700 8702	(082) 893 6875		(086) 535 6519
BUSINESS MANAGERS					
Alfred Nzo & Joe Gqabi		(039) 727 4007	(082) 899 2351		(039) 727 4218
Buffalo City & Amathole		(043) 701 6004	(082) 737 7290		(086) 555 1186
Nelson Mandela Academic		(047) 502 4922 / 4189	(082) 872 9986		(047) 502 4051
Nelson Mandela Bay & Sarah Baartman		(041) 395 6158	(082) 888 9098		(041) 395 6147
OR Tambo & Chris Hani		(043) 709 6019	(082) 807 6635		(047) 531 1407
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Andries Vosloo (Somerset East)	(042) 243 1465	(076) 793 9745	08h00 – 17h00		ON CALL
Aliwal-North	(051) 634 2398	(079) 893 0966	08h00 – 17h00		ON CALL
All Saints	(047) 548 1025	(082) 803 8808	08h00 – 20h00	08h00 – 12h00	ON CALL
Bambisana	(039) 253 7524	(082) 899 2399	08h00 – 17h00		
Bisho	(040) 635 0579 / 0582	(082) 899 2403	08h00 – 19h00		
Butterworth	(047) 491 8690	(078) 671 8384	24 hours	08h00 – 17h00	ON CALL
Cala	(047) 877 0357 / 0037	(082) 882 9963	08h00 – 18h00		
Canzibe	(047) 568 8576	(082) 804 0204	08h00 – 20h00		ON CALL
Cecilia Makiwane	(043) 708 2218 / 2477	(082) 906 0081	24 hours		

EASTERN CAPE PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Cofimvaba	(047) 874 8020 / 0095	(072) 628 9818	08h00 – 20h00	08h00 – 12h00	ON CALL
Cradock	(048) 881 4343	(082) 329 6448	08h00 – 18h00		ON CALL
Dora Nginza	(041) 464 4655 / 1065 / (072) 252 3107	(041) 464 4655 / 1065	24 hours	24 hours	
Dr Malizo Mpehle	(047) 542 8881 / 90	(082) 802 0236	08h00 – 17h00		ON CALL
Empiliswe ni	(051) 611 0061	(082) 899 2361	08h00 – 17h00		
Frere (East London)	(043) 701 6021 / 743 3000	(082) 737 7290	24 hours	24 hours	
Frontier (Queenstown)	(045) 839 4483 / 838 1916	(082) 807 2639	24 hours	24 hours	
Glen Grey	(047) 878 0121	(082) 897 1607	08h00 – 18h00		
Greenville	(039) 251 3267 / (064) 870 2743	(064) 870 2743	08h00 – 17h00		
Hewu	(040) 841 0036	(082) 590 5482	08h00 – 17h00		
Holy Cross	(039) 253 7542 / 7082	(082) 870 3506	08h00 – 18h00		ON CALL
Humansdorp	(042) 200 4255	(082) 803 1626	08h00 – 17h00		ON CALL
Isilimela	(047) 564 0009	(084) 255 4365	08h00 – 17h00		
Livingstone – Lab Support Services	(041) 453 3816 / (072) 252 0875	(041) 453 3816	24 hours	24 hours	
Livingstone – Chemical Pathology	(041) 405 2226 / (072) 252 0453	(041) 405 2226	24 hours	24 hours	
Livingstone – Haematology	(041) 405 2229 / (072) 252 0453	(041) 405 2229	24 hours	24 hours	

EASTERN CAPE PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Madwaleni	(047) 577 8812 / 8801	(079) 510 5618	08h00 – 18h00		ON CALL
Madzikane KaZulu Memorial	(039) 255 1653 / 0628	(082) 899 2297	08h00 – 17h00		ON CALL
Maluti	(039) 256 0547		08h00 – 17h00		
Midlands (Graaff–Reinet)	(049) 892 5195	(082) 807 0485	08h00 – 17h00		ON CALL
Mount Ayliff	(039) 254 0951	(082) 872 5834	08h00 – 19h00		ON CALL
Nelson Mandela Academic – Lab Support Services	(047) 502 4895 / 4951	(082) 616 0380	24 hours	24 hours	
Nelson Mandela Academic – Chemical Pathology	(047) 502 4894	(082) 321 1588	24 hours	24 hours	
Nelson Mandela Academic – Cytology	(047) 502 4889 / 4887	(072) 150 9991	07h30 – 16h30		
Nelson Mandela Academic – Haematology	(047) 502 4890 / 4891	(082) 324 7127	24 hours	24 hours	
Nelson Mandela Academic – Histology	(047) 502 4877 / 4879	(082) 871 9164	07h00 – 16h00		
Nelson Mandela Academic – Microbiology	(047) 502 4919		24 hours	24 hours	
Nelson Mandela Academic – Tuberculosis (TB)	(047) 502 4954 / 4957	(082) 619 6606	24 hours	24 hours	

EASTERN CAPE PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Nelson Mandela Academic – Virology and Serology	(047) 502 4953 / 4893	(082) 601 8616	24 hours		
Nessie Knight	(047) 553 6104		08h00 – 17h00		
Port Elizabeth Provincial (M2)	(041) 392 3348	(041) 395 6111	08h00 – 17h00		
Port Elizabeth Main Branch – Lab Support Services	(041) 395 6111 / 6145 / 6175	(082) 805 7375	24 hours	07h00 – 12h00 Saturday & Sunday	
Port Elizabeth Main Branch – Microbiology (Bacteriology)	(041) 395 6111 / 6125 / 6131 / 6197		07h00 – 17h30	07h00 – 13h00 Saturday & Sunday	
Port Elizabeth Main Branch – Microbiology (TB)	(041) 395 6111 / 6109 / 6171 / 6172 / 6132		24 hours	08h00 – 12h00 Saturday & Sunday	
Port Elizabeth Main Branch – Serology	(041) 395 6111 / 6169 / 6167		07h30 – 17h00	08h00 – 12h00 Saturday	
Port Elizabeth Main Branch – Virology	(041) 395 6111 / 6126 / 6123 / 6114		07h30 – 17h00	08h00 – 12h00 Saturday & Sunday	
Port Elizabeth Main Branch – Anatomical Pathology (Cytology)	(041) 395 6111 / 6140 / 6166		07h45 – 16h30	08h00 – 12h00 Saturday	

EASTERN CAPE PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Port Elizabeth Main Branch – Anatomical Pathology (Histology)	(041) 395 6111 / 6156 / 6157		08h00 – 17h00		
Port Alfred	(046) 624 1047	(082) 902 6435	08h00 – 17h00		ON CALL
Qumbu	(047) 553 8013	(082) 872 9242	08h00 – 17h00		
Settler's (Grahamstown)	(046) 622 5066	(082) 807 0481	08h00 – 19h00		ON CALL
SS Gida	(040) 658 0083 / 0039	(072) 910 2324	08h00 –18h00		
St Barnabas	(047) 568 7766 / 7769	(084) 255 4365	08h00 – 22h00		ON CALL
St Elizabeth	(039) 253 1238	(082) 899 2399	24 hours		ON CALL
Oliver and Adelaide Tambo (St Patrick's) Bizana	(039) 251 0288	(082) 899 2264	24 hours		ON CALL
Tafalofefe	(047) 498 6012	(082) 327 2270	08h00 – 17h00	08h00 – 12h00	
Taylor Bequest (Matatiele)	(039) 737 4714	(082) 604 1324	24 hours	24 hours	ON CALL
Taylor Bequest / Mount Fletcher	(039) 257 0528	(072) 910 0747	08h00 – 19h00		ON CALL
Uitenhage	(041) 961 0682 / 966 2020	(082) 807 2640	24 hours	24 hours	
Victoria	(040) 653 2715	(082) 899 2241	08h00 – 18h00		
Willowvale	(047) 499 1204	(072) 629 5529	08h00 – 19h00		
Zitulele	(047) 575 9550 / 9551 / 0055	(072) 628 9820	08h00 – 20h00	08h00 – 12h00	ON CALL

FREE STATE PROVINCE			
AREA / BUSINESS MANAGER	**TELEPHONE**	**MOBILE**	**FAX**
AREA MANAGER	(011) 489 9170	(082) 603 2577	
BUSINESS MANAGERS			
Free State	(051) 405 9348	(082) 908 4449	
Universitas	(051) 411 9951	(071) 670 3459	

LAB NAME	TELEPHONE	AFTER–HOURS / MOBILE	WEEKDAY HOURS	WEEKEND / PUBLIC HOLIDAY HOURS	CALL–OUT
3 Military (Depot)	(051) 402 1859	(051) 405 3025 / 3931 (Universitas)	08h00 – 17h00		
Bethlehem	(058) 303 5586	(082) 801 8279 / (083) 566 5469	08h00 – 21h00	08h00 – 12h00 Saturday	ON CALL
Boitumelo (Kroonstad)	(056) 212 2169	(082) 801 8279 / (082) 806 7619	08h00 – 20h00	08h00 – 12h00 Saturday	ON CALL
Bongani (Welkom)	(057) 396 6200	(057) 396 6200 / (082) 807 7843	24 hours	24 hours	
Botshabelo	(051) 534 1610	(082) 809 5520 / (082) 802 1457	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Fezi Ngubentombi (Sasolburg)	(016) 973 3837	(082) 804 1776	08h00 – 17h00		
Manapo	(058) 713 1700	(082) 907 4181 / (072) 136 0652	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
National District	(051) 405 2552 / 2438	(051) 405 3025 / 3931 (Universitas)	08h00 – 17h00	08h00 – 12h00 Saturday	
Pelonomi	(051) 405 9340	(051) 405 9343 / (082) 807 6634	24 hours	24 hours	

FREE STATE PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Universitas – Lab Support Services	(051) 405 3035	(051) 405 3025	24 hours	24 hours	
Universitas – Chemistry	(051) 405 2931 / 3784	(051) 405 2931 / 3784	24 hours	24 hours	
Universitas – Cytology	(051) 405 3044		08h00 – 17h00		
Universitas – Haematology	(051) 405 3887	(051) 405 3887	24 hours	24 hours	
Universitas – Histology	(051) 405 3051		08h00 – 17h00		
Universitas – Human Genetics	(051) 405 3047	(082) 879 6371 / 7674	08h00 – 17h00		
Universitas – INR Clinic	(051) 405 3072		07h00 – 16h00		
Universitas – Microbiology	(051) 405 3077 / 3078	(051) 405 3025 / 3931	08h00 – 17h00	07h30 – 12h00	ON CALL
Universitas – Virology	(051) 405 3162 / 2969	(051) 405 2969 / 3175	24 hours	24 hours	

GAUTENG PROVINCE			
AREA / BUSINESS MANAGER	**TELEPHONE**	**MOBILE**	**FAX**
AREA MANAGER	(011) 489 9650	(082) 807 2650	
BUSINESS MANAGERS			
Charlotte Maxeke Johannesburg **(CMJ)** (JHB)	(011) 480 8418 / (011) 489 8538	(071) 670 3389	
Chris Hani Baragwanath **(CHB)**	(011) 489 8792	(082) 872 9969	
Dr George Mukhari **(DGM)**	(012) 417 9358	(067) 412 8808	
Ekurhuleni and Tshwane	(011) 489 9154 / 9284	(082) 941 5672	
Johannesburg, Sedibeng and West Rand	(011) 489 9153	(082) 905 7016	
Tshwane Academic Division **(TAD)**	(012) 319 2177	(082) 884 5262	

LAB NAME	TELEPHONE	AFTER–HOURS / MOBILE	WEEKDAY HOURS	WEEKEND / PUBLIC HOLIDAY HOURS	CALL–OUT
Bertha Gxowa	(011) 873 0000	(083) 340 0300	07h00 – 22h00	07h00 – 14h00	ON CALL
Bheki Mlangeni	(011) 933 5454 / 9736		24 hours	24 hours	
Braamfontein – Lab Support Services	(011) 489 9053 / 9182		24 hours	08h00 – 12h00	
Braamfontein – TB	(011) 489 9347 / 9264 / 9352		24 hours	24 hours	
Braamfontein – Cytology	(011) 489 9400 / 9407 / 9417 / 9418		24 hours	08h00 – 16h30	
Braamfontein – Immunology	(011) 489 9412 / 9199 / 9069		24 hours	24 hours	

GAUTENG PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Braamfontein – Genetics Clinical & Counselling Section	(011) 489 9223	Medical Geneticist: (082) 659 7138 Genetic Counsellor: (072) 432 3043	08h00 – 16h30		
Braamfontein – Genetics Lab Manager	(011) 489 9286 / 9344		08h00 – 17h30		
Braamfontein – Genetics Aneuploidy Testing	(011) 489 9229 / 9231 / 9232 / 9436		07h00 – 16h30		
Braamfontein – Genetics Biochemistry	(011) 489 9220		07h00 – 16h30		
Braamfontein – Genetics DNA Profiling Laboratory (DPL) (paternity testing)	(011) 489 9471		08h00 – 16h30		
Braamfontein – Molecular Genetics	(011) 489 9217		08h00 – 16h30		
Braamfontein – Cytogenetics	(011) 489 9231 / 9232 / 9229		08h00 – 16h30		
Carletonville	(018) 788 6250 / 786 1902	(072) 616 8955	24 hours	24 hours	
Chris Hani Baragwanath – Lab Support Services	(011) 489 8739 / 8777 / 8776 / 8787	(060) 998 7512	24 hours	24 hours	
Chris Hani Baragwanath – Histology	(011) 489 8711 / 8710 / 8702 / 8654		06h30 – 16h30	06h30 – 10h00	

GAUTENG PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Chris Hani Baragwanath – Chemical Pathology	(011) 489 8781 / 8770 / 8768		24 hours	24 hours	
Chris Hani Baragwanath – Haematology	(011) 489 8748 / 8719 / 8747 / 8754		24 hours	24 hours	
Chris Hani Baragwanath – Microbiology	(011) 489 8740 / 8735 / 8729 / 8730		24 hours	24 hours	
Chris Hani Baragwanath – Satellite Lab	(066) 478 8453		24 hours	24 hours	
Chris Hani Baragwanath – STAT Lab	(011) 933 9736		24 hours	24 hours	
Charlotte Maxeke JHB – Lab Support Services	(011) 489 8484 / 8440		24 hours	24 hours	
Charlotte Maxeke JHB – Anatomical Pathology	(011) 489 8463		24 hours 08h00 – 17h00 Friday		
Charlotte Maxeke JHB – Chemical Pathology	(011) 489 8453 / 8458 / 8433		24 hours	24 hours	
Charlotte Maxeke JHB – Cytogenetics	(011) 489 8596	(071) 866 2852	08h00 – 17h00		ON CALL
Charlotte Maxeke JHB – Flow Cytometry	(011) 489 8409		24 hours	07h00 – 16h00 Saturday	
Charlotte Maxeke JHB – Haematology	(011) 489 8547 / 8809 / 8804	(082) 801 2732	24 hours	24 hours	

GAUTENG PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Charlotte Maxeke JHB – HIV Molecular	(011) 489 8547 / 8420	(082) 326 7102	24 hours		
Charlotte Maxeke JHB – Infection Control / Public Health	(011) 489 8578		08h00 – 17h00	08h00 – 12h00 Saturday	
Charlotte Maxeke JHB – Microbiology	(011) 489 8425 / 8426		24 hours	24 hours	
Charlotte Maxeke JHB – Virology	(011) 489 8517 / 8594	(082) 329 2914	07h00 – 19h00	07h00 – 16h00 Saturday	CALL OUT
Dr George Mukhari – Lab Support Services	(012) 521 3048		24 hours	24 hours	
Dr George Mukhari – Anatomical Pathology	(012) 521 5850		24 hours	24 hours	
Dr George Mukhari – Chemical Pathology	(012) 521 4062		24 hours	24 hours	
Dr George Mukhari – Cytogenetics	(012) 521 4070		24 hours	24 hours	
Dr George Mukhari – Haematology	(012) 521 5807		24 hours	24 hours	
Dr George Mukhari – Microbiology	(012) 521 4790		24 hours	24 hours	
Dr George Mukhari – Virology	(012) 521 5629		24 hours	24 hours	

GAUTENG PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Edenvale	(011) 882 4000 / 4001	(011) 489 0402 (Helen Joseph)	07h00 – 19h00	08h00 – 17h00	
Far East Rand	(011) 813 2136	(083) 349 0300	07h00 – 19h00	07h00 – 14h00	ON CALL
Helen Joseph	(011) 489 0402 / 0403 / 0405		24 hours	24 hours	
Jubilee	(012) 711 8901		24 hours	24 hours	
Kalafong	(012) 318 6838		24 hours	24 hours	
Kopanong	(016) 428 2601 / 7170 / 7106	(016) 988 1417 (Sebokeng)	07h00 – 19h00	07h00 – 19h00	
Leratong	(011) 419 3032 / 3118		24 hours	24 hours	
Mamelodi	(012) 801 1405	(012) 354 3856 (TAD)	07h00 – 18h00	08h00 – 12h00	
Odi	(012) 725 7800	(082) 901 5909	24 hours	07h00 – 14h00	ON CALL
Pholosong	(011) 812 5080	(011) 920 1126 (Tambo Memorial)	07h00 – 18h00	07h00 – 14h00	
Rahima Moosa	(011) 477 3038 / 4892 / 3859	(011) 489 0402 (Helen Joseph)	07h00 – 16h30		
Sebokeng	(016) 988 1438 / 1417		24 hours	24 hours	
South Rand	(011) 681 2068	(011) 489 0402 (Helen Joseph)	08h00 – 19h00	08h00 – 12h00	
Steve Biko (TAD) – Lab Support Services	(012) 354 3856		24 hours	24 hours	
Steve Biko (TAD) – Anatomical Pathology	(012) 319 2111		08h00 – 17h00		

GAUTENG PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Steve Biko (TAD) – Chemical Pathology	(012) 354 3871		24 hours	24 hours	
Steve Biko (TAD) – Haematology	(012) 354 3873		24 hours	24 hours	
Steve Biko (TAD) – Immunology	(012) 319 2938	(082) 906 7706 / (076) 590 0890	08h00 – 17h00; Transplant Unit only – 24 hours	Transplant Unit only – 24 hours	
Steve Biko (TAD) – Microbiology	(012) 319 2123		24 hours	24 hours	
Steve Biko (TAD) – Virology	(012) 319 2350		24 hours	24 hours	
Tambo Memorial	(011) 917 9605		24 hours	24 hours	
Tembisa	(011) 920 1126		24 hours	24 hours	
Thelle Mogoerane	(011) 909 1241	(082) 808 5906	24 hours	24 hours	
Yusuf Dadoo	(011) 660 7388 / 7389	(082) 886 5972	08h00 – 19h00	08h00 – 12h00	ON CALL

KZN PROVINCE			
AREA / BUSINESS MANAGER	**TELEPHONE**	**MOBILE**	**FAX**
AREA MANAGER	(031) 327 6718 / 6736	(083) 468 0552	
BUSINESS MANAGERS			
Academic Complex	(031) 240 2809	(082) 561 9993	
Ethekwini	(031) 327 6701	(082) 324 4564	
Harry Gwala – Ugu	(031) 327 6715	(079) 519 1223	
Lembe – Thungulu	(031) 327 6761	(083) 557 9628	
Maju – Mzinyathi	(034) 312 6338	(082) 676 4808	
Mkhanya – Zulu	(035) 838 1387	(083) 375 3223	
Mngungundlovu – Thukela	(033) 342 2876	(082) 676 4808	

LAB NAME	TELEPHONE	AFTER–HOURS / MOBILE	WEEKDAY HOURS	WEEKEND / PUBLIC HOLIDAY HOURS	CALL–OUT
Addington	(031) 327 2471 / 2473 / 2475 / 2476 / 2479	(079) 291 5332	24 hours	24 hours	
Appelsbosch	(032) 294 8006	(032) 294 800	08h00 – 22h00	ON CALL	ON CALL
Benedictine	(035) 831 7000	(079) 291 6587	24 hours	24 hours	
Bethesda	(035) 595 3255	(035) 595 3255	24 hours		ON CALL
Catherine Booth	(035) 331 9200	(071) 874 7701	08h00 – 19h00		ON CALL
Ceza	(035) 832 5055	(079) 291 6693	08h00 – 17h00		ON CALL
Charles Johnson Memorial (CJM)	(034) 271 0665 (034) 271 3434	(034) 271 6434	24 hours	24 hours	

KZN PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Christ The King	(039) 834 7522	(074) 819 8941 / (063) 647 3963	24 hours		ON CALL
Church of Scotland (COSH)	(033) 493 0968	(033) 493 0968	24 hours		ON CALL
Clairwood (Depot)	(031) 460 5055 / 5056 (Wentworth)	(072) 044 4272 (Wentworth)	07h30 – 16h00		
Dr. Pixley Ka Isaka Seme Memorial	(031) 530 1400	(031) 530 1400 / (072) 909 9410			
Dundee	(034) 212 1052	(034) 212 1052	24 hours		ON CALL
eDumbe	(034) 995 1441	(079) 291 6445	08h00 – 17h00		ON CALL
E.G. Usher Memorial (Kokstad)	(039) 797 8147	(063) 709 6763	08h00 – 00h00		ON CALL
Ekhombe	(035) 834 1000	(064) 751 1747	08h00 – 21h00		ON CALL
Emmaus	(036) 488 1570	(036) 488 1570	07h00 – 00h30		ON CALL
Eshowe	(035) 474 2052	(072) 379 1288	24 hours	24 hours	
Estcourt	(036) 342 7034	(036) 342 7000	24 hours Mon – Thursday		ON CALL
General Justice Cetshwayo Gizenga Mpanza (Stanger)	(032) 552 2553	(083) 230 6858	24 hours	24 hours	
GJ Crookes Hospital (Scottburgh)	(039) 976 1180 / (039) 978 7040	(060) 870 0205	24 hours	08h00 – 18h00 Saturday	ON CALL

KZN PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Greys	(033) 345 2952 / 2953 / 2983	(033) 345 2952 / 2953 / 2983	24 hours	24 hours	
Greytown	(033) 413 2056 / (033) 413 9411	(033) 413 9411	24 hours	07h00 – 16h00 Saturday	ON CALL
Harry Gwala Regional Hospital (Edendale)	(033) 395 4220 / 4196 / 4308	(033) 395 4220 / 4196 / 4308	24 hours	24 hours	
Hlabisa	(035) 838 1386	(079) 291 6518	24 hours	24 hours	
Inkosi Albert Luthuli – Anatomical Pathology	(031) 240 2693 / 2732 / 2733 / 2735 / 2740	(083) 997 5464 / (067) 841 5133	07h30 – 16h00		
Inkosi Albert Luthuli – Chemical Pathology	(031) 240 2574 / 2575	(066) 376 3484	24 hours	24 hours	
Inkosi Albert Luthuli – Cytology	(031) 240 2629 / 2630	(071) 896 6010	07h30 – 16h00		
Inkosi Albert Luthuli – Haematology	(031) 240 2689 / 2690	(031) 240 2689 / 2690	24 hours	08h00 – 20h00	
Inkosi Albert Luthuli – Microbiology	(031) 240 2775	(031) 240 2775	24 hours	24 hours	
Inkosi Albert Luthuli - Virology	(031) 240 2599 / 2600	(031) 240 1000	07h30 – 16h30	07h30 – 15h00	
Itshelejuba	(034) 413 2542	(079) 291 6329	24 hours		ON CALL
King Edward VIII – Lab Support Services	(031) 360 3079 / 3086	(031) 360 3079	24 hours	24 hours	

KZN PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
King Edward VIII – Chemical Pathology	(031) 360 3088	(066) 376 3484	24 hours	24 hours	
King Edward VIII – Haematology	(031) 360 3098 / 3092	(031) 360 3092 / 3098	24 hours	24 hours	
King Edward VIII – Microbiology	(031) 360 3188 / 3191	(031) 360 3188 / 3191	07h30 – 18h00 18h00 – 06h00	07h30 – 18h00	
King Dinizulu	(031) 777 1105 / 1103	(031) 777 1105 / (060) 318 5374	24 hours	24 hours	
KwaMashu Community Health Centre	(031) 503 1400	(066) 329 9900	24 hours		
Kwa-Magwaza (St Mary's)	(035) 450 8231	(066) 359 1793	08h00 – 23h00		ON CALL
Ladysmith	(036) 638 0226 / 1157	(036) 638 0226 / 1157	24 hours	24 hours	
Madadeni	(034) 328 8124 / 8005	(034) 328 8005 / 8223 / 8224	24 hours	24 hours	
Mahatma Gandhi Memorial	(031) 539 6290 / (031) 502 1019 / 3127		24 hours	24 hours	
Manguzi	(035) 592 0209	(079) 291 6800	24 hours		ON CALL
Mbongolwane	(035) 476 6242	(079) 971 6719	08h00 – 21h00		ON CALL
Montebello	(033) 506 7131	(066) 347 9538	07h00 – 23h00		ON CALL
Mosvold	(035) 591 0502	(079) 291 6699	24 hours		ON CALL
Mseleni	(035) 574 1004	(079) 291 5894	24 hours		ON CALL

KZN PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Murchison	(039) 687 6013	(060) 870 0090 / (063) 647 4153	24 hours	08h00 – 17h00 Saturday	ON CALL
Newcastle	(034) 328 0054	(034) 382 0064	24 hours		ON CALL
Ngwelezane	(035) 794 2941 / (035) 901 7107	(035) 794 2941 / (035) 901 7107	24 hours	24 hours	
Nkandla	(035) 833 5042	(072) 804 9343	08h00 – 22h00	08h00 – 12h00 Saturday	ON CALL
Nkonjeni	(035) 873 0107	(079) 699 3952	24 hours		ON CALL
Northdale	(033) 387 2502	(033) 387 2502	24 hours	24 hours	
Osindisweni	(032) 541 9200 / 36 / 37 / 38	(068) 387 4674 / (065) 293 5904	08h00 – 16h30		ON CALL
Port Shepstone	(039) 688 6114 / 3	(060) 8700 709	24 hours	24 hours	
Prince Mshiyeni Memorial	(031) 907 8226	(031) 907 8226	24 hours	24 hours	
Public Health	(031) 327 6752 / 78	(072) 045 0507	07h30 – 16h00		
Queen Nandi (Empangeni)	(035) 907 7144 / (035) 772 6097	(065) 164 1577 / (081) 346 5718	06h00 – 22h30		ON CALL
RK Khan	(031) 459 6290	(072) 414 4479	24 hours	24 hours	
Rietvlei	(039) 260 0017	(082) 560 6390	08h00 – 00h00		ON CALL
St Andrews	(039) 433 1955	(060) 870 0295	08h00 – 00h00	08h00 – 12h00 Saturday	ON CALL

KZN PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
St Apollinaris	(039) 833 9001 / 9002 / 9003 / 9004 / 9005 / 9006	(063) 647 4259	08h00 – 00h00		ON CALL
Umphumulo	(032) 481 4100	(072) 149 0323	07h30 – 22h00		ON CALL
Untunjambili	(033) 444 0015	(071) 075 6169	08h00 – 18h00		ON CALL
Vryheid	(034) 989 5946	(079) 291 5996	24 hours	24 hours	
Wentworth	(031) 460 5055 / 5056	(072) 044 4272	24 hours	24 hours	

LIMPOPO PROVINCE			
AREA / BUSINESS MANAGER	**TELEPHONE**	**MOBILE**	**FAX**
AREA MANAGER	(012) 842 7598	(082) 904 4416	(086) 620 3431
BUSINESS MANAGERS			
Capricorn	(015) 296 3781 / 3839	(083) 429 5504	(015) 296 4647 / 4557
Sekhukhune and Waterberg	(015) 296 3781 / 3910	(082) 616 1906	(015) 296 4647 / 4557
Vhembe Mopani	(015) 296 0653 / 3780	(082) 887 9039	(015) 296 4647 / 4557

LAB NAME	TELEPHONE	AFTER–HOURS / MOBILE	WEEKDAY HOURS	WEEKEND / PUBLIC HOLIDAY HOURS	CALL–OUT
Bela-Bela (Warmbaths)	(014) 736 2374	(082) 801 8267	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Botlokwa	(015) 527 8030	(082) 908 4476	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
CN Phatudi	(015) 355 4935	(082) 907 5191	08h00 – 17h00		ON CALL
Dilokong	(013) 214 8310	(082) 809 1317	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Donald Fraser	(015) 963 6369 / 9217	(082) 906 8802	08h00 – 19h00	08h00 – 12h00 Saturday	ON CALL
Elim	(015) 556 3250	(082) 906 8774	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Ellisras	(014) 763 2254	(082) 801 8266	08h00 – 17h00	09h00 – 12h00 Saturday	ON CALL
George Masebe	(015) 425 0055	(082) 908 4439	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL

LIMPOPO PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Groblersdal	(013) 262 5245	(082) 881 9670	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Helene Franz	(015) 505 0102	(082) 809 5971	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Jane Furse	(013) 265 9541 / 9542	(082) 880 0887	24 hours	24 hours	
Kgapane	(015) 328 3811 / 7868	(082) 909 3201	08h00 – 17h00		ON CALL
Knobel	(015) 221 1634	(083) 630 5793	08h00 – 17h00		ON CALL
Lebowakgomo	(015) 632 5347	(082) 802 4294	24 hours	24 hours	
Letaba	(015) 303 0132 / 0239	(082) 908 4463	24 hours	24 hours	
Louis Trichardt	(015) 516 6880	(082) 806 6927	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Malamulele	(015) 851 0068	(082) 907 5190	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Mankweng	(015) 267 6530	(082) 908 4472	24 hours	24 hours	
Maphutha Malatjie (Namakgale)	(015) 769 1379	(082) 809 5972	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Matlala	(013) 264 5109	(083) 633 6879	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Mecklenburg	(015) 619 0435	(082) 908 4778	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Mokopane	(015) 483 4077 / 4047	(082) 809 1316	24 hours	24 hours	

LIMPOPO PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Musina	(015) 534 0151	(082) 201 2620	08h00 – 17h00		ON CALL
Nkhensani (Giyani)	(015) 812 1360 / 3661	(082) 807 5677	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Nylstroom	(014) 717 4435	(082) 801 8265	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Philadelphia	(013) 983 0358 / 0142	(082) 880 9112	08h00 – 18h00	08h00 – 12h00 Saturday	ON CALL
Pietersburg (Polokwane)	(015) 297 1099 / 1100 / 1101	(082) 801 8262	24 hours	24 hours	
Potgietersrus	(015) 491 2370	(082) 803 2920	08h00 – 17h00		ON CALL
Sekororo	(015) 383 0123 / 9426	(082) 909 3231	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Seshego	(015) 223 6519	(082) 801 9108	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Siloam	(015) 973 0453	(082) 806 6896	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
St Ritas	(013) 298 1017	(082) 906 8745	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Thabazimbi	(014) 777 2174	(082) 907 6904	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Tshilidzini	(015) 964 2238	(082) 908 7225	24 hours	24 hours	
Van Velden (Tzaneen)	(015) 307 1596	(082) 801 1829	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL

LIMPOPO PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Witpoort	(014) 769 0197	(083) 680 0141	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL
Zebediela	(015) 662 1198	(082) 802 0836	08h00 – 17h00	08h00 – 12h00 Saturday	ON CALL

MPUMALANGA PROVINCE					
AREA / BUSINESS MANAGER		**TELEPHONE**	**MOBILE**		**FAX**
AREA MANAGER		(012) 842 7598	(082) 904 4416		(086) 620 3431
BUSINESS MANAGERS					
Ehlanzeni		(013) 752 2052 / 2053	(082) 615 1548		(013) 752 2104
Gert Sibande and Nkangala		(017) 811 3305	(079) 519 1248		(013) 752 2104
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Amajuba (Volksrust) (Depot)	(017) 735 1994	Closed	08h00 – 17h00		
Barberton	(013) 712 2763	(082) 807 2629	08h00 – 17h00	10h00 – 14h00	ON CALL
Bethal (Depot)	(017) 647 2533	Closed	08h00 – 17h00		
Bernice Samuel (Delmas)	(013) 665 1059	Speed dial 22259 (013) 665 8200 if phoning from outside hospital	08h00 – 17h00		ON CALL
Embhuleni	(017) 883 1504	(082) 882 4679	08h00 – 17h00	08h00 – 12h00	ON CALL
Ermelo	(017) 811 3305 / 3402 / 2860	(082) 499 0912	24 hours	24 hours	
Evander	(017) 632 2075	(082) 807 7198	08h00 – 17h00	08h00 – 12h00	ON CALL
Kwa Mhlanga	(013) 947 9169 / 2557	(072) 044 4354	08h00 – 17h00	08h00 – 12h00	ON CALL
Lydenburg	(013) 235 4487 / 3609	(060) 987 0040	07h30 – 16h00	08h00 – 12h00 Saturday	ON CALL
Mapulaneng	(013) 799 0202	(082) 804 9956	08h00 – 17h00		ON CALL
Matikwana	(013) 708 7010	(083) 629 8574	08h00 – 17h00		ON CALL
Middelburg	(013) 282 5443	(060) 902 2747	24 hours	08h00 – 12h00	ON CALL

MPUMALANGA PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Mmamethlake	(012) 721 3867	(082) 900 2157	08h00 – 19h00	10h00 – 14h00	ON CALL
Piet Retief	(017) 824 1314	(082) 809 2088	08h00 – 17h00	08h00 – 12h00	ON CALL
Rob Ferreira (Nelspruit)	(013) 741 1014	(082) 808 2862	24 hours	24 hours	
Shongwe	(013) 781 0632 / 0670	(083) 645 9094	08h00 – 17h00	08h00 – 12h00	ON CALL
Standerton	(017) 712 4011	(082) 807 8939	08h00 – 17h00		ON CALL
Themba	(013) 796 0236	(082) 808 2842	24 hours	24 hours	
Tintswalo	(013) 795 5151	(082) 881 1671	08h00 – 17h00		ON CALL
Tonga	(013) 780 3621	(082) 908 5213	08h00 – 17h00	08h00 – 12h00	ON CALL
Witbank	(013) 656 6646	(082) 807 6941	24 hours	24 hours	

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES (NICD)					
		TELEPHONE	MOBILE		FAX
DIRECTOR		(011) 386 6137			
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Centre for Emerging and Zoonotic Diseases Clinical Advice Hotline	(082) 883 9920				
Centre for Enteric Diseases	(011) 386 6235 / (011) 555 0348				
Centre for Enteric Diseases – Bacteriology	(011) 555 0334 / 0360				
Centre for Enteric Diseases – Virology	(011) 555 0370				
Centre for Opportunistic, Tropical and Hospital Infections	(011) 555 0304 / (011) 555 0311				
Centre for Respiratory Diseases and Meningitis	(011) 555 0488 / (011) 386 6373				
Centre for Sexually Transmitted Infections (STI)	(011) 555 0461				
Centre for Tuberculosis	(011) 885 5321 / (011) 885 5315				
Centre for Vaccines and Immunology	(011) 386 6330				

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES (NICD)					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Electron Microscope Laboratory	(011) 386 6424 / (011) 386 6376				
Public Health, Surveillance and Response	(011) 386 6337 / (011) 555 0392 / (011) 555 0542 / (011) 555 0541	(082) 807 6770 / (082) 940 4780 / (079) 871 7278 / (082) 607 4591			24/7 Clinician on call Outbreak Hotline

NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH (NIOH)					
		TELEPHONE	MOBILE		FAX
DIRECTOR		(011) 712 6413			
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Analytical Services Section	(011) 712 6535 / 6440		08h00 – 16h00		
Biobank	(011) 712 6507		08h00 – 16h00		
Epidemiology Section	(011) 712 6436		08h00 – 16h00		
Human Immunodeficiency Virus (HIV) / TB Department	(011) 712 6516		08h00 – 16h00		
Information Technology (IT) Department	(011) 712 6512		08h00 – 16h00		
Information Services (Library)	(011) 712 6557		08h00 – 16h00		
Occupational Hygiene	(011) 712 6500		08h00 – 16h00		
Immunology / Microbiology	(011) 712 6475		08h00 – 16h00		
Occupational Medicine	(011) 712 6462		08h00 – 16h00		
Toxicology	(011) 712 6428		08h00 – 16h00		
Pathology	(011) 712 6597		08h00 – 16h00		

NORTH WEST PROVINCE					
AREA / BUSINESS MANAGER		**TELEPHONE**	**MOBILE**	**FAX**	
AREA MANAGER		(011) 489 9170	(082) 603 2577		
BUSINESS MANAGER		(018) 293 3512 / 3517	(082) 882 5284	(018) 381 0658 / 0157	
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Brits	(012) 252 0483 / 2848		07h30 – 20h00		ON CALL
Ganyesa	(053) 998 3666 / 1001	(060) 500 5914	08h00 – 17h00		
Gelukspan	(018) 336 1153 / 9200 / 9262	(060) 869 9721 / (063) 048 6711	08h00 – 21h00	08h00 – 12h00	ON CALL
Job Shimankana Tabane (Rustenburg)	(014) 592 2792 / 2791 / (014) 594 1803		24 hours	24 hours	
Joe Morolong (Vryburg)	(053) 927 2001		24 hours	24 hours	
Klerksdorp (Depot)	(018) 465 4772	(072) 460 8746	07h00 – 16h00		
Lehurutshe	(018) 363 4148 / 4207 / 4566		08h00 – 22h00		ON CALL
Mafikeng	(018) 383 3936 / 3686		24 hours	24 hours	
Moses Kotane	(014) 556 3992		24 hours	07h00 – 19h00	ON CALL
Potchefstroom	(018) 297 5525 / 5526		24 hours	24 hours	
Taung	(053) 994 1030		08h00 – 22h00		ON CALL
Tshepong	(018) 465 4088 / 7860		24 hours	24 hours	
Tshepong TB Lab	(018) 465 5478		24 hours	24 hours	
Wolmeranstad	(018) 596 1708 / 7860	(082) 807 7843	07h00 – 16h00		

NORTHERN CAPE PROVINCE					
AREA / BUSINESS MANAGER		**TELEPHONE**	**MOBILE**		**FAX**
AREA MANAGER		(021) 417 9377	(082) 322 0950		
BUSINESS MANAGER		(053) 831 3969	(082) 889 8974		
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Central Karoo (De Aar)	(053) 631 0669 / 0189 / 0190	(082) 809 5859	08h00 – 18h00		ON CALL
Dr Harry Surtie (Upington)	(054) 339 0950 / (054) 332 9139 / 9140 / 9141	(082) 804 9887	24 hours	08h00 – 13h00 23h00 – 08h00	
Dr Izak van Niekerk (Springbok)	(027) 712 1169 / 1099	(082) 807 3566	08h00 – 19h00		ON CALL
Robert Mangaliso Sobukwe (Kimberley – Lab Support Services)	(053) 833 1641 / 831 2895	(053) 833 1641 / 831 2895	24 hours	24 hours	
Robert Mangaliso Sobukwe (Kimberley) – Chemical Pathology	(053) 802 2172	(053) 802 2172	24 hours	24 hours	
Robert Mangaliso Sobukwe (Kimberley) – Haematology	(053) 802 2167	(053) 802 2167	24 hours	24 hours	
Robert Mangaliso Sobukwe (Kimberley) – Histology	(053) 802 2169		08h00 – 17h00		
Robert Mangaliso Sobukwe (Kimberley) – Microbiology	(053) 802 2166	(053) 802 2166	24 hours	07h00 – 14h00 19h00 – 07h00	

NORTHERN CAPE PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Robert Mangaliso Sobukwe (Kimberley) – TB	(053) 802 2168	(053) 802 2168	24 hours	10h30 – 16h30 19h00 – 07h00	
Tshwaragano	(053) 774 0647 / 0011	(082) 803 9149	08h00 – 23h00		ON CALL

WESTERN CAPE PROVINCE			
AREA / BUSINESS MANAGER	**TELEPHONE**	**MOBILE**	**FAX**
AREA MANAGER	(021) 417 9377	(082) 322 0950	
BUSINESS MANAGERS			
Groote Schuur & Red Cross Children's Hospital	(021) 404 5294	(067) 097 2012	
Tygerberg	(021) 938 4259	(082) 808 7554	
Western Cape	(021) 417 9374	(082) 880 9878	

LAB NAME	TELEPHONE	AFTER–HOURS / MOBILE	WEEKDAY HOURS	WEEKEND / PUBLIC HOLIDAY HOURS	CALL–OUT
Beaufort West	(023) 415 1447	(082) 809 5322	08h00 – 17h00		ON CALL
George	(044) 874 2022	(082) 809 5274	24 hours	24 hours	
Greenpoint – Lab Support Services	(021) 417 9300 / 9368	(021) 417 9300 / 9368	24 hours	24 hours	
Greenpoint – Haematology	(021) 417 9341 / 9342	(021) 417 9341 / 9342	24 hours	24 hours	
Greenpoint – Chemical Pathology	(021) 417 9330 / 9331 / 9335	(021) 417 9335	24 hours	24 hours	
Greenpoint – Virology	(021) 417 9381 / (067) 429 3551	(067) 429 3551	08h00 – 17h00		ON CALL
Greenpoint – TB	(021) 417 9360 / 9361	(021) 417 9360 / 9361	24 hours	24 hours	
Greenpoint – STAT lab at New Somerset Hospital	(021) 402 6375	(021) 402 6375	24 hours	24 hours	
Greenpoint – Public Health	(021) 417 9354 / 9355	(021) 417 9300 / 9368	08h00 – 17h00		

WESTERN CAPE PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Greenpoint – Histology	(021) 417 9344	(072) 620 6537 (Registrar on call)	08h00 – 17h00		ON CALL
Groote Schuur – Lab Support Services	(021) 404 4129 / 4166		24 hours	24 hours	
Groote Schuur – Anatomical Pathology (Cytology)	(021) 404 6252 / 3515	(072) 620 6537 (Registrar on call)	08h00 – 17h00		
Groote Schuur – Anatomical Pathology (Histology)	(021) 404 3000	(072) 620 6537 (Registrar on call)	08h00 – 17h00		ON CALL
Groote Schuur – Chemical Pathology	(021) 404 4129 / 4135	(072) 620 8419 (Registrar on call)	24 hours	24 hours	
Groote Schuur – Inherited Metabolic Diseases	(021) 404 4449 / (021) 650 1630		08h00 – 17h00		
Groote Schuur – Haematology	(021) 404 4129	(082) 879 6378 (Registrar on call)	24 hours	24 hours	
Groote Schuur – Haematology (Molecular)	(021) 404 4129 / 4449		08h00 – 17h00		
Groote Schuur – Virology	(021) 404 4129	(021) 404 4129 to obtain Registrar on call number	08h00 – 17h00		ON CALL
Groote Schuur – Microbiology	(021) 404 5298 / 5301	(082) 907 5282 (Registrar on call)	08h00 – 20h00		

WESTERN CAPE PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Groote Schuur – Tissue Immunology	(021) 404 4502	(021) 404 4129 to obtain on-call number	08h00 – 17h00		ON CALL
Groote Schuur – Immunology	(021) 404 4129 / 4130	(021) 404 4129	08h00 – 17h00		
Groote Schuur – Human Genetics (Cytogenetics)	(021) 404 4509	(021) 404 4129	08h00 – 17h00		
Groote Schuur – Human Genetics (Molecular)	(021) 404 4550	(021) 404 4129	08h00 – 17h00		
Helderberg (Somerset West)	(021) 852 3623	(082) 809 5662	08h00 – 17h00		ON CALL
Hermanus	(028) 312 5275	(082) 328 1592	07h30 – 17h30	10h00 – 14h00	ON CALL
Karl Bremer	(021) 949 6141	(021) 949 6141 / (021) 918 1471 / 1470 / (079) 511 7076	08h00 – 00h00	08h00 – 14h00	ON CALL
Khayelitsha	(021) 361 0038 / 0075	(021) 361 0038 / 0075	24 hours	24 hours	
Knysna	(044) 382 0991	(044) 874 2022	08h00 – 17h00	08h00 – 12h00	ON CALL
Mitchells Plain	(021) 371 7921	(082) 605 9756	24 hours	24 hours	
Mosselbay	(044) 690 3745	(044) 874 2022	08h00 – 17h00	13h00 – 17h00	ON CALL
Oudtshoorn	(044) 279 1104	(082) 809 5989	08h00 – 17h00	09h00 – 13h00	ON CALL
Paarl	(021) 860 2719 / 2720 / 2721	(082) 807 5626	24 hours	24 hours	

WESTERN CAPE PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Red Cross – Anatomical Pathology	(021) 658 5209	(072) 622 6672 (Pathologist on call)	07h00 – 17h00		ON CALL
Red Cross – Chemical Pathology	(021) 658 5224 / 5226		24 hours	24 hours	
Red Cross – Haematology	(021) 658 5203 / 5204		24 hours	24 hours	
Tygerberg – Results	(021) 938 4330 / 4904 / 4931	(021) 938 4934	24 hours	24 hours	
Tygerberg – Histology Results	(021) 938 5226 / 5350		07h30 – 17h00		
Tygerberg – Lab Support Services	(021) 938 4934	(021) 938 4934	24 hours	24 hours	
Tygerberg – Anatomical Pathology (Histology)	(021) 938 4036 (Routine)	Radio room: (021) 938 6666	07h30 – 17h00	08h00 – 12h00	ON CALL
Tygerberg – Anatomical Pathology (Cytology)	(021) 938 4040 / 4202	(021) 938 4911 Radio room: (021) 938 6666	07h30 – 16h00	Call hospital and ask for Cytopathologist on call	ON CALL
Tygerberg – Chemical Pathology	(021) 938 4936	(021) 938 4904 / 4931 / 4934	24 hours	24 hours	
Tygerberg – Haematology (Routine)	(021) 938 5750	(021) 938 5750 Radio room: (021) 938 6666	24 hours	24 hours	
Tygerberg – Haematology (Blood grouping)	(021) 938 4122	(021) 938 5750 Radio room: (021) 938 6666	24 hours	24 hours	

WESTERN CAPE PROVINCE					
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Tygerberg – Haematology (Bone marrow)	(021) 938 4122	(021) 938 5750 Radio room: (021) 938 6666	24 hours	24 hours	
Tygerberg – Haematology (Coagulation)	(021) 938 4615	(021) 938 5750 Radio room: (021) 938 6666	24 hours	24 hours	
Tygerberg – Microbiology	(021) 938 4006 / 4007 / 4012	(079) 872 9616 Radio room: (021) 938 6666	06h00 – 20h00	06h00 – 20h00	ON CALL
Tygerberg – Immunology	(021) 938 4001	(021) 938 4001 / 4018 ext. 5278 Radio room: (021) 938 6666	08h00 – 17h00	08h00 – 13h00	
Tygerberg – Virology	(021) 938 9557	Radio room: (021) 938 6666 (Request registrar / pathologist on call)	07h00 – 16h00	07h30 – 12h00	ON CALL
Tygerberg – Genetics (Molecular)	(021) 938 9557		06h00 – 15h00		
Vredendal	(027) 213 3924	(083) 625 6310	08h00 – 17h00		ON CALL
West Coast District (Vredenburg)	(022) 713 4468 / 4467	(083) 631 5738	08h00 – 18h00 ON CALL: 18h00 – 06h00		ON CALL
Worcester	(023) 348 1401 / 1407	(083) 925 4350	24 hours	24 hours	

FORENSIC CHEMISTRY LABORATORIES					
HEAD		**TELEPHONE**	**MOBILE**		**FAX**
HEAD: Forensic Chemistry Laboratories			(066) 532 6983		
LAB NAME	**TELEPHONE**	**AFTER–HOURS / MOBILE**	**WEEKDAY HOURS**	**WEEKEND / PUBLIC HOLIDAY HOURS**	**CALL–OUT**
Forensic Chemistry Laboratory – Cape Town	(021) 442 8976	(066) 247 9739	07h00 – 17h00	CLOSED	Not applicable
Forensic Chemistry Laboratory – Durban	(031) 301 1915	(066) 247 9750	07h00 – 17h00	CLOSED	Not applicable
Forensic Chemistry Laboratory – Johannesburg		(066) 261 2803	07h00 – 17h00	CLOSED	Not applicable
Forensic Chemistry Laboratory – Pretoria		(066) 247 9753	07h00 – 17h00	CLOSED	Not applicable

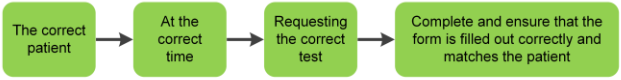
SECTION 8.0

PROCESS FLOW

8.0 PROCESS FLOW

8.1 Process Flow for Diagnostic / Public Health Laboratories

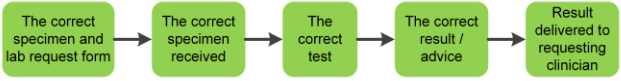
Step 1. Requesting Clinician ensures:



Step 2. Phlebotomist, Nurse or Clinician collecting the specimen checks and ensures (double checking the request form and specimen label against the patient wrist band / file or asking patient for their name):

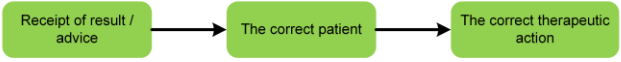
Step 3. Person undertaking logistics stage (messenger, courier, transport) ensures:

Step 4. Laboratory checks and ensures:



NOTE: The laboratory may reject an inappropriately collected, incorrectly labelled specimen or inappropriate specimen type

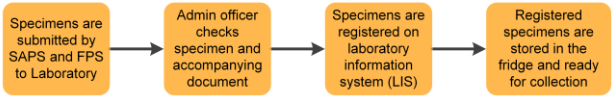
Step 5. Responsible Clinician / Nurse checks and ensures:



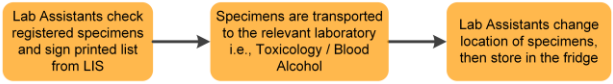
Note: Counselling should be conducted where relevant e.g., HIV and genetics.

8.2 Process Flow for Forensic Chemistry Laboratories

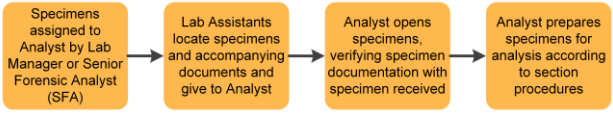
Step 1. Specimen registration
Specimens are received and registered by admin officers at reception.



Step 2. Specimen transportation
Specimens are collected, transported, and stored by Lab Assistants in the Blood Alcohol fridge (change of location).

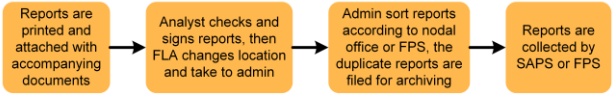


Step 3. Opening and preparing specimens for analysis
Specimens are assigned, opened, and prepared for analysis by Forensic Analysts using section procedures.



Step 4. Analysis of specimens
Specimens are analysed, reprocessed, authorised, and reports printed by Forensic Analysts according to section procedures.

Step 5. Reporting
LIS generates specimen reports once the Lab Manager has checked results.



SECTION 9.0

REQUEST FORMS

9.0 REQUEST FORMS

9.1 General

NHLS provides request forms to be completed for all specimens.
Forms have unique barcode numbers and, therefore, should not be photocopied.

Please complete the appropriate form in full so that the laboratory can process specimens correctly. Ensure the correct patient details are entered. Please write legible.

The following information is essential for specimen processing:

- Patient **name/surname, sex, age/date of birth, folder number, identity document (ID) number/passport number, and cellular phone number (providing the cellular phone number is important to expedite the issue of National Priority Programme test results to patients e.g., TB results):** To ensure that the laboratory data is matched to the correct patient and that appropriate age and sex adjusted reference intervals are supplied on the report.
- Patient's **location (hospital ward/clinic):** To ensure that the laboratory reports are sent to the appropriate location. **Please use the official names of the facilities and avoid using abbreviations.**
- **Collection date and time** of specimen: Gives indication of the time interval between collection and receipt/processing of the specimen. This is critical to assess analyte stability. Please do not pre-date forms.
- The **clinician's full name, HPCSA/SANC number, and contact details:** So that he/she can be contacted to obtain clinical history or communicate critical results. A reliable contact number of the ward or clinic can also be provided.
- **Electronic Gate Keeping (EGK):** Please provide the approval code if required.
- The **name of the person collecting the specimens:** Information is needed if the person collecting the specimens is not the same as the requesting clinician.
- **Clearly indicate test required:** Place a tick mark inside the test box or write the test name legibly to avoid any confusion about the specific test requested.
- **Type of specimen, including collection site (where necessary):** For Microbiology, be specific about the type of specimens e.g., sputum, gastric aspirate, type of urine as well as type of swab, NOT Pus swab. For Chemistry, please indicate the fluid type e.g., CSF, urine, pleural fluid, peritoneal fluid/ascites, synovial fluid, pericardial fluid.

- **Clinical diagnosis/information of the patient:** Assist with correct processing of the specimen and with interpretation of the results. For certain tests detailed clinical information is mandatory. Please indicate special circumstances e.g., if the patient is pregnant (and trimester if possible), a premature infant, pre- or post-blood transfusion, if post-transfusion, document the number of units and type of blood product transfused (e.g., packed red blood cells), and the time window of specimen collection relative to transfusion time. If it was unavoidable to collect specimens from a limb with IV infusion, please document the type of IV fluid.

Babies' specimens

If the specimen belongs to a baby, clearly state that it is the baby's specimen. In cases of multiple births, clearly indicate which twin the specimen is from (e.g., Twin A or Twin B). Use the baby's own folder number, not the mother's, to prevent the application of adult reference intervals, which could lead to misinterpretation and misdiagnosis.

Electronic Order Entry

Some facilities make use of their relative electronic order entry system, this is supported by the NHLS laboratory information system (LIS).

SHOULD YOU REQUIRE SPECIMENS TO BE TREATED URGENT, PLEASE INDICATE "URGENT" OR "STAT" ON THE FORM.

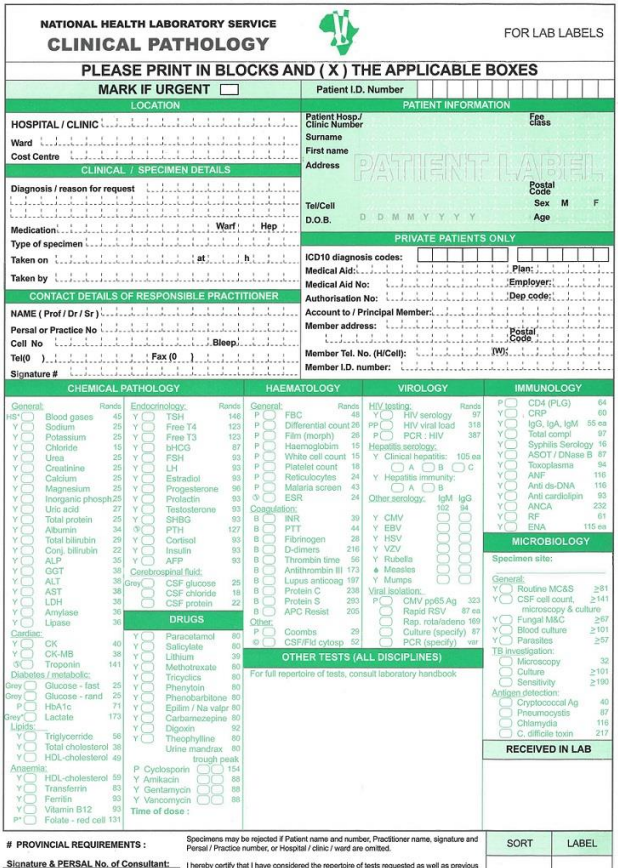


Fig. 9-1. Hospital general request form (see Fig. 11-1 on page 83 for description of specimen key next to each test)

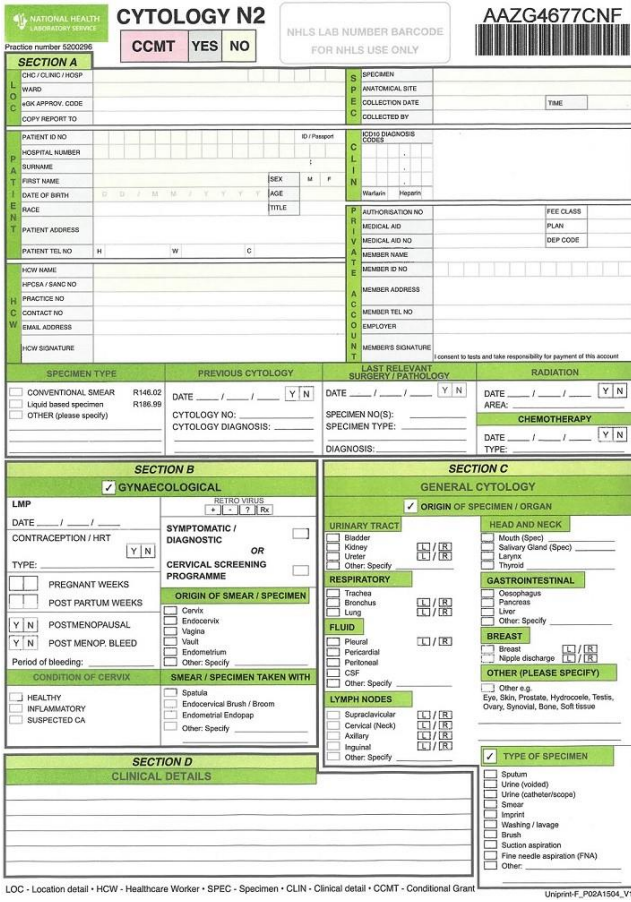
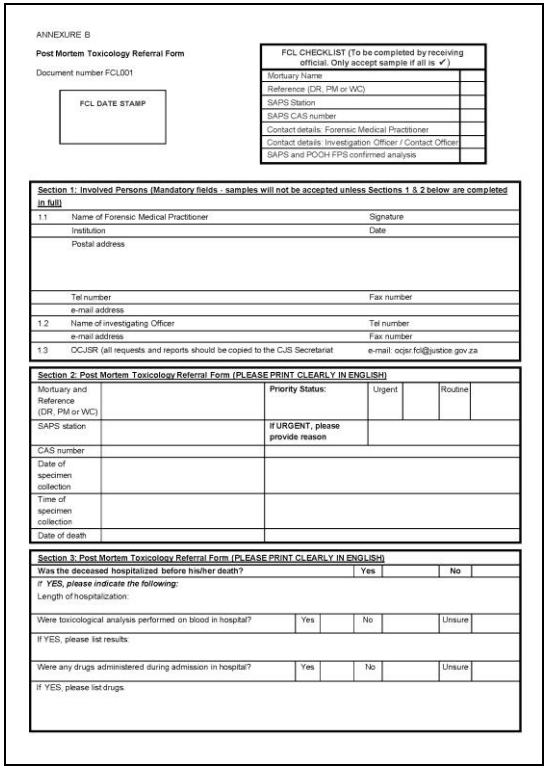


Fig. 9-2. Cytology N2 request form

9.2 Forensic Chemistry Laboratories

Every specimen or set of specimens forwarded to a Forensic Chemistry Laboratory (FCL) for blood alcohol, carboxyhaemoglobin, or toxicological examination for medico-legal purposes in connection with a death must be accompanied by a fully completed postmortem toxicology referral form (FCL001) and postmortem blood alcohol form (FCL003).



ANNEXURE B

Post Mortem Toxicology Referral Form

Document number FCL001

FCL DATE STAMP

FCL CHECKLIST (To be completed by receiving official. Only accept sample if all is ✓)	
Mortuary Name	
Reference (DR, PM or WC)	
SAPS Station	
SAPS CAS number	
Contact details: Forensic Medical Practitioner	
Contact details: Investigation Officer / Contact Officer	
SAPS and POCH FPS confirmed analysis	

Section 1: Involved Persons (Mandatory fields - samples will not be accepted unless Sections 1 & 2 below are completed in full)

1.1	Name of Forensic Medical Practitioner	Signature
	Institution	Date
	Postal address	
	Tel number	Fax number
	e-mail address	
1.2	Name of investigating Officer	Tel number
	e-mail address	Fax number
1.3	OCJSR (all requests and reports should be copied to the CJS Secretariat	e-mail: ocjsr.fcl@justice.gov.za

Section 2: Post Mortem Toxicology Referral Form (PLEASE PRINT CLEARLY IN ENGLISH)

Mortuary and Reference (DR, PM or WC)		**Priority Status:**	Urgent		Routine	
SAPS station		**If URGENT, please provide reason**				
CAS number						
Date of specimen collection						
Time of specimen collection						
Date of death						

Section 3: Post Mortem Toxicology Referral Form (PLEASE PRINT CLEARLY IN ENGLISH)

Was the deceased hospitalized before his/her death?			**Yes**		**No**	
If YES, please indicate the following:						
Length of hospitalization:						
Were toxicological analysis performed on blood in hospital?	Yes		No		Unsure	
If YES, please list results:						
Were any drugs administered during admission in hospital?	Yes		No		Unsure	
If YES, please list drugs:						

Fig. 9-3. Case history and toxicology request form (FCL001)

HP05-2014DI – ITEM 21 BID RESPONSE DOCUMENT

ANNEXURE B

Document number: FCL003 Version: Revision 05 Effective Date: Kit implementation

FORENSIC PATHOLOGY SERVICES

(Pathologist to Complete in full and in duplicate or make a copy)

This form is to be used to request for the analysis of blood for the presence of ethanol and/or carboxyhaemoglobin or toxicology analysis, or eye fluid for the presence of ethanol.

Address of mortuary:

_____

_____

_____

_____

Contact person at mortuary: _____ **Telephone number:** _____

Expiry date of the kit: _____

Analysis requested:

1. A sample container containing a **blood / eye fluid (please ✓)** sample with identifying marking DR/PM_____ or WC/____/_____ and SAPS station _____ CAS_____ and re-sealed with seal number _____ is being handed in at the Forensic Chemistry Laboratory, Cape Town / Durban / Johannesburg / Pretoria by _____

2. The sample is to be analysed for the presence of **(please ✓):**

   Ethanol ☐ Carboxyhaemoglobin ☐ Toxicology Suspected Compound/s: ☐

   _____

   _____

Note to Forensic Medical Practitioner: If Ethanol and/or CO and/or Toxicology analysis is required, two/three blood samples have to be submitted, one for each analysis. Complete one form for each blood sample.

Signature of Forensic Medical Practitioner: _____ Date: _____

For laboratory use only:

Laboratory reference number or bar-coded label if issued by Laboratory: _____

Laboratory Official name and signature: _____

HP05-2014DI – ITEM21 BID RESPONSE DOCUMENT 4

Date received (laboratory date stamp)

Fig. 9-4. Postmortem blood alcohol request form (FCL003)

SECTION 10.0

SPECIMEN COLLECTION CONTAINERS

10.0 SPECIMEN COLLECTION CONTAINERS

10.1 General

The NHLS will provide selected specimen collection materials upon request. Examples of provided materials are shown in Figs. 10-1 to 10-12 below. Please contact your local laboratory and specify which materials you require; contact details can be found in Table 7-1 on pages 21 to 57. Refer to the guidelines in Table 20-1 on page 203 to ensure the correct container is used. Guidelines for specimen collection are provided in Section 11 on pages 81 to 86. Please adhere to these guidelines to ensure the laboratory provides reliable results.

Examples of materials for specimen collection

Fig. 10-1. Examples of blood collection tubes

Fig. 10-2. Blood culture bottles

Fig. 10-3. Swabs without transport medium

Fig. 10-4. Swab with transport medium

Fig. 10-5. Swab with Amies charcoal-containing transport medium

Fig. 10-6. Sterile universal containers

Fig. 10-7. Slides and slide mailer / container

Fig. 10-8. Histology specimen containers

Fig.10-9. Dried blood spot (DBS) card

10.2 Forensic Chemistry Laboratories

10.2.1 Postmortem specimen collection kits

10.2.1.1 Toxicology specimen collection kits

- The Forensic Pathology Service (FPS) facility manager is responsible for procurement of these kits from the relevant vendor.
- Before a kit is opened for the receipt of specimens the seals should be inspected by the authorised person and only kits with intact seals should be used for packing toxicological specimens.
- The intact seals are evidence that the containers inside the kit have been properly prepared for the receipt of specimens.
- Place specimens into the appropriate containers as specified in the instruction leaflet in the Toxicology Sampling Kit.

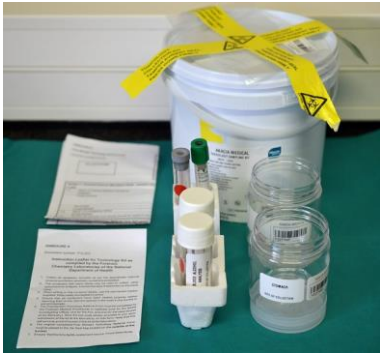


Fig. 10-10. Postmortem specimen collection kit

Fig. 10-11. Additional evidence that may accompany postmortem specimens (can include syringes, tablets, utensils, vomit found at the scene of crime / deceased)

- Only the prescribed containers containing Sodium Fluoride (preservative) as well as Potassium Oxalate (anti-coagulant) should be used for purposes of alcohol concentration determination.

Fig. 10-12. Postmortem blood alcohol specimen collection kit (open and sealed)

SECTION 11.0

GENERAL SPECIMEN COLLECTION GUIDELINES

11.0 GENERAL SPECIMEN COLLECTION GUIDELINES

Several essential steps are required for successful specimen collection:

- Identify the patient.
- Assess the patient's general physical condition (e.g., hydration, nutrition, stress).
- Complete the request form, including requested tests, patient information, and confirm the need for any special requirements.
- Prepare the necessary equipment/consumables and the patient.
- Collect the specimen in the appropriate specimen container at the required volume and with appropriate mixing if required.
- Discard all used collection material into the appropriate waste containers.
- Label the collection container with a patient ID label or handwritten information at the patient's side.
- Assess the need for specimen re-collection and/or possible rejection.
- Recognise complications associated with the collection procedure and manage accordingly.
- Promptly send the specimens with the request form to the laboratory or place specimens at the designated area for collection by laboratory personnel.
- **The National Health Act, Section 14, states the following:**
  1) **All information concerning a client/patient, including information relating to his or her health status, treatment or stay in a health establishment, is confidential.**
  2) **Subject to Section 15, no person may disclose any information contemplated with regards to health status, treatment or stay in a health establishment that is confidential, unless:**
     a) **The user consents to that disclosure in writing,**
     b) **A court order or any law requires that disclosure, or**
     c) **Non-disclosure of the information represents a serious threat to public health.**
- **Taking verbal or written consent for a blood test is a clinical responsibility and the requesting clinician is accountable when phlebotomists are requested to perform venepunctures and finger pricks for tests that require additional counselling and consent e.g., for HIV and genetic tests.**
- **In the case of fine needle aspiration (FNA), consent by the requesting clinician is advised. However, some FNA practitioners may choose to obtain their own consent in addition to the clinical consent.**

Reference: South African National Department of Health. National HIV Testing Services: Policy, 2016.

11.1 Patient identification

Verbal identification

- Greet the patient and identify yourself.
- Ask the patient to state his/her full name. Always ask patients to state their names. ***Avoid asking, "Are you John Smith?" as many patients may tend to say yes to anything in the outpatient setting.***
- Ask the patient's date of birth and ask them to spell their names if you want to query the patient's identity.

Verifying identification

Examination of any of the following should follow verbal identification:

- Identity book.
- Wristband: All information on the wristband should match the details provided on the request form. **Note:** A wristband lying on the bedside table may NOT be used for identification.
- Ankle band: Used for paediatric patients and newborns.
- Hospital/clinic card/book.
- Hospital card/book: Should be inspected to confirm the patient's name, hospital number and date of birth.

NOTE: Bed Number – A bed number on the request form cannot be used to identify ward patients.

11.2 Completing the request form

Complete the test request forms as described in Section 9.

11.3 Collecting the specimen

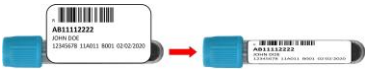
Specimens should be collected according to the guidelines set out in the appropriate sections in this manual. Any specimens that require invasive sampling techniques should be conducted with the appropriate clinical consultation. Please do not transfer specimens from one collection container to another as this may lead to the mixing of additives or preservatives.

11.4 Labelling of primary specimen containers

- Please ensure that specimens are properly labelled with adequate information to ensure that the specimen is traceable to the patient and the accompanying request form.
- Clearly label the specimen container with the patient's name, folder number or label all specimens with one of the peel-off, pre-printed barcoded labels from the request form and place it on the labelling area.

INSTRUCTIONS TO COMPLETE THIS FORM
1. When completing the form, ensure that writing is legible, and all tick marks are placed clearly in the tick boxes. 2. Please label all specimens with one of the peel-off, pre-printed labels, *in addition* to the patient identification label. 3. Use the correct specimen tubes, according to the specimen key next to each test. 4. If TB or CCMT tests are requested, the Data Collection questions must be completed.

APPLY BARCODE LENGTHWISE



Specimen key	Specimen tubes
Y	**Y**ellow / red with gel
R	**R**ed without gel
G	**G**reen (heparin)
Grey	**Grey** (fluoride)
P	**P**urple (EDTA)
B	**B**lue (citrate)
PP	**P**earl / white / purple (EDTA) with gel separator

Fig. 11-1. Proper labelling of blood tubes

11.5 Specimen rejection criteria

Please ensure that all the specimens are collected and transported correctly. This will allow proper diagnostic testing to be done by the laboratory.

The following are examples of specimens that are unacceptable for testing:

- Unlabelled or improperly labelled specimens i.e., specimens with information that does not match the request form.
- Incomplete request forms.
- Specimens received in leaking, cracked, or broken containers.
- Specimens not appropriate for a particular test.
- Incorrect specimen container or tube.
- Specimens with obvious (visually apparent) contamination.
- Expired tubes or other collection devices/containers.
- Incorrect temperature and/or packaging of specimen.
- Stability of the analyte in the specimen has been exceeded (specimen is too old upon receipt).
- Inadequate volume: Over- or underfilling of specimen container (see Figs. 11-2 to 11-4 on the next page).
- Request form or specimen missing upon submission to the laboratory.
- Insufficient clinical information for certain tests e.g., Genetics.
- Electronic Gate Keeping (EGK), as per Department of Health (DOH) rules.
- Specimen haemolysed for certain tests.
- Specimen clotted for certain tests.

Specimens may also be rejected if the specific conditions for that particular test listed in Table 25-1 are not met.

Exceptions to rejection of specimens may be made for critical specimens such as cerebrospinal fluid (CSF), tissue, and Forensic postmortem specimens, after consultation with the responsible health care worker.

Rejection notification:

- A printed report will be provided to the requesting health care professional via the routine report delivery process.
- SMS notification will be sent to the requesting healthcare professional who has activated this option during the WebView application process.
- **FCLs do not reject specimens**; refer to Section 24 for anomalies reported.

Examples of inadequate volume or overfilling of tubes:

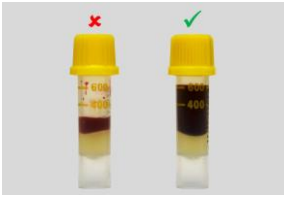


Fig. 11-2. Mini collect/Paediatric clotted (yellow top) tubes – Insufficient/ underfilled and sufficient

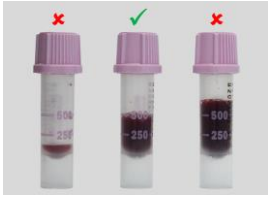


Fig. 11-3. Mini collect/Paediatric EDTA (purple top) tubes – Insufficient/ underfilled, sufficient, and overfilled

Fig. 11-4. Adult sodium citrate (blue top) tubes for coagulation studies – Insufficient/ underfilled, sufficient, and overfilled

11.6 Specimen packaging

- Always use sealable plastic bags with a separate pouch for the laboratory request form.
- The specimen must be placed in the sealed bag, with the form placed in the outer pouch of the bag. Multiple specimens from the same patient can be placed in one bag, but ONLY specimens from that same patient.
- Ensure that all specimens are properly sealed to avoid leaking in transit. **NOTE:** Do not staple plastic bags.
- A red biohazard sticker or label must be used on all specimens of patients suffering from or suspected of having infectious diseases that may put laboratory staff at risk e.g., Viral Haemorrhagic Fever (VHF). Please contact the laboratory BEFORE specimen collection to establish the correct procedure. Refer to section 21.8.2.1 – Suspected VHF protocol in brief.

11.7 Specimen transport

Arrangements have been made with different facilities for specimen transport to the laboratory. Ensure that the specimens are transported in the conditions as described in Table 25-1 under the specific test requested. All specimens are to be placed in containers at the central collection point. These are then taken to the laboratories by different methods depending on the arrangements with the facility:

- Delivered by hospital staff members.
- Collected by NHLS messengers and delivered to the laboratory following a specific schedule.
- Collected by drivers either employed by the NHLS or a courier company contracted by the NHLS and delivered to the laboratory following a specific schedule.
- **Postmortem specimens – FCL**
  - The authorised personnel who conducted the postmortem examination will be responsible for the collection of specimens.
  - The FPS personnel are responsible for sealing, labelling, and dispatching of specimens in the presence of the authorised person.
  - **Specimens must be transported to the laboratory by FPS/SAPS personnel.**

11.8 Multiple specimens

Please submit a separate specimen for tests that are processed in different sections of the laboratory e.g., CD4 and HIV viral load testing require separate specimens. Failure to do this may lead to any of the following:

- Delay in results as some tests may have to wait for others to be completed before being done.
- Possibility of errors due to aliquoting.
- Possibility of inadequate specimen volume preventing all the requested tests from being done thus delaying patient management when another specimen must be sent at a later stage.

Always send a separate specimen for HIV tests to avoid possible false-positive results due to cross contamination in the laboratory.

SECTION 12.0

SAFETY AND INFECTION CONTROL

12.0 SAFETY AND INFECTION CONTROL

Due to contact with sick patients and their specimens, it is important to follow safety and infection control procedures. Always follow the hand hygiene approach described in Fig. 12-1 on the next page.

PROTECT YOURSELF

12.1 Practise universal precautions

- Wear gloves and protective gear when handling blood/body fluids.
- Change gloves after each patient contact.
- Wash hands frequently or use appropriate disinfectant, after each patient.
- Dispose of all items in the appropriate waste containers.
- Dispose of needles in a sharp's container immediately upon removal from the patient's vein. Do not bend, break, or recap needles to avoid accidental needle puncture or splashing of contents.
- Clean up any blood spills or any other potentially infectious specimens with a suitable disinfectant (please refer to your local facility's document).

12.2 Body fluid exposure (e.g., needle stick, eye splash, etc.)

- Remain calm.
- Remove your gloves and dispose of all contaminated materials in the appropriate waste container.
- Rinse the affected area under running water.
- Record the patient's name and ID number.
- Follow your institution's injury on duty guidelines regarding further treatment and follow-up.

12.3 Protect the patient

- Place blood collection equipment away from patients, especially children and psychiatric patients.
- When wearing gloves, change them between patients and wash or disinfect your hands frequently.
- For point-of-care devices, clean as per manufacturer's instruction.

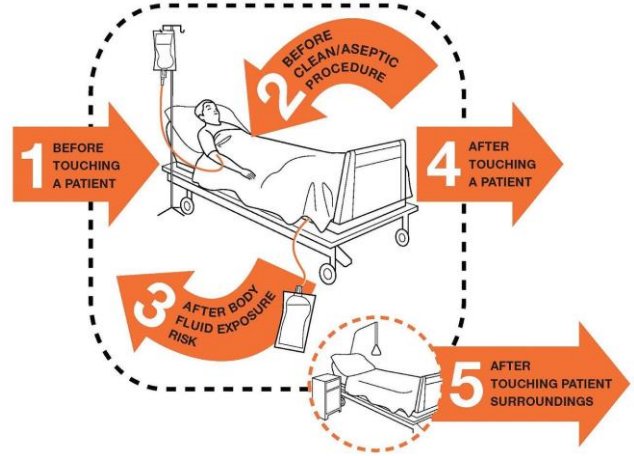


Fig. 12-1. The “5 Moments for Hand Hygiene” approach.

SECTION 13.0

BLOOD SPECIMEN COLLECTION PROCEDURE

13.0 BLOOD SPECIMEN COLLECTION PROCEDURE

The procedure below is to be followed for collection of specimens where blood must be collected for testing in all disciplines of the laboratory e.g., Chemical Pathology, Haematology, Immunology, Microbiology, Serology and Virology. For blood culture collection procedure, refer to Section 17.2.6.

Please follow the guidelines given in Table 25-1 on the type of tube to be used and the instructions to follow for each test.

Before drawing blood for an HIV screening test, counselling should be done by the relevant Health Care Practitioner. Counselling records are kept in the patient's folder.

13.1 Venepuncture procedure

The venepuncture procedure is complex, requiring both knowledge and skill to perform. Each phlebotomist generally establishes a routine that is comfortable for her or him. Several essential steps are required for every successful collection procedure:

- Identify the patient.
- Assess the patient's general physical condition (e.g., hydration, nutrition, stress).
- Check the request form for requested tests, patient information, and any special requirements.
- Prepare the blood collection materials, the patient, and the puncture site.
- Perform the venepuncture.
- Collect the specimen in the appropriate tube to the required filling level following the correct order of draw and invert the tubes 6−8 times.
- Label the collection tubes with patient identity, and request form bar code label at the bedside or in the drawing area in the presence of the patient.
- Assess the adequacy and suitability of the specimen(s) prior to sending to the laboratory.
- Observe complications associated with the phlebotomy procedure, if any and manage accordingly.
- Promptly send the specimens with the request form to the laboratory or place specimens at the designated area for collection by laboratory personnel.

13.1.1 Order of draw for venepunctures

Blood collection tubes must be drawn in a specific order to avoid cross-contamination of additives between tubes. The recommended order of draw is summarised in Table 13-1.

Table 13-1. Order of draw for venepunctures and appropriate specimen tubes

Collection tube	Additive	Tests	Special instructions
Blood culture bottles 	Sodium polyanethol-sulphonate (SPS) inactivates lysozyme, some antibiotics, and parts of complement cascade	Culture	Refer to Section 17.2.4 for volume of blood to be collected, and Figs. 17-2 & 17-3 for blood culture collection procedure
Blue Top 	Sodium Citrate	Coagulation tests e.g., INR, PTT, fibrinogen & D-dimer	**Full draw required** (Volume stated on tube – Adult tube: 3.2 mL; Paeds tube: 1.8 mL OR 0.9 mL) **Invert gently 3−4 times**
Red Top 	Clot activator, silicone coated	Selected tests only e.g., Meth (see Table 25-1)	**Cannot be used for CSF specimens** Invert 5 times after sampling
Yellow Top 	Serum Separating Tube (SST) – clot activator & gel	Most clinical chemistry, serology, immunology & toxicology	Invert 5 times after sampling to ensure mixing of clot activator & blood
Royal blue Top 	Clot activator	Trace elements	Invert 8 times after sampling
Green Top 	Sodium or lithium heparin (light green with gel)	Certain tests e.g., traditional cytogenetic studies & flow cytometry	Invert 8 times after sampling to ensure mixing of anticoagulant with blood to prevent clotting
Purple / Lavender Top 	Dipotassium ethylenediaminetetra-acetic acid (K_2EDTA)	Certain haematology, clinical chemistry, molecular genetic studies, toxicology & virology	Invert 8 times after sampling to ensure mixing of anticoagulant with blood to prevent clotting
Royal blue Top 	K_2EDTA	Trace elements	Invert 8 times after sampling
Pink Top 	K_2EDTA	Cross match	Invert 8 times after sampling to ensure mixing of anticoagulant with blood to prevent clotting
Pearl / White Top  **OR** **Purple top** 	K_2EDTA with gel separator	HIV viral load, HIV drug resistance genotyping	Invert 8 times after sampling to ensure mixing of anticoagulant with blood to prevent clotting
Grey Top 	Sodium fluoride & potassium oxalate or Na_2EDTA	Glucose, lactate	Full draw required Invert 8 times after sampling to ensure mixing of additives with blood
Light yellow Top 	Acid Citrate Dextrose (ACD)	Tissue typing, cross match	Invert 4 times after sampling

PLEASE NOTE: The colour of the collection tube top may vary slightly between different manufacturers. Select the collection tubes according to the desired additive.

*When using a butterfly device (winged collection system), first draw a specimen to discard in a beige/tan top tube, then proceed to draw a blue top tube.

NOTE: *Tubes with additives must be thoroughly mixed (by gentle inversion and not shaking). Erroneous test results may be obtained when the blood is not thoroughly mixed with the additive, especially tests for Haematology. Overzealous mixing also results in haemolysis. Certain tests cannot be performed accurately in the presence of haemolysis.*

WARNING: ***Do not pour contents from one tube into another as this will cause cross contamination of additives, which may cause erroneous test results.***

Please refer to Table 13-1 on previous page for more information.

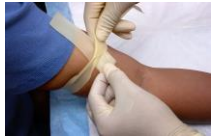
13.1.2 Venepuncture site selection

- Although the larger and fuller median cubital and cephalic veins of the arm are used most frequently, wrist and hand veins are also acceptable for venepuncture. If other sites are needed, clinical consultation should be sought.
- Certain areas are to be avoided when choosing a site:
  - **Extensive scars from burns and surgery:** It is difficult to puncture the scar tissue and obtain a specimen.
  - **The upper extremity on the side of a previous mastectomy:** Test results may be affected because of lymph oedema.
  - **Haematoma:** May cause erroneous test results. If another site is not available, collect the specimen distal to the haematoma.
  - **Intravenous therapy (IV)/blood transfusions:** Fluid may dilute the specimen, so collect from the opposite arm if possible. Otherwise, satisfactory specimens may be drawn below the IV by following these procedures:
    - Turn off the IV for at least 2 minutes before venepuncture.
    - Apply the tourniquet below the IV site. Select a vein other than the one with the IV.
    - Perform the venepuncture. Draw 5 mL of blood and discard before drawing the specimen tubes for testing.
  - **Cannula/fistula/heparin lock:** Hospitals have special policies regarding these devices. In general, blood should not be drawn from an arm with a fistula or cannula without consulting the attending physician.
  - **Oedematous extremities:** Tissue fluid accumulation may alter test results.

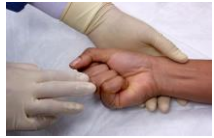
QUICK GUIDE TO PERFORMANCE OF A VENEPUNCTURE

Always practice universal safety precautions

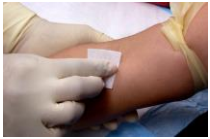
1. Gather blood collection materials.



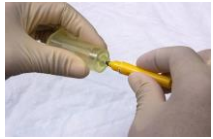
2. Apply tourniquet about 7.5−10 cm above the venepuncture site.



3. Have patient form a fist so veins are more prominent.



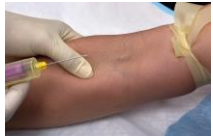
4. After palpating the path of the vein, clean the venepuncture site with alcohol using a circular motion. Allow area to dry.



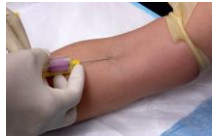
5. Assemble needle and vacuum tube.

6. Insert the collection tube into the holder until the tube reaches the needle.

7. Remove cap from needle.



8. Use your thumb to draw skin tight about 2.5−5 cm below the venepuncture site. Hold skin tight through Step 9.



9. Insert the needle, bevel side up, into the vein.

10. Properly dispose of all contaminated supplies.

Courtesy of:

CDC Centers for Disease Control and Prevention

Fig. 13-1. A quick guide to performance of a venepuncture.

13.1.3 Procedure for vein selection

- Palpate and trace the path of veins with the index finger. Arteries that pulsate are most elastic and have a thick wall. Thrombosed veins lack resilience, feel cord-like, and roll easily.
- If superficial veins are not readily apparent, gently tap the site with the index and second finger, apply a warm, damp washcloth to the site for 5 minutes, or lower the extremity over the bedside to allow the veins to fill.

13.1.4 Performance of a venepuncture

- Please also see Fig. 13-1 on the previous page for a *Quick guide to performance of a venepuncture*.
- Approach the patient in a friendly, calm manner. Provide for their comfort as much as possible and gain the patient's co-operation.
- Identify the patient correctly (as per Section 11.1 on page 82).
- Practice universal infection control precautions as described under Safety and Infection Control (Section 12 on page 89).
- Properly fill out the appropriate request form as described in Section 9 on pages 65 and 66, indicating the test(s) ordered.
- Verify the patient's condition. Fasting, dietary restrictions, medications, timing, and medical treatment are all of concern and should be noted on the laboratory request form.
- Position the patient: The patient should sit in a chair, lie down, or sit up in bed.
- Carefully hyperextend the patient's arm.
- Apply the tourniquet 7.5−10 cm above the selected puncture site. Do not place too tightly or leave on for more than one minute.
- The patient should make a fist without pumping the hand.
- Select the venepuncture site.
- Prepare the patient's arm using an alcohol wipe. Cleanse in a circular fashion, beginning at the site and working outward. Allow to air dry.
- Hold the patient's arm firmly using your thumb to draw the skin taut and anchor the vein. The needle should form a 15- to 30-degree angle with the surface of the arm. Swiftly insert the needle through the skin and into the lumen of the vein. Avoid excessive trauma and probing.
- As soon as the blood flows into the first tube, release the tourniquet.
- Remove the needle from the patient's arm using a swift backward motion.
- Press down on the gauze once the needle is out of the arm, applying adequate pressure to avoid the formation of a haematoma.
- Dispose of needle in a sharps container WITHOUT RECAPPING.
- Dispose of contaminated materials/supplies in the designated waste containers.

- Have the patient hold a small gauze pad over the puncture site for a couple of minutes to stop the bleeding. Cover the puncture site with sterile gauze, held in place with an elastic plaster.
- Mix and label all appropriate tubes at the patient's bedside. Label the tubes with the appropriate patient information as described in Section 11.4, page 82.
- Send specimens to the laboratory immediately.

NOTE: Special handling requirements: Some specimens need to be immediately transported to the laboratory under special conditions e.g., ammonia and homocysteine on ice and cryoglobulins at 37ºC (the specimen tube is best transported in an insulated flask with water at 38−40ºC; pre-arrange with the laboratory). Refer to the complete test list in Table 25-1 for full details of other analytes which may require special transport conditions.

13.2 Additional considerations

13.2.1 Tourniquet use

- Ideally, the tourniquet should be in place for no longer than one minute as this may cause blood pooling at the site of venepuncture termed haemoconcentration of elements that are not filterable (i.e., proteins). The hydrostatic pressure causes some water and filterable elements to leave the extracellular space.
- Affects packed cell volume (PCV) and other cellular elements.
- The following serum chemistry tests can be affected by tourniquet use which should, therefore, be minimised:
  - Calcium
  - Lactate
  - Potassium
  - Total protein
  - Iron
  - Cholesterol
  - Triglycerides
  - Bilirubin
  - Aspartate aminotransferase.

13.2.2 Preventing a haematoma

- Use the major superficial veins.
- Make sure the needle fully penetrates the uppermost wall of the vein, otherwise blood may leak into the surrounding soft tissue.
- Remove the tourniquet before removing the needle.
- Apply pressure to the venepuncture site after specimen collection.

13.2.3 Preventing haemolysis

- The use of a closed system, including a vacuum blood collection tube and tube holder, is recommended for venepuncture.
- Allow the venepuncture site to air dry, to allow the alcohol to evaporate.
- Use an appropriate needle gauge (size) for the age of the patient.
- Avoid drawing blood from a haematoma.
- If using a needle and syringe, avoid pulling or pushing the plunger forcefully.
- Invert tubes with anticoagulant additives gently 5−10 times.
- Avoid probing i.e., traumatic venepuncture.

13.2.4 Preventing haemoconcentration

An increased concentration of larger molecules and formed elements in the blood may be due to several factors:

- Prolonged tourniquet application (no more than one minute).
- Massaging, squeezing, or probing a venepuncture site.
- Sclerosed or occluded veins.

13.2.5 Using indwelling lines or catheters

- Indwelling lines or catheters pose a potential source of test error due to contamination by catheter fluid.
- Most lines are flushed with a solution of heparin to reduce the risk of thrombosis. It is essential to discard a specimen at least three times the volume of the line before a specimen is obtained for analysis.

13.3 Factors that may affect patient results

- **Therapeutic drug monitoring:** Different pharmacological agents have different patterns of administration, body distribution, metabolism, and elimination that affect the drug concentration as measured in the blood. Many drugs will have “peak” and “trough” levels that vary according to dosage levels and intervals. Check for timing instructions in Table 25-1 for drawing the appropriate specimens. Timing of phlebotomy relative to drug dosing must be stated on the request form.
- **Effects of exercise:** Muscular activity has both transient and longer lasting effects. Creatine kinase (CK), aspartate aminotransferase (AST), lactate dehydrogenase (LDH), troponin, lactate and platelet count may be affected.
- **Stress:** May cause transient elevation in white blood cells (WBCs) and elevated adrenal hormone values (cortisol and catecholamines). Anxiety that results in hyperventilation may cause acid-base imbalances.
- **Diurnal rhythms:** Diurnal rhythms are body fluid and analyte fluctuations during the day e.g., serum cortisol levels are highest early in the morning

but are decreased in the afternoon. Serum iron levels tend to drop during the day. You must check the timing of these variations for the desired collection point.

- **Posture:** Postural changes (supine to sitting, etc.) are known to influence laboratory results of some analytes. Certain larger molecules are not filterable into the tissue; therefore, they are more concentrated in the blood. Enzymes, proteins, lipids, iron, and calcium are significantly increased with changes in position.
- **Other physiological factors:** Age, sex, menstrual cycle, and pregnancy have an influence on some laboratory results. Normal reference intervals are often noted according to age and sex, and therefore it is crucial to supply this information on the request form.
- **Technical factors:**
  - Tourniquet application (for certain analytes e.g., ionised calcium, blood should be collected without a tourniquet)
  - Reduce tourniquet application to less than one minute
  - Incorrect collection tube selection
  - Toppling between different collection tubes
  - Incorrect order of the draw
  - Incorrect specimen volume
  - Delay in analysis (refer to Table 25-1 for individual analyte details)
  - Incorrect transport conditions (refer to Table 25-1 for individual analyte details).

13.4 Troubleshooting guidelines

- If an incomplete collection or no blood is obtained:
  - Change the position of the needle. Move it forward (it may not be in the lumen of the vein) or move it backward (it may have penetrated too far).
  - Adjust the angle (the bevel may be against the vein wall).
  - Loosen the tourniquet. It may be obstructing blood flow.
  - Try another tube. There may be no vacuum in the one being used.
  - Re-anchor the vein. Veins sometimes roll away from the point of the needle and puncture site.
- If the blood stops flowing into the tube:
  - The vein may have collapsed – re-secure the tourniquet to increase venous filling. If this is not successful, remove the needle, take care of the puncture site, and redraw from a new site.
  - The needle may have pulled out of the vein when switching tubes. Hold blood collection tube holder firmly and place fingers against patient's arm, using the flange for leverage when withdrawing and inserting tubes.

- Problems other than an incomplete collection:
  - A haematoma forms under the skin adjacent to the puncture site; release the tourniquet immediately and withdraw the needle. Apply firm pressure and redraw from a new site.
  - The blood is bright red (arterial) rather than dark red (venous). Apply firm pressure to the puncture site for more than 5 minutes.

13.5 Skin puncture procedures for capillary blood collection

13.5.1 Order of draw for skin punctures

- **The recommended order of draw for skin punctures is different from venepunctures** and is summarised in Table 13-2 below.
- Capillary blood is not suitable for blood cultures and most coagulation tests.

Table 13-2. Order of draw for skin punctures and appropriate specimen tubes

Collection tube	Additive	Tests	Special instructions
Purple / Lavender Top 	K_2EDTA	Haematology	Invert tube 10 times after sampling to prevent clotting
Green Top 	Lithium heparin	Chemistry	Invert tube 10 times after sampling to prevent clotting
Mint green Top 	Lithium heparin & Gel for plasma separation	Chemistry	Invert tube 10 times after sampling to prevent clotting
Grey Top 	NaFl / Na_2EDTA	Glucose	Invert tube 10 times after sampling to properly mix the additive and blood
Yellow Top 	Clot activator & Gel for serum separation	Chemistry	Invert tube 5 times after sampling
Red Top 	None	Chemistry, serology, blood banking	

NOTE: *Tubes with additives must be thoroughly mixed (by gentle inversion and not shaking). Erroneous test results may be obtained when the blood is not thoroughly mixed with the additive, especially tests for Haematology. Overzealous mixing also results in haemolysis. Certain tests cannot be performed accurately in the presence of haemolysis.*

WARNING: ***Do not pour contents from one tube into another as this will cause cross contamination of additives, which may cause erroneous test results.***

Please refer to Table 13-2 above for more information.

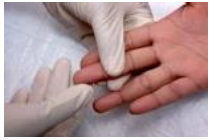
13.5.2 Performance of a finger prick

- Please also see Fig. 13-2 on the next page for a *Quick guide to performance of a finger prick*.
- Follow the procedure as outlined in Section 13.1.4 for greeting and identifying the patient. As always properly fill out the appropriate request form, indicating the test(s) ordered.
- Verify the patient's condition. Fasting, dietary restrictions, medications, timing, and medical treatment are all of concern and should be noted on the laboratory request form.
- Practice universal infection control precautions as described in Section 12.1 on page 89. Position the patient. The patient should sit in a chair, lie down, or sit up in bed.
- The best locations for performing a finger prick are the 3rd and 4th fingers of the non-dominant hand. Do not use the tip of the finger or the centre of the finger. Avoid the side of the finger where there is less soft tissue, where vessels and nerves are located, and where the bone is closer to the surface. The 2nd (index) finger tends to have thicker, callused skin. The 5th finger tends to have less soft tissue overlying the bone. Avoid puncturing a finger that is cold or cyanotic, swollen, scarred, or covered with a rash.
- Clean skin with an alcohol wipe and allow to dry.
- Using a sterile lancet, make a skin puncture just off the centre of the finger pad. The puncture should be made perpendicular to the ridges of the fingerprint so that the drop of blood does not run down the ridges.
- Wipe away the first drop of blood, which tends to contain excess tissue fluid.
- Collect drops of blood into collection device by gently massaging the finger. Avoid excessive pressure that may squeeze tissue fluid into the drop of blood.
- Follow the recommended order of draw (see Section 13.5.1).
- Cap, rotate and invert the collection device to mix the blood collected.
- Have the patient hold a small gauze pad over the puncture site for a couple of minutes to stop the bleeding.
- Be sure to dispose of the lancet in the appropriate sharps container.
- Dispose of contaminated materials/supplies in designated waste containers.
- Label all tubes with the appropriate information at the patient's bedside. Label the tubes with the patient's name and hospital/clinic number.
- Send specimen(s) to the laboratory immediately or place the specimen(s) in a designated collection area.

QUICK GUIDE TO PERFORMANCE OF A FINGER PRICK

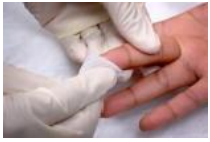
Always practice universal safety precautions

1. Gather all supplies.



2. Position hand palm-side up. Choose whichever finger is least calloused.

3. Apply intermittent pressure to the finger to help the blood to flow.



4. Clean the fingertip with alcohol. Start in the middle and work outward to prevent contaminating the area. Allow the area to dry.

5. Hold the finger and firmly place a new sterile lancet off-centre on the fingertip.

6. Firmly press the lancet to puncture the fingertip.

7. Wipe away the first drop of blood with a sterile gauze pad or cotton ball.

8. Collect the specimen. Blood may flow best if the finger is held lower than the elbow.

9. Apply a gauze pad or cotton ball to the puncture site until the bleeding stops.

10. Properly dispose of all contaminated supplies.

Courtesy of:

CDC Centers for Disease Control and Prevention

Fig. 13-2. A quick guide to performance of a finger prick.

13.5.3 Blood collection from babies (heel prick)

- In most circumstances, the recommended location for blood collection on a newborn baby or infant is the heel.
- Gently pre-warm the infant's heel to obtain capillary blood.
- Clean the site to be punctured with an alcohol wipe. Dry the cleaned area with a dry cotton swab. Hold the baby's foot firmly to avoid sudden movement.
- Using a sterile blood lancet, puncture the side of the heel. Do not use the central portion of the heel because you might injure the underlying bone, which is close to the skin surface. Do not use a previous puncture site. Make the cut across the heel print lines so that a drop of blood can well up and not run down.
- Wipe away the first drop of blood with a piece of clean, dry cotton. Since newborns do not often bleed immediately, use gentle pressure to produce a rounded drop of blood. Do not use excessive pressure or heavy massaging because the blood may become diluted with tissue fluid.
- Fill the capillary tube(s) or micro collection device(s) as needed following the recommended order of draw (see Section 13.5.1).
- When finished, elevate the heel, place a piece of clean, dry cotton on the puncture site, and hold it in place until the bleeding has stopped.
- Be sure to dispose of the lancet in the appropriate sharps container.
- Dispose of contaminated materials in appropriate waste containers. Remove your gloves, dispose appropriately, and wash your hands.
- Label all tubes with the appropriate information at the patient's side.
- Send specimen(s) to the laboratory immediately or place the specimen(s) in a designated collection area.

SECTION 14.0

ANATOMICAL PATHOLOGY

14.0 ANATOMICAL PATHOLOGY

14.1 Routine histopathology

14.1.1 General

- The Anatomical Pathology Department offers a comprehensive tissue diagnostic service. All specimens must be submitted in 10% neutral buffered formalin. The ratio of formalin to tissue should be 10:1 volume.
- URGENT specimens should be marked accordingly to allow for priority processing.
- Specimens from patients with potential biohazards (e.g., HIV, Hepatitis B, Hepatitis C) should be labelled appropriately.
- All specimens should be submitted with full patient demographic details including the surname and first name of the patient, the hospital number of the patient, the age and sex of the patient as well as the referring clinician's name, practitioner number, location, and a contact phone number. In addition, all specimens should be submitted with as much detailed clinical information as possible. This expedites diagnosis.

14.1.2 Frozen sections

- All routine frozen sections as well as emergency, frozen sections must be arranged with the pathologist on emergency duty who will ensure that the emergency team is ready to receive the specimen(s).
- Frozen sections must be booked by contacting the administrative office.
  - The administrative clerk will require details such as patient name, hospital number, site of biopsy, requesting clinician and expected date and time of arrival of the frozen biopsy to record the booking.
  - All prior biopsy numbers must also be provided, and it is advisable to book at least one day in advance.
  - The consulting pathologist must be contacted for the clinical discussion.
- If the clinical grounds for a frozen section are altered or the frozen section is cancelled, this must be conveyed to the pathologist office.
- The tissue for frozen section must NOT be submitted in a fixative.

14.1.3 Special biopsies

14.1.3.1 Muscle biopsy

- Diagnostic appraisal of muscle biopsies requires 3 specimens, one each for light microscopy, enzyme studies and electron microscopy.
- All muscle biopsies must be submitted on cardboard on stretch and NONE of these must be immersed in saline.
- All light microscopy specimens must be submitted in 10% buffered formalin.
- For enzyme studies, specimens must be wrapped in saline-moistened gauze and placed in an appropriately sized container which must be transported on wet ice.
- For electron microscopy, the specimen must be submitted in 2.5% glutaraldehyde fixative (see Table 14-1 on the next page). The expiry date of glutaraldehyde is indicated on the container.
- The fixatives (formalin and glutaraldehyde) may be obtained by contacting the laboratory.

14.1.3.2 Renal biopsy

- Diagnostic appraisal of renal biopsies requires 3 specimens, one each for light microscopy, immunofluorescence (IMF) and electron microscopy.
- NONE of these are submitted immersed in saline.
- All light microscopy specimens must be submitted in 10% buffered formalin or corrosive formalin (mercuric chloride + formaldehyde).
- For IMF, specimens must be submitted in IMF transport medium (pH 7.2) and for electron microscopy, specimens must be submitted in 2.5% glutaraldehyde fixative (see Table 14-1 on next page).
- The fixatives (10% buffered formalin, glutaraldehyde, and IMF medium) may be obtained by contacting the laboratory.

14.1.3.3 Nerve biopsy

- Diagnostic appraisal of nerve biopsies requires 2 specimens, one each for light microscopy and electron microscopy.
- Nerve biopsies must be submitted on cardboard on stretch.
- The specimen for light microscopy must be submitted in 10% buffered formalin and the specimen for electron microscopy must be submitted in 2.5% glutaraldehyde fixative (see Table 14-1 on next page).

14.1.3.4 Skin biopsy

- Diagnostic appraisal of a skin biopsy most often requires a single specimen for light microscopy submitted in 10% buffered formalin.
- Should IMF be required, an additional biopsy should be submitted in saline-moistened gauze and placed in an appropriately sized container. The specimen must NOT be immersed in saline.

14.1.3.5 Biopsies for histochemistry in the case of patients with Hirschsprung disease

Obtain tissue by suction of rectal biopsy or full thickness of rectal biopsy. Put on saline-moistened gauze to avoid folding of the strip of tissue for Acetylcholinesterase staining in laboratories where available. If no histochemical staining is available, the specimen should be placed in 10% buffered formalin. If a biopsy is sent for histochemistry, an additional specimen may be sent in formalin if possible.

Table 14-1. Fixatives for special biopsies

Special biopsy	Light microscopy	Electron microscopy	Immuno-fluorescence	Enzyme histology
Muscle	10% buffered formalin	2.5% glutaraldehyde	Not applicable	Saline-moistened gauze
Nerve	10% buffered formalin	2.5% glutaraldehyde	Not applicable	Not applicable
Renal	10% buffered formalin or corrosive formalin (mercuric chloride + formaldehyde)	2.5% glutaraldehyde	IMF transport medium	Not applicable
Skin	10% buffered formalin	Not applicable	Saline-moistened gauze	Not applicable

14.1.4 Postmortem examination

All potential autopsies should be discussed with the pathologist in charge of the autopsy service. Autopsies on persons who died of unnatural causes must be performed by a Government Pathologist and will thus be referred to the Government mortuary for autopsy.

14.1.5 Electron microscopy

Specimens specifically intended for electron microscopy should be submitted in glutaraldehyde fixative. Containers are available directly from the laboratory on request. Tissue to be submitted must be no more than 5 x 5 x 5 mm cubes.

14.1.6 Immunohistochemistry

The laboratory does a range of more than 200 immunohistochemical stains used for diagnostic as well as for prognostic purposes. Oestrogen receptor and progesterone receptor stains, as well as proliferation markers and diagnostic markers such as HER2/neu are stocked. Although the use of these is usually at the discretion of the pathologist, they can be performed upon request if required for the management of the patient.

14.1.7 Histology Polymerase Chain Reaction (PCR)

Some laboratories offer PCR testing for B-cell and T-cell gene rearrangement, real-time detection of *Mycobacterium tuberculosis*, synovial sarcoma, parvovirus, and human herpesvirus 8 (HHV-8), nested PCR detection of *Bartonella*, microsatellite instability studies, Epstein-Barr virus (EBV) and human papilloma virus (HPV). If available, these can be performed on request. Please contact the pathologist allocated to the case.

14.1.8 Urgent specimens

Small biopsies, submitted urgently before 12h00, can be processed rapidly on request with a turnaround time of 4−5 hours, and a result can be given within 5 hours; however, this is not recommended as a routine since the morphology is not well preserved.

14.2 Cytology

14.2.1 General

14.2.1.1 Labelling specimens and request forms

- All slides, vials and specimen bottles should be labelled with the name of the patient and a unique ID (MRN or birth date).
- A completely filled-out request form (i.e., Cytology N2 request form – see page 68) should accompany the specimen, with full demographic details, nature of specimen, clinical history including retrovirus information, relevant previous investigations or treatment, histology, and cytology reference numbers.

Please note that the laboratory is legally entitled to return specimens that do not have these details legibly supplied

14.2.1.2 Special instructions

- Urgent cases should be discussed with the cytology laboratory, as these will only be done by prior arrangement. Please refer to Table 7-1 for the relevant contact numbers.
- Where more than one investigation (e.g., microbiology, chemistry, and cytology) is to be done, please submit a separate specimen for cytology where possible.
- Slides/smears prepared by the clinician e.g., Pap smears or gastric brushings should be fixed promptly and correctly (refer to Section 14.2.1.3 below for Fixation technique).

14.2.1.3 Fixation technique

- Proper fixation is necessary and important to ensure clear nuclear detail. Air-dried specimens cause distortion, loss of cytoplasmic density that cannot be coloured properly and loss of clear nuclear detail.
- When preparing a slide e.g., Pap smear or bronchial / oesophageal / gastric brushings, the smear should be smeared in one direction with one motion.
- All prepared smears should be fixed immediately using cytological fixative. Liquid based cytology (LBC) specimens are fixed with the liquid in the vial – do not add additional fixative.
- Check expiry date.

14.2.2 Female genital tract (FGT)

14.2.2.1 Specimens include:

- Cervical
- Vaginal
- Vault
- Vulva
- Endocervical
- Endometrial smear.

14.2.2.2 Sampling technique to yield adequate smears using conventional or liquid–based cytology (LBC) method

14.2.2.2.1 Preparing the patient

- Sampling of cervix is paramount for specimen adequacy. Cells from this area (particularly the squamo-columnar junction) are often the first to show pathologic changes.
- Have a good light source.
- Before inserting the speculum lubricate with saline or water – avoid the use of lubricant jelly.
- Remove excessive discharge, blood or mucus from the cervix using a dabbing motion – do not wipe.
- How to visualise the cervical os when not seen:
  - First, establish if the patient does not have a history of hysterectomy.
  - If the patient had a hysterectomy, the smear should be treated as a vault smear.
  - To enable visualising the cervix you may ask the patient to cough, push, or bear colon or put a pillow or a rolled towel under the pelvic area at the back.
  - Rotate the speculum up/down/sideways to locate the cervix until the cervical os is visualised.
  - For obese patients/patients with excess vaginal tissue walls that obscure the vaginal pathway, cut the tip of a male condom, roll it over the speculum and re-insert into the vaginal canal.

14.2.2.3 Conventional method

14.2.2.3.1 Materials required

Figures 14-1, 14-2, and 14-3 are materials required for collection for the conventional method of testing.

Fig. 14-1. Fixative, pencil, and frosted slide

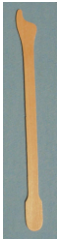


Fig. 14-2. Aylesbury spatula

Fig. 14-3. Slide holders

14.2.2.3.2 Collection technique

- Label slide with patient's name and birth date on frosted end with a pencil.
- Sampling different sites in the FGT:
  - Cervical smear (see Fig. 14-4 on the next page)
    - Take cervical smear by inserting the Aylesbury spatula; the extended tip goes into the endocervical os and the short tip fully contacts the ectocervix with emphasis on the squamo-columnar junction.
    - Firmly rotate spatula one full turn – 360°.
    - Spread the specimen evenly along the length of a slide and turn the spatula to spread both sides onto the slide. Do not apply specimen on the frosted end.
  - Endocervical smear
    - Take an endocervical smear by gently inserting a cytology brush into the endocervical canal and rotate the brush one full turn – 360°.
    - Spread specimen evenly by rotating the brush back and forth over the slide.
  - Vaginal or vault smear
    - Take vaginal/vault smear using spatula end of the Aylesbury spatula. Obtain the specimen by gently scrapping the vaginal/vault wall.
- Spread the specimen evenly along the length of a slide and turn the spatula to spread both sides onto the slide. Do not apply specimen on frosted end.
- Immediately fix by spraying with a cytology fixative (within 10 seconds) and allow to air-dry.

- Package the slide into the slide container and transport to laboratory at room temperature.

Quick guide for collection using conventional method

Fig. 14-4. A quick guide for collection using the conventional method

14.2.2.4 Liquid–based cytology (LBC) method

14.2.2.4.1 Materials required

Figures 14-5, 14-6, and 14-7 are materials required for collection for LBC.

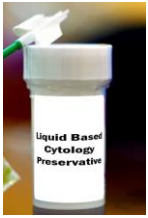


Fig. 14-5. Vial with LBC preservative

Fig. 14-6. Combi brush

Fig. 14-7. Cervix brush

14.2.2.4.2 Collection technique

- Label the vial with the patient's name, date of birth and apply the label horizontally around the bottle.
- Sampling different sites in the FGT:
  - Cervical specimen (see Fig. 14-8 on the next page)
    - Insert the central bristles of the brush into the endocervical canal deep enough to allow the shorter bristles to fully contact the ectocervix.
    - Firmly rotate the brush 360° in a clockwise direction by rolling the shaft between the thumb and forefinger.

    - Cervix Combi Brush: Rotate 1.5 to 2 times
    - Cervix Brush (broom): Rotate 5 times
  - Use wide sweeping motions if there is extensive erosion or if the cervical os is too wide.
- Endocervical specimen
  - Take an endocervical smear by gently inserting a cytology brush into the endocervical canal, rotate the brush one full turn – 360° and then rinse into the preservative solution.
- Vaginal or Vault smear
  - Take vaginal/vault smear by firmly sweeping the vaginal/vault wall.

- Rinse the brush immediately into LBC preservative by pushing/squashing it into the bottom of the vial 10 times, forcing the bristles to bend apart – Do not leave the tip of the brush in the vial when using Thin Prep.
  - As a last step, swirl the brush to ensure that no specimen remains attached.
  - Discard the collection device into the biohazard waste box.
- Tighten the cap so that the black lines on the vial and cap overlap (to ensure there is no leakage).
- Place the vial and request form in a specimen bag and transport to the laboratory at room temperature.

Quick guide for collection using LBC

Please access a video if needed: https://youtu.be/UAu7xT9183M

Record **Paste** **Collect** **Rinse** **Tighten** **Ship**

Fig. 14-8. A quick guide for collection using LBC

14.2.3 Non-gynaecological / General cytology

14.2.3.1 Respiratory system

- Examples include:
  - Sputum
  - Bronchial brushings/washings
  - Tracheal aspirates

- Nasal smears
- Broncho-alveolar lavage (BAL)
- Pharyngeal brushings
- Antral aspirates/sinus washings

Fig. 14-9. Supplies for respiratory specimens

14.2.3.1.1 Sputum

Submit sputum after an early morning deep cough to ensure that sputum, and not saliva, is collected.

- Collect 6 sputa on consecutive days – 6 specimens on the same day do not yield equivalent results.
- Provide full clinical details including history, examination, and results of ancillary investigations e.g., radiology.
- State clearly if the patient is a smoker or asthmatic.
- State clearly if the patient has been treated with positive pressure oxygen.
- Label the specimen containers and complete the cytology request form.
- Give the patient clear instructions on how to produce a specimen as shown in Fig. 17-5 on page 153.
- Use the supplied universal containers:
  - The specimen container must be tightly capped and clearly labelled (this should be done by the health care professional requesting the specimen and should include the relevant clinical information as well as the diagnostic tests required).
  - The specimen should be transported to the laboratory as soon as possible after collection.
  - If there is a delay in transport to the laboratory, for example from an outside clinic, then specimens should be refrigerated.

    DO NOT FREEZE SPECIMENS.

14.2.3.2 Fluids

- Examples include:
  - Pleural
  - Peritoneal
  - Pericardial
  - Hydrocele
  - Cerebrospinal fluid (CSF)
  - Cyst fluid
  - Amniotic fluid
  - Peritoneal washings
  - Endometrial fluid
  - Ventricular fluid
  - Percutaneous lung fine needle aspiration (FNA)
  - Endoscopic bronchial FNA
- Ensure that fluids reach the laboratory as soon as possible as degenerate fluids are not suitable for accurate cytodiagnosis. Please preserve fluids in 50−70% alcohol if a delay in transit is anticipated.
- CSF must reach the cytology laboratory on the day of collection, preferably within 4 hours of collection.
- If a clot forms in the fluid, it will be sectioned and examined. A separate report will be issued.
- If the fluid has been obtained during an intra-operative procedure, please state this clearly on the request form.

14.2.3.2.1 CSF

- Follow instructions for completing request form in Section 9 on page 68.
- Follow the same procedures as described in Section 17.3 on pages 148−149.
- Use plain tube for collection.

14.2.3.3 Gastro-intestinal tract

- Examples include:
  - Oesophageal brushing
  - Gastric brushings
  - Duodenal brushings
  - Ampullary brushings
  - Pancreatic duct aspirates
  - Bile duct aspirates
  - Bile duct brushings
  - Colonic brushings
  - FNA pancreas percutaneous or FNA of liver.

- It is very important that the clinician fixes the slides immediately (within 10 seconds) with cytology spray fixative to prevent the degeneration of cells as this compromises cytodiagnosis. Please see 14.2.1.3 on page 111 for correct fixation of specimens.

14.2.3.4 Urogenital tract

- Examples include:
  - Voided urine (**NOTE:** 24-hour urine collections are unsuitable for cytodiagnosis)
  - Catheterised urine
  - Ureteric urine
  - Renal cyst aspirate
  - Renal pelvis brushings
  - Urethral smear
  - Percutaneous FNA of bladder and renal masses.
- State clearly if the patient has recently:
  - Undergone catheterisation
  - Undergone cystoscopy
  - Undergone retrograde radiography
- Cells in urine deteriorate rapidly. Specimens must reach the laboratory within 24 hours.

14.2.3.5 The breast

- Examples include:
  - Nipple discharge
  - Nipple smears
  - Breast aspirates.

14.2.4 Fine needle aspiration (FNA)

The cytology department may provide two FNA services:

- Impalpable/Deep/Image-guided FNA
  - Contact the radiologist to arrange for the procedure.
  - Please note that cystic lesions cannot be processed on site.
- Superficial or palpable lesions.
  FNA biopsy clinics:
  - In many regions/hospitals there is a clinic that provides an FNA service staffed by the NHLS.
  - For the location and hours of these clinics please contact the local cytology laboratory.
  - Patients who are on oxygen, receiving blood products, or are too ill to

be transported by wheelchair to the clinic will be aspirated in the ward. For children under the age of 13 years who require FNA, please contact the laboratory to discuss whether FNA should be performed under sedation or not. Please contact the clinic/pathologist to arrange for these procedures to be done in the ward/outpatient clinic.

- Send the bed letter with the patient (if an inpatient) or a note with the clinical history and referring clinician/contact telephone number (if an outpatient).
- Please make every effort to ensure the patient has his/her FNA booked before admission.
- Clearly indicate the area to be aspirated (preferably mark the lesions on the patient to ensure the correct site is aspirated).
- Please inform us if the patient has undergone previous FNAs.
- If a booked FNA is cancelled, inform us well in advance.
- If you cannot refer a patient to an FNA clinic run by the Cytopathology unit, see the technique of fine needle aspiration below.
- Training on the correct technique of FNA is available from the NHLS cytology laboratories. Please contact your local laboratory to arrange this; refer to Table 7-1 on pages 21−57.

14.2.4.1 FNA collection procedure

PLEASE NOTE: This procedure is for palpable lesions and NOT for deep-seated lesions, which should be conducted under radiological guidance. If an abscess is suspected, please submit material for microscopy, culture, and sensitivity (MC&S) and/or fungal culture.

If a non-Hodgkin lymphoma is suspected, please rinse the needle, and perform a separate pass. Please place material in a suitable fixative e.g., RPM1 and submit it to the laboratory as a matter of urgency.

The patient is booked for the procedure to be performed.

- Identify yourself and explain the procedure to the patient.
- Check the patient's folder or clinician's request note to establish the site of the lesion and to check the patient's identity.
- **Consent by the requesting clinician is advised. However, some FNA practitioners may choose to obtain their own consent in addition to the clinical consent.**
- Record the clinical information, patient's information, the aspirators name, site of the lesion and the number of passes and number of slides on the request form.
- Follow instructions for completing the request form in Section 9 on page 68.

How to prepare the FNA smear:

- Label all slides (on the frosted portion) in pencil with the patient's name or hospital number.
  NOTE: Do not label slides with barcodes. Put barcodes on slide container.
- Examine the nature of the lesion i.e., solid, cystic, mobile, etc.
- Clean the overlying skin with an antiseptic.
- Mobilise the lesion with two fingers to lessen the movement of the lesion when it is pricked.
- Pull the plunger back no more than 1 mL.
  PLEASE NOTE: Aspirates from children as well as all thyroids should be done with a 23-gauge needle.
- Insert the sterile 22-gauge (or 23-gauge as noted above) needle with an attached 10 mL or 20 mL syringe into the lesion (not directly in the centre of the lesion to avoid necrotic material) with the dominant hand while the mass is stabilised with the non-dominant hand.
- The syringe-piston should be retracted to approximately the 5 mL mark to produce and maintain a negative pressure.
- Move the needle up and down and around in all angles to loosen the cells.
- The needle is moved in various directions to sample cells from different areas of the mass while maintaining the negative pressure.
- Do not allow the needle to leave the lesion.
- Allow the plunger to return to its original position when only the nub of the syringe is filled with aspirate material. Withdraw after releasing the plunger.
- Withdraw the needle and disconnect the syringe.
- Fill the syringe with air and reconnect to the syringe.
- Express the material/aspirate onto the slide NEAR to the frosted end (see Fig. 14-10 below) while holding the needle to prevent it from being disconnected from the syringe if the needle is blocked.

Frosted end

Fig. 14-10. Deliver specimen onto slide.

- Place the second slide on the first, and gently but firmly allow the specimen to spread to the edges (see Fig. 14-11 below).

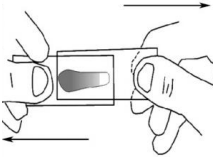


Fig. 14-11. Put slides together.

- Pull the 2 slides apart keeping them firmly but gently completely apposed (see Fig. 14-12 below).

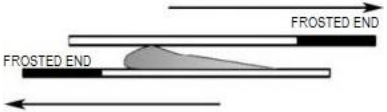


Fig. 14-12. Pull slides apart.

- Hold the slide horizontally (if the slide is held at an angle, the specimen may be sprayed off the slide), and the aerosol spray fixative 17−22 cm from the glass slide. Spray-fix the first slide and allow the second one to air-dry.
- Clearly mark the slides to indicate which one is fixed, and which one is air-dried.
- Repeat the procedure if needed.
- Fix slides immediately.
- Fig. 14-13 below shows prepared FNA slide smear.

Fig. 14-13. Example of a prepared smear showing appearance of properly smeared specimen with good distribution of material.

- Label all slides (on the frosted portion) in pencil with the patient's name or hospital number.
  NOTE: Do not label slides with barcodes. Put barcodes on slide container.

- If TB is suspected clinically, rinse the needle and syringe in TB transport medium (available from certain NHLS cytology laboratories) or in sterile saline and send for mycobacterial culture and/or GeneXpert.
- After the procedure, discard the needle into a sharps container, and apply a plaster over the needle hole on the patient.
- Inform the patient where and when to get their results.
- Send the specimen and the request form to the laboratory for processing and diagnosis.

14.2.4.2 Special investigations

Special stains are available e.g., Ziehl-Neelsen for Mycobacteria (TB testing), silver stains for fungi, etc. Other special investigations available include immunocytochemistry, fluorescence in situ hybridization, and flow cytometry. Please note that these special investigations will only be requested by the pathologist based on the relevant clinical information supplied by or in consultation with the clinician.

14.2.4.3 Oral and maxillo-facial pathology

The discipline offers the following services:

- Surgical pathology diagnoses, including biopsies and other tissue specimens (e.g., resections) from the oral cavity, jaw bones and surrounding anatomical regions. Kindly refer to the description of the routine diagnostic service in Anatomical Pathology for further details and the array of special services offered. Please submit whenever possible a (panoramic) radiograph and/or computed tomography (CT) scans for accurate diagnosis of bone lesions. **NOTE:** Frozen sections on bony specimens are not possible.
- Microscopic examination of oral mucosa surface brushings to detect fungal infection and bacterial overloads can be performed. Kindly sample with a cervix-brush and submit exfoliative smears (on glass slides fixed with cytospray or alcohol) to the anatomical pathology laboratory with the specific request to stain for periodic acid-Schiff (PAS).
- On-site clinical and radiological consultations in oral mucosal diseases and jaw lesions on request.
- Punch and/or scalpel biopsies, surface cytology brushings/modified deep (semi-invasive) cytology sampling for oral mucosal lesions and fine needle aspirations/core needle biopsies of oral deep soft tissues can be performed under local anaesthesia in the FNA clinic.

SECTION 15.0

CHEMICAL PATHOLOGY

15.0 CHEMICAL PATHOLOGY

15.1 Specimen types

15.1.1 Blood specimens

- Blood must be collected into the appropriate tube, and must be transported at the correct temperature, and must reach the laboratory within a period not exceeding the test's stability.
- For certain tests, other special collection or transport conditions may be required. For all test requirements, see Table 25-1.

15.1.2 Urine specimens

15.1.2.1 Random urine specimen

- Urine should be collected into appropriately labelled sterile universal specimen containers supplied by the laboratory.
- All urine specimens should be stored cool or refrigerated until transported.
- Some urine tests may require additives as indicated in Table 25-1. Please note that some additives may be corrosive and/or toxic.
- Some urine specimens may need to be transported immediately to the laboratory on ice as indicated in Table 25-1.

15.1.2.2 24-hour urine collection

- The 24-hour collection container should be collected from the laboratory and labelled with appropriate patient identifiers.
- Instructions for 24-hour urine collection for the patient:
  - Void (discard) first morning urine.
  - Collect all urine passed for 24 hours including the first morning urine of the next day into a small clean container and after each void carefully transfer contents into the 24-hour urine container.
  - Return the 24-hour urine container to the clinic after completing the collection.
- The facility must ensure that the 24-hour urine collection is sent to the laboratory as soon as possible.
- Some urine collections may need to be stored in the refrigerator or on ice until delivery to the laboratory (see Table 25-1).
- Some urine collections require an accompanying serum specimen e.g., creatinine clearance (see Table 25-1).
- Some urine collections may require additives as indicated in Table 25-1. Please note that some additives may be corrosive and/or toxic.

15.1.3 Cerebrospinal fluid (CSF)

- Please follow collection instructions in Section 17.3 on pages 148−149.
- Tubes:
  - Glucose: grey top tubes
  - CSF chemistry: Plain collection tube without additives or tan top tube
- For certain investigations, paired samples are required e.g.:
  - CSF IgG index and assessment for oligoclonal banding (in suspected multiple sclerosis): A simultaneous CSF (plain tube without additives) and blood (yellow top tube) are mandatory.
  - CSF glucose: A simultaneous blood specimen for glucose (grey top tube) is recommended.

15.1.4 Fluids

- Tubes:
  - Glucose: Grey top tubes
  - Fluid chemistry: Plain collection tube without additives.

15.1.5 Stool

- Collect into a sterile universal container. Refer to Table 25-1 for specific test-related stool collection instructions.
- Some tests can only be performed on diarrheal stools e.g., stool osmolality.
- Some tests require paired specimens, a clotted blood specimen (yellow top tube) and a stool specimen e.g., alpha-1 antitrypsin clearance.
- Some tests require shipment to the laboratory on ice e.g., stool osmolality.

15.1.6 Stones

- Collect specimen and put it in a dry specimen container.
- Please send the stone intact; do not reduce or sample.
- Do not send more than one stone per anatomical site.

15.1.7 Saliva

See Table 25-1 for saliva collection for cortisol determination.

15.2 Special instructions

15.2.1 Unstable tests

- For certain tests, the period between collection and analysis is critical e.g.:
  - Blood gas
  - Ammonia

- Ionised calcium
- Lactate
- Adrenocorticotropic hormone (ACTH)
- Calcitonin
- Homocysteine
- Renin

- Please refer to Table 25-1 for specific instructions.

15.2.2 Fasting blood specimens

- A variety of tests require prior fasting:
  - Glucose (e.g., fasting plasma glucose, oral glucose tolerance test)
  - Triglycerides
  - Lipoprotein electrophoresis
  - Gastrin
- Collect blood specimens using the guidelines in Section 13 and Table 25-1.
- Complete the request form and follow instructions for completing the request form in Section 9.
- For all tests that require fasting, the patient should be fasted for at least 8−12 hours prior to the test.
- Some patients' fasts may require close clinical monitoring, such as the elderly, acutely ill patients, and babies.
- If patients cannot go without water, sips of water may be taken during the fast.

15.2.3 Oral glucose tolerance test (OGTT)

- Take note of medication known to affect glucose tolerance e.g., corticosteroids, oestrogen, and thiazide diuretics.
- Perform the test after 3 days of unrestricted diet, containing at least 150 g of carbohydrate per day, and an overnight fast (at least 8 hours).
- Patients should sit quietly for 30 minutes prior to and for the duration of the test. Smoking, walking/exercise, food, or drinking (other than water) should be avoided.
- Take baseline/fasting glucose specimen (grey top tube). Label the specimen and request form, place both in a specimen transport bag, and keep securely until the OGTT specimens have all been taken. Then send all the specimens in one specimen transport bag to the laboratory for analysis. Clearly indicate the timing of each blood specimen.
- Non-pregnant adults and pregnant women: a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in 250 mL water is ingested over 5 minutes.

- Children: 1.75 g/kg anhydrous glucose dissolved in water to a maximum of 75 g is ingested over 5 minutes.
- Timing commences at the initiation of drinking the glucose load.
- Due to the risk of skin contamination with glucose, discard used gloves and wash hands including those of the patient.
- Repeat a glucose measurement 2 hours post-glucose load.

15.2.4 Blood gas analysis

- Arterial puncture to facilitate the collection of a whole blood specimen carries a slight medical risk and should not be undertaken by anyone who has not been properly trained to perform it.
- Arterial collection of blood is suitable for all acid-base derangements, while venous blood only allows assessment of metabolic abnormalities.
- Please state clearly on the request form whether the sample is arterial or venous in origin.
- When collecting venous blood, avoid prolonged application of a tourniquet as it may cause changes in the results.
- Arterial and venous specimens are best collected anaerobically with lyophilised heparin anticoagulant in sterile syringes. If pre-heparinised syringes are unavailable, then liquid heparin may be used. The syringe should contain only enough heparin to wet the wall and fill the dead space occupied by the hub.
- Avoid exposure of arterial blood to atmospheric air as it causes changes to results.
- If any air bubbles are present in the syringe, expel these immediately upon removing the needle from the puncture site before mixing the specimen. Air bubbles may cause changes to the results.
- Dispose of the needle safely in a sharp's container.
- If the syringe is open to air, place a tightly fitting cap on the tip of the syringe to maintain anaerobic condition.
- The blood gas specimen must be hand delivered to the laboratory at room temperature within 15 minutes of collection if pO_2 and oxygen saturation are of concern. In other cases, the specimen should be transported to the laboratory at room temperature within 30 minutes of collection.

15.2.5 Aldosterone and renin

- Record time of day and position of the patient (supine or upright). Careful standardisation of the patient preparation and sampling condition is strongly recommended for valid results.
- To screen for primary aldosteronism, simultaneous measurement of aldosterone and renin is recommended to determine the aldosterone-to-

renin ratio.

- The following factors should be noted when preparing patients for investigation for hyperaldosteronism:
  - Patients should maintain liberal dietary salt intake prior to testing.
  - Hypokalaemia should be corrected with supplemental potassium chloride tablets prior to testing (the absence of hypokalaemia does in no way exclude primary hyperaldosteronism).
- The following drugs may confound interpretation of results and should be discontinued before further investigation:
  - At least 4 weeks before testing: Diuretics (including spironolactone).
  - At least 2 weeks before testing: Beta-blockers, clonidine, methyl-dopa, non-steroidal anti-inflammatories, angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers and dihydropyridine calcium channel blockers.
  - The best drugs to use in the interim are prazosin or verapamil slow release.
  - After discontinuation of the above-mentioned drugs, it is recommended that serum creatinine and electrolytes are repeated.
  - Contraceptive agents (which may influence results) are not withdrawn unless confident of alternative effective contraception.
- Minimum specimen volumes: Aldosterone 1.5 mL and renin 1.8 mL (avoid haemolysis).

15.2.6 Urinary vanillyl mandelic acid (VMA) and fractionated metanephrines

- It is recommended that all medication (particularly anti-hypertensives, anti-inflammatories, antihistamines, and aminophylline/theophylline) should be discontinued for 3 days prior to and during the 24-hour urine collection.
- Most anti-hypertensives cause falsely increased values. The following are contra-indicated due to analytical interference (this is method dependent) and should be replaced by alternatives: ACE inhibitors, methyldopa, beta-blockers.
- The following anti-hypertensives are preferred because they do not cause falsely elevated values: clonidine or guanethidine.
- Taper and discontinue treatment with the following psycho-active drugs two weeks before assessment: Tricyclic anti-depressants, monoamine oxidase inhibitors (MAOIs), phenothiazines and lithium.
- Patients should avoid caffeine and nicotine 2 days before and during the 24-hour urine collection.
- The 24-hour urine collection containers can be obtained from the laboratory prior to the collection. The container must be acidified with hydrochloric acid.

- Supply 3 consecutive 24-hour urine collections (acidified, see Table 25-1).
- Please note all current medication on the request form.

15.2.7 Urine 5-HIAA (5-hydroxy-indoleacetic acid)

- The 24-hour urine collection containers can be obtained from the laboratory prior to the collection.
- Urine should be collected into a dark container, and the specimen refrigerated during collection.
- Patients should avoid dietary sources of 5-hydoxyindoles (e.g., walnuts, bananas, avocados, eggplant, pineapples, plums, and tomatoes) 3−4 days before and during 24-hour urine collection.
- It is recommended that the following medication should be discontinued for 3 days prior to and during 24-hour urine collection: L-dopa, methyldopa, isoniazid, imipramine, MAOIs, phenothiazines, reserpine, cough and cold preparations containing guaiphenesin or glycerol guaiacolate.
- Essential medication should be replaced by suitable alternatives.
- Please note all current medication on the request form.

15.2.8 Prolactin

The following drugs may cause increased prolactin levels:

- Dopamine receptor antagonists e.g., phenothiazines, metoclopramide, sulpiride
- Dopamine depleting agents e.g., methyl-dopa, reserpine
- Oestrogens
- H2-receptor blockers e.g., cimetidine
- Tricyclic antidepressants.

15.2.9 Lactate

- The patient should be at absolute rest for 2 hours before blood is drawn.
- The patient may not move hand or arm immediately before or during the procedure.
- A tourniquet should preferably not be used, but if one is used it should only be applied for 30 seconds. If applied longer, the tourniquet should be removed with the needle still in the vein and the blood allowed to circulate for at least 2 minutes before the specimen is collected.
- Discard the first 2 mL of blood.

15.2.10 Porphyrins

- All specimens (EDTA blood (purple top tube), urine, and stool) should be collected, if clinically relevant, during an acute exacerbation and must be protected from light during collection and transport.
- Please indicate clearly on the request form the presence of skin lesions, abdominal complaints, neurological features, or a family history, as this will assist in the interpretation of the results.

15.2.11 Sweat test

- Sweat testing can be performed using two different methods: sweat conductivity and sweat chloride testing. Sweat conductivity testing measures the electrical conductivity of sweat and is considered a screening test. Sweat chloride testing directly measures the concentration of chloride ions and is the gold standard for diagnosing cystic fibrosis (CF).
- **Patient Preparation:**
  - Patient condition: The patient should be in a clinically stable condition without any acute illness and not receiving mineralocorticoids.
  - Clothing: The patient should wear a short-sleeve shirt and have a warm jacket or blanket available.
  - Skin preparation: Do not apply any creams or ointments on the day of the sweat test.
  - Fluid and Diet: The patient should consume a normal diet and drink plenty of fluids (water, milk, juice) before and during the test.
  - Scheduling: Avoid scheduling procedures requiring fasting on the same day as the sweat test. It is advisable to postpone testing until full-term infants are at least 2 weeks old, and preterm infants are at least 2 weeks old and weigh more than 2 kilograms. If tests cannot be postponed, it is recommended to repeat the test at a later stage to confirm the findings.
  - Medication Continuation: The patient should continue all medications except diuretics.
- **Causes for False Negative Results:**
  Patients with oedema and hypoproteinaemia may yield false negative sweat test results. Repeat the test once the oedema has resolved.
- **Causes for False Positive Results:**
  False positive sweat test results may occur in patients with malnutrition, anorexia nervosa, atopic dermatitis, pseudohypoaldosteronism, untreated hypothyroidism, and glycogen storage disease type 1. Treatment with mineralocorticoids and topiramate has also been associated with false positive results.

- **Indications for Repeat Testing:**
  1) CF Diagnosis Confirmation: CF diagnosis should not rely on a single positive result. Perform a confirmatory test when the result is positive.
  2) Intermediate Sweat Test Results: Repeat testing in patients with intermediate sweat test results.
  3) Suspicion of CF: Repeat testing in patients with a negative sweat test result but a clinical presentation highly suggestive of CF.

  Repeat testing should be conducted when the patient is in a clinically stable condition, adequately hydrated, and not experiencing any acute intercurrent illness.

15.2.12 Aluminium serum and urine specimen collection

- The use of a stainless-steel needle for the collection of blood should be avoided to minimise contamination. An acceptable alternative is the use of a polypropylene intravenous cannula.
- Phlebotomy should be performed with a syringe, the blood transferred into trace element tubes (royal blue top, additive-free) and left standing to form a clot.
- The tubes are spun, and serum transferred with a plastic pipette to another trace metal tube before being sent to the referral laboratory for analysis. Polypropylene tubes are recommended for use; glass and rubber stoppers should be avoided.
- The use of anticoagulants is very problematic and can cause contamination, as most of them are either metal chelators or polyanions. Therefore, no serum separators or anticoagulants should be used.
- All polythene plastic containers that are used for the collection of urine should be acid washed before use. For further handling of the specimen, powder-free gloves must be worn.
- Likely sources of contamination for aluminium specimens come from water, dust, and reagent acids.

SECTION 16.0

HAEMATOLOGY

16.0 HAEMATOLOGY

16.1 Specimen collection

16.1.1 General guidelines

- Collect the blood specimens using guidelines in Section 13.
- Use the guide in Table 13-1 on page 94 for appropriate containers.
- Observe the safety precautions in Section 12.
- See Table 25-1 for list of tests offered.
- Always put on appropriate personal protective equipment.
- Always discard all collection material in appropriate biohazard containers.
- Complete the request form as outlined in Section 9.

16.1.2 Bone marrow

- Make an appointment in advance with the laboratory for bone marrow collection.
- Please book Monday to Thursday preferably in the morning, so that the slides and trephine biopsy can be sent with the courier service in the afternoons to the relevant testing laboratory.
- Please discuss the patient with the laboratory staff where the marrow will be interpreted to ensure that all the relevant samples have been collected for analysis.
- Bone marrow aspirates clot faster than peripheral blood; it is therefore advisable to make smears immediately at the bedside without delay and store the rest of the aspirate in an EDTA (purple top) tube. More films can then be performed in the laboratory as required.
- For most haematology conditions the following specimens are required to ensure an accurate diagnosis: Peripheral blood smear, aspirate smear, an aspirate sample for cytogenetics in a heparin tube (green top), extra peripheral blood slides/aspirate slides to be prepared for fluorescence in situ hybridization (FISH) if required, a peripheral blood/aspirate specimen for flow cytometry and a specimen for molecular investigations – discuss with the tertiary institution.
- Please perform an imprint of the trephine biopsies to ensure the assessment of cytology in the event that the aspirate is suboptimal.
- Complete the request form (please refer to Section 9).
- Air dry the slides completely before packing.
- Pack slides separately.
- Collect blood specimens for full blood count, platelet count and differential count at the same time since these results will be needed for interpretation of results.

- Discard all collection materials in appropriate biohazard containers.
- Aspirated specimens must be accompanied by a full clinical history.
- Do not flush the syringe with heparin prior to aspiration as this causes a blue stain on the slides rendering interpretation of morphology difficult.
- Do not spray fixative onto slides.
- Each slide must be individually labelled. Please pack aspirate slides in a separate specimen bag from trephine biopsy, as the transporting medium of the trephine biopsy may leak and destroy the integrity of the aspirate slide, making interpretation impossible. Also, exposure to formalin vapour may affect morphology and staining of slides.
- Please ensure that the correct SOP is being used for fixing the trephine biopsy as this is a very critical step in ensuring a good sample for analysis.
- Please ensure that the correct medium for transportation of the trephine biopsy is being used. Refer to the relevant SOP of the laboratory or contact the local laboratory.

16.2 Immunophenotyping by Flow cytometry

- Specimen type: EDTA (purple top) tube (peripheral blood or bone marrow aspirate) or heparinised (green top) tube.
- Other fluids: Cerebrospinal fluid (CSF), ascitic tap or pleural fluid. Prior arrangement and discussion with the laboratory are required.
- Volume: 2−5 mL.
- Storage conditions: Room temperature.
- Detailed clinical history required.
- Specimen will be rejected after 24 hours. Exception: CD4 count – 96 hours.
- If transportation delays are anticipated, please discuss with the relevant laboratory, for a possible stabilising medium.
- Common indications for immunophenotyping: CD4 count and percentage (%), lymphocyte subsets (B-cells, T-cells, Natural Killer cells), acute leukemia, chronic lymphoid leukemia, plasma cell myeloma, CD34 stem cell enumeration, DNA ploidy analysis, paroxysmal nocturnal haemoglobinuria, and platelet flow cytometry for selected platelet disorders.

SECTION 17.0

CLINICAL MICROBIOLOGY and INFECTIOUS DISEASES

17.0 CLINICAL MICROBIOLOGY and INFECTIOUS DISEASES

- It is of critical importance that clinicians use the following guidelines for the proper collection and transport of specimens.
- Complete diagnostic information is crucial to ensure optimal processing of specimens.

The quality of results depends on the quality of specimens

- Consequences of poorly collected and/or poorly transported specimens include:
  - Failure to isolate the causative micro-organism, and
  - Recovery of contaminants or normal microbial flora, which may be misleading, and result in incorrect treatment of the patient.

17.1 General guidelines for specimen collection

- To minimise contamination, use strict aseptic techniques when collecting specimens.
- Collect specimens prior to initiation of antimicrobial therapy.
- Collect specimens from anatomical sites most likely to yield pathogens and least likely to yield contaminants.
- Use appropriate collection containers/devices.
- Tissue or fluid submitted for culture is always superior to material on swabs – see Fig. 17-1 on the next page.
- Submit adequate volumes of specimens.
- Always wear appropriate protective clothing.
- If the patient may be infected with pathogens known to be hazardous to laboratory personnel (based on provisional clinical diagnosis), please notify the laboratory prior to sending the specimen(s) (see Table 7-1 on pages 21 to 57 for relevant contact telephone numbers).
- Provide complete information including:
  - The type of specimen submitted (be specific e.g., pleural fluid).
  - Specific site from which specimen was collected.
  - Specific pathogens that are being sought (to optimise culture conditions for these organisms).
  - Methods by which specimens were collected e.g., midstream urine specimen or catheter urine specimen.

FOR QUALITY MICROBIOLOGY RESULTS, SEND TISSUE AND FLUIDS

Swabs don't do the job.....

- Only 3 out of 100 bacteria absorbed on a swab make it to culture
- Anaerobes on swabs die upon exposure to air, but survive in tissues and fluids
- Swabs hold only 150 microlitres of fluid

Do the Math:

An effective culture requires:

5 Agar plates ± 1 Broth + 1 Gram stain

If a swab yields only 3 bacteria, what are the chances for a successful culture?

Make the Right Choice!

Good specimens

- Tissue (in sterile container)
- Fluid (in sterile container, NOT on a swab)

Bad specimens

- Any swab where tissue or fluid can be collected
- Fluid or tissue placed in a swab tube/device
- Any superficial specimens

Fig. 17-1. Quality microbiology specimens.

17.1.1 Guidelines for proper specimen transport

- Collect specimens in sturdy, sterile, screwcap, and leak-proof containers with lids that do not create aerosols when opened.
- Please contact a microbiologist for advice regarding appropriate specimens to collect and how to collect them.
- All specimens should be transported to the laboratory promptly. Failure to do so may result in fastidious bacteria dying and becoming overgrown by non-fastidious bacteria.
- If prompt delivery is not possible specimens should be refrigerated at 4−8°C, with the following exceptions:
  - Blood cultures should be kept at room temperature.
  - CSF specimens should be kept at room temperature unless they are to be cultured for viruses. If viral cultures are requested an aliquot should be removed aseptically and stored at 4−8°C.
  - Specimens that may harbour temperature-sensitive organisms such as *Neisseria* species should be left at room temperature.

17.1.2 Specimen containers

Sterile plastic/glass tubes or plastic vials with/without transport medium. The purpose of the transport medium is to maintain viability of organisms and to prevent contaminants (which may be present in specimen) from overgrowing pathogens. Refer to Section 10.0 on pages 73−74 for images of different specimen containers.

17.1.2.1 Swabs

Table 17-1. Swab types

Swab type	Comments
Calcium alginate-tipped (CalgiSwabs)	• Can be toxic to viruses and some strains of gonococci; therefore, these swabs should be used only if the specimen is inoculated directly onto culture media or transported in non-nutrient media containing charcoal to absorb or neutralise inhibitory substances. • **UNSUITABLE for PCR testing**.
Cotton-tipped	• May contain fatty acids that could be inhibitory to some bacteria and *Chlamydia* spp.
Dacron-tipped	• Can be used for collection of viral specimens and facilitate survival of *Streptococcus pyogenes* (Group A Strep). • **Suitable for PCR testing (if non-wooden shafts).**
Wooden shaft	• Wood may contain toxic products which could inactivate herpes simplex virus (HSV). • **UNSUITABLE for PCR testing.**
Flexible wire shafts and small tips	• Enable easier collection of nasopharyngeal and male urethral specimens.

17.1.2.2 Sterile screwcap universal containers

- Useful for collection of urine, sputum, stool, broncho-alveolar lavage (BAL), and biopsy/tissue specimens.
- Add a small amount of sterile saline to biopsy/tissue specimens to prevent specimens from drying out.
- Never place biopsy/tissue specimens in formalin* or swab container/swab collection device or wrap in gauze.

***NOTE:** Formalin kills micro-organisms and therefore renders specimens unsuitable for microbiological testing.

17.1.2.3 Sterile Petri dishes / slides

- Useful for hair or skin-scraping specimens.
- Tape petri dish/slides securely prior to transport.

17.1.2.4 Sterile tubes

- Sterile screwcap glass/plastic tubes without additives.
- Can be used for collection of sterile fluids, pus, broncho-alveolar lavage (BAL) / bronchial brush specimens and other aspirates.

17.1.2.5 Viral transport medium (VTM)

Please refer to the Virology section (Section 21.0).

17.2 Blood cultures

17.2.1 General principles

- Blood cultures are the specimens of choice for the microbiological diagnosis of sepsis, infective endocarditis, and pyrexia of unknown origin (PUO).
- If a blood culture is positive, empirical antimicrobial agents can be advised based on Gram stain results.
- Blood must be collected as early as possible during a febrile episode, and ideally **before administration of antibiotics**.
- Blood obtained from one venepuncture site defines one blood culture, regardless of the number of bottles filled.
- **Each blood culture should be collected from a different venepuncture site.**
- Although firm evidence is unavailable, it is believed that the routine use of anaerobic bottles is not warranted, particularly in resource-limited settings.
- If collecting blood from patients already on antimicrobials, culture bottles containing polymeric beads (which inactivate antibiotics), should be used.
- In patients with presumed sepsis or septic shock, blood cultures should be collected ideally before or within 45 minutes of antimicrobial administration.

- Blood should not be drawn through indwelling venous or arterial lines unless line sepsis (central line-associated bloodstream infection (CLABSI)) is suspected.
- If blood for culture is drawn from an indwelling line, another blood culture should be simultaneously collected from a peripheral site so that the differential time to positivity may be calculated. Remember to indicate clearly on the bottles which one was taken from the line and which one from the peripheral site.
- Collection of arterial blood cultures does not provide any advantage over venous blood cultures.
- Please note: Blood for fungal culture should be collected directly into standard blood culture bottles.
- If blood/bone marrow is sent for the isolation of *Mycobacterium tuberculosis* or non-tuberculous Mycobacteria, BACTEC Myco/F Lytic bottles should be used. *An EDTA (purple top) tube is NOT acceptable.*
- It is a medico-legal requirement to indicate the following in the patient's notes: Collection of blood for culture, indication, site(s), date and time of collection and name of phlebotomist.

17.2.2 Optimal number of blood cultures

- **One blood culture is rarely, if ever, sufficient, or advisable.** It is difficult to interpret a positive result on a single culture unless an unequivocal pathogen is isolated.
- **Guidelines recommend:**
  - For suspected infective endocarditis, collect 3 aerobic blood culture bottles, each from a different peripheral site, 30 minutes apart.
  - For other infections, collect 2 aerobic blood culture bottles, each from a different peripheral site at the same time.
  - The recommended optimal blood volume is 40 mL (i.e., 2 bottles per set of blood cultures x 2 sets); however, in resource-limited areas, one bottle per set can be collected.

17.2.3 Timing of blood culture collection

- Blood can be obtained from two separate sites within minutes of each other from patients who are acutely ill or those in whom the likelihood of continuous bacteraemia is high.
- If patients are suspected to have intermittent bacteraemia, multiple blood cultures should be collected 6−36 hours apart.
- Antibiotics should not be withheld in sick patients apart from a reasonable delay to collect more than one culture specimen.

17.2.4 Volume of blood to be collected

- **Adequate volumes of blood are critical as it improves detection of pathogens and reduces time to detection.**
- Adults: A minimum of 10 mL (and preferably 20 mL) of blood should be obtained per draw (i.e., 10 mL per bottle).
- Infants and children: See Table 17-2 below.

Table 17-2. Blood volumes for children

Weight (kg)	Blood volume (mL)	Bottle type
≤1 – 2	1 – 2	Paediatric bottle x1
2.1 – 13	4	Paediatric bottle x1
13.1 – 36	8 – 10	Adult bottle x1 **or** Paediatric bottles x2
>36	20	Adult bottles x2

17.2.5 Follow-up blood cultures

These are important in the management of specific infections including:

- *Staphylococcus aureus* and *Staphylococcus lugdunensis* bloodstream infections (BSIs): Collect 2−4 days after start of appropriate therapy.
- Candida BSIs: Collect 3 times weekly until the first negative culture. Treatment duration should be 14 days from the first negative blood culture following initiation of appropriate antifungal therapy.

17.2.6 Blood culture collection procedure

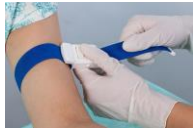
- Please also see the *Quick guides to blood culture collection* in adults and children on pages 146 and 147 respectively.
- Gather all supplies that will be required, including:
  - Blood culture bottles
  - Needle and syringe **or** blood collection tube holder and butterfly needle/ double-needle collection set
  - Sterile gloves
  - Surgical mask
  - Tourniquet
  - 70% isopropyl or ethyl alcohol solution (or other suitable skin disinfectant such as chlorhexidine or povidone iodine)
  - Sterile pack containing cotton/gauze swabs, sterile paper sheet and waste bag
  - Forceps (optional)
  - Alcohol swabs
  - Adhesive strip

- Sharps container
- Patient labels
- Plastic bag for specimen transport

- Wash hands with soap and water or disinfect with alcohol hand disinfectant before opening the sterile blood culture pack onto the trolley.
- Remove the sterile sheet and place under the patient's arm. Pour alcohol solution (or other suitable skin disinfectant) into fluid recess located on blood culture tray/pack. Drop needle and syringe onto sterile field.
- Apply tourniquet and palpate for a suitable vein. Wash hands with soap and water or disinfect with alcohol hand disinfectant. Dry hands or rub the hand disinfectant in until dry. Put on sterile gloves.
- Remove the blood culture bottle's lid without touching the top of the bottle. Disinfect the top of each bottle with an alcohol wipe (not iodine) before inoculating the bottle.
- Clean the puncture site with a 70% isopropyl or ethyl alcohol solution (or other suitable skin disinfectant). Cleanse in a circular manner, beginning at the centre of the site and working outwards. Allow 1−2 minutes for the disinfectant to dry.
- Do not touch the venepuncture site after preparation and prior to performing venepuncture.
- Insert needle into the vein and collect at least 10 mL of blood from adults and at least 1 mL of blood from children. **Always collect blood for the blood culture first** and then for other tests.
- Release tourniquet. Remove needle from puncture site. Place dry cotton ball on puncture site and apply pressure. If iodine was used to cleanse the site, remove remaining iodine with 70% alcohol as it can cause irritation in some patients.
- If a needle and syringe were used, do not change the needle before injecting the blood into the blood culture bottle(s).
- Dispose of needle and syringe in a sharps container without recapping.
- Dispose of contaminated materials/supplies in the designated waste containers.
- **Gently invert** blood culture bottles to mix the blood and culture medium.
- **Label the blood culture bottles as follows:** Make sure patient labels do not cover the bottle's barcode label or bottom.
- **Complete lab request form legibly** and indicate date, time and site of collection, the diagnosis and clinician's name and contact details.
- Deliver blood culture bottles to the laboratory promptly. **If there is a delay in transport to the laboratory**, do not refrigerate the bottles, rather **keep them at room temperature**.

QUICK GUIDE TO BLOOD CULTURE COLLECTION IN ADULTS

1. **Gather supplies**
2. **Open sterile blood culture pack onto trolley**
   - Place sterile sheet under patient's arm
   - Pour 70% alcohol into bowl
   - Drop needle and syringe onto sterile field



3. **Apply tourniquet and palpate for vein**

4. **Wash hands with soap and water or disinfect hands with 70% alcohol.** Dry hands or rub alcohol in until dry. Put on sterile gloves.
5. **Disinfect bottle top** with an alcohol wipe

6. **Prepare venepuncture site:**
   - Clean site with 70% alcohol or other suitable skin disinfectant
   - **Do not clean site with an alcohol wipe**
   - Allow 1−2 minutes to dry

7. **Perform venepuncture:**
   - Always collect / inoculate blood culture bottles first
   - Collect **10 mL** blood per bottle

8. **Release tourniquet and remove needle;** place dry cotton ball on puncture site and apply pressure

9. **If a needle and syringe were used, do not change needle** between blood collection and inoculation of bottles
10. **Gently invert bottles a few times**

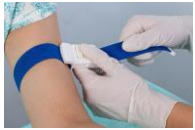
11. **Label blood culture bottles:** Do not cover bottle's barcode or bottom
12. **Complete lab request form legibly and indicate** date, time and site of collection, diagnosis, and clinician's name and contact details

13. **Place bottles and lab request form in plastic bag** and transport to laboratory promptly
14. **If there is a delay in transport to the laboratory,** keep bottles at room temperature

Fig. 17-2. A quick guide to performance of blood culture collection in adults.

QUICK GUIDE TO BLOOD CULTURE COLLECTION IN CHILDREN

1. **Gather supplies**
2. **Open sterile blood culture pack onto trolley**
   - Place sterile sheet under patient's arm
   - Pour 70% alcohol or chlorhexidine into bowl
   - Drop needle and syringe onto sterile field

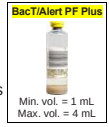


3. **Apply tourniquet and palpate for vein**

4. **Wash hands with soap and water <u>or</u> disinfect hands with 70% alcohol.** Dry hands or rub alcohol in until dry. Put on sterile gloves.
5. **Disinfect bottle top** with an alcohol wipe

6. **Prepare venepuncture site:**
   - Clean site with 70% alcohol **or** chlorhexidine
   - **Do not clean site with an alcohol wipe**
   - Allow 1−2 minutes to dry

7. **Perform venepuncture:**
   - Always collect / inoculate blood culture bottle(s) first
   - Draw from different sites if >1 bottle collected



Weight (kg)	Blood volume (mL)	Bottle type
≤1 – 2	1 – 2	Paediatric bottle x1
2.1 – 13	4	Paediatric bottle x1
13.1 – 36	8 – 10	Adult bottle x1 <u>or</u> Paediatric bottles x2
>36	20	Adult bottles x2

8. **Release tourniquet and remove needle;** place dry cotton ball on puncture site and apply pressure
9. **If a needle and syringe were used, do not change needle** between blood collection and inoculation
10. **Gently invert bottle(s) a few times**

11. **Label blood culture bottle(s):** Do <u>not</u> cover bottle's barcode or bottom
12. **Complete lab request form legibly and indicate** <u>date</u>, <u>time and site of collection</u>, <u>diagnosis</u>, and <u>clinician's name and contact details</u>

13. **Place bottle(s) and lab request form in plastic bag** and <u>transport to laboratory promptly</u>
14. **If there is a delay in transport to the laboratory,** <u>keep bottle(s) at room temperature</u>

Fig. 17-3. A quick guide to performance of blood culture collection in children.

17.3 Cerebrospinal fluid (CSF)

CSF is collected for the diagnosis of meningitis and is usually obtained by lumbar puncture. Subdural taps and ventricular aspiration may also be used.

- Please also see a *Quick guide to lumbar puncture procedure* on the next page.
- The lumbar puncture should be performed using an aseptic technique and should not be undertaken by anyone who has not been properly trained to perform it. Infection control guidelines recommend that the clinician wear a surgical mask when performing a lumbar puncture.
- The patient is appropriately draped and an area overlying the lumbar spine is disinfected using the same skin preparation as required for collection of blood cultures (see Section 17.2.6 on page 144).
- All microbiological CSF specimens should be collected in plain collection tubes without additives or if these are not available, red top tubes without gel may also be used.

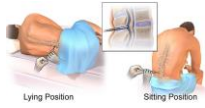
NOTE: Please collect CSF in separate tubes for chemistry, cell count, microbiology, and other tests (e.g., TB, virology). **DO NOT SEND ONE SPECIMEN FOR MULTIPLE TESTS.** When a single specimen is sent with a request for multiple tests, the specimen must be split. This process can result in contamination of the specimen and a false-positive culture result.

- Each bacteriological and fungal test requires at least 1.5 mL of CSF, although larger volumes are preferred.
- Dispose of needle in a sharps container without recapping.
- Dispose of contaminated materials/supplies in the designated waste containers.
- The specimens should be transported to the laboratory promptly and processed as soon as possible.
- If delay in processing is unavoidable, the specimens should be kept at room temperature.
- When requesting antigen testing on CSF, please ensure that you have specified whether bacterial or cryptococcal antigen detection is required.

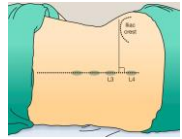
NOTE: Processing CSF for Mycobacteria
The number of Mycobacteria present in the CSF is small; therefore, a large volume of CSF (5−10 mL) is necessary to maximise recovery of the organism in culture.

QUICK GUIDE TO LUMBAR PUNCTURE PROCEDURE

1. **Gather supplies**
2. **Put on surgical mask**



3. **Position patient in bed:** Arch patient's back towards you

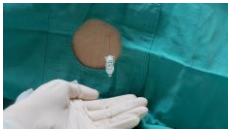


4. **Identify anatomic landmarks:** The L4 spinous process is at level of posterior-superior iliac crest

5. **Wash hands with soap and water <u>or</u> disinfect hands with 70% alcohol.** Dry hands or rub alcohol in until dry. Put on sterile gloves.
6. **Clean lumbar puncture site** with 70% alcohol or other suitable skin disinfectant

7. **Place sterile sheet with hole over site**
8. **Anaesthetise skin** overlying entry site and then deeper tissues

9. **Insert needle at L3-L4 or L4-L5 interspace in adults and at L4-L5 in children;** hold needle parallel to bed and advance it towards umbilicus



10. **Remove the stylet periodically to check for CSF**
11. **Measure the opening pressure with manometer**

12. **Collect CSF** in sterile screwcap tubes without additives
    - Use <u>separate tubes</u> for chemistry, cell count, microbiology, and other tests (e.g., TB, virology)
    - Collect ≥1.5 mL for each bacteriological and fungal test
    - Collect 5−10 mL CSF for TB culture in a separate tube
13. **Reinsert stylet before removing needle.** Place dry cotton ball on puncture site and apply pressure.
14. **Label tubes**
15. **Place tubes and lab request form in plastic bag** and <u>transport to laboratory promptly.</u>
16. **If delay in transport to laboratory,** <u>keep tubes at room temperature.</u>

Fig. 17-4. A quick guide to performance of lumbar puncture procedure.

17.4 Bone marrow

- Aspirate bone marrow for Mycobacterial culture into a BACTEC Myco/F Lytic blood culture bottle or sterile heparinised tube.
- Also make 2 smears for special fungal stains if required and submit this together with the culture specimen.
- Aspirate bone marrow for typhoid/enteric fever into an aerobic blood culture bottle with or without antibiotic-neutralising beads (depending on whether patient has already received antibiotics or not).

17.5 Sterile fluids and tissue specimens

Sterile fluids (e.g., synovial, culdocentesis, and serous cavity fluids) should be collected aseptically. Submit fluid and tissue in containers indicated in Tables 17-3 (below) and 17-4 (on next page) respectively.

Table 17-3. Containers for sterile fluids

Sterile fluid containers	
Sterile universal containers or sterile tubes without additives	
Blood culture bottle: • Collect 8−10 mL per bottle (adults) and 1−4 mL per bottle (children) • Submit ≥1 mL of fluid in EDTA tube for cell count	
Heparin tube: • For bloody specimens (to prevent clotting)	
DO NOT SUBMIT SYRINGE WITH NEEDLE	

Table 17-4. Containers for tissue specimens

Tissue		
Collect aseptically at time of surgery	• Sterile universal container (keep specimen moist by adding sterile saline) • ***Do not add formalin***	

NOTE: Swabs are the least desirable specimen for culture of fluids and are discouraged

17.6 Nasopharyngeal and respiratory tract specimens

17.6.1 Specimens for lower respiratory tract infections

- Appropriate specimens include sputum, tracheal aspirates, bronchial washings, bronchial brushes, bronchial brush specimens, lung biopsy specimens, broncho-alveolar lavage (BAL) fluid, transtracheal aspirates, lung aspirates, and nasogastric aspirates.
- Endotracheal tube tips should NEVER be submitted for culture.

NOTES:

- If infection with *Legionella pneumophila* is suspected, a urine specimen should be submitted for urine antigen testing.
- Sputum induced with hypertonic saline has greater sensitivity for the diagnosis of *Pneumocystis jiroveci* than expectorated sputum.
- **If bacterial pneumonia is suspected, submission of concomitant blood cultures is recommended.**

17.6.1.1 Sputum specimens

- The patient should be given clear instructions on how to produce an early morning sputum specimen as shown in Fig. 17-5 on page 153.
- Aerosols containing TB bacilli may be produced during collection of a sputum specimen and it is therefore advisable to collect specimens away from other people and in a well-ventilated area.
- An adequate specimen should contain at least 5 mL of sputum.
- The specimen should be collected in a sterile universal container.

- **PLEASE close the lid tightly to prevent leaking of the specimen**, and clearly label the container. This should be done by the health care professional requesting the specimen. Please indicate the relevant clinical information on the request form as well as the diagnostic tests required.
- For the diagnosis of pulmonary TB, clearly identify the type of investigation required as per the algorithms in Figs. 17-6 to 17-9 on pages 154 to 157 respectively. If microscopy, culture, and sensitivity (MC&S) for organisms other than TB is required, please request a standard MC&S.
- The specimen should be transported to the laboratory as soon as possible after collection.
- If there is a delay in transport to the laboratory e.g., specimen from an outside clinic, specimens should be refrigerated. DO NOT FREEZE SPECIMENS.
- Discard all collection material in appropriate biohazard containers.

Induced sputum collection procedure:

- Have patient rinse mouth with water after brushing the gums and tongue.
- With the aid of a nebuliser, have patient inhale about 25 mL of 3−10% sterile saline.
- Collect induced sputum in a sterile container. **PLEASE close the lid tightly to prevent leaking of the specimen**.

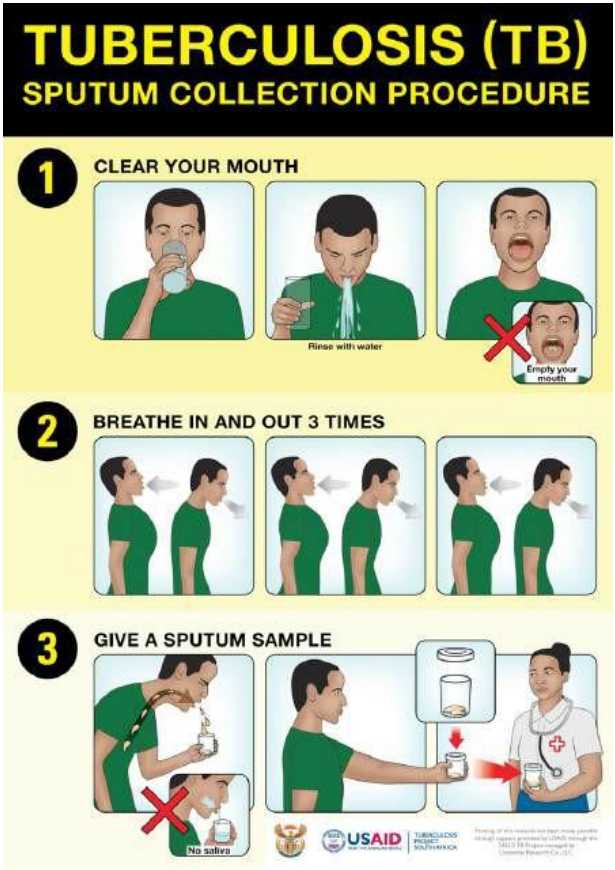


Fig. 17-5. Sputum collection procedure.

17.6.1.2 TB–NAAT diagnostic algorithms (National)

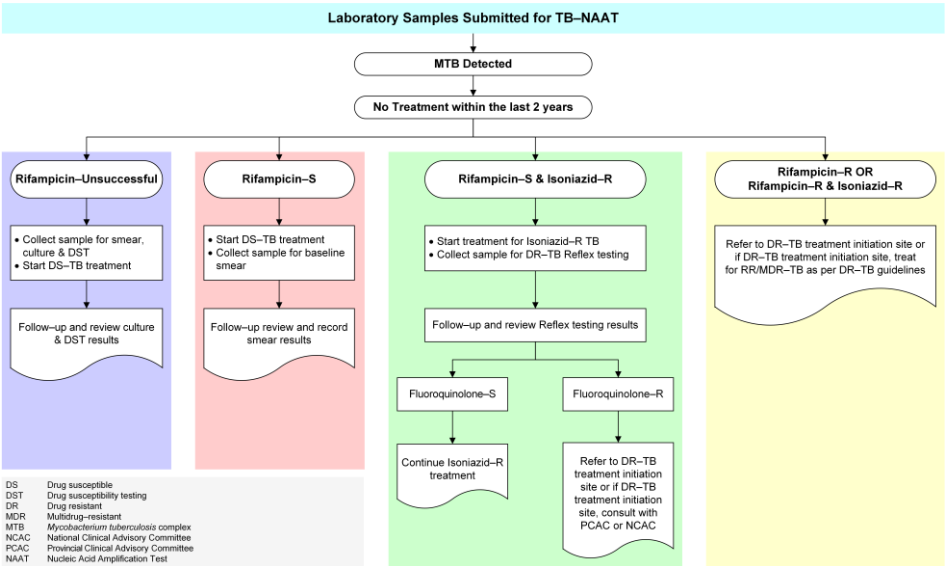


Fig. 17-6. Algorithm for management of patients with MTB detected by NAAT who have not received treatment in last 2 years

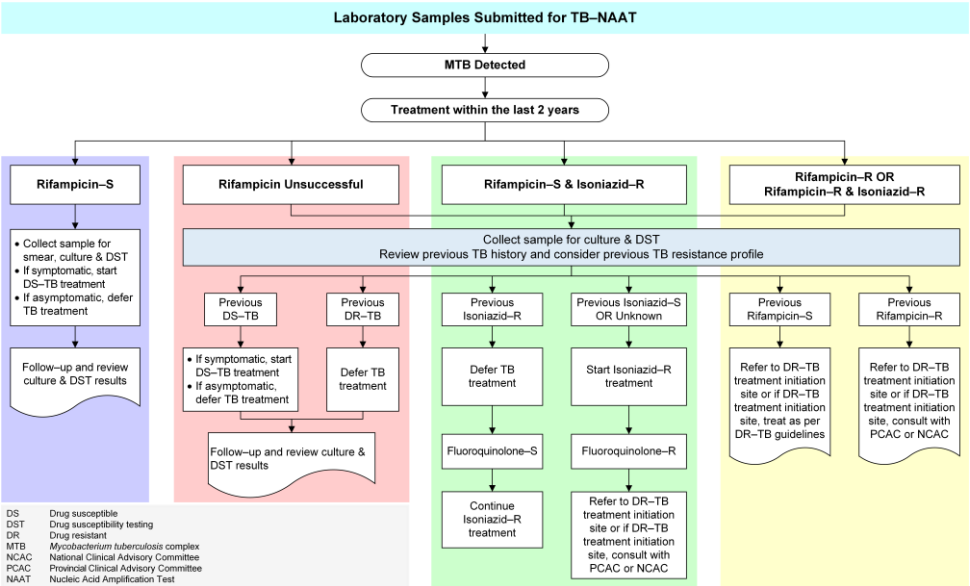


Fig. 17-7. Algorithm for management of patients with MTB detected by NAAT who received treatment in last 2 years

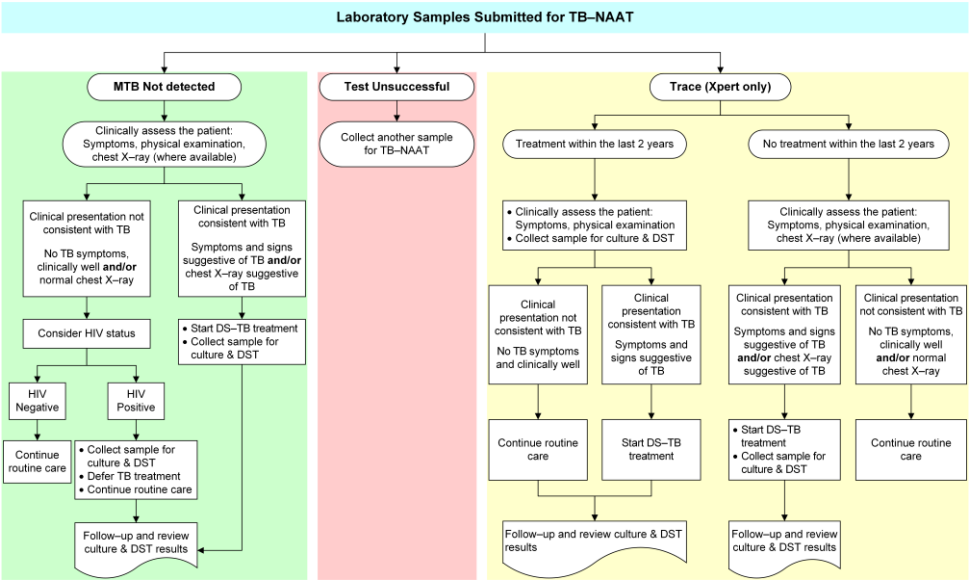


Fig. 17-8. Algorithm for management of patients with Negative, Unsuccessful, and Trace TB–NAAT results

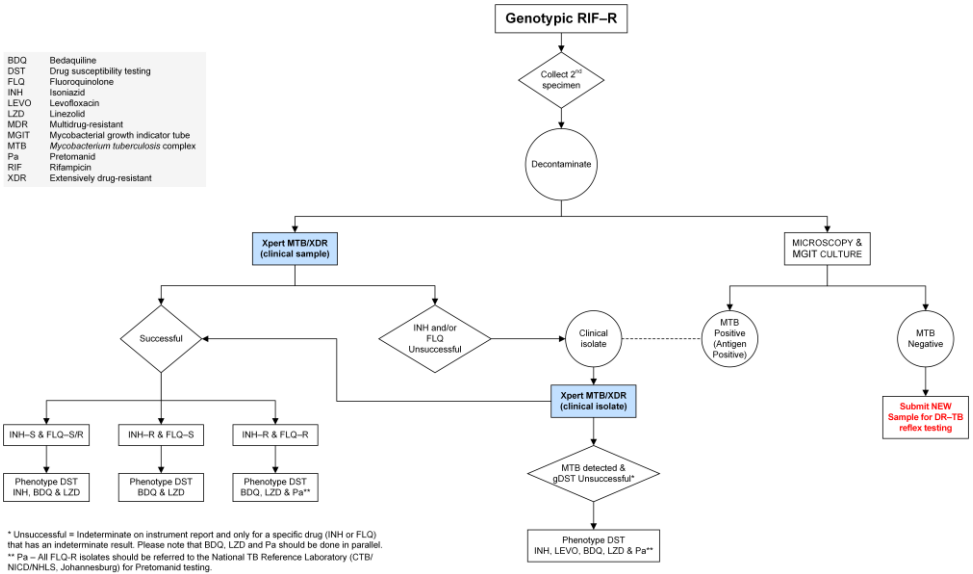


Fig. 17-9. Laboratory workflow for DR–TB Reflex testing

17.6.2 Nasopharyngeal specimens

17.6.2.1 Throat swabs

- Routinely used for the diagnosis of Group A Streptococcal pharyngitis.
- Depress tongue gently with a tongue depressor.
- Extend sterile swab between the tonsillar pillars and behind the uvula.
- Avoid touching the cheeks, tongue, uvula, or lips.
- Sweep the swab back and forth across the posterior pharynx, tonsillar areas, and any inflamed or ulcerated areas to obtain a specimen.
- Send the swab to the laboratory in suitable transport media, as soon as possible.

17.6.2.2 Nasal swabs

Submitted primarily for the detection of nasal carriers of *S. aureus*.

NOTE: Nasal cultures do not predict the etiologic agents of sinusitis, otitis media or lower respiratory tract infections.

- Carefully insert a moistened sterile swab at least 1 cm into the nose.
- Rotate swab against the nasal mucosa and leave in place for 10−15 seconds.
- Repeat the process on the other side using the same swab.
- Send the swab to the laboratory in suitable transport media as soon as possible.

17.6.2.3 Nasopharyngeal swabs

- Collected primarily for the detection of carriers of *Neisseria meningitidis* and to diagnose *Bordetella pertussis* (see Section 17.6.2.5.2 on the next page for additional information on collection for *B. pertussis*).
- If pertussis is suspected, the laboratory must be alerted before the specimen is sent to ensure that the appropriate culture media is available.
- Nasopharyngeal swabs should not be used to detect the etiological agents of sinusitis.

Collection procedure:

- Remove excess secretions or exudate from the nose.
- Carefully insert a flexible, small-tipped swab through the nose into the posterior nasopharynx.
- Rotate the swab against the nasopharyngeal membrane and allow it to remain in place for 10−15 seconds.
- Keep the swab near the septum and floor of the nose during collection.
- Send the swab to the laboratory in suitable transport media, as soon as possible. DO NOT REFRIGERATE SPECIMENS.

17.6.2.4 Nasopharyngeal aspirates

Nasopharyngeal aspirates are appropriate specimens for the detection of:

- *Bordetella pertussis*
- *Corynebacterium diphtheriae*
- *Neisseria gonorrhoeae*
- *Neisseria meningitidis*

The laboratory must be alerted before the specimen is sent to ensure that the appropriate culture media is available.

17.6.2.5 Unusual pharyngeal pathogens

17.6.2.5.1 *Neisseria gonorrhoeae* (gonococcal pharyngitis)

- Nasopharyngeal aspirates or swabs of the tonsillar pillars and the posterior pharynx should be collected.
- Swabs should only be used if there is a very short interval between collection and plating.
- The swab should be placed in a non-nutrient transport medium such as Amies or Stuart's transport medium.
- If a delay in transport to the laboratory is inevitable, the specimen should be inoculated onto New York City agar at the time of collection.

NOTE: Since this is not part of routine testing, please clearly indicate a request for *N. gonorrhoeae* culture on the request form.

17.6.2.5.2 *Bordetella pertussis* (whooping cough)

- Specimens should preferably be collected before antibiotic treatment.
- Specimens for PCR:
  - Nasopharyngeal swabs on Dacron, Rayon, or nylon-flocked swabs with **non-wooden shafts,** and/or nasopharyngeal aspirates (>0.5 mL).
  - Also see Section 19.7 on page 185.
- Specimens for culture:
  - Nasopharyngeal swabs/aspirates or sputum specimens.
  - Small-tipped calcium alginate, Dacron, and nylon-flocked swabs are suitable for culture. Rayon and cotton swabs should be avoided since they contain fatty acids that are toxic to *B. pertussis*.
  - Swabs should be placed in Regan-Lowe transport medium or Amies charcoal-containing transport medium (see Fig. 17-10 on next page).
  - Ideally, specimens for culture should be inoculated at the patient's bedside onto charcoal-based media.
  - Contact the laboratory to obtain appropriate culture media before specimens are collected.

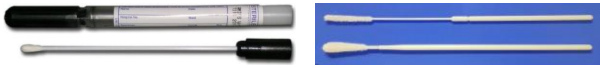


Fig. 17-10. Left: Swab with Amies charcoal-containing transport medium. Right: Nylon-flocked swabs (top swab with thin, flexible shaft for collection of nasopharyngeal specimens and bottom swab with non-flexible shaft for throat specimens).

17.6.2.5.3 *Corynebacterium diphtheriae*

- Suspected cases:
  - Swabs should preferably be collected prior to initiating antibiotic therapy and taken from the oropharynx, underneath the pseudomembrane (if present), and the nasopharynx.
  - Pseudomembrane tissue should also be collected if possible and placed in sterile saline (not formalin).
  - Dacron, Rayon, or nylon-flocked swabs should be used and placed in Amies or Stuart's transport media (see Fig. 17-10 above).
  - Specimens must be transported to the laboratory, with ice packs, as soon as possible.
- Contacts:
  - Nasopharyngeal (or nasal) and oropharyngeal swabs should be collected prior to chemoprophylaxis.
  - Following completion of chemoprophylaxis, swabs should be collected again from *C. diphtheriae*-positive contacts to ensure eradication of carriage.
  - Dacron, Rayon, or nylon-flocked swabs should be used and placed in Amies or Stuart's transport media (see Fig. 17-10 above).

17.7 Oral cultures

Indicated for the diagnosis of oral candidaemia and fusospirochetal disease (Vincent's angina).

- Rinse the mouth with sterile saline.
- Wipe the lesion with sterile gauze.
- Swab or scrape areas of exudation or ulceration.

17.8 Ocular specimens

17.8.1 General considerations

- Several different techniques are used to collect specimens from different parts of the eye by an ophthalmologist as per clinical guidelines.

- The following specimen types can be tested by the laboratory:
  - Conjunctiva/lid margin specimens
  - Corneal scrapings
  - Intra-ocular fluid
  - Lacrimal gland
  - Lacrimal sac
  - Lacrimal duct
- These specimens should be inoculated directly onto culture/transport media at the patient's bedside or theatre and slides are to be prepared at the time of collection (available from the laboratory).
- A conjunctival swab should accompany any specimen collected by an invasive method, as this will serve as a control (the conjunctiva is consistently colonised with environmental/ocular adnexal flora).
- Send prepared smears and inoculated media promptly to the laboratory.

17.8.2 Special considerations

- *N. gonorrhoeae*: Use a swab with Amies transport medium to collect the specimen; inoculate the scrapings onto a New York City agar plate at the patient's bedside.
- Fungi: Inoculate onto appropriate media e.g., Sabouraud Dextrose agar at the patient's bedside.
- Anaerobes: Inoculate into anaerobic transport media or directly onto appropriate media at the patient's bedside.
- Viruses: Use Dacron/cotton swabs with non-wooden shafts and send the specimen in the appropriate viral transport medium.
- *Chlamydia trachomatis*: Use only a Dacron swab (available on request from the laboratory) to collect the specimen. Please mark the request form clearly when testing for *Chlamydia* is required.

NOTE: All special transport media and agar plates must be collected from the laboratory BEFORE specimens are collected.

17.9 Tissue biopsies, aspirates / swabs of abscesses and fluids

17.9.1 General principles

- The character of the lesions in question may limit the usefulness of these cultures. Lesions connecting with skin, mucosal surfaces or the gastro-intestinal tract will be encumbered by the presence of indigenous microflora. Therefore, for meaningful culture results, surgically obtained tissue samples, aspirates of closed abscesses and aliquots of pus/fluid are preferred rather than swabs.

- Swabs of superficial skin ulcers, the skin surface of sinus tracts and from open abscesses often yield mixed bacterial flora, which do not reflect the organisms of true infectious significance. Therefore, every effort should be made to sample from deeper aspects of the lesion with careful avoidance of the contaminated tissue surface.
- When anaerobic bacteria are suspected, the specimen should ideally be inoculated into anaerobic transport medium (available on request from the laboratory) at the bedside and promptly transported to the laboratory.
- When looking for fastidious or unusual organisms please notify the laboratory so that cultures can be appropriately set up and held for prolonged incubation as needed.
- Providing the laboratory with the location and type of wound/abscess/tissue as well as a clinical diagnosis are useful as it can hasten recognition of specific pathogens associated with the specific type of infection.
- Specimens can be transported to the laboratory using:
  - A sterile universal container
  - Transport medium (e.g., Amies or Stuart's medium).

17.9.2 Tissue biopsies

- Specimens collected at the time of surgery/endoscopy should be submitted in sterile universal containers without formalin (see Table 17-4 on page 151).
- The specimen should be kept moist by the addition of normal saline.
- **PLEASE close the lid tightly to prevent the contents from leaking.**

17.9.3 Pus specimens

17.9.3.1 Aspirates

- Disinfect collection site with 70% alcohol or other suitable skin disinfectant. **Allow 1−2 minutes for the disinfectant to dry.**
- Obtain specimen via percutaneous needle aspiration or surgery using strict aseptic technique.
- Aspirate the deepest part of the lesion using a 3−5 mL syringe and a 22-23-gauge needle.
- If the initial aspirate fails to yield material, inject normal saline subcutaneously and repeat the aspiration attempt.
- Please refer to Table 17-3 on page 150 for suitable containers to use.

17.9.3.2 Deep lesions

- Disinfect collection site with 70% alcohol or other suitable skin disinfectant. **Allow 1−2 minutes for disinfectant to dry.**
- Aspirate the deepest part of the lesion.
- If the specimen is collected in theatre, submit a portion of the wall of the lesion as well.
- Please refer to Section 17.5 on page 150 for suitable containers to use.

17.9.3.3 Burn wounds

- The surface of burn wounds may become colonised by the patient's own microbial flora or by environmental organisms.
- While surface cultures of burn wounds may be helpful from the standpoint of evaluating potential pathogens that exist on the patient and in the burns ward, they do not give any indication of the status of the wound itself.
- Assess the burn wound site clinically for signs of inflammation and purulence. Remove all superficial slough and debris prior to sampling. Disinfect collection site with 70% alcohol or other suitable skin disinfectant. **Allow 1−2 minutes for disinfectant to dry.**
- Submit **tissue** as **specimen of choice.** Collect two punch biopsies and submit one for culture (in a sterile universal container with sterile saline) and the other one for histology (in a container with formalin). **PLEASE close the lids tightly to prevent contents from leaking.**
- If exudate appears, sample it firmly with a swab.
- Sampling of different areas of the burn wound is recommended, as organisms may not be evenly distributed.

17.9.3.4 Pus swabs

- Disinfect collection site with 70% alcohol or other suitable skin disinfectant. **Allow 1−2 minutes for disinfectant to dry.**
- Use a premoistened swab to firmly swab the base or margin of the lesion.
- Take care to avoid adjacent skin margins.

NOTE: Dry swabs are unacceptable specimens. Send specimens to the laboratory as soon as possible or submit them in a suitable transport medium (e.g., Amies or Stuart's) if a delay is anticipated.

17.9.4 Ulcers

- Disinfect collection site with 70% alcohol or other suitable skin disinfectant. **Allow 1−2 minutes for disinfectant to dry.**
- Remove overlying debris.
- Curette the base of the ulcer; collect exudate from ulcer using a syringe or swab.

17.9.5 Rectal biopsy

- Specimens requiring microbiological culture should NOT be submitted in formalin. Submit the specimens in a sterile universal container in normal saline to prevent them from drying out. **PLEASE close the lid tightly to prevent contents from leaking.**

17.10 Stool specimens

17.10.1 General principles

- Specimens should be collected in sterile universal containers. **PLEASE close the lid tightly to prevent contents from leaking.**
- Containers should be clean and dry. The presence of water or urine can result in inaccurate interpretation of results.
- Suspected clinical diagnosis should be indicated on the request form. This is essential where special media or tests are required for culture and identification of certain organisms e.g., *Clostridioides* (previously *Clostridium*) *difficile*, *Vibrio cholerae* or opportunistic parasites in HIV infection.
- Obtain unformed stool specimens.
- Do not submit more than one stool specimen for a particular patient in a 24-hour period.
- Stool specimens should preferably be sent within the first 3 days of admission.

NOTE: Diarrhoea developing after this period is usually nosocomial in origin, i.e., antibiotic-associated diarrhoea. In these cases, *C. difficile* testing should be requested.

17.10.2 Rectal swabs

- Rectal swabs should NOT be submitted UNLESS:
  - Stool cannot be obtained (e.g., during initial stage of typhoid/enteric fever when patients are often constipated), or
  - Screening for carriage of multidrug-resistant (MDR) organisms (e.g., carbapenem-resistant Enterobacterales (CRE) or vancomycin-resistant enterococci (VRE)).
- Please indicate the purpose of the rectal swab (e.g., VRE or CRE screening) clearly on the request form.
- These swabs must be placed in transport media after collection e.g., Cary-Blair, Amies, or Stuart's transport medium, which is available from the laboratory.
- Collection method:
  - Moisten the swab in sterile transport medium.
  - Gently insert the swab 2−3 cm into the anal canal and rotate to sample anal crypts. Remove the swab and inspect for visible faeces.

- Immediately insert the swab into the transport medium and deliver to the laboratory promptly. If delays are anticipated, the swab in transport medium can be refrigerated.

17.11 Parasitology specimens

17.11.1 General principles

- Requests for parasite examination must be clearly stated on the request form.
- Stool specimens should be transported to the laboratory as soon as possible – within 30 minutes if *Entamoeba histolytica* is suspected.
- Substances such as bismuth, antibiotics and anti-motility agents can interfere with parasite detection.
- Please provide relevant clinical information e.g., opportunistic parasites in HIV infection require special staining procedures.
- Several specimens may be needed to identify the presence of parasites due to intermittent excretion. Therefore, stool specimens should be collected every other day or on consecutive days but not all on the same day.

17.11.2 Specimen collection for parasites

Please see specimen collection instructions in Table 17-5 below.

Table 17-5. Specimen collection instructions for parasitic infections

Parasite	Specimen type	Special instructions
Acanthamoeba culture	For *Acanthamoeba* keratitis, corneal scraping, or biopsy in saline	**NOTE:** Contact NICD for instructions
Bilharzia (*Schistosoma*) Antibodies	5 mL clotted blood (yellow top tube)	
Bilharzia (*Schistosoma*) microscopy	Stool, urine specimen in a universal container	**NOTE:** Optimal collection time of urine for *Schistosoma haematobium* and stool for *Schistosoma mansoni* is between 10h00 and 14h00. Please state clearly on the request form that Bilharzia (*Schistosoma*) microscopy is requested
Cysticercus Antibodies	5 mL clotted blood (yellow top tube)	
Echinococcus Antibodies	5 mL clotted blood (yellow top tube)	
Entamoeba histolytica IgG	5 mL clotted blood (yellow top tube)	
Entamoeba histolytica microscopy	Fresh stool specimen in a universal container	**NOTE:** Stool specimen must reach laboratory within 30 minutes of collection

Parasite	Specimen type	Special instructions
Enterobius vermicularis	Collect specimens using cello tape method	See Section 17.11.3 for collection instructions
Giardia lamblia microscopy	Stool specimen in a universal container	
Larvae of *Strongyloides stercoralis*	Stool, small bowel aspirate (also sputum, vomitus, urine, or CSF in disseminated infection) in a universal container	**NOTE:** Handle specimen with care as the larvae are infective
Leishmania (cutaneous) Microscopy and PCR	Skin biopsy specimens should be taken from the edge of the lesion, not the centre	If possible, the specimen should be divided in 2 (send one half in saline and the other half in 70% ethanol, both on ice). Please indicate clearly which container contains 70% ethanol and which one saline.
Leishmania (mucocutaneous)	Please contact the referral laboratory for collection and transport details	
Leishmania (visceral)	Please contact the referral laboratory for collection and transport details	
Malaria rapid screen	4 mL EDTA blood (purple top tube)	
Malaria smear	4 mL EDTA blood (purple top tube)	**NOTE:** Specimen must be tested within 24 hours of collection
Microfilaria microscopy	4 mL EDTA blood (purple top tube)	**NOTE:** Please contact the referral laboratory for special sampling instructions
Parasite microscopy	Stool, urine, fluid aspirate, **or** tissue specimen in a universal container	
Toxoplasma gondii IgG	5 mL clotted blood (yellow top tube)	Refrigerate specimen if transport is delayed
Toxoplasma gondii IgM	5 mL clotted blood (yellow top tube)	
Trypanosomes	4 mL EDTA blood (purple top tube)	**NOTE:** Contact referral laboratory for instructions. In all patients who test positive for African trypanosomiasis, a CSF specimen must be submitted to exclude CNS involvement
Worm and tapeworm identification	Worm or proglottid in a universal container	**NOTE:** Please submit proglottids in normal saline

Please note that for some parasites, a PCR may be performed at the Parasitology Reference Laboratory if strongly suspected. For these, and queries on unusual parasites, requests should be made to the closest NHLS laboratory which will liaise with the Reference Laboratory about tests offered, specimen collection, and turnaround times (TATs).

17.11.3 Cello tape preparation for pinworm (*Enterobius vermicularis*)

- The sticky surface of cello tape should be pressed against the patient's peri-anal skin in the morning before going to the bathroom or taking a bath (since the female worm lays her eggs during the night on the peri-anal skin). Please see Fig. 17-11 below. Scrapings from under the nails may also be used, in the case of older children who are able to scratch their peri-anal area.
- The tape should be placed on a glass slide and sent to the laboratory for microscopic examination of eggs.
- Repeated examinations may be indicated.

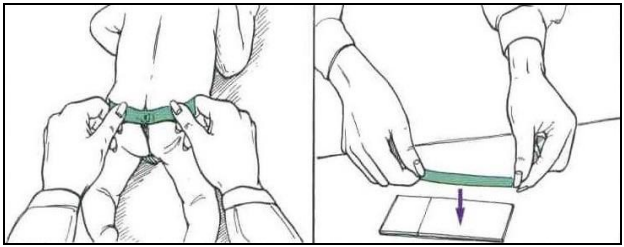


Fig. 17-11. Cello tape method for pinworm diagnosis (wear gloves).

17.12 Urine specimens

17.12.1 General principles

- Urine is normally a sterile body fluid. If urine specimens are not collected properly, contamination with normal flora of the perineum, urethra and vagina can occur, resulting in inaccurate results.
- Please stipulate the type of specimen e.g., midstream urine, suprapubic urine aspirate, or catheter urine specimen.
- Early morning and midstream urines are the preferred specimens and have the best yield.
- Suprapubic aspirates may be required from infants.
- Specimens >48 hours old may be rejected unless refrigeration has occurred.
- Do not force fluids prior to urine collection as this will dilute colony counts and result in potential misinterpretation.
- Never submit urine collected in a bedpan or urinal.

17.12.2 Midstream or clean-catch specimen collection

17.12.2.1 Females

- Thoroughly cleanse the urethral area with soap and water (not disinfectant); rinse the area with wet gauze pads (see Fig. 17-12 below).
- While holding the labia apart, begin voiding.
- After several mL have passed, collect a midstream portion without stopping the flow of urine.

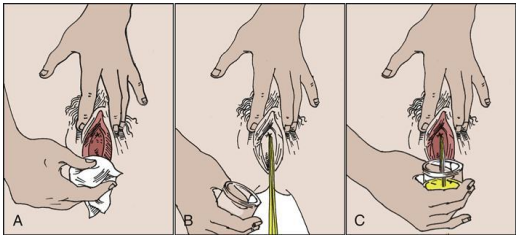


Fig. 17-12. Collection of midstream urine specimens in females.

17.12.2.2 Males

- Cleanse the glans with soap and water (not disinfectant); rinse with wet gauze pads (see Fig. 17-13 below).
- Holding the foreskin retracted, begin voiding.
- After several mL have passed, collect a midstream portion without stopping the flow of urine.

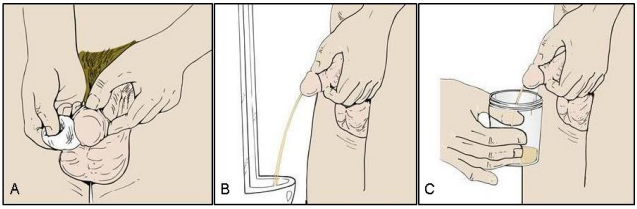


Fig. 17-13. Collection of midstream urine specimens in males.

17.12.3 Catheter specimens

17.12.3.1 Indwelling urinary catheter specimen collection

Urine collected from indwelling catheters is often contaminated with colonising flora; therefore, specimens should be collected as follows (also see Fig. 17-14 below):

- Disinfect the catheter collection port with 70% alcohol. Allow to dry.
- Use a needle and syringe to aseptically collect 5−10 mL urine.
- Transfer specimen to sterile container. **PLEASE close the lid tightly to prevent contents from leaking.**

NOTES:

- DO NOT submit **Foley catheters or their tips** as these specimens are of no value due to extensive contamination by colonising flora. **If submitted, these specimens will be rejected.**
- DO NOT collect urine from the collection bag.

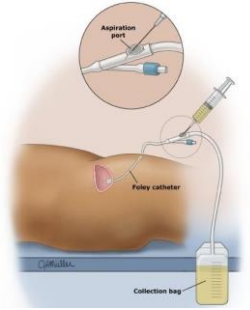


Fig. 17-14. Collection of catheter urine specimen.

17.12.3.2 Straight / in-out catheter specimen collection

- Thoroughly cleanse the urethral area with soap and water; rinse the area with wet gauze pads.
- Aseptically, insert a catheter into the bladder.
- After allowing about 15 mL to pass, collect urine to be submitted in a sterile container.
- Remove the catheter immediately. This specimen should be clearly marked as an “in-out catheter specimen”.

NOTE: If preparation is inadequate, the procedure may introduce urethral flora into the bladder and increase the risk of iatrogenic infection.

17.12.4 Parasites, dysmorphic cells and casts

- Requests for parasites and/or casts must be clearly stated on the request form.
- These specimens must arrive promptly at the laboratory.
- **Note:** The optimal collection time of urine for *Schistosoma haematobium* is between 10h00 and 14h00 when ova excretion is the highest.

17.12.5 Renal tuberculosis

- Urine specimens for acid-fast bacilli (AFB) microscopy and TB culture may be a useful adjunct in the diagnosis of renal TB.
- Up to three early morning (first void) urine specimens should be submitted (200−400 mL per specimen).
- Urine microscopy for AFB is not a sensitive screening tool. However, TB culture has a better yield provided that a sufficient number of specimens are submitted (i.e., sensitivity of culture is 80−90% if at least three early morning urine specimens are cultured).

17.13 Mycology specimens

Please indicate clearly on the request form if mycology investigations are required.

17.13.1 Tissue specimens

- Collect tissue biopsies aseptically.
- Put the specimen in a sterile universal container and do NOT add saline.
- Transport to the laboratory immediately or refrigerate at 2−8°C if transport is delayed.

17.13.2 Purulent exudates and fluids

- Pus should be aspirated aseptically from closed lesions where possible and placed in a sterile universal container and transported to the laboratory as soon as possible.
- Wound dressings can be sent for examination of granules if mycetoma or actinomycosis is suspected clinically.
- Pus swabs are generally inferior specimens and should be avoided.
- Other swabs (e.g., vaginal, penile, throat, oral) should be transported to the laboratory as soon as possible.
- Aspirate bone marrow into a BACTEC Myco/F Lytic blood culture bottle or sterile heparinised tube. Also make 2 smears for special fungal stains and submit together with the culture specimen.

- Pleural, peritoneal, and joint fluids should be collected aseptically in a clean sterile universal container. Bloody specimens can be collected in a heparinised collection tube to prevent clotting.
- Corneal scrapings obtained by a platinum spatula must be transferred onto an agar plate (Blood agar, Sabouraud Dextrose agar) at the patient's bedside or in theatre during surgery. Smears of the scraped material should also be prepared on clean, alcohol-flamed slides.

17.13.3 Urine, stool, and rectal swabs

- Collect urine in a sterile universal container and send to laboratory without delay.
- Stool specimens or rectal swabs for fungal culture are rarely useful as the significance of fungi present in such contaminated material is controversial.

17.13.4 Lower respiratory tract infections

- Collect specimens appropriately in sterile universal containers without additives (as described in Section 17.6.1 on page 151) and send to the laboratory for processing.
- When a delay in transport is expected, refrigeration is not advisable if histoplasmosis is suspected.
- Collect three early morning specimens.
- Lung biopsy or aspirates are also appropriate specimens.
- Please specify on the request form if a fungal infection is suspected.

17.13.5 Skin

- Clean the area of skin where a specimen will be collected with 70% alcohol if ointments or other topical medications have recently been applied.
- Scrape the active peripheral edge of the lesion with a scalpel or the end of a microscope slide.
- Place the scales in a sterile Petri dish or container or between two glass slides taped together and send promptly to the laboratory.

17.13.6 Nails

- Cleanse nails thoroughly with an alcohol wipe.
- Scrape deeply using a blunt scalpel to obtain recently invaded nail tissue.
- Initial scrapings are usually contaminated and thus should be discarded.
- Clippings of whole thickness of the affected nail can be obtained using nail clippers.
- Place the scrapings and nail clippings in a sterile Petri dish or container and send promptly to the laboratory.

17.13.7 Hair and scalp

- Send basal portions of infected hair and scalp skin scrapings from the affected areas promptly to the laboratory in a sterile container to prevent overgrowth of contaminating fungi.

17.13.8 Beta−D glucan Fungitell® assay

- This is an adjunct test for the qualitative detection and quantitation of (1-3)-β-D glucan (BDG), a component of the fungal cell walls of most fungi.
- The test should be performed in conjunction with microbiological culture of appropriate specimens, septic markers, and radiology where applicable.
- This test detects BDG in the blood of patients with invasive fungal infections, including *Pneumocystis jiroveci*.
- Not recommended for *Cryptococcus* spp. and zygomycetes as these fungi release little or no BDG in human serum.
- Please ensure that a **separate/dedicated specimen tube** is submitted when referring specimens for BDG testing. When a single specimen is sent with a request for multiple tests, the specimen must be split. This process can result in contamination of the specimen and a false-positive result by the BDG assay.
- Conditions interfering with BDG results include:
  - Haemolysis
  - Specimen turbidity due to lipemia
  - Icterus (high bilirubin)
  - False negatives
    - Early candidaemia (recommend submitting repeat specimen if continued clinical suspicion and initial BDG specimen negative)
    - Certain strains of *Candida parapsilosis*
    - Immune complex disease
    - *Cryptococcus neoformans*
    - Zygomycetes
  - False positives
    - Haemodialysis with cellulose membrane
    - Administration of blood products (immunoglobulin or albumin)
    - Antibiotics: Amoxicillin-clavulanate, piperacillin-tazobactam (not due to the antibiotic itself; however, BDG is present in cellulose filters used during manufacturing)
    - Use of surgical gauze containing glucan
    - Severe bacterial infections and mucositis.

SECTION 18.0

COMMUNICABLE AND REPORTABLE DISEASES

18.0 COMMUNICABLE AND REPORTABLE DISEASES

Category 1 organisms

Definition:

Notifiable medical conditions that require immediate reporting by the most rapid means available upon diagnosis followed by a written or electronic notification to the Department of Health **within 24 hours of diagnosis** by healthcare providers, private health laboratories or public health laboratories.

Notifiable medical conditions:

- Acute flaccid paralysis
- Acute rheumatic fever
- Anthrax
- Botulism
- Cholera
- Congenital rubella syndrome
- Coronavirus disease-2019 (COVID-19)
- Diphtheria
- Enteric fever (typhoid or paratyphoid fever)
- Foodborne illness outbreak*
- Haemolytic uremic syndrome (HUS)
- Listeriosis
- Malaria
- Measles
- Meningococcal disease
- Mpox (Monkey Pox)
- Multisystem Inflammatory Syndrome (MIS-C)
- Pertussis
- Plague
- Poliomyelitis
- Rabies (human)
- Respiratory disease caused by a novel respiratory pathogen**
- Rift valley fever (human)
- Rubella virus
- Smallpox
- Viral haemorrhagic fever diseases***
- Waterborne illness outbreak
- Yellow fever

*Foodborne illness outbreak is an incident in which two or more persons experience a similar illness (gastrointestinal) and are epidemiologically linked.
**Examples of novel respiratory pathogens include novel influenza A virus, Middle East respiratory syndrome (MERS) coronavirus (MERS-CoV), and SARS.
***Viral haemorrhagic fever diseases include Ebola virus, Marburg virus, Lassa virus, Lujo virus, new world arena viruses, Crimean-Congo haemorrhagic fever or other newly identified viruses causing haemorrhagic fever.

Note: For more information, please refer to the NICD website.

Category 2 organisms

Definition:

Notifiable medical conditions to be notified through a written or electronic notification to the Department of Health **within seven (7) days of clinical or laboratory diagnosis** by health care providers, private health laboratories or public health laboratories.

Notifiable medical conditions:

- Agricultural or stock remedy poisoning
- Bilharzia (schistosomiasis)
- Brucellosis
- Congenital syphilis
- *Haemophilus influenzae* type b
- Hepatitis A
- Hepatitis B
- Hepatitis C
- Hepatitis E
- Lead poisoning
- Legionellosis
- Leprosy
- Maternal death (pregnancy, childbirth, and puerperium)
- Mercury poisoning
- Soil-transmitted helminths (*Ascaris lumbricoides*, *Trichuris trichiuria*, *Ancylostoma duodenale*, *Necator americanus*)
- Tetanus
- Tuberculosis: Pulmonary
- Tuberculosis: Extra-pulmonary
- Tuberculosis: Multidrug-resistant (MDR-TB)
- Tuberculosis: Extensively drug-resistant (XDR-TB)

Note: For more information, please refer to the NICD website.

Category 3 organisms

Definition:

Notifiable medical conditions to be notified through a written or electronic notification to the Department of Health **within 7 days of diagnosis** by private and public health laboratories.

Notifiable Medical Condition / Pathogen(s) to notify

- Ceftriaxone-resistant *Neisseria gonorrhoeae*
- Endemic arboviral diseases: West Nile virus, Sindbis virus, Chikungunya virus
- Non-endemic arboviral diseases: Dengue fever virus, other imported arboviruses of medical importance
- Non-typhoidal Salmonellosis: *Salmonella* spp. other than *S.* Typhi and *S.* Paratyphi
- Shiga toxin-producing *Escherichia coli*
- *Shigella* spp.

Note: For more information, please refer to the NICD website.

Category 4 organisms

Definition:

Notifiable medical conditions to be notified through a written or electronic notification to the Department of Health **within 1 month** of diagnosis by private and public health laboratories.

Notifiable Medical Condition / Pathogen(s) to notify

- Carbapenemase-Producing Enterobacterales (previously Enterobacteriaceae)
- Glycopeptide (Vancomycin)-Resistant Enterococci
- Glycopeptide (Vancomycin)-Resistant *Staphylococcus aureus*: hGISA* and GISA**
- Colistin-Resistant *Pseudomonas aeruginosa*
- Colistin-Resistant *Acinetobacter baumannii*
- *Clostridioides difficile*

*Heterogeneous Glycopeptide-Intermediate *S. aureus* (hGISA)
**Glycopeptide-Intermediate *S. aureus* (GISA)

Note: For more information, please refer to the NICD website.

Notification of new cancer cases

Regulation 380 of the National Health Act of 2003 made reporting of all new cancer diagnoses to the National Cancer Registry (NCR) compulsory from April 2011. The amendment makes provision for the establishment of Population-Based Cancer Registration and also stipulates the compulsory notification of all new cancer cases on the prescribed form. The NCR conducts sentinel population-based cancer surveillance at selected sites with surveillance officers actively collecting data. The cancer reporting form is available electronically on the Notifiable Medical Conditions Application (https://mstrmobile.nicd.ac.za/nmc/) for clinicians to complete. Failure to comply with the provisions of Regulation 380, is regarded as an offence which may lead to prosecution. Cancer notification forms are to be submitted to the NCR within 3 months of diagnosis. Forms are to be completed in duplicate in BLOCK LETTERS. The original must be submitted to the NCR and the copy to be retained in the patient's folder.

Cancer notification forms can be submitted to the NCR via:

E-mail: cancer.registry@nhls.ac.za or through the Notifiable Medical Conditions Application

Tel: (011) 555 0548

For a detailed description of the new regulations please see:
https://www.gov.za/documents/national-health-act-regulations-cancer-registration
Act No. 61 of 2003 – Regulations related to Cancer Registration No. R.380.

SECTION 19.0

INFECTION CONTROL

19.0 INFECTION CONTROL

19.1 Haemodialysis water

19.1.1 Test frequency and timing

19.1.1.1 Routine

Collect samples for monitoring purposes at least monthly.

19.1.1.2 Repeat

Collect repeat samples when bacterial counts exceed the allowable level. If culture growth exceeds permissible standards, re-culture the water system, usually weekly, until acceptable results are obtained.

19.1.1.3 Ad hoc

Collect samples when clinical indications suggest pyrogenic and/or septic complications following a specific request by the clinician and/or the infection control practitioner.

19.1.1.4 Timing

If the water system has been treated with formaldehyde or chlorine for sanitisation, flush the system completely before collecting samples. Drain and flush storage tanks and water lines (flush time of 15 minutes recommended) before collecting samples. Culture water and dialysis fluid monthly unless a greater frequency is dictated by historical data at your institution.

19.1.2 Sample collection, transport, and storage

19.1.2.1 Dialysis water

- Use standard universal specimen containers (i.e., used for urine, sputum specimens).
- Sample at a point immediately past the water production system e.g., reverse osmosis system, deionization units.
- Sample wherever storage of water occurs e.g., storage tank used to store water from the water treatment system.
- Sample just before water enters the dialysis machine or central proportioner.

19.1.2.2 Dialysate

- Following dialysis, collect fluid from dialyser.
- Single-pass system: Sample where dialysate leaves dialyser.
- Re-circulatory system: Sample at the periphery of the re-circulation chamber containing the coil dialyser.

19.1.2.3 Volume

- Collect a minimum of 5 mL from each sample point into sterile universal containers.

19.1.2.4 Method

- At each point of collection, open the valve and allow the water to flow for a minimum of 2 minutes before the sample is collected.

19.1.2.5 Transport and storage

- Culture of dialysis water and dialysate must preferably start within 30 minutes of collection. If delays are expected, store the samples at 4−5ºC and culture within 24 hours of collection.

19.2 Collection of water from hydrotherapy pools

- At least 30 mL of water sample should be collected from both the deep and shallow ends of the pool. The sample collection container should contain sodium thiosulphate to neutralise the pool chlorine unless the sample can be processed within 3−4 hours of collection. Water samples should be tested twice a week. Where there are financial constraints the sampling should not be less than every two weeks.
- The container should be held with the mouth in the direction of the water flow so that the sample does not become contaminated with bacteria from the sampler's hand.
- Samples must be delivered to the laboratory in a polystyrene container with ice packs within 2 hours of sample collection.
- If chlorination is done manually, samples should be taken before the next dose is added to the pool or at the beginning of the day before there is any bathing.

19.3 Culture of continuous ambulatory peritoneal dialysis fluid

Specimen collection and transport:

- Enclose dialysate bag in a larger plastic bag. Place this bag into a disposable plastic bag and transport it to the laboratory.
- Transport:
  - For immediate delivery, transport at room temperature.
  - For delayed delivery (i.e., >1 hour after collection) refrigerate but DO NOT freeze.

19.4 Culture of intravascular devices

19.4.1 Specimen collection

- To prevent contamination by skin micro-organisms and antibiotic ointment, clean the skin insertion site with an iodophore (e.g. povidone-iodine) and alcohol prior to removal of the cannula.
- Remove the cannula in an aseptic manner once the alcohol has dried and send promptly to the laboratory in a sterile container.
- If purulence of the catheter exit site is evident, send pus in a sterile container for microscopy, culture, and sensitivity (MC&S).

19.4.2 Long catheters

- Two portions of these catheters should be sent for culture – the distal intravascular tip and the proximal transcutaneous segment.
- Each segment should be approximately 2 to 3 cm long.

19.4.3 Short catheters

- The cannula is cultured in its entirety following removal of the hub.
- To remove the hub, use sterile scissors, or snap off the steel needles with a sterile haemostat.

19.4.4 Specimen transport

- Transport catheter tips in a sterile universal container (without saline).
- Use a universal specimen container.
- If tips are cut to a proper length (send proximal portion, ideally <5 cm), there is no need to bend them for insertion into the sterile universal container.
- Tips must be cultured within 2 hours of collection to prevent desiccation of micro-organisms.

19.5 Surveillance cultures for multidrug-resistant micro-organisms and as part of infection prevention and control strategies

19.5.1 Selective culture for fungi

Collect urine, stool, and oropharyngeal specimens by using the techniques for obtaining these specimens for routine cultures as described previously. Please state clearly on the request form that fungal culture is required. If known, please specify which *Candida* spp. is being sought.

19.5.2 Surveillance culture for vancomycin-resistant Enterococci (VRE), methicillin-resistant *Staphylococcus aureus* (MRSA) and carbapenem-resistant Enterobacterales (CRE)

- All swab specimens are submitted in the transport media that are routinely used for other swab cultures.
- Please state clearly on the request form the type of surveillance required.
- In general sites are as follows:
  - MRSA: Anterior nares, axilla, groin.
  - VRE and CRE: Rectal swab.

NOTE: *Active screening is usually performed in certain situations guided by site-specific policies (outbreaks/high risk patients). Discuss with Microbiologist/ Infection Control Practitioner regarding local policy.*

19.5.3 Selective bowel culture

- A rectal swab or a stool specimen is collected and submitted as if for routine culture.

19.6 Information and samples required to diagnose infusate-related sepsis

19.6.1 Required information

- The time of administration of the infusate.
- The diagnosis of the patient's underlying condition.
- Time taken until the manifestation of adverse effects (e.g., pyrexia after administration).
- State if there are any other patients with similar symptoms and signs after receiving the same infusate batch number.
- The batch number and details of the infusate in question.
- The blood culture result from the patient taken at the time of suspected infusate-related sepsis.
- If any additives were administered with the infusion or added directly to the bag by a pharmacist.
- How the bag was stored prior to administration.
- The procedure followed when setting up the bag i.e., how the skin was disinfected and if the health care worker was wearing gloves.
- Was the bag inspected for leaks?

19.6.2 Samples

The following samples are required which must be sent to the laboratory in separate sealed plastic bags:

- The full intravenous (IV) set and infusate in use at the time when the patient spiked a temperature.
- Any “Add-in-line” bags.
- A blood culture taken through the line.
- A blood culture taken from a remote venepuncture site.
- A swab from each catheter hub.
- A swab from the skin site.
- The transcutaneous segment of the catheter.
- The distal portion of the catheter.
- Any other bags with the same batch number.

19.6.3 Collection and transport of infusates

- Aerobic BacT/Alert bottles must be used.
- The plastic cap on the BacT/Alert bottle must be removed, and the rubber bung must be disinfected with an alcohol swab containing 70% isopropyl alcohol.
- When the alcohol has evaporated, under strictly aseptic conditions, inoculate 10 mL of infusate sample into the BacT/Alert bottle.
- Each bottle must be accompanied with its own slip containing all relevant data regarding the sender (name, address, contact numbers, account details), batch number, site, date, and barcode sticker, which must be removed from the bottle.
- The slip must be attached to the corresponding bottle.
- The BacT/Alert bottles must be sent to the referral laboratory in a safe container to prevent breakage of the bottles.

19.7 Polymerase chain reaction (PCR) detection of *Bordetella pertussis* in nasopharyngeal swabs and aspirates

- Nasopharyngeal specimens must be taken with Dacron, Rayon, or nylon-flocked swabs (with non-wooden shafts) since calcium alginate swabs and swabs with wooden shafts strongly inhibit the PCR. If a specimen has been taken using another type of swab, and cannot be repeated, the Molecular Laboratory will process it according to a protocol with less chance of success than with the Dacron swabs.
- If there is inhibition of the internal control, it will be reported as “No result” as inhibition is suspected, and the result for *B. pertussis* is unknown.

- After streaking the swab head onto a charcoal *Bordetella* agar plate (preferably done by the clinician at the bedside, or by laboratory staff), it must be placed into a sterile container and sent to the Molecular Laboratory as soon as possible.
- This can be done by placing the swab into a plastic bag and sealing (not the original swab wrapping, unless that is sealed), or by cutting the shaft off (not too close to the head) and sending in a universal specimen container. Please indicate the type of swab used when sending for analysis.
- Nasopharyngeal and sinus aspirates, sputum, and throat swabs can also be sent for analysis.
- Leaking specimens, specimens older than 10 days and gel swabs will be rejected.

19.8 PCR detection of toxigenic *Clostridioides difficile* in stool specimens

- Loose, unformed stool specimens are required for the detection of *C. difficile* infection. Formed stool will be rejected.
- These are to be collected in sterile containers that will not leak.
- Leaking specimens and specimens older than 48 hours will be rejected.
- **NOTE:** Test-of-cure is not recommended.

19.9 Infection control tests

19.9.1 Clinical specimens

- Peritoneal dialysis bags (MC&S)
- Intravascular device tips (MC&S)
- Screening for VRE
- Screening for CRE
- Screening for MRSA
- Extended identification of aerobes and anaerobes

19.9.2 Specialised antibiotic susceptibility testing

- Etests
- Phenotypic tests for CRE
- Synergy testing by Etests
- Colistin broth microdilution testing
- *Nocardia* broth microdilution testing
- Heterogeneous Glycopeptide-Intermediate *S. aureus* (hGISA) testing
- Minimum inhibitory concentration (MIC) testing

19.9.3 Outbreak investigations

- Clinical – Stool and vomitus
- Food
- Air sampling
- Rodac surface cultures
- Air settle plates
- Surface swabs
- Positive pressure testing (smoke tubes)
- Testing of water for *Legionella*
- Culturing of sputum for *Legionella*
- Urine antigen test for *Legionella pneumophila* serogroup 1

19.9.4 Public Health Microbiology

- Water
  - Total bacterial counts
  - Coliform counts
  - *Escherichia coli (E. coli)* counts
  - Water for culture detection and identification of *Vibrio cholerae*
- Dairy products
  - Total bacterial counts
  - Coliform counts
  - *E. coli* counts
  - Milk phosphatase
  - Culture for bacteria (routine) and culture for yeasts and moulds (only on request)
- Food
  - Total plate counts
  - Coliform counts
  - *E. coli* counts
  - Culture for *S. aureus, Bacillus cereus, Clostridium perfringens, Listeria monocytogenes, Campylobacter* spp., *Salmonella* spp., *E. coli* O157, *Shigella* spp., *Yersinia enterocolitica, Vibri*o spp., yeasts, and moulds.
- Toxin testing
  - *S. aureus*
  - *B. cereus*
  - *C. perfringens*
- Molecular biology laboratory testing
  - PCR for VRE screening
  - PCR for MRSA screening

- PCR for *B. pertussis*
- PCR for *Pneumocystis jiroveci*
- PCR for Atypical pneumonia
- PCR for *C. difficile*
- PCR for Enteric pathogens
- PCR for bacterial meningitis
- Molecular typing (fingerprinting) of nosocomial pathogens in elucidation of nosocomial outbreaks
- Bacterial sequencing
- Pan-fungal sequencing.

SECTION 20.0

PUBLIC HEALTH

20.0 PUBLIC HEALTH

20.1 General guidelines for sample collection and transport

It is of critical importance that Clinicians/Environmental Health Practitioners (EHP) use the following guidelines for the proper collection, discarding of consumables utilized during collection, and the appropriate transport of samples, as the quality of results hinges on this.

Consequences of poorly collected and/or poorly transported samples include:

- Failure to isolate the causative microorganism, and
- Recovery of contaminants or normal microbial flora, which may be misleading, and result in improper treatment of the patient.

20.1.1 Clinical specimens

- Use strict aseptic techniques to prevent contamination when collecting specimen.
- Use sterile, leak-proof containers with lids that do not create an aerosol when opened.
- Specimens and request forms from different collection sites should ideally be placed in separate plastic bags with the request form in the separate pouch of the plastic bag to prevent damage in the case of a leak in transit and packaged as per the relevant legal requirements.
- Collect clinical specimens prior to initiation of antimicrobial therapy.
- Collect specimens from anatomic sites most likely to yield pathogens and least likely to yield contaminants.
- Provide complete information on the request form including all clinical data. Ideally, all tests that are referred electronically to the Public Health Laboratory should be accompanied by the request form.

20.1.2 Environmental, food and water samples

- The selection of samples or sites must be described in the sampling method.
- The sampling plan must be made available to the laboratory by the EHP prior to sampling.
- Any preparation and treatment of samples must be stated on the request form.
- Use strict aseptic techniques to prevent contamination when collecting samples.
- Collect samples in sturdy, sterile, screwcap, and leak-proof containers with lids that do not create aerosols when opened.

20.1.3 Proper sample transport

- Samples should be promptly transported from the collection site to the receiving laboratory at temperatures not exceeding 8°C unless specified otherwise.
- This also applies to samples being transported from a peripheral laboratory to the Public Health Laboratory.

20.1.4 Sample containers

- The appropriate sample container must be used for the sample collected/ test type.
- The container must be clearly labelled (use indelible ink) with the following details:
  - Sample type
  - Date of sample collection
  - Patient's initial and surname – for clinical specimens
  - Sample reference number/patient's hospital or clinic number
  - Submitting institution and ward where applicable
  - Contact person's details to convey results.
- All the sample containers below are obtainable from the nearest laboratory, after prior arrangement:
  - **Sterile screwcap universal container:** Used for collection of urine and stool
  - **Sterile tubes:** Collection tubes (with/without additives) used for sterile fluids
  - **Sterile 120 mL plastic bottles:** Used for the collection of water samples
  - **One-litre plastic water bottles:** Used for collection of water samples for *Legionella*
  - **Moore pad parcels:** Used for collection of river water for cholera culture
  - **Sterile plastic screwcap bottles:** Used for collection of food samples
  - **¼ strength Ringer's solution:** Used for surface swabs
  - **Selenite Cysteine:** Used for surface swabs when testing for *Salmonella* spp.
  - **Fraser broth:** Used for surface swabs when testing for *Listeria* spp.
  - **Sterile swabs:** Individually packed, used for surface swabs.

20.2 Samples (milk, food, and water)

20.2.1 Collection of samples to test food products, surfaces and utensils for the presence of food poisoning organisms

20.2.1.1 Food sampling

- Sampling should be systematic, and articles sampled should cover as wide a range as possible.
- All food and beverage components of a shared meal suspected of causing a foodborne outbreak should be sampled.
- Where possible, different types of foods must be placed in separate containers (e.g., “curry and rice” – put curry in one sample container and rice in another).
- The quantity of food taken for each sample must be sufficient (at least 100 g).
- **PLEASE NOTE:** Sterile 120 mL sample containers are available from the Public Health Laboratory.
- Sample labels must be filled in completely before the sample is dispatched. The following information must appear on the label:
  - The date and time of sampling
  - If the sample has been submitted in a cooler box on ice
  - Sample type i.e., chicken, gravy, water, etc.
  - Site sample was taken from (samples may be taken from one site where the food outbreak occurred but the same item may have been sampled from leftovers in the fridge and from the remains of a meal).
  - The name of the outbreak should be recorded in the “Sample Description” column.
  - All details of the sender including:
    - Name and ID number
    - Department/Health Authority address
    - Telephone number
    - Cell phone number
    - E-mail address
    - Alternative contact name and phone number.
  - Please use the back of the document to fill in details of symptoms, toxic reactions, deaths, etc. The sample must be immediately placed in a cooler box surrounded by crushed ice or ice packs, or any other suitable refrigeration, which can reduce the temperature of the sample.
- If samples are to be transported or sent over long distances, please DO NOT use crushed ice as it will melt and may affect the integrity of the sample(s).

- Preserve the cold chain until delivered to the Public Health Laboratory. The temperature of the samples must not exceed 8°C.

20.2.1.2 Clinical specimens for food poisoning

- When investigating a suspected food poisoning outbreak, clinical specimens are often not collected. Thus, critical information in tracing the outbreak is unavailable.
- It is essential to link the organisms isolated from the food samples with organisms isolated from the people affected.
- Clinical specimens include faeces (or rectal swab) and vomitus.
- Please note that these specimens and request forms should be labelled: “Foodborne disease outbreak” or “Foodborne pathogens”.
- Stools: Microscopic examination for leucocytes, red blood cells, and parasites.
- Stools and rectal swabs: Culture for *Salmonella*, *Shigella*, *E. coli* O157*, Clostridium perfringens, Bacillus cereus, S. aureus, Campylobacter jejuni, Listeria monocytogenes, Vibrio cholerae,* and *Yersinia enterocolytica.*
- Vomitus: Cultured for *S. aureus* and *B. cereus*.

20.2.1.3 Sample collection and transport

- The specimens must be clearly labelled with the patient’s name, hospital number, date and time of collection and a brief history of food/fluids consumed by the patient.
- It would be ideal to send the patient stool specimen and relevant food samples to the laboratory at the same time.
- Samples should be hand-delivered in a cooler box directly to the laboratory.
- Samples from remote areas should not be dispatched via conventional delivery systems on a Friday or before a public holiday.
- Stools and/or rectal swabs may be sent as part of the investigation of a suspected food poisoning outbreak.
  - Specimens should be submitted as soon as possible.
  - When testing food handlers or other individuals in a potential chain of transmission, stool cultures should be collected and tested until a minimum of two consecutive negative stool specimens are collected, with each specimen collected more than 24 hours apart.
  - Stool specimens should be submitted to the laboratory in a sterile universal container.
  - Care should be taken to ensure that the specimen is not contaminated with urine.
- Rectal swabs should be submitted to the laboratory in an appropriate transport medium, such as Cary-Blair transport medium.

- Vomitus
  - A vomiting episode occurring between 15 minutes and a couple of hours after the ingestion of foodstuffs or fluids may indicate that the food poisoning is due to a pre-formed enterotoxin.
  - The major aetiological considerations are *S. aureus* and *B. cereus,* and vomitus may be investigated for these organisms.
  - The samples should be collected in sterile universal containers and sent to the laboratory as soon as possible with the food that was eaten.
- Food samples
  - Culture for *Salmonella*, *Shigella*, *E. coli* O157*, C. perfringens, B. cereus, S. aureus, C. jejuni, L. monocytogenes, V. cholerae,* and *Y. enterocolytica* will be performed at the Public Health Laboratory.
- Toxin tests
  - *C. perfringens* toxin test will be done on specimens of faeces only.
  - Toxin tests for *S. aureus* and *B. cereus* will be done if these organisms are isolated from clinical or food samples.

20.3 Environmental swabs

- Samples are collected by swabbing from a group of four articles or components of the same kind and must not include samples taken from any article or component of a different kind. If the number of articles or components of one kind sampled is less than four, the sample is collected from this lesser number.
- Sterile absorbent cotton wool-tipped swabs are used for collection of bacteriological samples.
- For the purpose of sampling, two McCartney 10 mL bottles containing 10 mL of ¼ strength Ringer's solution are required for each article or group of articles or component or group of components.

20.3.1 Area to be swabbed

- In the case of cups, glasses and other drinking utensils, the samples are collected from the exterior and interior surface to a depth of at least 12 mm from the top of the rim.
- In the case of spoons and ice-cream scoops, the samples are collected from the entire inner and outer surface of the bowl.
- In the case of plates, saucers, bowls, etc., over an area of approximately 2500 mm^2 of the surface which comes in contact with the food.
- In case of all other articles or components, samples are collected from all parts of the surface likely to come into contact with the food.

20.3.2 Method of swabbing

- The defined area or areas of each article or component or group of articles from which a sample is to be taken shall be swabbed as follows:
  - First, using a swab moistened with Ringer's solution from one of the McCartney bottles (ensuring excess moisture is removed from the swab by expressing it inside the bottle before removal), swab a 50 x 50 mm area. After sampling, immediately immerse the swab in the same bottle, break off the protruding stick above the bottle's neck, and replace the screw-top.
  - Immediately afterwards, over the same defined area(s), use a dry swab and insert it into the second bottle containing Ringer's solution.
- In each case, ensure each bottle is clearly marked to identify the source of the sample (the article or component from which the sample was taken) and to distinguish the wet from the dry swab.
- The person collecting these samples must, at the time of sampling, record in duplicate the name and address of the premises, the number of articles or components in the group sampled, the sampling time, and the identification mark on each bottle.
- Immediately following the sampling process, the bottles with the swabs, along with the duplicate copy of the recorded details from the previous paragraph, should be delivered to the laboratory within three hours of collection. Where immediate delivery is not possible, samples must be maintained at a temperature not higher than 5°C.

20.4 Collection of milk samples

- Samples are collected using aseptic techniques and transferred to sterile containers while taking precautions to prevent sample contamination.
- Sample containers are surrounded by crushed ice or another suitable refrigerant that can make contact with the container and is effective in reducing and maintaining the temperature until the samples are delivered to the laboratory, ensuring they are kept at a temperature not exceeding 2−8°C.
- In the case of milk or cream, it must be clearly stated whether it is pasteurized, certified, raw, or ultra-heat treated (UHT).
- The volume of the sample must be sufficient i.e., ± 100 mL. Sterile 120 mL sample containers are available from the nearest laboratory.
- A minimum of 50 g of reconstituted powdered milk should be sent to the laboratory at room temperature. Where the powdered milk has been reconstituted, please indicate on the request form if the milk has been pasteurized or not. The water that was used for reconstituting the milk must be sent to the laboratory for investigation as well.

20.5 Collection of domestic potable water samples

- A sterile container should be used. Sterile 120 mL containers are available from the nearest laboratory.
- Alternatively, a glass bottle may be used that has been boiled for 5 minutes and then placed in an oven to air dry at 100°C.
- Allow the water to run for 5 minutes.
- Collect 100−200 mL in a sterile container and ensure that the lid is securely in place.
- Provide all relevant information, including the address as well as telephone and fax numbers, on the request form.
- Place the sample in a cooler box with ice packs and transport it to the laboratory without delay.
- Tests performed for microbiological potability include total plate count (TPC), coliforms, and *E. coli*.
- Samples must be received in the testing laboratory Mondays to Thursdays from 08h30 to 14h00.

20.6 Collection of water samples for the culture of *Salmonella* spp. (including *S.* Typhi), *Shigella* spp. and *Vibrio cholerae*

20.6.1 Sample collection

- One-litre bottles are available from the laboratory. These may be used for Total Plate Count (TPC), coliforms, *E. coli*, *Salmonella,* and *Shigella* testing. For *V. cholerae* testing, an additional one litre sample is required for each test.
- Sterile 100 mL containers are also available, and these may be used for TPC, coliforms, and *E. coli* testing.
- Request forms are also available from the laboratory. Please ensure that a separate request form is used for each sample type e.g., water, food, or milk.
- Liaise with the laboratory ahead of time if you wish to bring a large batch of samples. This is to ensure that adequate media stocks are on hand.
- Start the sampling session early enough in the day to ensure that the samples can reach the laboratory early enough to be processed on the same day.
- In case there are delays, it is recommended to avoid collecting samples the day before a long weekend or on a Friday.
- When sampling from a borehole or tap, allow the water to run for a few minutes so that you do not sample stagnant water in the pipes. Bacterial counts from stagnant water may not be reflective of the true water quality.

- Ensure that the sample is clearly labelled with a marker pen and that the sample container is not leaking.
- Immediately place the sample into a cooler box containing plastic ice packs. Please note that ice blocks from a domestic refrigerator are not a suitable alternative.
- As soon as the sampling session is completed, transport the samples to the laboratory without delay.

20.6.2 Procedure for neutralising chlorine in water samples

- Sodium thiosulphate is used to neutralise chlorine in water samples.
- This is to prevent false negative results due to chlorine activity after the sample is taken.
- Please note that this is only for chlorinated water as supplied by your local municipality and does not apply to river water, dam water, borehole water, or other environmental water samples.
- 0.5 mL of a 1% solution of sodium thiosulphate is added to a 100 mL sample of water. This will inactivate up to 60 parts per million chlorine in the sample.
- It is still important to transport the sample to the laboratory in a cooler box with ice packs as soon as possible.

20.7 Collection of water samples for *Legionella* culture (tested according to ISO 11731)

20.7.1 Sample containers

- Samples of water should be collected in glass, polyethylene, or similar containers able to hold a volume of 1000−2000 mL. One-litre sample bottles are available from the laboratory.
- If the sample containers have been used before, they should be cleaned, rinsed with distilled or mains tap water, and then pasteurized using flowing hot water (>70°C) or steam for at least 5 minutes, or autoclaved at 121°C ± 1°C for 15 minutes.
- Small sterile containers with a capacity of 100−250 mL may be used to collect slime, deposit, or sediment.
- Access to sample points may be difficult, which can make the use of glass containers unsafe because of possible breakage.

20.7.2 Sampling in the presence of Biocide

- If the water sampled contains or is thought to contain an oxidizing biocide, then add an excess of an inactivating agent to the container before or at the time of sampling.
- Chlorine and other oxidizing biocides are inactivated by the addition of potassium thiosulphate or sodium thiosulphate to the container at a concentration of 100 mg per litre.
- For other biocides, the addition of a universal neutralising agent is not yet practicable.

20.7.3 Sampling frequency

- The frequency of monitoring is determined by the level of risk evaluated during the risk assessment e.g., the number of people exposed. The level of risk would vary in different environments.
- It is recommended that low-risk systems should be sampled at least annually.
- If a cooling system has not been in use during the winter months, it should be tested before start-up.

20.7.4 Sample volume

- A minimum of 500 mL is required but 2000 mL is preferred, especially if the water is clear.

20.7.5 Transport to the laboratory

- Samples should be transported to the laboratory between 2°C and 8°C and should be protected from sunlight during transportation.
- Deliver the samples to the laboratory as soon as possible, preferably within one working day but not more than 2 days.
- The maximum time interval between taking the sample and processing is 5 days.
- If the delivery of the sample to the laboratory is delayed, the sample should be stored at 2−8°C.

20.8 Collection of water samples for *Legionella pneumophila* Most Probable Number (MPN) method

20.8.1 Sample containers

- Samples of water should be collected in 120 mL sample containers.

20.8.2 Sample volume

- Minimum sample volumes required is 100 mL.

20.8.3 Transportation to the laboratory

- Samples are transported to the laboratory less than 24 hours after collection at 2−8°C.

20.9 Sewage Effluent and Water Samples for the Culture of *Vibrio cholerae / Salmonella* spp. (including *S.* Typhi)

A Moore pad consists of multiple layers of surgical gauze with wire/string tied to one corner to allow the pad to be fixed in a flowing stream or sewage or water for the detection of *V. cholerae* and *Salmonella* spp. It is useful only for rivers and flowing water sources and offers no particular advantage over other sampling methods for stationary water sources. Surveillance using Moore pads should only be done in high-risk areas where there is a definite chance of cholera or *Salmonella* being detected.

20.9.1 Sample requirements

- Commercially available plain gauze swabs measuring approximately 10 x 10 cm are recommended for sewer pads.
- String/wire of appropriate length. Wire is recommended if rats may be present in sewers.
- Sterile forceps.
- Double strength Alkaline Peptone Water (cholera).
- Buffered Peptone Water (*Salmonella*).

20.9.2 Method

- Fold the gauze over a few times and secure with string/wire.
- Immerse the swab to hang below the surface of the sewage stream.
- The swab should remain in place for 24−72 hours, after which it is removed.
- Gloves must be worn when removing the swab from the sewage stream. Use a pair of sterile forceps and hold the sewer swab above the opening of the wide neck bottle of appropriate broth.
- If the swab is too large to insert into the bottle, cut off a piece of swab with a pair of sterile scissors.
- The forceps and the scissors may be sterilised by keeping them submerged in a container with methylated spirits. Remove when needed and set light with a match/lighter, taking care not to burn hands.

20.9.3 Transportation to the laboratory

- Samples must be taken to the laboratory on the same day of collection.
- If the pad is older than 24 hours, it will not be processed as there will be overgrowth of enteric organisms.

20.10 Air settle plates

- Air settle plates are used to determine the number of microorganisms to settle out of the air by gravity over a specified period.

20.10.1 Sample requirements

- Blood agar is used to isolate bacteria. If a specific organism is sought, a selective medium may be used.
- To isolate fungi (yeast and mould), Sabouraud Dextrose agar is used.

20.10.2 Method

- If plates are refrigerated, remove about 30 minutes before being used.
- Do not use expired or contaminated plates.
- Label base of the plates with the location and date of collection.
- Raise the lid of the agar plate to expose the medium. The lid should rest on the edge of the plate to expose the entire surface of the agar. This should be done in the chosen position(s) approximately 1 m from the floor for 10−60 minutes.
- After exposure time, close the agar plate with the lid and document the exposure time of the plate on the base of the agar.
- Secure the plates with tape or Parafilm or plastic bag.

20.10.3 Transportation to the laboratory

- Send agar plates to the laboratory at room temperature within 24 hours of collection.

20.11 Sterility testing

20.11.1 Sample requirements

Samples tested include pharmaceutical products such as intravenous fluids, antimicrobial substances, eye drops, suture materials, sterile gauze, vaccines, antisera, and water used for irrigation during operations, etc. All substances that may come into contact with wounds or be introduced into the human body and can cause bacterial infections if they are contaminated can be included in this group of samples. Such substances must be sterile before use.

20.11.2 Transportation to the laboratory

- Samples are transported to the laboratory in their original package at room temperature.

20.12 Theatre / Cleanroom audits

- There are several reasons why a hospital theatre/cleanroom validation inspection is requested.
- A newly built or recently upgraded facility should be validated before use.
- In case of an outbreak, it may be desirable to exclude the theatre as a possible source.
- Annual or bi-annual check as per hospital policy.
- Cleanroom audits as requested by the customer.

20.12.1 Routine audits

Routine audits should be conducted annually. As such the year plan should be submitted at the start of the year. The plan will assist the laboratory to ensure the availability of staff, media (agar plates) and that instrument is available and in good working order.

1. All building and engineering work must be complete (new or renovated theatre).
2. All ducting must be vacuum cleaned (new or renovated theatre).
3. The plant must be running on full power for 24 hours before testing.
4. Ensure high-efficiency particulate absorbing (HEPA) filter has been serviced and is in good working condition.
5. Assess that the theatre air changes are adequate (20−25 air changes per hour with 4 fresh air changes per hour).
6. Ensure all surfaces are effectively cleaned with a 2-step cleaning process i.e., first with water and detergent and secondly with disinfectant cleaning.
7. There must be no other activity in the theatre.
8. The theatre is vacant for at least 2 hours prior to testing.

20.13 Available Public Health tests

Table 20-1. Public Health sample instructions

Public Health test		Sample required
Moore pad culture (cholera and *Salmonella*)		Moore pads
Salmonella / *Shigella* / *V. cholerae* / *E. coli* 0157:H7 agglutination		Plate or slope
Environmental swabs		Swab in ¼ strength Ringer's solution or selenite cystine or Fraser broth
Food samples		**Sample required**
Food testing		Minimum 100 g sample for all tests
Individual tests	Total plate count (enumeration)	
	Coliform and *E. coli* (enumeration)	
	Coagulase positive *Staphylococcus* (count)	
	Culture for *S. aureus*	
	Culture for *B. cereus* (count)	
	Culture for *C. perfringens* (count)	
	Salmonella	
	Shigella	
	Y. enterocolytica	
	E. coli O157	
	Faecal enterococci	
	Listeria species	
	Vibrio species	
	Campylobacter species	
Toxin testing	*Bacillus cereus*	
	Staphylococcus aureus	
	Clostridium perfringens	
Milk and dairy products		**Sample required**
Milk & dairy product testing		Minimum 100 mL sample for all tests
Individual tests	Aerobic bacterial count	
	Total coliform and *E. coli* count	
	Alkaline phosphatase test	
	Culture for *Cronobacter sakazakii*	

Milk and dairy products		Sample required
Individual tests	Culture for *S.* Typhi / *Salmonella* spp.	
	Culture for Coagulase positive *Staphylococcus*	
	Culture for *C. perfringens*	
	Culture for *B. cereus*	
Water samples		**Sample required**
Water testing		120 mL sample for all tests
Individual tests	Enumeration of Total plate count (Potable water)	
	Enumeration of coliform and *E. coli* count	
	E. coli Type 1 Count	
	Enumeration of Total plate count (Dialysis water)	
	Culture for *S.* Typhi / *Salmonella* spp.	1 litre of water
	Culture for *Shigella* spp.	1 litre of water
	Culture for *V. cholerae*	1 litre of water
	Culture for *Legionella* species (count)	1 litre of water
Miscellaneous Microbiological Tests		
Air settle plates		Blood agar and Sabouraud Dextrose agar plates
Sterility testing		Intravenous fluids, antimicrobial substances, eye drops, suture materials, sterile gauze, vaccines, antisera, and water used for irrigation during operations
Theatre / Cleanroom audit		ROADAC plates and air sampler

SECTION 21.0

VIROLOGY

21.0 VIROLOGY

21.1 General

- Be specific in your request i.e., state the specific virus AND the specific test method e.g., human immunodeficiency virus (HIV) serology, HIV polymerase chain reaction (PCR), Cytomegalovirus (CMV) or HIV viral load etc. Alternatively state clinical presentation or syndrome including relevant risk factors (e.g., underlying illness, contact) and any suspected viral cause. Contact your local virology department if uncertain or advice is required.
- In general, if the disease is localised in an accessible organ system e.g., pneumonia, diarrhoea, meningitis, send an appropriate specimen from the organ system in question e.g., bronchoalveolar lavage (BAL), stool and cerebrospinal fluid (CSF).
- For systemic diseases such as measles, rubella, and for hepatitis, a clotted (yellow or red top) blood specimen for serological testing is usually indicated.
- All HIV serology, PCR and viral load and drug resistance testing require a dedicated specimen for testing.
- For needle stick injuries, please refer to your local health facility's needle stick injury protocol – testing of source patient (HIV serology, Hepatitis B surface antigen serology, Hepatitis C antibody serology) and exposed health care worker (HIV serology, Hepatitis B surface antibody serology, Hepatitis C antibody serology) is necessary.
- Diagnosis of congenital infection in neonates:
  - **CMV:** Urine or saliva should be collected within 21 days of life – diagnosed by PCR. PCR on blood or dried blood spots (DBS) is less sensitive; CMV IgM antibodies may be false-negative or false-positive.
  - **Rubella:** In patients with suspected congenital rubella, specimens include throat swabs, urine, and cataracts from surgery for rubella virus PCR or serology for rubella virus IgM antibodies.

21.2 Guide to appropriate specimen collection and transport

Any patient test result from the virology laboratory is dependent on the quality of the specimen received. A poorly collected and/or poorly transported specimen can result in:

- Failure to identify a causative virus
- Contamination with bacteria or fungi
- Haemolysis of blood specimens
- Refer to Sections 11.3 and 11.5 for guidance on specimen collection and rejection criteria.

Specimen requirements:

- Swabs for Virology tests, particularly PCR, should not be placed in gel.
- Each specimen must be collected using aseptic/sterile technique.
- The lid of all specimen containers must be tightened to prevent leakage and contamination.
- The specimen container must be labelled with the correct patient details which must match the request form properly.
- Specimens must be kept cold during transportation by using ice or ice packs and must reach the laboratory within 24 hours of collection.
- Specimens must be transported promptly to the laboratory.
- Failure to do this may result in loss of specimen integrity and degradation of viral nucleic acids.

Certain specimens (e.g., swabs, biopsies) must be placed in viral transport medium (VTM) during transit. VTM prevents specimens from drying and prevents the growth of microbial contaminants. It is available from your local laboratory. Frozen VTM must be thawed before use. Once inoculated, VTM can be kept at 2−8ºC.

Table 21-1. Specimen collection methods

Specimen	Collection method
Biopsies / Tissue specimens	• Tissue specimens should preferably be sent in a sterile container with VTM. If VTM is not available, use sterile water or saline – DO NOT use formalin. • Brain tissue for rabies investigation should be transported in sterile 50% glycerol saline. Please refer to the Rabies: Antemortem and postmortem specimen collection guide on pages 218−219 for further details.
Blood	• For viral serology, send a serum specimen (yellow top or red top) tube, or plasma using an EDTA (purple top) tube. • For PCR, send a plasma specimen. For HIV viral load, use an EDTA with gel separator (pearl/white/purple top) tube and mix the blood and the anticoagulant well.
Bone marrow	• Bone marrow aspirate must be collected in an EDTA (purple top) tube.
CSF	Please refer to Section 17.3 on page 148−149 for advice on proper collection of CSF specimens using aseptic techniques. **NOTE:** As far as possible CSF must be collected PRIOR to administration of antiviral or antimicrobial therapy (but without causing delay to initiation of such therapy based on clinical suspicion!).

Specimen	Collection method
CSF	• Ideally 1−2 mL should be submitted to the laboratory for virological testing – larger volumes increase the chance of viral detection. • The ideal tube for collecting CSF specimens for virological testing is a sterile tube with no additives or clot activators. • CSF specimens should be promptly transported to the laboratory. Failure to do so may result in the non-detectability of some viruses. VTM is not required.
Ulcer swab	• Remove a sterile swab from container (without gel). • Rub swab tip in the lesion/ulcer in a circular motion and place tip into VTM. • Break off the swab and tighten container lid. • Dacron swabs are preferable for PCR testing since cotton and wood may inhibit the PCR.
Scabs	• Loose scabs or crusts can be collected with a sterile forceps and placed into sterile containers with or without VTM. • If scabs are still attached to roof, rather collect swab specimens.
Stool	• Specimens should be submitted in a sterile screw cap container as soon as possible after collection (i.e., within 1−2 hours). Care should be taken to ensure that the specimen is not contaminated with urine. • A freshly passed stool specimen (3−4 g) is sufficient for virological testing. • No VTM is needed. • Specimens for acute flaccid paralysis (AFP) surveillance should be sent to the laboratory on ice.
Respiratory samples: Broncho-alveolar lavage (BAL) / Throat swabs / Nasal swab or washings / Naso-pharyngeal swab or aspirates	**NOTES:** • Infections of the lower respiratory tract are a major cause of morbidity and mortality. • Diagnosis of these infections is frequently complicated by specimen contamination with upper respiratory tract secretions during collection. • Please refer to Section 17.6 on page 151 for guidelines on the proper collection of respiratory tract specimens. • All specimen containers must be tightly closed – leaking specimens will compromise the quality of results. • Specimens must be promptly transported to the laboratory. Failure to do so may result in loss of specimen integrity which can lead to unreliable results.

Specimen	Collection method
Respiratory samples: Nasal washings / Naso-pharyngeal aspirates / BAL	• If immediate delivery is not possible, specimens should be kept at 4−8°C until delivery to the laboratory. Specimens should reach the laboratory within 24 hours of collection. **Nasopharyngeal swabbing:** • Remove a sterile swab from container (without gel). • Insert the swab into the nostril, parallel to the palate. If you detect resistance, pull back the swab and try reinserting it at a different angle, closer to the floor of the nasal canal – do not use force. The swab should reach a depth equal to the distance from the nostrils to the outer opening of the ear. Then slowly pull out the swab while rotating it. **Throat swabbing:** • Remove a sterile swab from container (without gel). • Use a tongue depressor and good light. Rub swab tip against posterior pharyngeal wall of the pharynx and place tip into VTM. Break off the upper portion of the swab and tighten the container lid. • Swabs may be sent dry or in VTM to the lab. **NOTE:** Dacron swabs are preferable for PCR testing since cotton and wood may inhibit the PCR. Multiple swabs taken from the respiratory tract of the same patient can be pooled into a single container of VTM.
	Nasal washings / Naso-pharyngeal aspirates: • Use a sterile syringe to aspirate. • Tighten container lid. **BAL:** • Add to a sterile tube.
Urine	• Urine must be sent in a sterile universal container. • Please refer to Section 17.12 on page 167 for guidelines on the proper collection of urine specimens.
Vesicle / Eye fluid	• Aspirate at least 0.2 mL vesicle/blister fluid using an insulin syringe. • VTM should be decanted to about 0.5 mL to avoid over-dilution of specimen. • Once specimen is collected, aspirate VTM into and out of syringe several times. • Release fluid into container and tighten lid. • Do not leave needle and syringe in container. These should be discarded in an appropriate sharp container.

21.3 Viral hepatitis screening

Table 21-2. Guidance on the correct test to be requested

QUESTION	CORRECT TEST
Does my patient have acute hepatitis A?	Hepatitis A virus (HAV) IgM antibodies
Is my patient immune to hepatitis A? (HAV immunity can be due to previous infection or vaccination)	Hepatitis A virus IgG antibodies (anti-HAV IgG)
Does my patient have hepatitis B (acute or chronic) infection?	Hepatitis B virus surface antigen (HBsAg)
Does my patient have acute hepatitis B?	Hepatitis B virus core IgM (anti-HBc IgM) **NB:** Only if HBsAg is positive
Does my patient have highly active hepatitis B?	Hepatitis B virus e-antigen (HBeAg) and e-antibody (HBeAb)
Is my patient immune to hepatitis B? (HBV immunity can be due to previous infection or vaccination)	Hepatitis B virus surface antibodies (anti-HBs)
Does my patient have hepatitis C?	Hepatitis C virus antigen and/or antibodies (anti-HCV or HCV Ag/Ab). If patient is Hepatitis C antibodies positive (and antigen negative for anti-HCV Ag/Ab test), do HCV PCR for confirmation.

Kindly note the following:

- Send a clotted (yellow or red top tube) blood specimen for all viral hepatitis serology testing.
- Hepatitis A and B are common in South Africa (SA). Hepatitis C epidemiology in the general population is poorly characterised. The seroprevalence is high in high-risk groups, such as people who inject drugs and men who have sex with men.
- Hepatitis A does not cause a chronic infection, and therefore does not cause cirrhosis or hepatocellular carcinoma. On the other hand, hepatitis B and C infections can become chronic and cause cirrhosis and hepatocellular carcinoma.
- Positive Hepatitis C antibody test should be confirmed by molecular (PCR) testing.
- Hepatitis D virus (HDV) is acquired either as a co-infection with HBV or as a superinfection in people with HBV infection. HDV can cause acute or chronic infection.
  If HDV is suspected, send blood (purple top tube) for HDV PCR.
- Hepatitis E virus (HEV) seroprevalence rates in South Africa vary by province and range between 2% and 29%. HEV can present as an acute and chronic infection – cases for both have been reported in South Africa.

If HEV is suspected, the following tests may be requested:

- HEV serology: anti-HEV IgM and IgG
- HEV PCR assays

NB: If HDV and HEV are suspected, contact your local laboratory for assistance and advice.

21.4 HIV testing

- HIV infection diagnosis in an adult or child older than 24 months of age is made by a serology test on a clotted (yellow or red top tube) blood specimen. If the screening serology is positive, confirmatory serology will automatically be done on the same specimen. A second clotted blood specimen should be sent for repeat testing to confirm the diagnosis.
- HIV-exposed children younger than 18 months are screened using PCR on a DBS or an EDTA (purple top tube) specimen and confirmed by PCR.
- Children between the ages of 18 and 24 months are screened using serology and confirmed by PCR.
- Please refer to the *Quick Guide to Specimen Collection for HIV PCR* on the next page for guidelines on DBS collection.
- HIV viral load testing is available for monitoring in patients already on antiretroviral therapy and is performed on an EDTA (purple top tube) or EDTA with gel separator (pearl/white/purple top tube) blood specimen.
- HIV drug resistance genotyping is offered for patients failing PI-based or integrase strand transfer inhibitor (INSTI-) based antiretroviral therapy for at least 2 years. The patient's viral load and treatment history must be indicated on the request form. Specimen type for testing is blood collected in an EDTA with gel separator tube or EDTA tube. Resistance testing for patients failing dolutegravir-based regimens must be discussed with the virology laboratory.

PLEASE NOTE: *Separate specimens are required for CD4 and HIV viral load testing as these tests are performed in separate sections of the laboratory. Please also keep in mind that specimens for CD4 must be kept at room temperature, while specimens for HIV viral load testing should be refrigerated. Specimens for CD4 should be placed in a separate bag to keep from mixing them with other specimens and getting accidentally put in the refrigerator. HIV counselling and consent should be obtained from the patient by the attending healthcare worker before the test is done.*

Fig. 21-1. QUICK GUIDE TO SPECIMEN COLLECTION FOR HIV PCR

Two types of blood specimens can be used for an HIV PCR test:

- Dried blood spots (DBS)
  - DBS are technically easier to obtain and are suitable for blood sampling in the primary healthcare setting.
  - The DBS card has 5 pre-printed circles with perforated edges and space for labelling.
  - DBS can be collected from a heel, toe, or finger prick or prepared from venous blood.
  - DBS is the preferred specimen type as blood specimens are prone to degradation and DBS is stable at room temperature.
- Whole blood in an EDTA (purple top) tube
  - Mix blood well to avoid clotting. Clotted blood specimens interfere with HIV PCR test results.

Materials required:

1. **DBS collection kit**
   a) Instructions for performing the procedure are printed on the back of each kit. The kit contains consumables for:
2. **Blood sampling**
   a) Disinfectant for skin (e.g., alcohol swab)
   b) Single use, loaded lancing device (e.g., Hemocue)
   c) Cotton wool or gauze
3. **Collection**
   a) DBS card
   b) Desiccant sachet
   c) Sealable plastic bag
4. **PLUS, you will need:**
   a) CCMT (ARV) NHLS laboratory request form with bar-coded stickers
   b) Powder-free gloves
   c) Drying rack
   d) Biohazard bag: A sealable plastic bag for specimen packaging.

Method:

- Confirm the patient's identity and check the expiry date on the filter paper card.
- Write the name, date of birth and collection date on the filter paper card and complete the request form.
- Select an appropriate puncture site.

In infants and small children, you can use the sides of the heel or big toe. Draw an imaginary line from the midpoint of the big toe to the heel and one from between the 4th and 5th toes to the heel. The areas to the side of these lines on the heel and big toe are safe to use.

In children older than 9 months the finger may be used.

- Warm the area e.g., with a soft cloth moistened with warm water, for 3−5 minutes to encourage blood flow.
- Wash your hands, dry thoroughly and put on gloves.

- Clean the area with an alcohol swab and allow it to dry thoroughly. Failure to allow the alcohol to dry may dilute the specimen.
- Puncture the site using a freshly unpacked sterile lancet.
- Dispose of the lancet safely into a sharps or infectious waste disposal container.
- Wipe away the first blood drop using a clean cotton wool swab. The initial drop contains tissue fluid that may dilute the specimen.

- Allow another large blood drop to form.
- Lightly touch filter paper card onto blood drop. Apply blood only to the side of the filter paper card with the printing on. Allow blood to soak through and to radiate to completely fill the circle but do not layer more than one blood drop onto the same circle. Do not touch the blood spots with your hands or gloves!
- Allow the next drop of blood to form and soak it onto the next marked circle. Repeat until at least three marked circles are filled with blood.
- The pre-printed circles hold ± 75 µL blood each when completely filled. Cards with insufficient blood cannot be processed since the PCR result may be unreliable.

- Apply pressure to the puncture site using clean gauze (or cotton wool) to stop further bleeding and apply a plaster strip to puncture site.
- Place the card in the drying rack without the blood touching the rack.
- Do not allow blood spots to come into contact with any surface or each other.
- Allow it to dry thoroughly for at least 3 hours while keeping it away from sunlight, dust, or insects.
- Place the card with a desiccant sachet into an airtight sealable bag.
- Close the bag and send it together with the request form to the laboratory.
- During transport the specimens should not be left in the car as exposure to sunlight and heat may deteriorate the specimens.

Features of acceptable and unacceptable DBS specimens

Acceptable:

- At least three pre-printed circles should be completely filled with blood.
- The CCMT (ARV) NHLS laboratory bar-coded sticker should be affixed and the DBS card completely and accurately labelled.

Unacceptable:

The laboratory cannot process these DBS cards and repeat specimens will be required to obtain a PCR result.

- Patient details on DBS card are not legible.
- Patient details on DBS card and CCMT (ARV) NHLS laboratory request form do not match, and no barcode sticker is affixed.
- Insufficient specimen for processing.
- Blood spotted outside the pre-printed circle and DBS cards containing clotted/crusted blood.
- Blood spots with serum rings due to contamination with alcohol.

21.5 HPV Genotyping (High-risk)

21.5.1 Specimen collection

- Cervical/endocervical specimen – cervical swab, or cytobrush in liquid-based medium (Surepath or Thinprep, PreservCyt or equivalent solution). Refer to Section 14.2.2.4 for collection technique.
- Anal specimen – anal swab. Place the swab into a liquid-based medium (Surepath or Thinprep, PreservCyt or equivalent solution), and carefully break the swab stick.

21.6 Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2)

SARS-CoV-2 is the pathogen that causes the coronavirus disease 2019 (COVID-19). The clinical spectrum of COVID-19 ranges from an asymptomatic or mild flu-like illness to a severe pneumonia requiring critical care. PCR or rapid antigen tests may be performed, and specimen types include nasal or nasopharyngeal or throat swab, nasal washing, nasopharyngeal aspirates, and bronchoalveolar lavage (BAL) for SARS-CoV-2 PCR.

21.6.1 Who should be tested?

21.6.1.1 Hospitalised patients

- Symptomatic patients must be prioritised, and test results should be received within 24 hours.
- All other patients should be tested upon admission.

21.6.1.2 Any person with symptoms where COVID-19 infection is a possible cause

- Persons at high-risk for infection or poor outcomes e.g., health care workers, individuals older than 60 years, those with comorbidities, and pregnant women, should be prioritised.

21.6.1.3 Postmortem testing

- Postmortem should be conducted in line with current guidelines.

NOTE: Refer to NICD website for updated testing guidelines: https://www.nicd.ac.za/diseases-a-z-index/disease-index-covid-19/frequently-asked-questions/.

21.6.2 SARS-CoV-2 Serology Testing

21.6.2.1 SARS-CoV-2 rapid antigen test

Required specimen type is upper respiratory tract specimens such as oropharyngeal, nasal, or nasopharyngeal swabs or lower respiratory tract specimens such as sputum or tracheal aspirates.

21.6.2.2 SARS-CoV-2 antibody test

- Unlike the PCR and rapid antigen tests, the SARS-CoV-2 antibody test is not for diagnosis.
- Nucleocapsid antibodies is to determine antibodies following natural SARS-CoV-2 infection or vaccination.
- Spike antibodies to determine antibodies following vaccination against SARS-CoV-2.
- Specimen type is clotted blood in yellow top tube.

Refer to Table 21-1 for guidance with SARS-CoV-2 respiratory specimen collection.

21.7 Expanded Program on Immunisation (EPI)-related surveillance

21.7.1 Acute flaccid paralysis (AFP) surveillance

21.7.1.1 Case definition

- A child under 15 years of age with sudden onset of weakness (AFP) of any limb(s), excluding injury but including Guillain-Barré syndrome and transverse myelitis, OR
- A person of any age with paralytic illness in whom a clinician suspects polio.

21.7.1.2 Suspected AFP notification and testing protocol in brief

- Report the case to the local/provincial surveillance officer and obtain an Epidemiological identification (EPID) number – AFP is a Category 1 Notifiable Medical Condition (NMC).
- Complete the case investigation form with the relevant information, including the EPID number. The case investigation form can be obtained from your local surveillance or infection control officer. Alternatively, the form can be downloaded from the following website: NMC_Case_Notification_Form_NOTIFICATION_PAGE_v2_final-Mar2018.pdf (nicd.ac.za).
- Conduct a thorough neurological examination and carefully document the site of paralysis, muscle tone, power, and reflexes.
- Collect two stool specimens, taken 24−48 hours apart, within 14 days of onset of paralysis.
- Send the stool specimens ON ICE, together with the case investigation form to the laboratory to reach the NICD within 3 days after specimen collection.

21.7.2 Measles (rash-based) surveillance

21.7.2.1 Case definition

- Fever
- Maculopapular rash
- Cough, coryza or conjunctivitis

21.7.2.2 Suspected measles notification and testing protocol in brief

- Report the case to the local/provincial surveillance officer and obtain an EPID number.
- Complete the case investigation form with the relevant information, including the EPID number. The case investigation form can be obtained from your local surveillance or infection control officer. Alternatively, the form can be downloaded from the following website: NMC_Case_Notification_Form_NOTIFICATION_PAGE_v2_final-Mar2018.pdf (nicd.ac.za).
- Send the case investigation form AND a clotted (yellow or red top) blood specimen to the laboratory.
- The specimens should be stored at 4−8°C until shipment takes place and should be transported to the NICD on ice packs.
- Throat swabs using the specific VTM will only be collected under specific situations in consultation with NICD. The VTM will be supplied by NICD to the district CDC/EPI coordinator, in consultation with the provincial office.
- Measles is a Category 1 notifiable medical condition (NMC) and immediate reporting within 24 hours of diagnosis is required.

21.8 Special viral pathogens

21.8.1 Suspected human rabies

- Initial symptoms are often non-specific and may include fever, headache, malaise, pruritus and paraesthesia/tingling or pain around the original wound site (which may be healed by the time rabies disease presents).
- A history of animal, particularly dog, exposures provide important epidemiological evidence towards the rabies diagnosis. Lack of history of animal exposure does not exclude the diagnosis of rabies e.g., these events may be mundane (i.e., licks on broken skin or mucosal membranes such as the eyes and nose; small nicks or scratches may also transmit the viruses), young children may not report all exposures, exposures to animals such as bats may be cryptic, and the patient may be unaware of the exposure event.
- Thereafter rabies in humans may present in two ways: Furious/encephalitic rabies or dumb/paralytic rabies.
  - Symptoms of furious/encephalitic rabies include restlessness, agitation,

hallucinations, difficulty with speaking and swallowing, hyper salivation, hydrophobia, and aerophobia.
- With dumb/paralytic rabies symptoms appear over a longer period of time and include ascending (often asymmetrical) flaccid paralysis and confusion with progression to coma.

- Although these signs are characteristic of rabies they may or may not be present in all patients. Rabies disease is always progressive with rapid deterioration of patients over a couple of days. Few patients are hospitalised for more than 1−2 weeks.

21.8.1.1 Protocol for request of laboratory investigation of suspected human rabies cases

- Fully complete the suspected human rabies case history form.
- Call the NICD-NHLS Hotline at (082) 883 9920 or the national line at 0800 029 999 or your local laboratory to inform them about the suspected rabies case.
- Rabies is a category 1 notifiable medical condition and immediate reporting within 24 hours of diagnosis is required.
- Collect appropriate ante- or postmortem specimens according to the *RABIES: Antemortem and Postmortem Specimen Collection Guide* below.

RABIES: Antemortem and Postmortem Specimen Collection Guide

Antemortem specimens

Suitable antemortem specimens for rabies testing include saliva, nuchal skin biopsy and CSF. Submitting a full range of specimens for suspected rabies cases is recommended.

Postmortem specimens

It is important to conduct laboratory investigations on persons who died from a suspected rabies virus infection. A brain specimen (small parts (about 2 cm by 2 cm) cerebellum and cerebrum in glycerol saline) is the preferred specimen, which may be conducted by a Forensic Pathologist. However, if not available, clinicians may obtain a postmortem nuchal skin biopsy for rabies diagnosis.

Saliva specimens

- Collect at least 500 µL of saliva into a universal specimen container – often easiest using a syringe or suction device. Sputum is NOT an acceptable specimen. Swabs are not preferred.
- If possible, collect 3 specimens in total: 1 specimen daily on 3 consecutive days (NOT 3 specimens on the same day).

CSF specimens

- Collect at least 500 µL of CSF in a sterile tube without additives or clot activator.

Nuchal skin biopsy

- A section of skin, 5−6 mm in diameter and ≈ 5−7 mm depth, must be taken from the nape of the neck (see Fig. to the right). It is important that specimens contain hair follicles and should be of sufficient depth to include the cutaneous nerves at the base of hair follicles.
  - Collect the skin biopsy. This can be done as an excision or punch biopsy.
  - Moisten a piece of gauze with saline or water.

- Place the skin biopsy onto, and cover with, a piece of moist gauze.
- Place the gauze with the biopsy into a screw-top container.

Brain specimens

- Whole, half or sections of both the cerebellum and the cerebrum should be submitted.
- Place the specimen in a sterile screw-top container and submerge the specimen in 50% glycerol saline (half volume glycerol and half phosphate buffered saline [PBS]). If glycerol saline is not available: Freeze and send ASAP. DO NOT place in formalin.

Transportation

- The specimens should be packaged in accordance with the guidelines for the transport of dangerous biological goods (triple packaging using absorbent material) and transported directly to:

  Special Pathogens Unit
  National Institute for Communicable Diseases (NICD)
  National Health Laboratory Service (NHLS)
  No. 1 Modderfontein Rd
  Sandringham, 2131
  Gauteng, South Africa
- Keep the specimen cool and send it to the laboratory, ASAP.
- ALL specimens should be labelled AND accompanied by a fully completed Suspected Human Rabies Case History Form.

Please inform the NICD-NHLS Hotline [(082) 883 9920], a 24-hour service for all healthcare professionals countrywide, when submitting specimens for rabies diagnosis.

NOTE: The Hotline is NOT a service for the public. The public should contact the Department of Health for any queries.

- Send the specimens and the fully completed case history form to the laboratory as soon as possible. The case history form can be obtained from the following website:
  NMC_Case_Notification_Form_NOTIFICATION_PAGE_v2_final-Mar2018.pdf (nicd.ac.za).

21.8.2 Suspected Viral Haemorrhagic Fever (VHF)

- The diagnosis of VHF should be considered in any patient who presents with:
  - Acute onset of fever of ≥38°C (less than 3 weeks' duration).
  - Severe prostrating or life-threatening illness.
  - Bleeding manifestations (at least two of the following: haemorrhagic or purpuric rash, petechiae, epistaxis, haematemesis, haemoptysis, blood in stool, or other evidence of bleeding) may be present.
  - No predisposing factors for a bleeding diathesis.
  - An appropriate travel or exposure history, such as:
    - Travel to or residence in an outbreak area within 21 days of onset of illness, or
    - Contact with a dead or sick animal (e.g., bats, mosquitoes, ticks, rodents, or primates), or
    - Epidemiological exposure, including contact with a suspected or probable or confirmed VHF case.

- A wide range of conditions (bacterial, viral, and parasitic infections as well as non-infectious causes) should be considered in the differential diagnosis of VHF.

21.8.2.1 Suspected VHF protocol in brief

- Follow your local regional or provincial protocol for the management of suspected or confirmed viral haemorrhagic fever cases.
- Contact your local virologist or infectious disease specialist physician to discuss the case, including appropriate specimen collection.
- VHF is a category one NMC and immediate reporting within 24 hours of diagnosis is required.
- Report all suspected cases to the NICD and NHLS 24-hour Hotline for Clinical Advice at (082) 883 9920.

21.8.2.2 The following principles should be observed in the collection of all patient specimens

- Only specimens essential for diagnosis or monitoring should be obtained.
- Specimens should be collected by an experienced staff member. Staff should wear the appropriate personal protective equipment as per institutional protocols for infection control, including long-sleeved gowns, aprons, gloves, and face shields or surgical masks with eye protection during specimen collection.
- Wherever possible, glass containers should not be used. Disposable sharp objects, such as scalpel blades, should be placed in puncture-resistant waste containers immediately after use and later autoclaved before disposal or incineration.
- Blood specimens must be collected with extreme care to avoid self-inoculation. Needles should not be bent, broken, removed from disposable syringes, or otherwise handled. After use, blood-taking equipment should be immediately placed in a rigid plastic waste container filled with disinfectant solution and autoclaved before disposal or incineration.
- The entire outside surface of each specimen container should be wiped with disinfectant, and a label should be attached bearing the patient's name, hospital number, source of the specimen and date of collection. Clinical laboratory specimens should be placed in plastic bags that are sealed, and then transported in durable, leak-proof containers directly to the receiving area of the laboratory by the responsible health care worker. The outside of these bags should be wiped with a disinfectant solution such as 1:100 dilution of household bleach before leaving the patient's room.

- VHF specimens must not be delivered to the general receiving laboratory under any circumstances, it is the responsibility of the clinician in charge of the suspected VHF patient to contact the laboratory and arrange for the specimens to be received.

Laboratory staff should be alerted to the nature of the specimens

Adapted from: Abraham E, et al. Viral Hemorrhagic Fevers (VHFs) Contingency Plan – Ontario, Canada.

SECTION 22.0

GENETIC TESTING: SAMPLE COLLECTION, TRANSPORT, AND PATIENT REFERRAL

22.0 GENETIC TESTING: COLLECTION, TRANSPORT, AND PATIENT REFERRAL

Results of tests for inherited disorders carry serious medical and social implications for the patient and his/her family. For this reason, patients should be counselled by a clinician/medical geneticist/genetic counsellor on the genetic background, informativity and potential implications of the test results. The relevant details may be obtained by contacting the laboratory (see Table 7-1 on pages 21−57).

Written, informed consent should be obtained for certain types of genetic testing e.g., predictive or carrier. This should be obtained from the patient, or in the case of a minor, from the parents or guardians. It is also very important to provide the laboratory with a detailed family history (a pedigree sketch, if possible) and clinical information, as this may have an impact on the test report and subsequent counselling. This information may be provided by completing a special Genetic test request form, which should be available from the referral laboratory. Alternatively, the Hospital, Clinic or Comprehensive Care request form may be used, with additional notes attached.

All test requests referred for genetic testing, including aneuploidy screening (QF-PCR analysis), single gene testing, MLPA and routine chromosomal analysis (karyotyping), must contain adequate and relevant clinical information indicating the reason for the request. This information is essential for ensuring that appropriate testing is performed and to assist with the interpretation of results.

Failure to provide clinical information associated with any test request will result in the specimen being discarded and a rejection report being issued.

It is also essential that all request forms contain clear contact details of the requesting clinician.

22.1 Cytogenetics

Cytogenetic studies refer to the study of chromosomes. Cytogenetic tests can be divided into:

1) Traditional cytogenetic tests (e.g., cell culture, karyotyping, and fluorescent *in situ* hybridization (FISH)), and
2) Molecular cytogenetic tests (e.g., multiple ligase-dependent probe amplification (MLPA), quantitative fluorescence polymerase chain reaction (QF-PCR) for aneuploidy and microarray analysis).

22.1.1 Specimen types

- Peripheral blood
- Cord blood
- Amniotic fluid
- Bone marrow
- Chorionic villi specimens (CVS), products of conception (POC), and skin
- Specimens for FISH studies

22.1.2 Specimen collection

All specimens are to be kept at room temperature or in fridge until collected for transport to the laboratory.

22.1.2.1 Peripheral blood

- For traditional cytogenetic tests, specimens should be collected using sterile technique into a 5 mL heparinised (green top) tube. A minimum of 2 mL blood should be collected. If using a paediatric tube, 0.5 mL of blood is sufficient for the culture and analysis.
- For molecular cytogenetic test, blood specimens should be collected using sterile technique into a 5 mL EDTA (purple top) tube. A minimum of 2 mL blood should be collected. If using a paediatric tube, 0.5 mL of blood is sufficient.
- For haematological cytogenetics, a minimum of 4 mL of blood should be collected into a heparinised (green top) tube. A blast count of at least 20% is required for initiation of peripheral blood leukemic cell cultures.

22.1.2.2 Amniotic fluid

- Approximately 10−15 mL of amniotic fluid should be collected into a sterile 25 mL universal container supplied by the laboratory. If the initial volume of specimen is blood-stained, the remainder should be collected into a second tube to reduce the amount of maternal contamination (both tubes are submitted). Some specimen syringes have a rubber plunger which is toxic to cells. It is therefore advisable to transfer the fluid into a universal container as soon as possible after sampling. The amniotic fluid should reach the laboratory within 24 hours of sampling.
- If molecular prenatal testing (i.e., mutation analysis for single gene disorders) is requested in addition to cytogenetic analysis, an additional volume of the fluid should be collected (approximately 5 mL) into a separate, clearly marked, universal container.

22.1.2.3 Bone marrow aspirate

- At least 1−5 mL of bone marrow should be collected into a 5 mL heparinised (green top) tube, using sterile techniques.

22.1.2.4 Chorionic villus samples (CVS), products of conception (POC), and skin

- All specimens should be taken using sterile technique and transported to the laboratory in sterile saline. DO NOT fix in formalin.
- Whole foetuses or large tissue specimens are not a suitable sample type for genetic testing, as genetic laboratories do not have resection or appropriate disposal facilities.

22.1.2.5 Specimens for FISH studies

Different types of specimens can be used for constitutional and oncology FISH studies. Most constitutional FISH tests, except 22q deletion syndrome, have been replaced by MLPA. The following specimens can be used for FISH:

- Amniotic fluid
- EDTA and heparinised blood specimens
- Peripheral blood smears
- Heparinised bone marrow aspirate specimens
- Bone marrow smears
- Fluid specimens (e.g., pleural or ascitic fluid)
- Paraffin-embedded tissue (3−5 µm sections on positively charged slides)
- Cytological preparations
- Cell suspensions from cultured peripheral blood lymphocytes or bone marrow aspirates
- Single cell isolated from solid tumours
- Single cell suspensions
- Buccal swabs

22.1.3 Specimen transport

- Specimens should be transported in cooler boxes (ice packs may be used) and protected from direct sunlight.
  NB: Specimens MUST NOT BE FROZEN. Cooler boxes and ice packs may be used.
- Fresh specimens for culture and FISH studies must reach the referral laboratory within 48 hours of sampling.
- Older specimens will be discarded due to significant risks of infection.

22.2 Molecular genetics

Molecular genetic testing is based on analysis of extracted genetic material (DNA or RNA), for the purpose of mutation detection. This, for the most part, involves testing for heritable monogenic disorders and certain types of cancers. DNA-based parentage and human leukocyte antigen (HLA) typing is also offered.
Requests for testing are categorised as:

- **Diagnostic:** The patient is symptomatic.
- **Predictive:** The patient is asymptomatic but is at risk of having inherited a mutation previously detected in other members of his/her family and developing symptoms at a later stage in life. It is important to realise that some predictive genetic tests have a predictive testing protocol attached to them. For example, predictive testing for Huntington Disease follows an international protocol whereby individuals must see a genetic counsellor, among other specialists, before the laboratory will perform the test. The referral laboratory can put you in touch with a genetic counsellor or medical geneticist who can advise you on how to refer your patient (see Table 7-1 on pages 21−57).
- **Carrier:** The patient is asymptomatic but may be carrying a disease-causing mutation, which could be passed onto his/her offspring in the case of autosomal recessive or X-linked conditions.
- **Prenatal:** DNA of an unborn foetus is tested for the presence of a disease-causing mutation.
- **Preclinical:** There is a known disease in the family and family members are tested before symptoms present as early intervention and management is warranted (e.g., sibling of a child with cystic fibrosis or Fanconi anaemia), or individuals who are tested as part of newborn screening programmes.

22.2.1 Specimen types

- Peripheral blood
- Amniotic fluid
- CVS
- Tissue (fresh, or fresh frozen, or formalin-fixed, paraffin-embedded (FFPE) tissue)
- Dried blood spot
- Other (buccal swabs, saliva, etc.)

22.2.2 Specimen collection

All specimens are to be kept at room temperature or in the fridge until collected for transport to the laboratory.

22.2.2.1 Peripheral blood

At least 5 mL of blood should be collected into an EDTA (purple top) tube. Where possible, two or three tubes should be collected to allow for potential future testing and storage. In paediatric cases, an attempt should be made to obtain at least 2 mL of blood. A lesser volume may yield insufficient DNA for certain types of analyses. In problematic cases, the testing laboratory should be contacted for details. Blood should be received within 72 hours of sampling, as prolonged delay will compromise the quality of the extracted DNA and may result in specimen rejection.

NB: It is essential to ensure proper mixing of the blood with the anticoagulant in the tube, as even partial clotting will drastically affect the DNA yield.

22.2.2.2 Amniotic fluid

Molecular prenatal testing may be requested alone or in addition to cytogenetic analysis. It is however recommended that mutation analysis be accompanied by karyotyping for aneuploidies and chromosomal structural aberrations. Care must be taken to collect a sufficient volume of the fluid, and to transport it according to the requirements for both types of investigations (see CYTOGENETICS). Amniotic fluids should be collected into sterile 25 mL universal containers supplied by the laboratory. If the initial volume of specimen is blood-stained, the remainder should be collected into a second tube to reduce the amount of maternal contamination (both tubes are submitted). An additional universal container should be collected if both molecular (e.g., mutation analysis) and cytogenetic testing are required. Some specimen syringes have a rubber plunger which is toxic to cells. It is therefore advisable to transfer the fluid into a universal container as soon as possible after sampling. Amniotic fluids should reach the laboratory within 48−72 hours of collection for molecular testing.

22.2.2.3 CVS and fresh tissue

- All specimens should be taken using sterile technique and transported in sterile saline to the laboratory. Do not freeze. Do not fix in formalin. Fresh tissue specimens for DNA extraction should not be larger than approximately 1 cm^3.
- **NB:** Whole organs or large tissue specimens are not a suitable specimen type for genetic testing, as genetic laboratories do not have resection facilities.

22.2.2.4 Formalin-fixed, paraffin-embedded (FFPE) tissue

- DNA can be extracted from tissue sections and used in molecular assays. This is most commonly done in cancer genetics, though it is also occasionally performed as part of other types of genetic investigations. Paraffin blocks or mounted (unfixed) sections may be submitted.
- It may be important to mount (do not fix) the section on a slide and delineate the extent of the tumour and the normal tissue in a section using a koki pen. This is specifically required for microsatellite instability (MSI) testing in Lynch syndrome and should be performed as shown on the next page. The laboratory where the test is performed should be contacted to confirm details.

22.2.2.5 Other specimen types

Genetic material can also be extracted from other specimen types such as buccal swabs, saliva, body fluids, etc. This however should be discussed with the referral laboratory before submitting the specimen, to confirm suitability for the specific investigation and methodology employed by the laboratory.

Specimens for mitochondrial genetics include peripheral blood – as per Section 22.2.2.1 on page 229, urine – 10 mL preferably early morning urine specimen in a universal urine container, tissue (i.e., muscle/liver) – to be frozen immediately and transported to the laboratory on dry ice unless it can be delivered to the lab on ice within 12 hours.

22.2.3 Specimen transport

Specimens for DNA studies

Specimens must be transported at room temperature and be protected from direct sunlight. All fresh blood/tissue/fluid specimens should reach the laboratory within 3 days of sampling.

NB: Except for tissue biopsy specimens for mitochondrial genetics, specimens MUST NOT BE FROZEN. Cooler boxes and ice packs may be used.

A: Following histological examination, the extent of the tumour must be delineated on the original H&E slide, by outlining it in a koki pen. The normal parts of the section should be marked out in a similar manner.
T = tumour, N = normal

B: Additional slides (3 or 4, if possible) of about 8 microns in thickness must then be cut for DNA extraction, using a fresh blade to prevent DNA contamination from other specimens. These unstained sections should then be lined up against the H&E slide and the tumour and normal parts outlined with a koki pen.

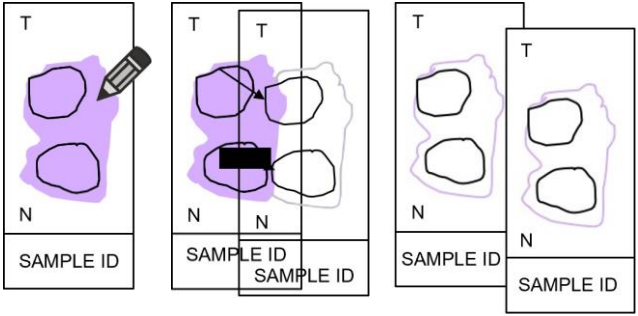


Fig. 22-1. Mounting unfixed sections

22.3 Referral of patients for genetic counselling and/or assessment by a medical geneticist

Patients with confirmed or suspected genetic conditions, and their families, should be referred. There is also a Medical Geneticist and Genetic Counsellor on call to answer any queries relating to genetic testing and/or patients with confirmed or suspected genetic diagnoses that clinical colleagues may have. Clinical genetic services are available in Gauteng, Western Cape, KwaZulu Natal and Free State. The NHLS Clinical Genetics Section can put you in touch with any existing Clinical Genetic Services within your province. The phone numbers can be found in Table 7-1 on pages 21−57.

SECTION 23.0

IMMUNOLOGY

23.0 IMMUNOLOGY

23.1 General

The five major disciplines in Immunology are: Auto-immune disease diagnostics, Allergology, Tissue Immunology, Immunodeficiency testing and Serology. Only four National Central laboratories cater for all these disciplines and most NHLS laboratories refer specialised Immunology tests to these major centres. The majority of testing is done on serum; therefore 5 mL clotted blood (red or yellow top tube) will suffice, with the exception of:

- Immunodeficiency testing (i.e., lymphocyte- and neutrophil function analysis etc.) require EDTA (purple top tube) blood.
- Tissue immunology (entails the isolation of viable cells or DNA) require ACD (light yellow top tube), EDTA (purple top tube), or heparinised (green top tube) blood, depending on the test and/or testing site requirement. Please liaise with the testing laboratory when human leukocyte antigen (HLA) typing is required.

23.2 Allergology – Testing for allergens (allergies)

Allergology or the identification of known allergen sensitisation are requested to diagnose:

- Atopy (i.e., causes for rhinitis/hay fever)
- Food allergies
- Sensitisation to occupational allergens
- Possible parasitic infections.

There are over 600 allergens available as well as a variety of mixed associated allergens (i.e., paediatric foods, nut mixes, mould mixes, etc.). It is impossible to cater for all these allergens and allergen availability should be confirmed with the testing laboratory. Please indicate clearly on the request form which specific allergens should be tested for.

23.3 Laboratory investigations for inborn errors of immunity (IEI) / primary immunodeficiency diseases (PID)

Inborn errors of immunity (IEI) / primary immunodeficiency diseases (PID) are a group of heterogeneous genetic disorders that cause enhanced susceptibility to recurrent and severe infections.

Warning signs of primary / genetic immunodeficiency:
Recurrent infections are the hallmark of genetic immunodeficiency, remembered by the acronym **SPUR** – Serious, Persistent, Unusual, Recurrent.
The warning sign may however include auto-immune manifestations in the very young.

A family history of genetic immunodeficiency must always be pursued in the work-up of suspected IEI/PID.

***SPUR** infections may be*:

Serious infections

- Eight or more new ear infections within 1 year.
- Two or more serious sinus infections within 1 year.
- Failure of an infant to gain weight or grow normally.
- Need for intravenous antibiotics to clear infections.
- Two or more deep-seated infections.

Persistent infections

- Two or more months on antibiotics with little effect.
- Two or more pneumonias within 1 year.
- Persistent thrush in mouth or elsewhere on skin, after age 1.

Unusual infectious agents

- Fungi or parasites (e.g., *Pneumocystis jiroveci* and Giardia).
- Bacille Calmette-Guérin (BCG)-osis.
- Systemic or deep infections with non-tuberculous mycobacteria or recurrent infections.
- Vaccine-associated poliomyelitis, infections with other live vaccines (measles, varicella, rotavirus).

Recurrent infections

- Deep skin or organ abscesses
- *Neisseria* infections
- Herpes viral infections
- Infections with encapsulated bacteria (*Streptococcus pneumoniae, Haemophilus influenzae* type b, *Moraxella catarrhalis*).

Some of these infections may be **alerted to by vigilance of the laboratory service**, before a clinical diagnosis is even considered and should be flagged by the Pathologist as possible PID when signing out these results – these include **BCG-osis in an HIV-negative infant, disseminated poliovirus infection, staphylococcal liver abscess culture in a child, recurrent meningococcal infection**. They also include results of severe **lympho/neutropenia, microplatelets, and agammaglobulinaemia.**

Basic tests for screening for the majority of clinically relevant PID – FBC & differential, IgG, IgM, IgA & IgE can be performed at or via a regional laboratory, these should point out the major antibody deficiencies which make up over 50% of PID.

23.3.1 Quick reference guide for tests, TrakCare codes and NHLS labs for PID testing

23.3.1.1 General screening tests

- Full Blood Count (FBC) with differential count and peripheral smear:
  The following effects, if noted on the peripheral smear, may be relevant to IEI or other pathology:
  - **Neutropenia:** May be congenital or cyclic or may occur in aplastic anaemia.
  - **Lymphopenia:** Suggests a possible T-cell disorder in the absence of HIV infection because 70% of circulating lymphocytes are T-cells.
  - **Leucocytosis** that persists between infections may occur in leukocyte adhesion deficiency.
  - **Thrombocytopenia** with low mean platelet volume (MPV) in male infants suggests possible Wiskott-Aldrich syndrome.
  - **Anaemia** may suggest anaemia of chronic disease or auto-immune haemolytic anaemia, which may occur in common variable immune deficiency (CVID) and other immunodeficiencies.
  - **Peripheral blood smear** should be examined for Howell-Jolly bodies and other unusual RBC forms, which suggest primary asplenia or impaired splenic function. Granulocytes may have morphologic abnormalities (e.g., giant granules in Chédiak-Higashi syndrome).
  - **Granules of myeloid cells** not stained – Myeloperoxidase deficiency.
- Exclude chronic infection: HIV, cytomegalovirus (CMV), Epstein-Barr virus (EBV), and tuberculosis (TB).

  NOTE: ***For PID testing, please contact the individual laboratory and discuss the case before sending specimens*****.**

Table 23-1. List of IEI tests

Test	Sample
Immunoglobulins	Clotted blood
Sweat test	In vivo
Autoimmune Antinuclear antibodies (ANA) / Celiac screen / Thyroid / Anti-neutrophil cytoplasmic antibodies (ANCA) / Diabetes mellitus (DM)	Clotted blood
Allergy: FX5 / Paediatric food and Phadiotop®	Clotted blood
T, B, and NK cell enumeration	
Lymphocyte phenotyping	1 EDTA tube, should reach lab within 24 hours

NOTE: *For further investigation of suspected IEI / PID, please contact the relevant laboratory to obtain further information.*

Depending on the history, examination, and screen results further testing should be directed as outlined below:

- **Humoral (B-cells and Ig subclasses)**
  - Cells & Ig subclasses
  - Vaccination response
- **T-cell function**
  - Lymphocyte proliferation
  - Naive / memory CD4 & CD8 cells
- **Phagocyte functions**
  - Oxidative burst
  - Phagocytic index & chemotaxis
- **Complement**
  - Total haemolytic C' (CH50/100)
  - C3, C4
  - C6
  - Factor B
  - C1 Esterase inhibitor
- **Specific panels**
  - Lamina-associated domain (LAD) / Auto-immune lymphoproliferative syndrome (ALPS) / αβ / γδ T-cells

Confirmatory, more specialised and genetic tests: Please contact the individual laboratory and discuss the case prior to sending specimens.

SECTION 24.0

FORENSIC CHEMISTRY LABORATORIES

24.0 FORENSIC CHEMISTRY LABORATORIES

24.1 Introduction

This section serves as a guide to the services offered by the NHLS Forensic Chemistry Laboratories (FCLs). Please contact the laboratory if any additional information is required (see Table 7-1 on page 57 for contact numbers of FCLs and their hours of operation).

As one of the specialised institutes within the NHLS, FCLs render services to the Forensic Pathology Services (FPS), South African Police Service (SAPS), and Department of Health (Environmental Health).

The locations of the four FCLs in South Africa, their customers, and services provided by each are indicated in Table 24-1 below.

Table 24-1. FCL locations, customers and services rendered

FCL location	Customers	Services rendered
Cape Town	Western Cape, parts of Northern Cape (Southern Region) and Eastern Cape (Toxicology and Food only)	Blood Alcohol, Food and Toxicology analysis
Durban	Eastern Cape and KwaZulu Natal	Blood Alcohol and Carbon Monoxide analysis
Johannesburg	Free State, South Gauteng and North West (Southern Region)	Blood Alcohol, Food and Toxicology analysis
Pretoria	Mpumalanga, Limpopo, Northern Cape (Northern Region), North Gauteng, North West and KwaZulu Natal (Toxicology only)	Blood Alcohol, Food and Toxicology analysis

24.2 Specimen Collection Guidelines

As per the National Forensic Pathology Services Committee (NFPSC) guidelines:

- The decision of whether to submit specimens for toxicological analysis should be made after careful assessment of all available facts regarding the death.
- Due consideration should be given to the circumstances under which the death occurred, with special reference to the clinical history of the deceased

immediately prior to his/her death, the findings of the postmortem examination and the results of police enquiries. Consultation with the clinician/family/ SAPS investigating officer is essential.

24.2.1 Completing the request form

- Complete the test request form as described in Section 9, pages 65−70.
- A receipt (indicating the laboratory reference number) needs to be obtained from the laboratory admissions person or the SAPS investigating officer to whom the specimens have been submitted.
- This receipt must be retained in the FPS postmortem record folder, for possible later production in court.

24.2.2 Specimen Collection for Postmortem Toxicology Analysis

Medico-legal postmortem examinations must be carried out by an authorised person appointed by the province for this purpose, on the body of a person who has allegedly died from unnatural causes, as soon as is possible.

24.2.3 Toxicology specimens for investigation

24.2.3.1 Specimens for analysis for alcohol concentration and/or ancillary forensic toxicological screening

- Blood, urine, eye fluid, or cerebrospinal fluid (CSF) may be submitted for analysis.
- Blood specimens should normally only be harvested from peripheral vascular sources such as the femoral or axillary vessels.
- Specimens for the determination of alcohol concentration should not be taken from body cavities or the heart, as localised diffusion of alcohol from the stomach into the surrounding tissues may occur.
- Only the prescribed containers containing Sodium Fluoride (preservative) as well as Potassium Oxalate (anti-coagulant) should be used for purposes of alcohol concentration determination.
- Where possible, the recommended containers should be filled to a level ranging between 50% and 75% of their total capacity, and the package instructions should be carefully adhered to.
- In cases where suitable blood specimens cannot be obtained, such as with charred or exsanguinated bodies, it may be appropriate to consider collecting muscle or vitreous specimens.
- The submission of urine specimens alone for determination of alcohol concentration is not recommended.

- **All specimens must be labelled, packaged, and sealed according to the instruction leaflets. The seal numbers must be recorded in the postmortem report.**
- The autopsy report should not be released until the alcohol and/or toxicology results have been obtained and interpreted.

24.2.3.2 Selection of specimens for toxicological analysis

- **Routine specimens**
  Poison is taken by mouth and is absorbed from the stomach and upper portions of the small intestine, is metabolised in the liver, and is mainly eliminated via the kidneys into the urine.
- **Fluid specimens to be submitted routinely for analysis**
  - Blood (clotted 10−50 mL)
  - Urine
  - Stomach and its contents
  - Bile
- **Additional specimens**
  The following "solid tissue" specimens may also be submitted where indicated:
  - Liver (without gallbladder) or portion thereof with its total mass stated.
  - Kidneys or portion thereof with its total mass stated.
- **Other specimens** may be submitted in addition to the above, depending on the circumstances, including:
  - Specimens found at the scene indicating the type of poison.
  - Vomiting is often an early sign of poisoning and much of the poison which has been taken may be ejected in the vomitus in an unaltered form. Analysis of the vomitus may thus afford very useful information as to whether poison was ingested and if so, in what form.
  - In cases in which the principal action of the poison is on the nervous system e.g., barbiturates, it may be desirable to submit the brain and sample of the CSF for analysis.
  - In cases of suspected carbon monoxide poisoning, blood should be submitted for carboxyhaemoglobin analysis.
  - Where heavy metal poisoning, such as arsenic, is suspected, hair and nail specimens should be submitted in addition to the routine specimens mentioned above. In cases of heavy metal poisoning, some of the poison may be excreted through the colon, leading to erosions of its mucous membrane. In such cases, the colon contents should be submitted for analysis.
  - The intestines should always be removed and opened at postmortem examination in cases of suspected poisoning. Both their contents and mucous membrane surfaces should be carefully inspected for the

presence of any abnormalities or lesions. If indicated, the intestinal contents should be submitted for analysis.

- Occasionally poison may be administered as an enema. In such cases the sigmoid colon and rectum should be examined after retention of contents. If indicated, the colon and rectal content should be submitted for analysis.
- Drugs/poisons may be administered by sniffing, injection into the subcutaneous tissues, muscles, or genital tract in cases of abortion. In such cases the appropriate tissues or organ should be submitted for analysis together with the appropriate control samples.
- In all cases of suspected poisoning, due consideration should be given to the taking of specimens for histological examination.

24.3 Specimen Rejection Criteria

FCLs do not reject any specimens submitted to the laboratory. An anomaly form is completed by the reception personnel and the customer, and this form is then kept on record. Anomalies are documented on certificates and affidavits.

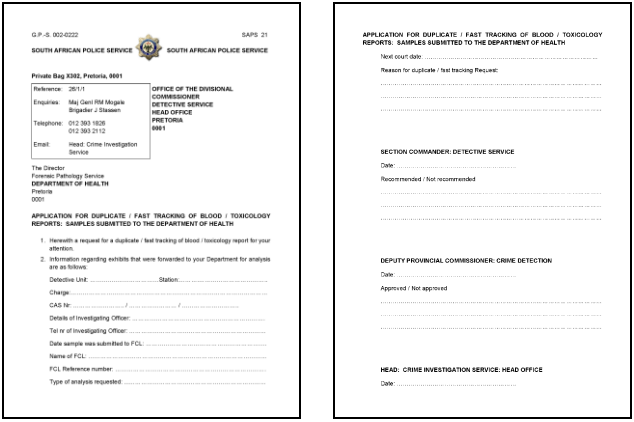
Anomalies reported on Affidavits and Certificates

- Unsealed (cable tie not fastened).
- Unsealed (cable tie assembled incorrectly and can therefore be pulled through).
- Unsealed (cable tie broken).
- Unsealed (container hole damaged).
- Unsealed (cable tie loosely bound – sample accessible).
- Unsealed (no outer seal).
- No red stickers cardboard box.
- Unsealed (seal not closed properly).
- Unsealed (string not threaded through holes of container).
- Unsealed (sealed on one side only).
- Observation: Seal number on outside does not match container label outside.
- Cardboard box was not sealed since no seal strip over edges of box.
- Cardboard box was not sealed since the seal strip was damaged.
- Observation: Specimen sealed with two different seal numbers.
- Unsealed (sealed on two sides only).
- Incorrectly sealed, 3 seals pasted on the polystyrene container inside the cardboard box.
- Inside and outside labels do not match.
- Inside label not attached.

- Both labels were inside and there was no identification of the specimen.
- No analysis possible. Specimen bottle broken.
- No analysis possible. Specimen tube broken.
- No analysis possible. Specimen was clotted.
- No analysis possible. Specimen dried up.
- No analysis possible. Specimen bottle was unused.
- No analysis possible. Specimen tube was unused.

24.4 Application for duplicate reports/Fast-tracking of specimens submitted for analysis

The laboratory shall give priority status to urgent specimens upon receipt of a written request as per the form below, signed by the relevant authorities.



G.P.-S. 002-0222 SAPS 21

SOUTH AFRICAN POLICE SERVICE SOUTH AFRICAN POLICE SERVICE

Private Bag X302, Pretoria, 0001

Reference: 25/1/1
Enquiries: Maj Gen/ RM Mogale
Brigadier J Slaawen
Telephone: 012 393 1826
012 393 2112
Email: Head: Crime Investigation Service

OFFICE OF THE DIVISIONAL COMMISSIONER
DETECTIVE SERVICE
HEAD OFFICE
PRETORIA
0001

The Director
Forensic Pathology Service
DEPARTMENT OF HEALTH
Pretoria
0001

APPLICATION FOR DUPLICATE / FAST TRACKING OF BLOOD / TOXICOLOGY REPORTS: SAMPLES SUBMITTED TO THE DEPARTMENT OF HEALTH

1. Herewith a request for a duplicate / fast tracking of blood / toxicology report for your attention.
2. Information regarding exhibits that were forwarded to your Department for analysis are as follows:

Detective Unit: ..... Station: .....
Charge: .....
CAS Nr: ...../...../.....
Details of Investigating Officer: .....
Tel nr of Investigating Officer: .....
Date sample was submitted to FCL: .....
Name of FCL: .....
FCL Reference number: .....
Type of analysis requested: .....

APPLICATION FOR DUPLICATE / FAST TRACKING OF BLOOD / TOXICOLOGY REPORTS: SAMPLES SUBMITTED TO THE DEPARTMENT OF HEALTH

Next court date: .....
Reason for duplicate / fast tracking Request:
.....
.....
.....

SECTION COMMANDER: DETECTIVE SERVICE

Date: .....
Recommended / Not recommended
.....
.....
.....

DEPUTY PROVINCIAL COMMISSIONER: CRIME DETECTION

Date: .....
Approved / Not approved
.....
.....
.....

HEAD: CRIME INVESTIGATION SERVICE: HEAD OFFICE

Date: .....

Fig. 21-1. Application form SAPS 21 for Fast-tracking and Duplicate reports

24.4.1 Request to fast-track specimens for analysis

The following specimens shall be **prioritised**:

- Specimens marked as URGENT by the client.
- Specimens requested by the clients to be prioritised e.g., court case.
- Specimens of a foreigner or high-profile case.
- Specimens for deoxyribonucleic acid (DNA) and blood alcohol analysis.
- Requests approved by the Head of the FCL.

Note that queries from private legal officials (e.g., private lawyers, members of the public or insurance companies) will not be assisted. Queries from these individuals will be redirected to the relevant prosecutor, court, investigating officer, station commander or mortuary manager.

24.4.2 Request for duplicate reports

- Original reports and certified copies will be provided exclusively to the laboratory's official clients.
- Two original reports are issued per specimen. Only one original report is issued to the client.
- The second original report is kept at the laboratory, along with the specimen's accompanying documentation, which is then archived.
- Requests for certified copies of issued reports from SAPS are directed to the Head of the FCL, then forwarded to the Principal Forensic Analyst using form SAPS 21.
- The laboratory shall retrieve the report and make a copy.
- The Principal Forensic Analyst or designate personnel shall stamp and sign as Commissioner of Oaths.
- The laboratory shall inform the client that the report is ready for collection.

SECTION 25.0

LIST OF TESTS OFFERED BY THE NHLS

25.0 LIST OF TESTS OFFERED BY THE NHLS

Table 25-1 from the next page onwards shows the tests, specimen types and special instructions for tests performed by the NHLS laboratories. Refer to your local laboratory or service level agreements signed between NHLS and the different provinces for turnaround time (TAT). The clinic and hospital TATs will also vary because of the transport between laboratory and clinic or hospital. Some tests are only done in certain laboratories depending on the resources available and the number of requests received per laboratory, please consider this factor as well for TATs.

Table 25-1. NHLS test list

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
11-deoxycortisol	5 mL clotted blood (yellow top tube)	Not to be measured within first 3 days of life.
17-hydroxyprogesterone (17-OHP)	5 mL clotted blood (yellow top tube)	Not to be measured within first 3 days of life. Avoid haemolysis. Specimen to reach laboratory within 24 hours. Kindly make sure the patient's age is clearly stated on the request form.
5-hydroxy-indoleacetic acid (5-HIAA)	24-hour urine collection (best practice) OR 20 mL random urine for babies	Please collect urine in a dark container containing HCl and refrigerate it during the collection process. See Section 15.2.7 on page 130 for detailed instructions and precautions.
5-α-Reductase Deficiency (SRD5A2) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
α-1-antitrypsin clearance	Timed (24-hour) stool collected in a pre-weighed container AND 5 mL clotted blood (yellow top tube)	To collect 24-hour stool specimen. Collect pre-weighed plastic container from the laboratory.
α-1-antitrypsin	5 mL clotted blood (yellow top tube)	
α-1-antitrypsin Deficiency (Serpina1) (DNA analysis)	4 mL EDTA blood (purple top tube)	Clearly mark for Genetic testing laboratory to avoid confusion. DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
α-1-iduronidase enzyme activity (Hurler's disease)	Adults: 12−15 mL ACD solution B (light yellow top tube) blood (3 tubes); Children: 5 mL ACD solution B (light yellow top tube) blood (1 full tube)	
α-foetoprotein (amniotic fluid)	5 mL amniotic fluid in a plain collection tube without additives	
α-foetoprotein (CSF)	1 mL CSF in a plain collection tube without additives	
α-foetoprotein (serum)	5 mL clotted blood (yellow top tube)	
α-galactosidase enzyme activity (Fabry's disease)	10 mL clotted blood in red top tube (no gel)	
α-Thalassaemia (DNA analysis)	4 mL EDTA blood (purple top tube)	A full blood count and Haemoglobin electrophoresis must be performed prior to DNA analysis. DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
α-Thalassaemia Mental Retardation Syndrome (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Acanthamoeba culture	For *Acanthamoeba* keratitis, corneal scraping, or biopsy in saline	**NOTE:** Contact NICD for instructions.
Acetaminophen (Paracetamol)	5 mL clotted blood (yellow top tube)	
Acetylcholine Receptor Antibodies	5 mL clotted blood (yellow top tube)	For transport separate serum and send frozen on dry ice.
Activated protein C resistance (APCR)	5 mL blood in sodium citrate (blue top) tube	Please provide full clinical history. Specimen should reach the laboratory within 6 hours of collection. If delays are anticipated, contact the relevant laboratory for further instructions.
Acute flaccid paralysis (AFP) surveillance	2 x fresh stool specimens in a universal container on ice taken 24−48 hours apart within 14 days of onset of paralysis	Case notification required. See Section 21.7.1 on page 216 for specific guidelines on this notifiable condition.
Acylcarnitine profile (plasma)	2 mL blood in heparin (green top) tube on ice	Deliver the specimen to the laboratory on ice immediately after collection. Essential to confirm fatty acid oxidation disorders. Please allow a turnaround time of 6−8 weeks.
Acylcarnitine profile (urine)	25 mL random urine in a universal container	Not offered as a standalone test. Needs to be coupled with blood specimen. Deliver the specimen to the laboratory on ice immediately after collection.
ADAMTS13 antigen, activity and auto- antibody	5 mL blood in sodium citrate (blue top) tube	Full clinical history required. Specimen must reach the laboratory within 6 hours of collection.
Adenosine deaminase (CSF)	0.5 mL CSF in a plain collection tube without additives	
Adenosine deaminase (fluid)	5 mL fluid in a plain collection tube without additives	Pus and bloody fluid specimens are unsuitable.
Adenosine deaminase (serum)	5 mL clotted blood (yellow top tube)	Anaerobic collection. Keep tube tightly stoppered. Allow to clot at room temperature. To be processed by the laboratory within 4 hours of collection.
Adenovirus isolation (culture)	Random urine specimen in a universal container OR respiratory tract specimen in viral transport medium (VTM)	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Adenovirus PCR	Random urine specimen in a universal container, respiratory tract specimen in viral transport medium (VTM), 4 mL EDTA blood (purple top tube), 5 mL clotted blood (yellow or red top tube), 1 mL CSF in a plain collection tube without additives OR 1−2 g fresh stool specimen in a universal container.	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Adenovirus typing	Random urine specimen in a universal container, respiratory tract specimen in viral transport medium (VTM), 4 mL EDTA blood (purple top tube), 5 mL clotted blood (yellow or red top tube), 1 mL CSF in a plain collection tube without additives OR 1−2 g fresh stool specimen in a universal container.	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Adenovirus type 40/41 Antigen Rapid test	1−2 g fresh stool specimen in a universal container	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Adrenocorticotrophic hormone	4 mL EDTA blood (purple top tube) on ice	Collect blood in pre-cooled collection tube. Place on ice immediately after collection and deliver to the laboratory. Consider factors such as prior administration of corticosteroids and time of sampling (diurnal variation).
Alanine aminotransferase (ALT)	5 mL clotted blood (yellow top tube)	
Albumin (CSF)	0.5 mL CSF in a plain collection tube without additives	
Albumin (fluid)	5 mL fluid in a plain collection tube without additives	
Albumin (urine)	25 mL random (early morning) or timed urine in a universal container	Testing is not recommended on blood-stained urine.
Albumin (serum)	5 mL clotted blood (yellow top tube)	Avoid prolonged stasis during venesection.
Alcohol (ethanol) (serum)	5 mL clotted blood (yellow top tube)	Results cannot be used for medico-legal purposes. Do not clean collection site with alcohol.
Aldolase	5 mL clotted blood (yellow top tube)	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Aldosterone	5 mL clotted blood (yellow top tube)	See Section 15.2.5 on page 128 for detailed instructions and precautions. Record time of day and position of the patient (supine or upright). Careful standardisation of the patient preparation and sampling condition is strongly recommended for valid results.
Alkaline phosphatase (ALP)	5 mL clotted blood (yellow top tube)	
Alkaline phosphatase (bone specific)	5 mL clotted blood (yellow top tube)	Avoid haemolysis during venesection.
Alkaline phosphatase iso-enzymes	5 mL clotted blood (yellow top tube)	Avoid haemolysis during venesection. A fasting specimen is preferred.
Allergy Test: Food Panel (RAST)	5 mL clotted blood (yellow top tube)	
Allergy Test: Inhalant Panel (RAST)	5 mL clotted blood (yellow top tube)	
Allergy Test: Inhalant screen (Phadiatop)	5 mL clotted blood (yellow top tube)	
Allergy tests (IgE-specific Antibodies)	5 mL clotted blood (yellow top tube)	Please specify allergens on the request form. Testing is done in batches.
Aluminium (serum)	5 mL blood in a trace metal (royal blue top, additive-free) tube	Test very prone to contamination. See Section 15.2.12 on page 132 for detailed instructions.
Aluminium (urine)	25 mL random urine in a universal container. Contact laboratory in case an acid-washed container is required (supplied by lab).	Test very prone to contamination. See Section 15.2.12 on page 132 for detailed instructions.
Amikacin	5 mL clotted blood (yellow top tube)	Trough levels to be collected 30 minutes prior to next dose, peak levels to be collected 30 minutes after a 1-hour infusion. Please state the time of last dose on the request form.
Amino Acids (CSF) (quantitative)	0.5 mL CSF in a plain collection tube without additives	Deliver the specimen to the laboratory immediately after collection. Individual amino acids may also be requested.
Amino Acids (serum or plasma) (quantitative)	2 mL clotted blood (yellow top tube) OR heparinised blood (green top tube)	Minimum acceptable volume 1 mL. Deliver the specimen to the laboratory immediately after collection. Pre-prandial specimen preferred. Individual amino acids may also be requested.
Amino Acids (urine)	25 mL random urine in a universal container on ice	Deliver the specimen to the laboratory immediately after collection. Individual amino acids may also be requested.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Aminolevulinic acid (ALA)	Random or 24-hour urine specimen	Protect specimen from light during collection and transport. Random urine specimen may be collected during an acute attack. Early morning urine is needed for latent porphyria.
Aminophylline (see Theophylline)		
Ammonia	Pre-arrange with the laboratory (minimum 2 hours before collecting blood), 4 mL EDTA blood (purple top tube) on ice	Neither patient nor phlebotomist may smoke in the 8-hour period prior to specimen collection. Avoid haemolysis. Fill tube up to fill line and keep the tube closed. Place specimen on ice immediately after collection and deliver to the laboratory within 15 minutes.
Amphetamines (urine) (qualitative)	25 mL random urine in a universal container	
Amylase (fluid)	5 mL fluid in a plain collection tube without additives	
Amylase (serum)	5 mL clotted blood (yellow top tube)	Serum lipase recommended for acute pancreatitis. Specimen to be processed by the laboratory within 2 hours of collection.
Amylase (urine)	25 mL random urine in a universal container	Deliver the specimen to the laboratory on ice immediately after collection. Serum lipase recommended for acute pancreatitis.
Andermann Syndrome (SLC12A6 gene) (Afrikaner) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Androgen Receptor Insensitivity (AR) (DNA analysis)	4 mL EDTA blood (purple top tube)	Please discuss with Groote Schuur – Inherited Metabolic Diseases laboratory prior to sending. DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Androstenedione	5 mL clotted blood (yellow top tube)	
Angelman/Prader Willi Syndrome Methylation study (DNA analysis)		DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Angiotensin-converting enzyme (ACE)	5 mL clotted blood (yellow top tube)	Icteric and lipaemic specimens are not suitable. Collect fasting specimen. Specimen to be processed by the laboratory within 6 hours of collection.
Anti - Adrenal Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Aquaporin 4 (AQP4) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Cardiac Muscle Antibodies	5 mL clotted blood (yellow top tube)	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Anti - Cardiolipin (ACLA) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Centromere Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Cyclic Citrullinated Peptide (CCP) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - DNase B titre	5 mL clotted blood (yellow top tube)	
Anti - double stranded DNA Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Endomysium Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Extractable Nuclear Antigen (ENA) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - factor Xa activity test for Low Molecular Weight Heparin (LMWH) and Direct oral anticoagulants (DOACs) e.g. Rivaroxaban	5 mL blood in sodium citrate (blue top) tube	Specimen must be taken 3 hours after last dose of LMWH. Specimen must reach the laboratory within 30 minutes of collection. For DOACs e.g. Rivaroxaban, please contact the relevant laboratory.
Anti - Fibrillarin Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Ganglioside Antibody screen (Immunoblot)	5 mL clotted blood (yellow top tube)	
Anti - gliadin (deamidated) Antibodies (IgA and IgG)	5 mL clotted blood (yellow top tube)	Work-up of Coeliac disease. If the patient is on gluten-free diet, the diagnostic tests for Coeliac disease may be false-negative.
Anti - Glomerular Basement Membrane (GBM) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Glutamic Acid Decarboxylase/Islet Antigen 2 (GAD/IA2) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Histone Antibodies	5 mL clotted blood (yellow top tube)	
Anti - IgE Receptor Antibodies	5 mL clotted blood (yellow top tube)	Specimens are batched and sent to Germany for testing. Turnaround time is approximately 3 months.
Anti - Islet Antigen 2 (IA2) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Jo-1 Antibodies	5 mL clotted blood (yellow top tube)	
Anti - La (SSB) Antibodies	5 mL clotted blood (yellow top tube)	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Anti - Liver/Kidney Microsomal Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Mi-2 Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Mitochondrial Antibodies	5 mL clotted blood (yellow top tube)	
Anti - myelin oligodendrocyte glycoprotein (MOG) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Myeloperoxidase (MPO) Antibodies/perinuclear ANCAs (pANCAs)	5 mL clotted blood (yellow top tube)	
Anti - myositis screen	5 mL clotted blood (yellow top tube)	
Anti - Neuronal Antibody screen (Cerebellum/ Paraneoplastic)	5 mL clotted blood (yellow top tube)	
Anti - Neutrophil Cytoplasmic Antibodies (ANCA)	5 mL clotted blood (yellow top tube)	
Anti - N-Methyl-D-aspartate (NMDA) Receptor Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Nuclear Antibodies (ANA)	5 mL clotted blood (yellow top tube)	
Anti - Nucleosome Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Pancreas Islet cell Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Parietal cell Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Phosphatidyl serine Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Phospholipid Antibodies	5 mL clotted blood (yellow top tube)	Both anti-cardiolipin antibodies (ACLA) and anti-β2 glycoprotein 1 antibodies will be tested.
Anti - Polymyositis/ Scleroderma (PM/Scl) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Proteinase 3 (PR3 cANCA) Antibodies	5 mL clotted blood (yellow top tube)	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Anti - Reticulin Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Ribonucleoprotein (RNP) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Ribosomal P Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Ro (SSA) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - *Saccharomyces cerevisiae* Antibodies (ASCA)	5 mL clotted blood (yellow top tube)	
Anti - Scleroderma 70 (Scl70) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Skeletal (Striated) Muscle Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Skin Auto-antibodies	5 mL clotted blood (yellow top tube)	
Anti - Smith (Sm) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Smooth Muscle Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Streptolysin O (ASO) titre	5 mL clotted blood (yellow top tube)	
Anti - Thrombin	5 mL blood in sodium citrate (blue top) tube	Specimen must reach the laboratory within 4 hours of collection. Drug history is important.
Anti - Thyroglobulin Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Thyroid peroxidase Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Thyroid stimulating hormone (TSH) receptor Antibodies	5 mL clotted blood (yellow top tube)	
Anti - Tissue Transglutaminase (tTG) Antibodies (IgA and IgG)	5 mL clotted blood (yellow top tube)	Work-up of Coeliac disease. If the patient is on a gluten-free diet, the diagnostic tests for Coeliac disease may be falsely negative.
Anti - U1 Ribonucleoprotein (RNP) Antibodies	5 mL clotted blood (yellow top tube)	
Anti - β2 Glycoprotein 1 Antibodies	5 mL clotted blood (yellow top tube)	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Antimullerian hormone (AMH)	5 mL clotted blood (yellow top tube)	
Apolipoprotein A1	5 mL clotted blood (yellow top tube)	
Apolipoprotein B	5 mL clotted blood (yellow top tube)	
Apt test (foetal haemoglobin)	5–10 mL gastric aspirate or meconium in a universal container	Deliver the specimen to the laboratory on ice.
Autosomal recessive polycystic kidney disease (PKHD1) Afrikaner (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
ARMS PCR BRAF (Hairy cell leukaemia)	4–8 mL EDTA blood (purple top tube) or Bone marrow aspirate or Extracted genomic DNA >10 ng/µl	
ARMS PCR BRAF (solid tumour)	FFPE tissue block or fresh tissue biopsy or 5−10 x 4 µm FFPE sections on normal glass slides	Tumour ringed area on H&E slide plus histology report to accompany tissue block
Arsenic (hair)	Hair plus roots	At least 100 mg hair plus roots is required – mark root end with a piece of cotton.
Arsenic (nails)	Nails	At least 100 mg of nails is required.
Arsenic (blood)	4 mL EDTA blood (purple top tube)	Patient must not eat seafood for 72 hours before specimen collection.
Arsenic (urine)	25 mL random urine in a universal container. Contact laboratory in case an acid-washed container is required (supplied by lab).	Patient must not eat seafood for 72 hours before specimen collection.
ARXdup24 (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Aryl sulphatase A enzyme activity (leukocyte) (metachromatic leukodystrophy)	Please contact the laboratory (Braamfontein) for tube type	Please write clearly on request form: DO NOT SPIN. Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection – specimen must reach the referral laboratory within 24 hours of collection.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Ashkenazi Jewish Screen (common Ashkenazi mutations: Cystic fibrosis, Fanconi Anaemia, Tay Sachs Disease, Canavan Disease, Familial Dysautonomia, Mucolipidosis IV, Niemann-Pick Disease Type A, Glycogen Storage Disease Type 1a, Bloom Syndrome) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Aspartate aminotransferase (AST)	5 mL clotted blood (yellow top tube)	Avoid haemolysis
Asperigillus Precipitin	5 mL clotted blood (yellow top tube)	
Astrovirus antigen ELISA	1−2 g fresh stool specimen in a universal container	Deliver the specimen to the laboratory on ice. Specimens are batched and testing is performed once a week.
Auto-immune encephalopathy	5 mL clotted blood (yellow top tube)	
Avian Precipitin (Budgerigar)	5 mL clotted blood (yellow top tube)	
Avian Precipitin (Parrot)	5 mL clotted blood (yellow top tube)	
Avian Precipitin (Pigeon)	5 mL clotted blood (yellow top tube)	
β-2 microglobulin (serum)	5 mL clotted blood (yellow top tube)	
β-2 microglobulin (urine)	25 mL random urine in a universal container	
β-2 transferrin (CSF)	Fluid in a plain collection tube without additives	Preferably collect 1 mL of fluid in question from ear/nose.
β-D Glucan	1−5 mL clotted blood (separate yellow top tube)	Please submit a separate blood collection tube. Test cannot be added as an after-request.
β-galactocerebrosidase enzyme activity (Krabbe's disease)	Adults: 12−15 mL ACD solution B (light yellow top tube) blood (3 tubes); Children: 5 mL ACD solution B (light yellow top tube) blood (1 full tube)	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
β-glucocerebrosidase enzyme activity (Gaucher's disease)	Adults: 12−15 mL ACD solution B (light yellow top tube) blood (3 tubes); Children: 5 mL ACD solution B (light yellow top tube) blood (1 full tube)	
β-human chorionic gonadotrophin (serum) (quantitative)	5 mL clotted blood (yellow top tube)	
β-human chorionic gonadotrophin (urine) (qualitative)	5 mL random urine in a universal container	
β-Thalassaemia (DNA analysis)	4 mL EDTA blood (purple top tube)	A full blood count and Haemoglobin electrophoresis must be done prior to DNA analysis. DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
B-type natriuretic peptide (BNP)	4 mL EDTA blood (purple top tube)	Avoid haemolysis during venesection.
Barbiturates (serum)	5 mL clotted blood (yellow top tube) ON ICE	
Barbiturates (urine) (qualitative screen)	25 mL random urine in a universal container	
Bardet-Biedl Syndrome (common Caucasian BBS1 mutation) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Bardet-Biedl Syndrome BBS10 (common Xhosa BBS10) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Barth Syndrome (TAZ1) (DNA analysis)	4 mL EDTA blood (purple top tube)	Only upon biochemical confirmation. DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Beckwith-Wiedemann syndrome	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Benzodiazepines (serum)	5 mL clotted blood (yellow top tube)	
Benzodiazepines (urine) (semi- quantitative screen)	25 mL random urine in a universal container	
Beta-cross links (B-CTx)	5 mL clotted blood (yellow top tube)	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Bile acids (serum)	5 mL clotted blood (yellow top tube)	Deliver the specimen to the laboratory on ice. Specimen to reach the laboratory within 2 hours of collection. Indicated for pregnant women with cholestasis of pregnancy. Require fasting. Avoid haemolysis during venesection.
Bile salts (urine)	25 mL random urine in a universal container	Qualitative test (only indicates whether bile salts present or absent). NOT appropriate for pregnant women with cholestasis of pregnancy.
Bilharzia (*Schistosoma*) Antibodies	5 mL clotted blood (yellow top tube)	
Bilharzia (*Schistosoma*) microscopy	Stool, urine specimen in a universal container	Optimal collection time of urine for *Schistosoma haematobium* and stool for *Schistosoma mansoni* is between 10h00 and 14h00. Please state clearly on the request form that Bilharzia (*Schistosoma*) microscopy is requested
Bilirubin (amniotic fluid) (OD 450)	15 mL amniotic fluid in a collection tube without additives	Protect specimen from light. Avoid contamination with blood during collection.
Bilirubin (conjugated/direct)	5 mL clotted blood (yellow top tube)	Prevent exposure to light.
Bilirubin (total)	5 mL clotted blood (yellow top tube)	Prevent exposure to light.
Bilirubin (urine) (qualitative dipsticks)	25 mL random urine in a universal container	Protect specimen from light (specimen must be wrapped in tin foil). Deliver to the laboratory within 4 hours of collection.
Biotinidase Deficiency (BDT) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Biotinidase enzyme activity	4 mL EDTA blood (purple top tube)	Before collecting the specimen, please arrange the test with the referral laboratory (obtain their contact details from the local laboratory). Deliver the specimen to the laboratory on ice.
BK virus PCR	4 mL EDTA blood (purple top tube) OR random urine specimen in a universal container	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Bleeding time	No blood specimen is required as the test is done on the patient at the bedside	Please contact the laboratory to arrange for the test.
Blood Alcohol and Fluoride	10 mL postmortem blood	Submit one specimen. All Blood alcohol specimens are tested for Fluoride.
Blood cultures	Adults: 20 mL blood divided between 2 blood culture bottles; Children: See Section 17.2.4 on page 144 for guidance on paediatric volumes.	Do not cover the bottom of the bottle or the bottle's barcode with the patient label. See Section 17.2.6 on page 144 for detailed collection instructions.
Blood gas	Capped heparin syringe, no air bubble	See Section 15.2.4 on page 128 for detailed instructions and precautions.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Blood Grouping: ABO Blood Grouping	4 mL EDTA blood (purple top tube)	Deliver the specimen to the laboratory at room temperature as soon as possible after collection.
Blood Grouping: Atypical antibody identification	4 mL EDTA blood (purple top tube)	Deliver the specimen to the laboratory at room temperature as soon as possible after collection.
Blood Grouping: Atypical antibody titration	4 mL EDTA blood (purple top tube)	Deliver the specimen to the laboratory at room temperature as soon as possible after collection.
Blood Grouping: Blood Group system phenotyping	4 mL EDTA blood (purple top tube)	Deliver the specimen to the laboratory at room temperature as soon as possible after collection.
Blood Grouping: Rhesus (Rh typing)	4 mL EDTA blood (purple top tube)	Deliver the specimen to the laboratory at room temperature as soon as possible after collection.
Blood-brain barrier studies (CSF IgG index)	1 mL CSF in a plain collection tube without additives AND 2 mL clotted blood (yellow top tube)	Please submit concomitant serum specimen for result interpretation.
Bloom Syndrome (Ashkenazi Jewish) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
BMT Chimerism analysis (DNA analysis)	4 mL EDTA blood (purple top tube)	
Bone Marrow Aspirate for Tuberculosis culture	Collect in BACTEC Myco/F Lytic blood culture bottle or sterile heparinised tube	Please clearly indicate specimen type on request form.
Bone Marrow Aspirate for *Salmonella* Typhi/Typhoid fever	Collect in an aerobic blood culture bottle	Please clearly indicate specimen type on request form.
Bone Marrow Aspirate (BMA) Morphology	6 x BMA slides	A full clinical history must be provided. Request Full Blood Count with Differential on the same day. Specimens must be delivered to the laboratory immediately after collection.
Bone Marrow trephine (BMT) (Histology)	Core biopsy in sterile container with formalin	Contact laboratory for preferred medium.
Bordetella pertussis culture	Sputum specimens and/or nasopharyngeal swab/aspirate in a sterile universal container	Please see Section 17.6.2.5.2 on page 159 for more details.
Bordetella pertussis PCR	Sputum specimens and/or nasopharyngeal swab/aspirate in a sterile universal container	Please see Section 17.6.2.5.2 on page 159 for more details.
Bordetella pertussis serology	5 mL clotted blood (yellow top tube)	Paired serum specimens for specific anti-PT antibodies should be collected

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
		during the early catarrhal stage (acute serum) and about 1 month later (convalescent serum). Serology should not be used for diagnosis in infants.
Breast Cancer Familial (common mixed ancestry mutations) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Breast Cancer Familial (common Afrikaner mutations) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Breast Cancer Familial (common Indian mutations) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Breast Cancer Familial (comprehensive BRCA1/BRCA2 mutation screen) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Breast Cancer Familial (common Ashkenazi Jewish mutations) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Brucella abortus (Malta fever) agglutination test	5 mL clotted blood (yellow top tube)	
Brucella IgG & IgM Antibodies	5 mL clotted blood (yellow top tube)	
Bruton's X-linked Agammaglobulinaemia (exon3 BTK) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Buffy coat smear	4 mL EDTA blood (purple top tube)	Requested as part of the Full Blood Count and platelets. Please arrange this test with the laboratory before specimen collection.
C1-Esterase inhibitor	5 mL clotted blood (yellow top tube)	
CA 125	5 mL clotted blood (yellow top tube)	
CA 15-3	5 mL clotted blood (yellow top tube)	
CA 19-9	5 mL clotted blood (yellow top tube)	
CA 72-4	5 mL clotted blood (yellow top tube)	
Cadmium (blood)	4 mL EDTA blood (purple top tube)	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Cadmium (urine)	25 mL random urine in a universal container. Contact laboratory in case an acid-washed container is required (supplied by lab).	
Caeruloplasmin	5 mL clotted blood (yellow top tube)	
Calcitonin	5 mL clotted blood (yellow top tube) on ice	Fasting blood specimen required. Deliver the specimen to the laboratory on ice immediately after collection. Specimen should be processed within 15 minutes.
Calcium (free/ionised)	Capped heparin syringe, no air bubble	Place specimen on ice immediately after collection and deliver to the laboratory within 30 minutes. Maintain anaerobic conditions.
Calcium (total)	5 mL clotted blood (yellow top tube)	Avoid prolonged stasis during venesection.
Calcium (urine)	Random or timed urine (U-Ca/day)	Collect a urine specimen in a container with HCl, which is available from the laboratory.
Calculus (stone) analysis	Clinical specimen in a universal container	Send the specimen as is, do not put in any fluid.
Calprotectin	Random stool specimen in universal container	
CALR exon 9 / MPL exon 10 mutations in Myeloproliferative neoplasms	4−20 mL peripheral EDTA blood (purple top tube)	Specimens must reach the Molecular Haematology laboratory within 72 hours of collection.
Canavan Disease (Ashkenazi Jewish) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Cannabinoids (urine) (semi-quantitative screen)	25 mL random urine in a universal container	
Carbamazepine (Tegretol)	5 mL clotted blood (yellow top tube)	Collect trough level just before next dose. Please state the time of last dose on the request form.
Carbohydrate-deficient transferrin (CDT)	5 mL clotted blood (yellow top tube)	
Carbon dioxide (total) (serum bicarbonate)	5 mL clotted blood (yellow top tube)	
Carbon dioxide (total) (urine bicarbonate)	10 mL random urine in a universal container	Please fill the urine container completely, ensuring there is no free air, and then deliver it to the laboratory on ice. Please submit simultaneous serum specimen for result interpretation.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Carboxyhaemoglobin	Contact laboratory for collection details	Before collecting the specimen, please arrange the test with the referral laboratory (obtain their contact details from the local laboratory). Please fill the tube completely, ensuring there is no free air, and then deliver it to the laboratory on ice immediately after collection.
Carbon monoxide	10 mL postmortem blood	
Carcinoembryonic antigen (CEA)	5 mL clotted blood (yellow top tube)	
Carnitine profile (serum)	5 mL clotted blood (yellow top tube)	Deliver the specimen to the laboratory on ice immediately after collection.
Carnitine profile (urine)	25 mL random urine in a universal container	Deliver the specimen to the laboratory on ice immediately after collection.
CAST (Cellular Assay Stimulation Test) assay	2 x 4 mL EDTA blood (purple top tube) ON ICE	Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection – specimen must reach referral laboratory within 24 hours of collection. Specimen must be wrapped in bubble wrap to prevent lysis. Some allergy tests are only available as CAST assays.
Cell count	3 mL serosal fluid in an EDTA (purple top) tube OR 1 mL CSF in a tube without any additives	For serosal fluid please contact your laboratory for specimen tube type.
Cerebrotendinous Xanthomatosis (CYP27A1) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Charcot-Marie-Tooth (CMT1A/HMSN1A) (PMP22 duplication) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Chitotriosidase enzyme activity (Gaucher's disease)	5 mL clotted blood (yellow top tube)	
Chlamydia polyvalent Antibodies (IFA)	5 mL clotted blood (yellow top tube)	
Chloride (CSF)	Test discontinued in several labs. Contact lab to confirm if test is still offered.	
Chloride (serum)	5 mL clotted blood (yellow top tube)	
Chloride (stool)	Watery stool in a universal container	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Chloride (urine)	25 mL random urine in a universal container	
Cholera culture	Fresh stool specimen in a universal container OR rectal swabs	Please indicate this request on the request form as this is not part of the routine stool culture.
Cholesterol (fluid)	5 mL fluid in a plain collection tube without additives	
Cholesterol (serum) (total)	5 mL clotted blood (yellow top tube)	
Cholinesterase (pseudo) (serum)	5 mL clotted blood (yellow top tube)	Avoid haemolysis during venesection.
Cholinesterase (red cell)	Contact laboratory for tube type	
Cholinesterase phenotyping (dibucaine and fluoride numbers)	5 mL clotted blood (yellow top tube)	Defer testing until after scoline apnoea has resolved.
Chromium (urine)	25 mL random urine in a universal container. Contact laboratory in case an acid-washed container is required (supplied by lab)	
Chromium (blood)	4 mL EDTA blood (purple top tube)	
Chromogranin A	Contact laboratory for tube type and special instructions	Patient must rest for 30 minutes before test. Deliver the specimen to the laboratory on ice.
Chromosome analysis (constitutional)	5 mL blood in lithium heparin (green top) tube without gel; 10 mL amniotic fluid; 10−15 mg chorionic villus specimen in a universal container; products of conception in a sterile container OR a minimum of 2 g tissue in normal saline in a universal container	Ensure meticulously sterile sampling conditions. Do not use expired tubes and avoid clotting. Specimens must reach the referral laboratory within 48 hours of collection.
Chromosome analysis (oncology)	5 mL leukemic blood in sodium/lithium heparin (green top) tube; bone marrow aspirate in a sodium heparin (green top) tube OR a minimum of 2 g tissue in normal saline in a universal container	Ensure meticulously sterile sampling conditions.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Chromosome breakage analysis: Fanconi Anaemia	5 mL blood in lithium heparin (green top) tube without gel	Do not use expired tubes and avoid clotting. Specimen must reach the referral laboratory within 48 hours of collection.
Chylomicrons	5 mL fluid in a plain collection tube without additives	
Circulating Immune Complexes (CIC)	5 mL clotted blood (yellow top tube)	
Citrate (urine)	25 mL random urine in a universal container or timed urine	Collect a 24-hour urine specimen in a container with HCl, which is available from the laboratory.
Citrulline	4 mL EDTA (purple top tube) or heparin (green top tube) blood	Before collecting the specimen, please arrange the test with the referral laboratory (obtain their contact details from the local laboratory). Deliver the specimen to the laboratory on ice immediately after collection.
Clonazepam (Rivotril)	Contact laboratory for tube type	Indicate on the request form weight and age of patient, and time of dose prior to specimen collection. Preferably take trough level just before next dose.
Clostridioides (previously *Clostridium*) *difficille* testing	Watery, unformed stool specimen in a sterile universal container (the stool should take the form of the container)	Deliver the specimen to the laboratory on ice. Submit 3 freshly passed stool specimens on separate days to increase the probability of detection.
Clozapine (Leponex)	5 mL clotted blood (yellow top tube)	
CNS virus panel PCR	1 mL CSF in a plain collection tube without additives	Specific viruses in the panel depend on the assay used by the different referral laboratories. Deliver the specimen to the laboratory on ice.
Cobalt (serum)	5 mL blood in a trace metal (royal blue top, additive-free) tube	
Cobalt (urine)	25 mL random urine in a metal-free container	
Cocaine (urine) (qualitative screen)	25 mL random urine in a metal-free container	
Codeine (urine) (semi-quantitative screen for opiates)	25 mL random urine in a universal container	
Cold agglutinins	4 mL EDTA blood (purple top tube)	This test must be arranged with the laboratory before specimen collection. Blood tubes, syringes, needles must be kept at 37ºC before and after blood collection.
Complement C3	5 mL clotted blood (yellow top tube)	
Complement C4	5 mL clotted blood (yellow top tube)	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Complement C6	5 mL clotted blood (yellow top tube)	
Complement (Total, Classic)	5 mL clotted blood (yellow top tube) on ice	Deliver the specimen to the laboratory on ice.
Complement, total haemolytic (CH50/100)	5 mL clotted blood (yellow top tube) on ice	Deliver the specimen to the laboratory on ice immediately after collection.
Congenital adrenal hyperplasia (CYP21A2) gene: MLPA (Multiplex ligation-dependent probe amplification); CYP21A2 Full gene sequencing (where indicated)	4 mL EDTA blood (purple top tube) (not to be frozen)	For MLPA, please submit clinical summary and 17-OHP results. Please note testing will not commence without 17-OHP results except under exceptional circumstances, discussed with the laboratory beforehand. CYP21A2 full gene sequencing will ONLY be performed if negative on MLPA and clinically very suggestive or where only one variant was detected on MLPA. Strong motivation required. Ideally Synachten stimulation testing performed before requesting.
Coombs (Direct - screening)	Contact laboratory for tube type	
Coombs (Direct - typing)	Contact laboratory for tube type	
Coombs (Indirect)	Contact laboratory for tube type	
Copper (liver) (Wilson's disease)	Liver biopsy	Collect biopsy specimens into sterile plastic tubes.
Copper (blood)	5 mL clotted blood (yellow top tube)	Avoid haemolysis during venesection.
Copper (urine)	24-hour urine collection (best practice) OR random urine in a universal container	
Corneal scraping MC&S	Labelled slides and brain heart infusion (BHI) plate	Please contact the laboratory for special instructions on specimen collection.
Cortisol (saliva)	Saliva collected into a Salivette device	Patient must not eat, chew gum or brush teeth 30 minutes before collection. Rinse mouth with cold water 5 minutes before collecting at least 0.5 mL saliva into collection device. Collection device to be collected from the laboratory.
Cortisol (serum)	5 mL clotted blood (yellow top tube)	
Cortisol (urine)	24-hour urine collection	Contact laboratory for advice on the appropriate collection container and preservative required.
Costello Syndrome (HRAS1) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Cotinine (nicotine)	5 mL clotted blood (yellow top tube)	
Coxiella burnetii (Q-fever) IFA	5 mL clotted blood (yellow top tube)	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Coxsackievirus B1 - 6 neutralising antibody titres	5 mL clotted blood (yellow top tube)	Two specimens taken 14 days apart is needed for meaningful interpretation.
C-peptide	5 mL clotted blood (yellow top tube)	
CPT2 Deficiency (CPT2) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Craniosynostoses (FGFR-related) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
C-reactive protein (CRP)	5 mL clotted blood (yellow top tube)	
Creatine kinase	5 mL clotted blood (yellow top tube)	
Creatine kinase isoenzymes	5 mL clotted blood (yellow top tube)	Avoid haemolysis during venesection. Before collecting the specimen, please arrange the test with the referral laboratory (obtain their contact details from the local laboratory).
Creatine kinase MB (CK-MB)	5 mL clotted blood (yellow top tube)	
Creatinine (fluid)	5 mL fluid in a plain collection tube without additives	
Creatinine (serum)	5 mL clotted blood (yellow top tube)	
Creatinine (urine)	Random or timed urine	
Creatinine clearance	5 mL clotted blood (yellow top tube) AND 24-hour urine collection	Concomitant blood specimen must be collected within urine collection period. Supply patient's mass and height on the request form for calculation of corrected creatinine clearance.
Cryoglobulins	Contact laboratory for specimen requirements	This test must be arranged with the laboratory before specimen collection. Specimen must be collected and delivered to the laboratory at 37ºC. Please state on the request form if patient is receiving anticoagulant therapy.
Cryohaemolysis test	4 mL EDTA blood (purple top tube) for the patient and 4 mL EDTA blood (purple top tube) for the control	Before collecting the specimen, please arrange the test with the referral laboratory (obtain their contact details from the local laboratory). When sending the patient's specimen, please include specimen from a normal control.
Cryptococcal antigen test (CrAg)	≥1.5 mL CSF in a plain tube without additives OR 3 mL clotted blood in red or yellow top tube	Please see Section 17.3 on pages 148–149 for lumbar puncture procedure.
Crystals (synovial fluid)	1 mL synovial fluid in a plain collection tube without additives	Please state clearly on the request form that the specimen was aspirated from a joint.
CSF bacterial antigen test	≥1.5 mL CSF in a plain tube without additives	Performed only on request.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
CSF Culture	≥1.5 mL CSF in a plain tube without additives	Please see Section 17.3 on pages 148–149 for lumbar puncture procedure. Deliver the specimen to the laboratory at room temperature as sending on ice may affect the viability of some fastidious organisms.
CSF Microscopy	≥1.5 mL CSF in a plain tube without additives	A Gram stain and cell count will be performed. Please send a separate tube for this test.
C-telopeptide	4 mL EDTA blood (purple top tube)	A morning fasting specimen is required.
Cyanide	2 x 4 mL EDTA blood (purple top tube)	
Cyanide	10 mL postmortem blood	
Cyclosporine	4 mL EDTA blood (purple top tube)	Collect peak level 2 hours after dose and trough level just before the next dose. Indicate clearly on request form whether specimen is peak or trough. Please write clearly on request form: DO NOT SPIN.
Cysticercus Antibodies	5 mL clotted blood (yellow top tube)	
Cystic Fibrosis (3120+1G>A) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Cystinosis (CTNS) gene: Common mutation/Full gene sequencing	4 mL EDTA blood (purple top tube) (not to be frozen)	Please submit clinical summary and results of urine/serum metabolic workup.
Cystic Fibrosis (Ashkenazi Jewish) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Cystic Fibrosis (50 CFTR mutation screen) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Cystic Fibrosis DeltaF508 (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Cystine (leukocytes)	4 mL heparin (green top tube) or EDTA (purple top tube) blood	Minimum 3 mL blood required. Please write clearly on request form: DO NOT SPIN. Specimen to be taken just before next dose of phosphocysteamine (patients on 12-hourly dosage regimen to omit dose on morning of clinic visit). Do NOT refrigerate or place on ice.
Cytochemistry: Peripheral blood or bone marrow aspirate	4 mL blood/bone marrow aspirate in EDTA tube or blood/bone marrow aspirate smear	Before collecting the specimen, please arrange the test with the referral laboratory (obtain their contact details from the local laboratory).

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Cytology (Fine Needle Aspirate)	Fine Needle Aspirate (FNA) taken from head and neck, breast, lymph nodes, and other non-palpable lesions	See Section 14.2.4.1 on pages 119–122 for guidelines on FNA procedure. FNA of deep-seated lesions must be performed under ultrasound or CT scan guidance. Smears to be stained with Pap stain must be fixed with a cytofixative or immersed into a suitable jar containing 96% ethanol and smears for Giemsa staining must be air-dried. Aspirates from different anatomical sites must be clearly defined.
Cytology (Gynaecological)	Pap smear taken from cervix, endocervix, vagina, vault, or endometrium	Please refer to Section 14.2.2.3 on page 113 for instructions on preparing a slide smear. Label the slides on the frosted end with a lead pencil. DO NOT label the slide with a barcode sticker. Smears must be fixed immediately with cytofixative before drying. Specimens collected with cotton wool swabs are not acceptable for routine gynaecological processing.
Cytology (Non-Gynaecological)	Sputum specimen in a universal container; other respiratory tract specimens, random urine specimen, other body fluids OR CSF in a plain collection tube without additives	Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection – specimens must reach the referral laboratory within 24 hours of collection. Syringes with needles still attached will not be accepted. Specimen collection containers must contain no additives.
Cytomegalovirus (CMV) IgG Antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Cytomegalovirus (CMV) IgG Antibodies avidity index	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Only done in suspected cases of congenital CMV when both CMV IgG & IgM are positive. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Cytomegalovirus (CMV) IgM Antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Cytomegalovirus (CMV) isolation (culture)	Urine specimen in a universal container OR respiratory tract specimen	Before collecting the specimen, please arrange the test with the referral laboratory (obtain their contact details from the local laboratory). Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Cytomegalovirus (CMV) PCR	1 mL CSF in a plain collection tube without additives; 5 mL urine specimen; tissue biopsy material; respiratory tract fluid aspirate, or amniotic fluid in a universal container	Biopsy material must be sent in normal saline (NEVER in formalin). Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Cytomegalovirus (CMV) viral load	4 mL EDTA blood (purple top tube) OR 1 mL CSF in a plain collection tube without additives	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
D-Dimer	Contact laboratory for preferred tube type	Specimen should be processed by the laboratory within 6 hours. If delays are anticipated, contact the laboratory for further instruction.
Deafness (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Dehydroepiandrosterone sulphate (DHEAS)	5 mL clotted blood (yellow top tube)	
Dentatorubral Pallidoluysian Atrophy (DRPLA) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Dichloromethane	25 mL random urine in a universal container	Deliver the specimen to the laboratory on ice.
Differential white cell count	4 mL EDTA blood (purple top tube)	Specimen must reach the laboratory as soon as possible after collection, preferably within 12 hours.
Digoxin (Lanoxin)	5 mL clotted blood (yellow top tube)	Collect the specimen 8–24 hours after the last dose. Please state the time of the last dose on the request form.
Diphtheria	Collect an oropharyngeal swab from the affected area (including pseudomembrane if present)	See Section 17.6.2.5.3 on page 160 for more detailed instructions.
Dolutegravir (ARV drug levels)	2 mL EDTA blood (purple top tube)	Kindly provide patient's drug regimen on the request form.
Down Syndrome screening (maternal blood)	5 mL clotted blood (yellow top tube)	Maternal blood specimen required. Indicate the following (specific form available from referral laboratory): Gestation (sonar/dates), maternal age/weight, DM, twins, previous abnormal pregnancy.
Drugs of abuse screen (urine) (qualitative)	25 mL random urine in a universal container	Includes screening tests (semi-quantitative) among others: Amphetamines, cocaine, cannabinoids, opiates, methadone, phencyclidine, barbiturates, benzodiazepines, tricyclic antidepressants.
Drugs of abuse (postmortem)	10 mL postmortem blood and urine	If the drug(s) are known, specify the drug name(s).
Duchenne / Becker Muscular Dystrophy (del/dup MLPA screen) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Dystonia (DYT1) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Echinococcus Antibodies	5 mL clotted blood (yellow top tube)	
Efavirenz (Stocrin) (ARV drug levels)	Contact laboratory for tube type	Kindly provide patient's drug regimen on the request form.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Elastase	Fresh stool specimen in a universal container	Deliver the specimen to the laboratory on ice. Stool volume: 5 mL.
Electron Microscopy (Anatomical Pathology)	Specimens must be fixed in 2.5% glutaraldehyde solution	Please phone the laboratory before collection to allow for preparation of the correct transport medium.
Entamoeba histolytica IgG	5 mL clotted blood (yellow top tube)	
Entamoeba histolytica microscopy	Fresh stool specimen in a universal container	Stool specimen must reach laboratory within 30 minutes of collection.
Enterobius vermicularis (pinworm)	Collect specimens using the cello tape method	Please see Section 17.11.3 on page 167 for collection instructions.
Enterovirus isolation (culture)	1−2 g fresh stool specimen in a universal container	The test is performed for Enterovirus positive PCR or viral isolation as part of acute flaccid paralysis (AFP) surveillance for suspected polio cases. See section 21.7.1 on page 216.
Enterovirus PCR	1 mL CSF in a plain collection tube without additives; respiratory tract specimen in viral transport medium (VTM) OR fresh stool specimen in a universal container	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Enterovirus typing	As for Enterovirus PCR (see above)	Before collecting the specimen, please arrange the test with the referral laboratory (obtain their contact details from the local laboratory). Transport specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Eosinophils	Random urine specimen, fresh sputum specimen OR nasal secretions in a universal container	Refrigerate specimen if transport is delayed.
Epstein-Barr virus (EBV) IgG Antibodies (EBVNA)	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Epstein-Barr virus (EBV) IgM Antibodies (VCA IgM)	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Epstein-Barr virus (EBV) PCR	1 mL CSF in a plain collection tube without additives OR 4 mL EDTA (purple top tube) OR 5 mL clotted (red or yellow top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Epstein-Barr virus (EBV) viral load	4 mL EDTA blood (purple top tube) OR 1 mL CSF in a plain collection tube without additives	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Erythrocyte sedimentation rate (ESR)	Contact laboratory for preferred tube type	Specimen must reach the laboratory within 6 hours of collection.
Erythropoietin	5 mL clotted blood (yellow top tube)	
Everolimus (Certican)	4 mL EDTA blood (purple top tube)	Please write clearly on request form: DO NOT SPIN
Eye specimens for MC&S	Various specimens	Please see Section 17.8 on page 160 for specific guidelines on specimen collection. Special transport media and plates must be collected from the laboratory before specimen collection.
Factor V	5 mL blood in sodium citrate (blue top) tube	Please provide full clinical history. Specimens should reach laboratory within 4 hours of collection. If delays are anticipated, contact the laboratory for further instructions.
Factor VII	5 mL blood in sodium citrate (blue top) tube	Please provide full clinical history. Specimens should reach laboratory within 4 hours of collection. If delays are anticipated, contact the laboratory for further instructions.
Factor X	5 mL blood in sodium citrate (blue top) tube	Please provide full clinical history. Specimens should reach laboratory within 4 hours of collection. If delays are anticipated, contact the laboratory for further instructions.
Factor XI	5 mL blood in sodium citrate (blue top) tube	Please provide full clinical history. Specimens should reach laboratory within 4 hours of collection. If delays are anticipated, contact the laboratory for further instructions.
Factor XIII	5 mL blood in sodium citrate (blue top) tube	Please provide full clinical history. Specimen should reach laboratory within 2 hours of collection. If delays are anticipated, contact the laboratory for further instructions.
Factor B (complement)	5 mL clotted blood (yellow top tube)	
Factor II	5 mL blood in sodium citrate (blue top) tube	Please provide full clinical history. Specimen should reach laboratory within 4 hours of collection. If delays are anticipated, contact the laboratory for further instructions.
Factor II G20210A mutation (DNA analysis)	4 mL EDTA blood (purple top tube)	Please provide full clinical history.
Factor IX	5 mL blood in sodium citrate (blue top) tube	Please provide full clinical history. Specimen should reach laboratory within 4 hours of collection. If delays are anticipated, contact the laboratory for further instructions.
Factor IX Inhibitor level	5 mL blood in sodium citrate (blue top) tube	Please provide full clinical history. Specimen should reach laboratory within 4 hours of collection. If delays are anticipated, contact the laboratory for further instructions.
Factor V Leiden mutation	4 mL EDTA blood (purple top tube)	Please provide full clinical history.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
(DNA analysis)		
Factor VIII & IX Inhibitor Screen	5 mL blood in sodium citrate (blue top) tube	Please provide full clinical history. Specimen should reach laboratory within 4 hours of collection. If delays are anticipated, contact the laboratory for further instructions.
Factor VIII	5 mL blood in sodium citrate (blue top) tube	Please provide full clinical history. Specimen should reach laboratory within 4 hours of collection. If delays are anticipated, contact the laboratory for further instructions.
Factor VIII Inhibitor level	5 mL blood in sodium citrate (blue top) tube	Please provide full clinical history. Specimen should reach laboratory within 4 hours of collection. If delays are anticipated, contact the laboratory for further instructions.
Factor XII	5 mL blood in sodium citrate (blue top) tube	Please provide full clinical history. Specimen should reach laboratory within 4 hours of collection. If delays are anticipated, contact the laboratory for further instructions.
Faecal occult blood	5 mL random stool specimen in a universal container. Contact the laboratory to confirm special instructions.	Contact the laboratory for advice on possible dietary restrictions, storage temperature and whether diarrhoeal stools are suitable. Deliver the specimen to the laboratory immediately after collection.
Familial Adenomatous Polyposis (FAP) (APC) common mutations (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Familial Dysautonomia (Ashkenazi Jewish) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Familial Hypercholesterolaemia (LDLR) common Afrikaner, Ashkenazi Jewish and Indian mutations (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Fanconi Anaemia (FANCA) (Afrikaner) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Fanconi Anaemia (FANCC) (Ashkenazi Jewish) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Fanconi Anaemia DNA test (FANCG 637-643 7bp	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
deletion) (DNA analysis)		
Fat globules	Random stool specimen in a universal container	Stool volume: 5 mL. Sudan staining of fat globules will be performed.
Ferritin	5 mL clotted blood (yellow top tube)	
Foetal sexing (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
FGFR-related craniosynostosis syndromes: Achondroplasia, Apert syndrome, Camtodactyly, tall stature, scoliosis and hearing loss (CATSHL), Crouzon syndrome, Crouzon syndrome with acanthosis nigricans, Crouzon/Jackson-Weiss syndrome, Crouzon/Pfeiffer syndrome, Hypochondroplasia, Jackson-Weiss syndrome, Muenke syndrome, Pfeiffer syndrome, Saethre-Chotzen syndrome, Thanatophoric Dysplasia I, Thanatophoric Dysplasia I (SADDAN), Thanatophoric Dysplasia II	4 mL EDTA blood (purple top tube)	FGFR3 and FGFR2 genes (common mutations). DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Fibrillarin antibodies	5 mL clotted blood (yellow top tube)	
Fibrinogen	5 mL blood in sodium citrate (blue top) tube	Specimens should reach laboratory within 6 hours of collection. If delays are anticipated, contact the laboratory for further instructions.
Fibrinogen degradation product	5 mL blood in sodium citrate (blue top) tube	Specimens should reach laboratory within 4 hours of collection. If delays are anticipated, contact the relevant laboratory for further instructions.
Fibroblasts (tissue culture)	Skin biopsy	Before collecting the specimen, please arrange the test with the referral laboratory (obtain their contact details from the local laboratory). Send specimen sterile in tissue culture medium (preferred) or saline. Do not freeze.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
FISH Constitutional: DiGeorge syndrome (22q11.2 microdeletion)	5 mL blood in a lithium heparin (green top without gel) tube OR 10 mL amniotic fluid in a universal container	Do not use expired tubes and avoid clotting. Specimen must reach the referral laboratory within 48 hours of collection.
FISH Constitutional: Pallister-Killian (tetrasomy 12p)	Buccal swabs (preferred) or 5 mL blood in a lithium heparin (green top without gel) tube or 10 mL amniotic fluid in a universal container	Do not use expired tubes and avoid clotting. Specimen must reach the referral laboratory within 48 hours of collection.
FISH 1p/19q codeletion in brain tumours	FFPE tissue block or at least four tissue sections on positively charged slides	Ringed tumour area on H&E slide to be submitted.
FISH Oncology: 10q23 deletion PTEN	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 11q13 rearrangement CCND1	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 11q22 deletion ATM	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 11q23 rearrangement KMT2A (MLL)	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 13q14 / 17p13 deletion D13S319/TP53	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 13q14 deletion RB1	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
FISH Oncology: 13q14.3 deletion (D13S319)	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 14q32 rearrangement IGH@	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 16p11 rearrangement FUS	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 17p13.1 / 11q22.3 deletion TP53/ATM	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 17p13.1 deletion TP53	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 17q21 rearrangement RARA	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 18q21 rearrangement BCL2 (MALT1)	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
FISH Oncology: 20q12 deletion (D20S108)	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 2p24 / CEP 2 for amplification of MYCN gene	FFPE tissue block or sections mounted on a positively charged slide	Ringed H&E stain should be submitted.
FISH Oncology: 3q27 rearrangement BCL6	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 6q23 deletion MYB	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 7q22 and 7q35 deletion	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: 7q31 deletion	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: Acute Lymphocytic Leukaemia, Acute Myeloid Leukaemia 11q23 rearrangement KMT2A (MLL)	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: Acute Myeloid Leukaemia (Acute Promyelocytic Leukaemia) t(15;17) PML/RARA	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
FISH Oncology: Acute Myeloid Leukaemia t(8;21) RUNX1/RUNX1T1 (AML1/ETO)	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: Acute Myeloid Leukaemia Inversion 16 CBFB/MYH 11	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: Aneuploidy in bladder cancer (CEP3 / CEP7 / CEP17 / 9p21)	Cytology Prepared slides	
FISH Oncology: B lymphoblastic leukaemia / lymphoma t(1;19) TCF3/PBX1 (E2A/PBX1)	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: Burkitt's lymphoma t(8;14) MYC/IGH	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: CCND1 for amplification of Cyclin D1	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: CEP 12 for aneuploidy	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
FISH Oncology: CEP 18 / CEP X for copy numbers of chromosome 18 / X	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: CEP 3 for aneuploidy	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: CEP 8 for aneuploidy	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: Chronic Eosinophilic Leukaemia 4q12 rearrangement FIP1L1/PDGFRA	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: Chronic Lymphocytic Leukaemia profile (p53, ATM, and 13q deletions, trisomy 12)	5 mL peripheral blood or bone marrow in lithium or sodium heparin (green top) tubes with transport medium OR 2 unstained blood or bone marrow slides	Specimens must be kept at room temperature. Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection – specimens must reach the referral laboratory within 24 hours of collection.
FISH Oncology: Chronic Myeloid Leukaemia, Acute Lymphocytic Leukaemia t(9;22) BCR/ABL1	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: CLL (13q34/13q14.3/CEP12)	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
FISH Oncology: CLL (17p13.1 / 11q22.3 deletion TP53/ATM, 13q34 / 13q14.3 (D13S319), CEP12 for trisomy 12)	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: Deletion 1p36 & duplication of 1q21	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: EGFR for amplification of Epidermal Growth Factor Receptor	FFPE tissue block or sections mounted on a positively charged slide	For solid tumours, a ringed H&E stain should be submitted.
FISH Oncology: ERBB2 (HER2/neu)	FFPE tissue block or sections mounted on a positively charged slide	For solid tumours, a ringed H&E stain should be submitted.
FISH Oncology: ETV6 (TEL) 12p13 gene rearrangement	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions. In the eventuality of insufficient Bone Marrow specimen, unstained blood/bone marrow slides can be used but cannot guarantee results.
FISH Oncology: Ewing's sarcoma 22q12 rearrangement EWSR1	FFPE tissue block or sections mounted on a positively charged slide	Ringed H&E stain should be submitted.
FISH Oncology: Follicular lymphoma t(14;18) IGH@/BCL2	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions. In the eventuality of insufficient Bone Marrow specimen, unstained blood/bone marrow slides can be used but cannot guarantee results.
FISH Oncology: Inversion 16 CBFB	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions. In the eventuality of insufficient Bone Marrow specimen, unstained blood/bone marrow slides can be used but cannot guarantee results.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
FISH Oncology: Lymphoma / Lung cancer 2p23 rearrangement ALK	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions. In the eventuality of insufficient Bone Marrow specimen, unstained blood/bone marrow slides can be used but cannot guarantee results.
FISH Oncology: Mantle Cell Lymphoma, Multiple myeloma t(11;14) CCND1/IGH	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions. In the eventuality of insufficient Bone Marrow specimen, unstained blood/bone marrow slides can be used but cannot guarantee results.
FISH Oncology: Multiple myeloma t(14;16) IGH/MAF	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions. In the eventuality of insufficient Bone Marrow specimen, unstained blood/bone marrow slides can be used but cannot guarantee results.
FISH Oncology: Multiple myeloma t(4;14) IGH@/FGFR3/WHSC1	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions. In the eventuality of insufficient Bone Marrow specimen, unstained blood/bone marrow slides can be used but cannot guarantee results.
FISH Oncology: MYC for amplification of MYC gene	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
FISH Oncology: MYC Translocations 8q24 rearrangement MYC	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	Paraffin embedded/Tissue section

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
FISH Oncology: Myelodysplastic syndrome, Acute Myeloid Leukaemia 5q31 deletion EGR1 locus	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions. In the eventuality of insufficient Bone Marrow specimen, unstained blood/bone marrow slides can be used but cannot guarantee results.
FISH Oncology: NMYC/CEP2 2p24.1	FFPE tissue block or sections mounted on a positively charged slide	Ringed H&E stain should be submitted.
FISH Oncology: Paediatric Acute Lymphocytic Leukaemia t(12;21) ETV6/RUNX1 (TEL/AML1)	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions. In the eventuality of insufficient Bone Marrow specimen, unstained blood/bone marrow slides can be used but cannot guarantee results.
FISH Oncology: Rhabdomyosarcoma 13q14 FOXO1 (FKHR) rearrangement	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes. For solid tumours, FFPE tissue block or sections mounted on a positively charged slide.	Ringed H&E stain should be submitted.
FISH Oncology: Sex-mismatched allografts CEP X / CEP Y for XX / XY ratios	Bone marrow aspirate OR leukemic blood in lithium or sodium heparin (green top) tubes	As methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions. In the eventuality of insufficient Bone Marrow specimen, unstained blood/bone marrow slides can be used but cannot guarantee results.
FISH Oncology: SS18 t(X;18)	FFPE tissue block or sections mounted on a positively charged slide	Ringed H&E stain should be submitted.
FISH Oncology: Synovial sarcoma 18q11.2 rearrangement SYT1	FFPE tissue block or sections mounted on a positively charged slide	Ringed H&E stain should be submitted.
FISH Oncology: t(11;19)MECT1-MAML2	FFPE tissue block or sections mounted on a positively charged slide	Ringed H&E stain should be submitted.
FISH Oncology: t(17;22) COL1A1/PDGFB	FFPE tissue block or sections mounted on a positively charged slide	Ringed H&E stain should be submitted.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
FISH Oncology: TFE3 Xp11	FFPE tissue block or sections mounted on a positively charged slide	Ringed H&E stain should be submitted.
FISH Oncology: TOP2A / CEP17 for TOP2A amplification	FFPE tissue block or sections mounted on a positively charged slide	Ringed H&E stain should be submitted.
FKRP-related muscular dystrophy	4 mL EDTA blood (purple top tube)	Afrikaner founder mutation and European/German mutation. DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
FLT3 (TKD, ITD mutations) (DNA analysis)	4 mL blood OR Bone marrow in EDTA (purple top) tube	
Fluid aspirate MC&S	5–10 mL aspirated fluid	Please refer to Section 17.5 on page 150 for collection container options.
Fluoride	25 mL random urine in a universal container on ice.	Deliver the specimen to the laboratory on ice.
FMR1-Related Disorders (POI, FXTAS) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Folate (serum)	5 mL clotted blood (yellow top tube)	
Follicle stimulating hormone (FSH)	5 mL clotted blood (yellow top tube)	
Fragile X Syndrome (FRAXA) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Fragile X syndrome (FRAXE) mild MR (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Fragment Analysis – CALR exon 9 mutation	4–8 mL EDTA blood (purple top tube) or bone marrow aspirate or extracted DNA >10 ng/L cytogenetic pellet	
Free fatty acids	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice.
Free light chains	5 mL clotted blood (yellow top tube)	
Free protein S	5 mL blood in sodium citrate (blue top) tube on ice	Please provide full clinical history. Specimen must reach the laboratory within 6 hours of collection.
Free T3 (Tri-iodothyronine)	5 mL clotted blood (yellow top tube)	
Free T4 (Thyroxine)	5 mL clotted blood (yellow top tube)	
Friedreich ataxia (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Frozen section (Anatomical pathology)	Fresh unfixed specimen	Pre-arrange with laboratory before surgery where available.
Fructosamine	5 mL clotted blood (yellow top tube)	
Full Blood Count (FBC), and differential (FBCD)	4 mL EDTA blood (purple top tube)	Specimen must reach the laboratory within 8 hours of collection.
Fungal MC&S	Specimen from potentially infected site in a universal container	Please refer to Section 17.13 on page 170 for collection instructions.
Gabapentin (Neurontin)	2 x 4 mL EDTA blood (purple top tube)	Collect blood specimen just before next dose.
Galactokinase enzyme activity (Galactosaemia type 2)	4 mL EDTA blood (purple top tube)	
Galactomannan antigen	5 mL clotted blood (yellow top tube)	
Galactosaemia enzyme screening test	5 mL unspun heparin (green top tube) blood	Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection – specimen must reach the referral laboratory within 24 hours of collection. Please write clearly on request form: DO NOT SPIN. Minimum 4 mL blood required. When sending the patient's specimen, please include specimens from both the parent and a normal control. If the child received a recent transfusion, testing should be postponed until ≥120 days post-transfusion.
Galactosaemia (GALT) S135L/Q188R/Full gene screening (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Galactose-1 phosphate uridyl transferase enzyme activity (Galactosaemia type 1)	0.5 mL EDTA blood (purple top tube) ACD solution B OR heparin also accepted	Send specimens on ice. Please write clearly on request form: DO NOT SPIN. If the child received a recent transfusion, testing should be postponed until ≥120 days post-transfusion. Patient to be on galactose (lactose) containing diet.
Gamma glutamyl transferase (GGT)	5 mL clotted blood (yellow top tube)	
Gastrin	5 mL clotted blood (yellow top tube)	Patient must fast for 10 hours before test. Discontinue interfering medication e.g. omeprazole, cimetidine. Deliver the specimen to the laboratory on ice within 2 hours of collection.
Gaucher Disease (Afrikaner) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Gaucher Disease (Ashkenazi Jewish) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Gaucher Disease (Black) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Gaucher Disease (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Genital swab for MC&S	Genital swab in suitable transport medium	Vaginal swabs are NOT suitable for the isolation of *Neisseria gonorrhoeae* or *Chlamydia* antigen detection, except in a child.
Gentamicin	5 mL clotted blood (yellow top tube)	Trough levels to be collected 30 minutes prior to next dose, peak levels to be collected 30 minutes after a 1-hour infusion. Please state the time of last dose on the request form.
Giardia lamblia microscopy	Stool specimen in a universal container	
Gilbert / Crigler-Najjar (UGT1A1) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Glucose (CSF)	0.5 mL CSF in a fluoride (grey top) tube	Simultaneous blood glucose measurement is recommended.
Glucose (fluid)	1 mL fluid in a fluoride (grey top) tube	
Glucose (plasma)	5 mL blood in a fluoride (grey top) tube	State on the request form whether random or fasting specimen. Fasting requires no food for 8−12 hours before collection. If patients cannot go without, water sips may be taken during the fast. See Section 15.2.3 on page 127 for details of oral glucose tolerance testing.
Glucose (urine) (dipsticks)	25 mL random urine in a universal container on ice.	Deliver the specimen to the laboratory on ice within 4 hours of collection.
Glucose-6-phosphatase enzyme activity (Glycogen storage disease type 1a)	Liver biopsy (preferably 2 specimens)	Arrange test with the laboratory before specimen collection, because it requires immediate processing. Collect biopsy specimens into sterile plastic tube.
Glucose-6-phosphate dehydrogenase (G6PD) deficiency screen (DNA analysis)	4 mL EDTA blood (purple top tube)	This is a qualitative screening test only. Please provide full clinical history.
Glutaric Aciduria Type 1 (GCDH) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Glutaric Aciduria type 1 (GCDH, A293T) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Glutathione Synthetase Deficiency (GSS gene) (DNA analysis)	2 x 4 mL EDTA blood (purple top tube) on ice to reach the laboratory within 48 hours.	Please arrange with Groote Schuur – Inherited Metabolic Diseases laboratory prior to sending. DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Glycated haemoglobin (HbA1c)	4 mL EDTA blood (purple top tube)	
Glycine (CSF)	1 mL CSF in a plain collection tube without additives AND 5 mL clotted blood (yellow top tube).	Submit simultaneous blood specimen in a yellow or green top tube.
Glycogen Storage Disease 1A (Ashkenazi Jewish) (DNA analysis)	4 mL EDTA blood (purple top tube)	
Glycogen Storage Disease 1A full gene sequencing (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Growth hormone	5 mL clotted blood (yellow top tube)	
Haematocrit (Hct)	4 mL EDTA blood (purple top tube)	Refrigerate the specimen if it is kept overnight.
Haemochromatosis (HFE) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Haemoglobin	4 mL EDTA blood (purple top tube)	
Haemoglobin (Unstable) (Heat stability test)	4 mL EDTA blood (purple top tube)	Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection. Specimen must be tested within 24 hours of collection.
Haemoglobin A2 (HbA2)	4 mL EDTA blood (purple top tube)	Please provide full clinical history (family, drug, and transfusion). Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory.
Haemoglobin gel electrophoresis and high-performance liquid chromatography (HPLC)	4 mL EDTA blood (purple top tube)	Please provide full clinical history (family, drug, and transfusion). Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory. Specimen must be tested within 72 hours of collection.
Haemoglobin F (HbF)	4 mL EDTA blood (purple top tube)	Please provide full clinical history (family, drug, and transfusion). Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory.
Haemoglobin H inclusion bodies	4 mL EDTA blood (purple top tube)	Specimen must be tested within 72 hours of collection.
Haemoglobin S (HbS)	4 mL EDTA blood (purple top tube)	Please provide full clinical history (family, drug, and transfusion). Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory.
Haemophilia A (F8A intron 1	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test,

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
inversion) (DNA analysis)		the patient and reason for testing. See Section 22 for additional information.
Haemophilia A (F8A intron 22 inversion) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Haemophilia A (F8A mutation screen) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Haemophilia A (F8A, exon 14) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Haemophilia B (F9) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Haemosiderin	30 mL random urine in a universal container	Fresh urine specimen is preferred.
Ham's Test	4 mL EDTA blood (purple top tube) AND 5 mL clotted blood (yellow top tube)	Contact the laboratory before specimen collection as the test must be booked at the referral laboratory.
Haptoglobin	5 mL clotted blood (yellow top tube)	
Heavy metals	Fingernail clippings/hair from autopsy	
Heinz bodies	2 x 4 mL EDTA blood (purple top tube)	Specimen must be tested within 24 hours of collection. Refrigerate specimen if kept overnight.
Helicobacter pylori Antibodies	5 mL clotted blood (yellow top tube)	
Hereditary neuropathy with liability to pressure palsies (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Heparin-induced thrombocytopenia	5 mL clotted blood (yellow top tube)	Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection – specimen must be tested within 24 hours of collection.
Hepatitis A virus (HAV) IgG Antibodies (anti-HAV IgG)	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hepatitis A virus (HAV) IgM Antibodies (anti-HAV IgM)	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hepatitis B virus (HBV) core IgM Antibodies (anti-HBc IgM)	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hepatitis B virus (HBV) core total (IgG and IgM) Antibodies (anti-HBc)	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Hepatitis B virus (HBV) e Antibodies (anti-HBe)	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hepatitis B virus (HBV) e Antigen (HBeAg)	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hepatitis B virus (HBV) surface Antibodies (anti-HBs)	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hepatitis B virus (HBV) surface Antigen (HBsAg)	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hepatitis B virus (HBV) qualitative PCR	4 mL EDTA blood (purple top tube)	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hepatitis B virus (HBV) viral load	4 mL EDTA blood (purple top tube)	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hepatitis B virus (HBV) genotyping and drug resistance testing (Lamivudine)	4 mL EDTA blood (purple top tube)	Only performed if HBV viral load is detectable. Deliver the specimen to the laboratory on ice.
Hepatitis C Antigen	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hepatitis C Total Antibody	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed. A positive result must be confirmed by sending a specimen for HCV PCR.
Hepatitis C virus (HCV) genotyping and drug resistance testing per gene	4 mL EDTA blood (purple top tube)	Only performed if HCV PCR is positive. Transport the specimen on ice.
Hepatitis C virus (HCV) PCR	4 mL EDTA blood (purple top tube)	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hepatitis C virus (HCV) viral load	4 mL EDTA blood (purple top tube)	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hepatitis D virus (Delta virus, HDV) PCR	4 mL EDTA blood (purple top tube)	Only request test if clinically indicated and if there is an established ongoing hepatitis B infection.
Hepatitis E virus (HEV) IgG Antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice.
Hepatitis E virus (HEV) IgM Antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice.
Hepatitis E virus (HEV) PCR	4 mL EDTA blood (purple top tube)	Deliver the specimen to the laboratory on ice. Refrigerate specimen if

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
		transport is delayed.
Hepatitis E virus (HEV) viral load	4 mL EDTA blood (purple top tube)	On special request only: Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hereditary Hearing Loss GJA1 (Connexin 43) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Hereditary Hearing Loss GJB2 (Connexin 26) (Ashkenazi) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Hereditary Hearing Loss GJB2 (Connexin 26) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Hereditary Hearing Loss GJB6 (Connexin 30) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Herpes simplex virus (HSV) types 1 & 2 IgG antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Herpes simplex virus (HSV) types 1 & 2 IgM antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Herpes simplex virus (HSV) PCR	1 mL CSF in a plain collection tube without additives; OR tissue biopsy material, OR fluid aspirate or lesion fluid in a universal container, OR ulcer scab or swab (sterile swab without gel) with or without viral transport medium (VTM)	Biopsy material must be sent in normal saline (never in formalin). Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Herpes simplex virus isolation (culture)	Lesion fluid OR swab from the ulcer base in viral transport medium (VTM)	Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Hexosaminidase A enzyme activity (Tay-Sachs disease)	13 mL ACD solution B (light yellow top tube) blood OR 5–7 mL EDTA (purple top tube) blood	Specimen must reach referral laboratory within 48 hours of collection.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Human herpesvirus 6 (HHV-6) PCR	4 mL EDTA blood (purple top tube) OR 1 mL CSF in a plain collection tube without additives	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Human herpesvirus 8 (HHV-8, Kaposi's sarcoma herpesvirus, KSHV) PCR	4 mL EDTA blood (purple top tube); 5 mL pleural fluid OR tissue biopsy material in a universal container	Biopsy material must be sent in normal saline (NEVER in formalin). Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
High Density Lipoprotein (HDL) Cholesterol	5 mL clotted blood (yellow top tube)	
Hippuric acid (screen for toluene exposure)	25 mL random urine specimen in a universal container	
Histology	Any tissue in fixative	Please ensure that the specimen is completely embedded in the solution.
Histoplasma Antigen test	Random urine specimen in a universal container	Kindly supply the clinical history on the request form. Specimen will only be processed if the clinical history is compatible with histoplasmosis. Deliver the specimen to the laboratory on ice.
Histoplasma serology	5 mL clotted blood (yellow top tube)	
HIV EIA (3rd generation)	5 mL clotted (red or yellow top tube) OR 4 mL EDTA (purple top tube) blood	Dedicated specimen should be sent for HIV test. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed. Confirmatory testing is done if the screening test result is positive.
HIV-1/2 Antibody/Antigen EIA (4th generation) screen	5 mL clotted (red or yellow top tube) OR 4 mL EDTA (purple top tube) blood	Dedicated specimen should be sent for HIV test. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed. Confirmatory testing is done if the screening test result is positive.
HIV p24 antigen	5 mL clotted (red or yellow top tube) OR 4 mL EDTA (purple top tube) blood	Dedicated specimen should be sent for HIV test. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed. Confirmatory testing is done if the screening test result is positive.
HIV rapid (4th generation)	5 mL clotted (red or yellow top tube) OR 4 mL EDTA (purple top tube) blood	Dedicated specimen should be sent for HIV test. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed. Confirmatory testing is done if the screening test result is positive.
HIV-1 or HIV-2 or HIV-1/HIV-2 PCR	1 x dried blood spot (DBS) card (minimum 3 spots) OR 1 mL EDTA (purple top tube) blood	Dried blood spot cards should be stored and transported in a specimen packet with a desiccant sachet at room temperature. EDTA specimen should be delivered to the laboratory on ice. Refrigerate specimen if transport is delayed.
HIV-1 viral load	4 mL EDTA (purple top tube) or EDTA with gel separator (pearl/white/purple top tube) blood	Specimen needs to be processed by the laboratory within 6 hours of collection.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
HIV-1 drug resistance testing	2 x 4 mL EDTA (purple top tube) or EDTA with gel separator (pearl/white/ purple top tube) blood	Indicate on the request form if Integrase resistance testing is indicated. Deliver the specimen to the lab on ice. Refrigerate specimen if transport is delayed.
HLA antibody screening	5–10 mL clotted blood (yellow top tube)	
HLA deceased donor group and cross- match	7 mL ACD solution B blood (light yellow top tube) OR 2 x 4 mL EDTA blood (purple top tubes) for the donor AND 5 mL clotted blood (yellow or red top tube) for the recipient	Deliver the specimen to the laboratory at room temperature.
HLA class I antibody identification	5–10 mL clotted blood (yellow top tube)	
HLA class I single Ab identification	5–10 mL clotted blood (yellow top tube)	
HLA class II antibody identification	5–10 mL clotted blood (yellow top tube)	
HLA class II single Ab identification	5–10 mL clotted blood (yellow top tube)	
HLA Donor blood group	7 mL ACD solution B (light yellow top tube) blood	
HLA Recipient group and cross-match	7 mL ACD solution B (light yellow top tube) blood AND 5 mL clotted blood (yellow or red top tube)	
HLA SABMR donor screening (DNA-based)	2 x 4 mL EDTA blood (purple top tube)	
HLA serological typing	7 mL ACD solution B (light yellow top tube) blood	
HLA-A* (Class I Molecular typing)	2 x 4 mL EDTA blood (purple top tube)	
HLA-B* (Class I Molecular typing)		
HLA-B27 (Class I Molecular Typing)	2 x 4 mL EDTA blood (purple top tube)	
HLA-B27 (Serology)	7 mL ACD solution B (light yellow top tube) blood	Deliver the specimen to the laboratory at room temperature.
HLA-C* (Class I Molecular	2 x 4 mL EDTA blood (purple top tube)	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
typing)		
HLA-DQB1* (Class II Molecular Typing)	Please contact the laboratory for tube type	
HLA-DRB1* (Class II Molecular Typing)	Please contact the laboratory for tube type	
HLA-DRB3* (Class II Molecular Typing)	2 x 4 mL EDTA blood (purple top tube)	
HLA-DRB4* (Class II Molecular Typing)	2 x 4 mL EDTA blood (purple top tube)	
HLA-DRB5* (Class II Molecular Typing)	2 x 4 mL EDTA blood (purple top tube)	
HNPP (Hereditary Neuropathy with Liability to Pressure Nerve Palsy) (PMP22 deletion analysis) (DNA analysis)	2 x 4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Homocysteine (plasma)	4 mL EDTA blood (purple top tube)	For methionine load: record patient weight on request form. Overnight fast (last meal low in protein) required. Take baseline and 6 hours post methionine load (0.1 g/kg in 200 mL orange juice). Deliver the specimens to the laboratory on ice within 30 minutes of collection.
Homocysteine (urine)	25 mL random urine in a universal container	Deliver the specimen to the laboratory on ice.
Homovanillic acid (HVA)	24-hour urine in a collection container with HCl (best practice); 20 mL random urine for children	Urine specimen must be refrigerated during collection.
HTLV I/II Antibodies	5 mL clotted blood (yellow top tube) OR 4 mL EDTA blood (purple top tube) OR 1 mL CSF in a plain collection tube without additives	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
HTLV-1 PCR	4 mL EDTA blood (purple top tube) OR 1 mL CSF in a plain collection tube without additives	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Human papilloma virus (HPV) genotyping	Cervical swab OR cytobrush in liquid transport medium (SurePath OR ThinPrep OR Equivalent)	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Human placental lactogen	5 mL clotted blood (yellow top tube)	
Huntington Disease (HTT) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Huntington disease-like 2 (JPH3) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Immunoglobulin A (IgA)	5 mL clotted blood (yellow top tube)	
Immunoglobulin E (IgE Total)	5 mL clotted blood (yellow top tube)	
Immunoglobulin G (IgG)	5 mL clotted blood (yellow top tube)	
Immunoglobulin G (IgG) Subclasses	5 mL clotted blood (yellow top tube)	Test includes IgG1, IgG2, IgG3 & IgG4.
Immunoglobulin M (IgM)	5 mL clotted blood (yellow top tube)	
Immunofixation (serum)	5 mL clotted blood (yellow top tube)	See protein electrophoresis (serum).
Immunofixation (urine)	Specimen collection: Timed or random (50 mL) urine collection	See protein electrophoresis (urine).
Immunophenotyping (Flow cytometry): Acute Lymphocytic Leukaemia	4–8 mL EDTA blood (purple top tube) or heparinised blood (green top tube) OR 2 mL bone marrow aspirate in an EDTA (purple top) tube	Please provide full clinical history. Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection. Specimen must reach the referral laboratory within 24 hours of collection.
Immunophenotyping (Flow cytometry): CD34 (stem cell enumeration)	4–8 mL EDTA blood (purple top tube) or heparinised blood (green top tube); 2 mL bone marrow aspirate in an EDTA (purple top) tube OR fluid from an apheresis bag	Please provide full clinical history. Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection. Specimen must reach the referral laboratory within 24 hours of collection.
Immunophenotyping (Flow cytometry): CD4	4 mL EDTA blood (purple top tube)	Please provide full clinical history. Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection. Specimen must reach the referral laboratory within 24 hours of collection.
Immunophenotyping (Flow cytometry): Chronic Lymphocytic Leukaemia	4–8 mL EDTA blood (purple top tube) or heparinised blood (green top tube) OR 2 mL bone marrow aspirate in an EDTA (purple top) tube	Please provide full clinical history. Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection. Specimen must reach the referral laboratory within 24 hours of collection.
Immunophenotyping (Flow cytometry): DNA Ploidy	4 mL EDTA blood (purple top tube)	Please provide full clinical history. Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection. Specimen must reach the referral laboratory within 24 hours of collection.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Immunophenotyping (Flow cytometry): Leukaemia Profile	4–8 mL EDTA blood (purple top tube) or heparinised blood (green top tube) OR 2 mL bone marrow aspirate in an EDTA (purple top) tube	Please provide full clinical history. Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection. Specimen must reach the referral laboratory within 24 hours of collection.
Immunophenotyping (Flow cytometry): Lymphocyte function	4 mL EDTA blood (purple top tube)	Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory. Specimen must reach the referral laboratory within 24 hours of collection.
Immunophenotyping (Flow cytometry): Multiple Myeloma Profile	4–8 mL EDTA blood (purple top tube) or heparinised blood (green top tube) OR 2 mL bone marrow aspirate in an EDTA (purple top) tube	Please provide full clinical history. Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection. Specimen must reach the referral laboratory within 24 hours of collection.
Immunophenotyping (Flow cytometry): Neutrophil function	4 mL EDTA blood (purple top tube)	Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory. Specimen must reach the referral laboratory within 24 hours of collection.
Immunophenotyping (Flow cytometry): Paroxysmal Nocturnal Haemoglobinuria (PNH)	4 mL EDTA blood (purple top tube)	Please provide full clinical history. Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection. Specimen must reach the referral laboratory within 24 hours of collection.
Immunophenotyping (Flow cytometry): Platelet Profile	4 mL EDTA blood (purple top tube)	Please provide full clinical history. Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection. Specimen must reach the referral laboratory within 24 hours of collection.
Immunophenotyping (Flow cytometry): T-, B- & NK-cell counts	4 mL EDTA blood (purple top tube) OR bronchoalveolar lavage fluid in a universal container	Arrange the test with the referral laboratory before collecting the specimen. Please contact the local laboratory to obtain the contact details for the referral laboratory.
Immunophenotyping (Flow cytometry): T-lymphocyte subset analysis	4 mL EDTA blood (purple top tube)	Please provide full clinical history. Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection. Specimen must reach the referral laboratory within 24 hours of collection.
Infection Control testing	Various samples	Please see Section 19.0 for specific guidelines on specimen collection and Infection Control tests offered.
Insulin	5 mL clotted blood (yellow top tube)	Fasting specimen is preferred. Avoid haemolysis during venepuncture. Any degree of haemolysis may falsely decrease insulin levels.
Insulin-like growth factor (IGF)-1	5 mL clotted blood (yellow top tube)	Please include the age and sex of the patient on the request form.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Interleukin (1–6)	5 mL clotted blood (yellow top tube)	
International Normalised Ratio (INR)	5 mL blood in sodium citrate (blue top) tube	Specimen should reach the laboratory within 6 hours of collection. If delays are anticipated, contact the relevant laboratory for further instructions.
Intravascular device tips for MC&S	Place tip in a universal container	
Intrinsic Factor Blocking Antibodies	5 mL clotted blood (yellow top tube)	
Iron	5 mL clotted blood (yellow top tube)	
Iron studies (iron, transferrin, transferrin saturation, ferritin)	5 mL clotted blood (yellow top tube)	Avoid haemolysis during venesection.
Isopropanol stability test	4 mL EDTA blood (purple top tube) from patient AND 4 mL EDTA blood (purple top tube) from a healthy control	Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection. Specimen must reach the referral laboratory within 4 hours of collection.
JAK2 exon 12 mutations (DNA analysis)	4 mL EDTA blood (purple top tube)	
JAK2 G1849T (V617F) mutation (DNA analysis)	4 mL EDTA blood (purple top tube)	
JC virus PCR	1 mL CSF in a plain collection tube without additives	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Kanamycin	5 mL clotted blood (yellow top tube)	Trough levels to be collected 30 minutes prior to next dose, peak levels to be collected 30 minutes after a 1-hour infusion. Please state the time of last dose on the request form.
Kennedy's Disease (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Ketones (acetoacetate) (quantitative)	Contact laboratory for tube type	Ensure timely processing of specimen in the laboratory by contacting the local laboratory before specimen collection. Deliver the specimen to the laboratory on ice within 30 minutes of collection.
Ketones (serum) (qualitative)	Test discontinued in several labs. Contact lab to confirm if test is still offered.	
Ketones (β-hydroxybutyrate) (quantitative)	Contact laboratory for tube type	Ensure timely processing of specimen in the laboratory by contacting the local laboratory before specimen collection. Deliver the specimen to the laboratory on ice within 30 minutes of collection.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Kleihauer test	4 mL maternal blood in EDTA (purple top) tube	Arrange the test with the referral laboratory before collecting the specimen. Please contact the local laboratory to obtain the contact details for the referral laboratory.
Lactate (CSF)	Contact laboratory for tube type	Deliver the specimen to the laboratory on ice. Contact referral laboratory for collection details.
Lactate (plasma)	5 mL blood in a fluoride (grey top) tube	Avoid use of tourniquet during venesection. Deliver to the laboratory within 30 minutes of collection. See Section 15.2.9 on page 130 for detailed instructions and precautions.
Lactate dehydrogenase (LDH) (fluid)	5 mL fluid in a plain collection tube without additives	
Lactate dehydrogenase (LDH) (serum)	5 mL clotted blood (yellow top tube)	
Lactate dehydrogenase isoenzymes	5 mL clotted blood (yellow top tube)	Avoid haemolysis during venesection.
Lamellar body count (amniotic fluid)	15 mL amniotic fluid in a collection tube without additives	Avoid contamination with blood and meconium during sampling.
Lamotrigine (Lamictin)	Contact laboratory for tube type	A steady state pre-dose (trough specimen) is required. This should be noted on the request form. Please indicate weight and age of patient, and time of last dose prior to specimen collection on the request form.
Larvae of *Strongyloides stercoralis*	Stool, small bowel aspirate (also sputum, vomitus, urine, or CSF in disseminated infection) in a universal container	Handle specimen with care as the larvae are infective.
Lead (urine)	25 mL random urine in a universal container. Contact laboratory in case an acid-washed container is required (supplied by lab).	
Lead (whole blood)	4 mL EDTA blood (purple top tube)	
Leber hereditary optic neuropathy (LHON) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Legionella Antibodies	5 mL clotted blood (yellow top tube)	
Legionella culture	Bronchoalveolar lavage (BAL) fluid or lung biopsy material in a sterile universal container	
Legionella urine Antigen test	Urine specimen in a universal container	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Leigh syndrome (LS) SURF1 (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Leigh syndrome (mitochondrial DNA analysis)	Frozen muscle biopsy (preferred) or 4 mL EDTA blood (purple top tube)	Muscle is the preferred specimen. Blood will be accepted. DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Leishmania (cutaneous) Microscopy and PCR	Skin biopsy specimens should be taken from the edge of the lesion, not the centre	If possible, the specimen should be divided in 2 (send one half in saline and the other half in 70% ethanol, both on ice). Please indicate clearly which container contains 70% ethanol and which one saline.
Leishmania (mucocutaneous)	Please contact the referral laboratory for collection and transport details	
Leishmania (visceral)	Please contact the referral laboratory for collection and transport details	
Leptospira Antibodies	5 mL clotted blood (yellow top tube)	
Lesch-Nyhan syndrome (HPRT1) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Leucocyte (Neutrophil) Alkaline Phosphatase	4 mL EDTA blood (purple top tube)	Test must be arranged with the laboratory in advance as the test must be performed within 30 minutes of collection.
Liddle syndrome (ENaC) (SCNN1B exon 13) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Liddle Syndrome (ENaC) SCNN1B R563Q) (African) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Lipase	5 mL clotted blood (yellow top tube)	
Lipoprotein electrophoresis	5 mL clotted blood (yellow top tube)	Fasting blood specimen required.
Lipogram (HDL, LDL, total cholesterol & triglycerides)	5 mL clotted blood (yellow top tube)	Fasting blood specimen required.
Lipoid Proteinosis (Afrikaner founder mutations) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Lipoprotein (a)	Contact your laboratory for tube type	
Liquid Based Cytology (LBC)	LBC Vial	Rinse the brush immediately into LBC vial solution by pushing/squashing it into the bottom of the vial 10 times, forcing the bristles to bend apart. Do not leave the tip of the brush inside the vial.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Lithium	5 mL clotted blood (yellow top tube)	Use lithium-free collection tubes. Draw trough level 12 hours after evening dose. Follow up at the same time of day. If toxicity is suspected, please mark as STAT and arrange for immediate analysis by the laboratory.
Low Density Lipoprotein (LDL) Cholesterol	5 mL clotted blood (yellow top tube)	In some laboratories, a lipogram is required for calculating LDL cholesterol using the Sampson and Friedewald equations, while in others, LDL cholesterol is directly measured.
LPL (Lipoprotein Lipase Type 1 Hyperlipoproteinaemia) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Lupus Anticoagulant	5 mL blood in sodium citrate (blue top) tube	This test is not suitable for heparinised patients. Specimen should reach the laboratory within 6 hours of collection.
Luteinizing hormone (LH)	5 mL clotted blood (yellow top tube)	
Lymphocyte proliferation	Heparin	Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory.
Lymphocytotoxic Antibodies	5 mL clotted blood (yellow top tube)	
Lynch syndrome (5 common South African variants)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Lysergic acid diethylamide (LSD) (urine screen)	25 mL random urine in a universal container	
Macroprolactin	5 mL blood in SST (yellow top) tube	Only performed if prolactin result is above the upper limit of the reference interval.
Magnesium (red cell)	5 mL blood in lithium-heparin (green top) tube	
Magnesium (serum)	5 mL clotted blood (yellow top tube)	
Magnesium (urine)	24-hour urine collection	Collect a 24-hour urine specimen in a container with HCl, which is available from the laboratory.
Malaria rapid screen	4 mL EDTA blood (purple top tube)	
Malaria smear	4 mL EDTA blood (purple top tube)	Specimen must be tested within 24 hours of collection.
Mandelic acid (urine)	5 mL random urine in a universal container	
Mandrax (methaqualone)	25 mL random urine in a universal container	Deliver the specimen to the laboratory on ice.
Manganese (blood)	4 mL EDTA blood (royal blue or purple top tube)	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Manganese (urine)	25 mL random urine in an acid-washed container is required	Collect urine specimen in an acid-washed container, which is available from the laboratory. Urine specimen must be refrigerated after collection.
Mast cell tryptase (suspected anaphylaxis)	5 mL clotted blood (yellow top tube)	
Maternal Cell Contamination screen (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
MCAD (ACADM, A985G) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
McArdle's Disease (PYGM R50X) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Measles virus IgM Antibodies for measles surveillance	5 mL clotted blood (yellow top tube)	This is a notifiable medical condition – requires case notification and EPID form. Please see Section 21.7.2 on page 217 for specific guidelines on this notifiable condition.
Measles virus IgG Antibodies	5 mL clotted blood (yellow top tube) OR 4 mL EDTA blood (purple top tube)	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Measles virus PCR	4 mL EDTA blood (purple top tube); 1 mL CSF in a plain collection tube without additives; random urine specimen OR respiratory tract specimen in a universal container (throat swab is the preferred specimen)	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Measles virus isolation	Urine specimen OR respiratory tract specimen in a universal container (throat swab is the preferred specimen)	Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Meningitis panel PCR	1 mL CSF in a plain collection tube without additives	Specific panel for viral targets depends on the assay used by the different referral laboratories. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Mercury (blood)	4 mL EDTA blood (purple top tube)	
Mercury (urine)	25 mL random urine in a universal container. Contact laboratory in case an acid-washed container is required (supplied by lab).	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
MERRF (Myoclonic epilepsy with ragged-red fibers) (DNA analysis)	Frozen muscle biopsy OR 10 mL random urine specimen in a universal container	DNA may also be extracted from blood or other body tissues, but urine and muscle are most reliable.
Metabolic screen	25 mL random urine in a universal container	Minimum 10 mL urine required. Deliver the specimen to the laboratory on ice immediately after collection.
Metanephrines (fractionated)	24-hour urine collection	Collect a urine specimen in a container with HCl, which is available from the laboratory. Supply patient height and weight on the request form. See Section 15.2.6 on page 129 for detailed instructions and precautions.
Methadone (qualitative)	25 mL random urine in a universal container	
Methaemoglobin	Contact laboratory for collection details	Please arrange the test with the laboratory before collecting the specimen. The collection tube must be filled completely, leaving no residual air. Deliver the specimen to the laboratory on ice immediately after collection.
Methamphetamine (Screen for ecstasy, MDMA)	25 mL random urine in a universal container	
Methanol	25 mL random urine in a universal container	
Methotrexate	5 mL clotted blood (red top tube)	
Methylhippuric acid (screen for xylene exposure)	25 mL random urine in a universal container	
Microarray (constitutional)	4–8 mL EDTA blood (purple top tube)	Referral via Genetic Services, accompanied by a completed Constitutional Microarray request form.
Microarray DNA copy number microarray: Panel for CLL (913q14.3, TP53, ATM, Trisomy 12)	2 x 4 mL EDTA blood (purple top tube) OR 1 mL bone marrow aspirate in EDTA (purple top) tube	Deliver the specimen to the laboratory at room temperature. The specimen must reach the referral laboratory within 48 hours of collection.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Microdeletion / duplication syndromes (MLPA) (DNA analysis) 1p36 deletion syndrome; 2p16 microdeletion; 2q23 microdeletion/MBD5; 2q33 microdeletion/SATB2; 3q29 microdeletion; 9q22.3 microdeletion; 15q24 deletion syndrome; 17q21 microdeletion; 22q13 / Phelan-McDermid; Cri du Chat syndrome, 5p15; DiGeorge syndrome 22q11; Distal 22q11 region; DiGeorge region 2, 10p14; Langer-Giedion syndrome, 8q; Miller-Dieker syndrome, 17p; NF1 microdeletion syndrome; Prader-Willi / Angelman; MECP2 / Xq28 duplication; Rubinstein-Taybi syndrome; Smith-Magenis syndrome; Sotos syndrome 5q35.3; Williams syndrome; Wolf-Hirschhorn 4p16.3	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Microfilaria microscopy	4 mL EDTA blood (purple top tube)	Please contact the referral laboratory for special sampling instructions
Microsatellite instability analysis (MSI) (DNA analysis)	FFPE tissue sections OR 4 mL EDTA blood (purple top tube)	See special instructions in Section 22.2.2.4 on page 230 under Genetic Testing.
Mitochondrial deletion screen (Kearn Sayers, Pearson Syndrome, CPEO) (DNA analysis)	Frozen muscle biopsy required for CPEO and Kearn Sayers; 4 mL EDTA blood required for Pearson Syndrome	DNA from blood may be accepted for Kearn Sayers patients under the age of 20 (although not recommended), but muscle is essential for CPEO.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Mitochondrial DNA copy number determination (mtDNA maintenance disorders) (DNA analysis)	Frozen muscle or frozen liver only (affected tissue) – to be sent on dry ice.	Please discuss with Groote Schuur – Inherited Metabolic Diseases laboratory before collecting the specimen.
Mitochondrial DNA full sequencing (including mtDNA inherited: MELAS, MERRF, Leigh (MILS), LHON, NARP, MIDD, KSS, CPEO, CIPO, DEAF, SNHL, KS, etc.)	Muscle biopsy preferred/EDTA blood and early morning urine accepted in some cases. Full clinical details required. Muscle essential for CPEO cases.	Please submit complete clinical summary and contact details of the consultant in charge.
Mitochondrial DNA (mtDNA) m.3243A>G mutation analysis for MELAS (Mitochondrial Encephalopathy with Lactic Acidosis and Stroke-like Episodes) or MIDD (Maternally Inherited Diabetes and Deafness)	Frozen muscle biopsy OR 10 mL random urine specimen in a universal container	DNA may also be extracted from blood or other body tissues, but urine and muscle are most reliable.
Mitochondrial neurohepatopathy (MPV17, c.106C>T common mutation) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Mitochondrial non-syndromic hearing loss (m.1555A>G variant detection)	Urine preferred / EDTA blood accepted	Please submit complete clinical summary and contact details of the consultant in charge.
Molluscum contagiosum Electron Microscopy (EM)	Lesion fluid (between two glass slides)	On special request only and need to be discussed with the referral laboratory before collecting the specimen – obtain their contact details from your local laboratory.
Monkey Pox DNA analysis	Lesion fluid OR lesion swab from the ulcer base in or without viral transport medium OR scabs	Transport specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Morphine (screen for opiates)	25 mL random urine in a universal container	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
MTHFR C677T mutation (DNA analysis)	4 mL EDTA blood (purple top tube)	
Mucolipidosis IV (Ashkenazi Jewish) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Mucopolysaccharides (glycosaminoglycans)	25 mL random urine in a universal container	Minimum 5 mL urine required. Deliver the specimen to the laboratory on ice immediately after collection.
Mucormycosis	Nasal scraping or tissue specimen in a universal container	Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory. Tissue should be submitted in normal saline.
Multiple Endocrine Neoplasia Type I (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Multiple Endocrine Neoplasia Type 2A (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Mumps virus IgG Antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice.
Mumps virus IgM Antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice.
Mumps virus PCR	1 mL CSF in a plain collection tube without additives; 5 mL random urine specimen in a universal container	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Mycophenolic acid (Cellcept)	5 mL clotted blood (yellow top tube)	Specimen needs to be processed by the laboratory within 4 hours of collection.
Mycoplasma IgG & IgM Antibodies	5 mL clotted blood (yellow top tube)	
Myoadenylate deaminase deficiency (AMPD1, C34T) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Myoglobin (plasma)	Contact laboratory for tube type	Deliver the specimen to the laboratory immediately after collection.
Myoglobin (urine) (qualitative)	25 mL random urine in a universal container on ice	Deliver the specimen to the laboratory on ice immediately after collection.
Myotonic Dystrophy (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
N-Acetyl Transferse 2 (NAT2) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
NARP (Neurogenic Weakness with Ataxia and Retinitis Pigmentosa) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Neuron specific enolase	5 mL clotted blood (yellow top tube)	
Neutrophil oxidative burst test	5 mL heparinised (green top tube) blood	Arrange the test with the referral laboratory before collecting the specimen. Please contact the local laboratory to obtain the contact details for the referral laboratory.
Nickel (blood)	5 mL heparinised (green top tube) blood	
Nickel (urine)	25 mL random urine in a metal-free container without preservative	
Niemann Pick Disease Type A (Ashkenazi Jewish) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Nocardia culture	Specimen from potentially infected site in a sterile universal container	Please state clearly on the request form that *Nocardia* culture is requested as prolonged incubation is required.
NPM1 (DNA analysis)	4 mL EDTA blood (purple top tube) OR Bone marrow	
Oculocutaneous Albinism type 2 (OCA2 deletion) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Oestradiol (E2)	5 mL clotted blood (yellow top tube)	
Oligoclonal bands	1 mL CSF in a plain collection tube without additives AND 5 mL clotted blood (yellow top tube)	Please submit simultaneous serum specimen for result interpretation.
Opiates (qualitative)	25 mL random urine in a universal container	
Orf virus electron microscopy (EM)	Lesion fluid (between two glass slides)	On special request only: Arrange the test with the referral laboratory before collecting the specimen. Please contact the local laboratory to obtain the contact details for the referral laboratory.
Organic acids	25 mL random urine in a universal container	Minimum 5–10 mL urine required. Deliver the specimen to the laboratory immediately after collection.
Orotic acid (urea cycle disorder)	4 mL EDTA (purple top tube) or heparinised (green top tube) blood	Deliver the specimen to the laboratory on ice immediately after collection.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Osmolality (serum)	5 mL clotted blood (yellow top tube)	
Osmolality (stool)	Watery stool specimen in a universal container	Deliver the specimen to the laboratory on ice.
Osmolality (urine)	25 mL random urine in a universal container	Deliver the specimen to the laboratory on ice.
Osmotic fragility	4 mL EDTA blood (purple top tube)	Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory.
Osteocalcin	5 mL clotted blood (yellow top tube)	Avoid haemolysis during venesection. Deliver the specimen to the laboratory on ice.
Osteogenesis imperfecta type III (OI-III) (DNA analysis)	4 mL EDTA blood (purple top tube)	Testing for the c.831dupC FKBP10 variant (common in the Indigenous Black South African population). DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
OTC (Ornithine Carbamoyltransferase Deficiency) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Oxalate	24-hour urine collection (best practice)	Collect a 24-hour urine specimen in a container with HCl, which is available from the laboratory. Deliver the specimen to the laboratory on ice.
Oxcarbazepine (Trileptal)	4 mL EDTA blood (purple top tube)	
Oxidative burst	5 mL heparinised (green top tube) blood	Specimen should reach the laboratory within 6 hours of collection.
Pandemic influenza A (H1N1) PCR	Respiratory tract specimen in viral transport medium (VTM)	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Paraneoplastic Antibodies	5 mL clotted blood (yellow top tube) OR CSF in a plain collection tube without additives	
Parasite microscopy	Stool, urine, fluid aspirate, OR tissue specimen in a universal container	
Parathyroid hormone (PTH)	4 mL EDTA blood (purple top tube)	
Parentage testing (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Partial thromboplastin time (PTT)	5 mL blood in sodium citrate (blue top) tube	Specimens must reach the laboratory within 6 hours of collection. If delays are anticipated, contact the relevant laboratory for further instructions.
Parvovirus B19 IgG Antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Parvovirus B19 IgM Antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Parvovirus B19 PCR	4 mL EDTA blood (purple top tube) OR biopsy material from an amniocentesis or cordocentesis in a universal container OR bone marrow aspirate in a sterile universal container	Biopsy material must be sent in normal saline (never in formalin). Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
PCR for B-cell immunoglobulin gene rearrangement (IgH)	4 mL blood, bone marrow aspirate, CSF, pleural or ascitic fluid in an EDTA (purple top) collection tube OR unstained peripheral blood or bone marrow slides	Refrigerate blood and bone marrow if kept overnight. Transport slides at room temperature.
PCR for T-cell gene rearrangement	4 mL blood, bone marrow aspirate, CSF, pleural or ascitic fluid in an EDTA (purple top) collection tube OR unstained peripheral blood or bone marrow slides	Refrigerate blood and bone marrow if kept overnight. Transport slides at room temperature.
PCR: t(11;14) CCND1/IGH@	4 mL EDTA blood (purple top tube)	
PCR: t(14;18) IGH@/BCL2	4 mL EDTA blood (purple top tube)	
Pertussis	Please see *Bordetella pertussis* in this table	Please see *Bordetella pertussis* in this table.
pH	5 mL urine, body fluids or stool	Performed with dipsticks.
Phagocytic index & chemotaxis	Heparin tube	Specimen should reach the laboratory within 6 hours of collection.
Phenobarbital (Gardenal)	5 mL clotted blood (yellow top tube)	Trough specimen recommended.
Phencyclidine (PCP) (qualitative)	25 mL random urine in a universal container	
Phenytoin (Epanutin)	5 mL clotted blood (yellow top tube)	A trough level (just before the next dose) is used to assess adequate therapy. A peak level (4−5 hours after dose and delayed up to 8 hours if taken with food) is used to assess toxicity.
Phosphate (serum)	5 mL clotted blood (yellow top tube)	
Phosphate (urine)	Random (2nd morning void) or timed urine	Collect a 24-hour urine specimen in a container with HCl, which is available from the laboratory. Please indicate on the request form whether you require the tubular reabsorption of phosphate and/or the tubular maximum

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
		reabsorption (TmP) to GFR ratio. For tubular reabsorption of phosphate a simultaneous clotted (yellow top tube) blood specimen is required.
Phosphatidyl glycerol (amniotic fluid)	15 mL amniotic fluid in a collection tube without additives	Avoid contamination with blood and meconium during sampling.
Phosphine	10 mL postmortem stomach contents	
Pinworm (*Enterobius vermicularis*)	Collect specimens using the cello tape method	Please see Section 17.11.3 on page 167 for collection instructions.
Platelet count	4 mL EDTA blood (purple top tube)	Specimen must reach the laboratory within 24 hours of collection.
Platelet function tests	5 x 5 mL blood in sodium citrate (blue top) tubes (contact laboratory prior to collection for exact requirements)	Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory. Do not refrigerate or transport specimens on ice. Full blood count should be performed on the same day. Please provide clinical and drug history.
Pneumocystis jiroveci (PCP) antigen detection (IFA)	Induced sputum or bronchoalveolar lavage (BAL) specimen in a firmly closed, screwcap universal container	
Pneumocystis jiroveci (PCP) PCR	Induced sputum or bronchoalveolar lavage (BAL) specimen in a firmly closed, screwcap universal container	
POLG spectrum disorders: including Alpers-Huttenlocher syndrome (AHS), autosomal recessive progressive external opthalmoplegia (arPEO), autosomal dominant progressive external opthalmoplegia (adPEO), sensory ataxia neuropathy dysarthria and opthalmoplegia (SANDO), ataxia neuropathy spectrum (ANS), mitochondrial recessive ataxia syndrome (MIRAS), myoclonic epilepsy myopathy sensory ataxia (MEMSA),	4 mL EDTA blood (purple top tube)	Please discuss with Groote Schuur – Inherited Metabolic Diseases laboratory prior to sending. DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
myocerebrohepatopathy spectrum (MCHS)		
Polio Types 1−3 neutralising antibody titres	5 mL clotted blood (yellow top tube)	Two specimens taken 14 days apart are needed for meaningful interpretation.
Porphobilinogen (PBG)	25 mL random urine in a universal container	Protect specimens from light during collection and transport. See Section 15.2.10 on page 131 for detailed instructions.
Porphyria (plasma emission spectra)	4 mL EDTA blood (purple top tube)	Protect specimens from light during collection and transport. See Section 15.2.10 on page 131 for detailed instructions.
Porphyria Cutanea Tarda (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Porphyria screen (total porphyrins: acute or chronic)	4 mL EDTA blood (purple top tube); 25 mL early morning urine specimen in a universal container AND fresh random stool specimen in a universal container	Protect specimens from light during collection and transport. See Section 15.2.10 on page 131 for detailed instructions.
Porphyria Variegata (PPOX R59W) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Porphyrins (fractionation)	4 mL EDTA blood (purple top tube); 25 mL early morning urine specimen in a universal container AND fresh random stool specimen in a universal container	Protect specimens from light during collection and transport. See Section 15.2.10 on page 131 for detailed instructions.
Potassium (serum)	5 mL clotted blood (yellow top tube)	Avoid haemolysis during venesection. Specimens must reach the laboratory within 24 hours of collection. Specimens must be kept at room temperature; refrigeration or contact with ice will falsely increase potassium results.
Potassium (stool)	Watery stool specimen in a universal container	
Potassium (urine)	Random or timed urine specimen	
Prader-Willi / Angelman Syndrome Methylation Study (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Pre-albumin	5 mL clotted blood (yellow top tube)	Transport specimen at room temperature.
Primary Hyperoxaluria Type 1 (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Primary Immune-deficiency	Please contact the laboratory for tube	Before collecting the specimen, arrange the test with the referral laboratory,

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
testing/Inborn errors of immunity testing	type	and obtain their contact details from the local laboratory.
Pro-BNP (NT)	Contact laboratory for tube type	Avoid haemolysis during venesection. Deliver the specimen to the laboratory on ice immediately after collection.
Procalcitonin (PCT)	5 mL clotted blood (yellow top tube)	
Progesterone	5 mL clotted blood (yellow top tube)	
Prolactin	5 mL clotted blood (yellow top tube)	See Section 15.2.8 on page 130 for detailed instructions and precautions.
Proliferating Cell Nuclear Antigen (PCNA)	5 mL clotted blood (yellow top tube)	
Prostatic specific antigen (free) (ratio)	5 mL clotted blood (yellow top tube)	
Prostatic specific antigen (PSA) (total)	5 mL clotted blood (yellow top tube)	
Protein (total) (CSF)	0.5 mL CSF in a plain collection tube without additives	
Protein (total) (fluid)	5 mL fluid in a plain collection tube without additives	
Protein (total) (serum)	5 mL clotted blood (yellow top tube)	
Protein (total) (urine)	Random or timed urine	
Protein C	5 mL blood in sodium citrate (blue top) tube on ice	Please provide full clinical history. Specimens must reach the laboratory within 6 hours of collection. If delays are anticipated, contact the relevant laboratory for further instructions.
Protein electrophoresis (Bence Jones protein) (urine)	Timed or random (50 mL) urine collection. Contact laboratory to confirm if preservative is required.	
Protein electrophoresis (serum)	5 mL clotted blood (yellow top tube)	
Protein S	5 mL blood in sodium citrate (blue top) tube on ice	Please provide full clinical history. Specimens must reach the laboratory within 6 hours of collection. If delays are anticipated, contact the relevant laboratory for further instructions.
Prothrombin (DNA analysis)	4 mL EDTA blood (purple top tube)	
Prothrombin time (PT)	5 mL blood in sodium citrate (blue top) tube	Specimens must reach the laboratory within 6 hours of collection. If delays are anticipated, contact the relevant laboratory for further instructions.
Pseudoxanthoma Elasticum	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test,

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
(*ABCC6*) (Afrikaner) (DNA analysis)		the patient and reason for testing. See Section 22 for additional information.
Public Health testing	Various samples	Please see Section 20.0 for sampling guidelines for Public Health testing. The nearest Public Health laboratory can also be contacted for further assistance.
Pus for MC&S	Aspirate in a sterile universal container or send pus swab if pus cannot be aspirated	Pus aspirate is the preferred specimen. Please indicate the site of pus collection as selective media may be required. See Section 17.9.3 on page 161 for collection instructions.
Pyruvate (blood)	Contact your laboratory for tube type and arrange with laboratory at least one day prior to collection.	Tested in conjunction with plasma lactate taken at the same time. Pyruvate will only be performed if the lactate result is elevated.
Pyruvate (CSF)	Contact the referral laboratory	Contact the referral laboratory before specimen collection.
QF-PCR: Aneuploidy (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
QR-PCR: Inversion 16 CBFB AML (Quantitative RNA test)	4 mL EDTA blood (purple top tube) OR Bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
QR-PCR: t(1;19) TCF3/PBX1 (E2A/PBX1) ALL (Quantitative RNA test)	4 mL EDTA blood (purple top tube) OR Bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
QR-PCR: t(12;21) ETV6/RUNX1 (TEL/AML1) ALL (Quantitative RNA test)	4 mL EDTA blood (purple top tube) OR Bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
QR-PCR: t(15;17) PML/RARA APL (Quantitative RNA test)	4 mL EDTA blood (purple top tube) OR Bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
QR-PCR: t(8;21) RUNX1/AML1T1 (AML1/ETO) AML (Quantitative RNA test)	4 mL EDTA blood (purple top tube) OR Bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
QR-PCR: t(9;22) BCR/ABL1 Mbcr ALL (Quantitative RNA test)	4 mL EDTA blood (purple top tube) OR Bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
QR-PCR: t(9;22) BCR/ABL1 Mbcr CML (Quantitative RNA test)	4 mL EDTA blood (purple top tube) OR Bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
QR-PCR: t(9;22) BCR/ABL1 p230 CML (Quantitative RNA test)	4 mL EDTA blood (purple top tube) OR Bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
Quinine	2 x 4 mL EDTA blood (purple top tube) wrapped in foil.	Specimens must be wrapped in foil and delivered to the laboratory immediately after collection for separation of plasma from cells.
Rabies (suspected)	Please see the Rabies: Antemortem & Postmortem Specimen Collection Guide in Section 21.8.1.1 on pages 218–219.	Please see Section 21.8.1.1 on pages 218–219 for specific guidelines on this notifiable condition.
Rectal biopsy	Biopsy material in a sterile universal container with normal saline (for MC&S) and in 10% formalin (for histology)	Specimens must be kept at 2−8ºC. Please state clearly which transport medium was used.
Rectal swab for MC&S	Rectal swab in transport medium	Indicated for typhoid/enteric fever (in initial stage when patients are often constipated) and screening for multidrug-resistant (MDR) organisms. Swab must be placed in transport medium and taken to the laboratory immediately after collection.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Red cell membrane studies (hereditary red cell membrane disorders)	2 x 6 mL ACD solution B (light yellow top tube) blood from patient AND one ACD solution B (yellow top tube) blood from healthy control	Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory. Results from FBC and reticulocyte count, haemolytic markers, Coombs test, Hb electrophoresis, osmotic fragility, cryohaemolysis, etc. must be available in advance.
Reducing substances (Benedict's screening test) (stool)	Random stool specimen in a universal container	Minimum 5 mL specimen required. Deliver the specimen to the laboratory on ice. A positive Benedict's test is followed, in some centres, by thin-layer chromatography to identify specific sugars.
Reducing substances (Benedict's screening test) (urine)	25 mL random urine in a universal container	Minimum 5 mL specimen required. Deliver the specimen to the laboratory on ice. A positive Benedict's test is followed, in some centres, by thin-layer chromatography to identify specific sugars.
Related living donor (RLD) flow cross match	Donor: 2 x 5 mL ACD solution B (light yellow top tube) blood AND 2 x 5 mL clotted (yellow top tube) blood; Recipient: 2 x 5 mL ACD solution B (light yellow top tube) blood AND 2 x 5 mL clotted (yellow top tube) blood	Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory. Specimens must be stored and transported at room temperature and must reach the laboratory within 24 hours of collection.
Renal biopsy	Specimen in fixative	Prior notification is required, then contact laboratory at least 24 hours in advance for specimen collection.
Renin (active) (mass)	4 mL EDTA blood (purple top tube)	Do NOT refrigerate specimen. See Section 15.2.5 on pages 128–129 for detailed instructions and precautions. Record time of day and position of the patient (supine or upright). Careful standardisation of the patient preparation and sampling condition is strongly recommended for valid results. Fasting specimens are recommended but not required.
Respiratory syncytial virus (RSV) Rapid EIA	Respiratory tract specimen (swabs in or without viral transport medium)	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Respiratory virus isolation (culture)	Respiratory tract specimen (swabs in or without viral transport medium)	Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Respiratory virus panel PCR	Respiratory tract specimen in viral transport medium	Specific panel viral targets depend on the assay used by the different referral laboratories. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Reticulocyte count	4 mL EDTA blood (purple top tube)	Specimen must reach the laboratory within 24 hours of collection.
Rett syndrome (*MECP2*) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Rheumatoid factor	5 mL clotted blood (yellow top tube)	
Rickettsia conorii (tick-bite fever) Antibodies (IFA)	5 mL clotted blood (yellow top tube)	
Rotavirus rapid antigen test	1−2 g fresh stool specimen in a universal container	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
RT-PCR: t(1;19) TCF3/PBX1 (E2A/PBX1) (Qualitative RNA test)	4 mL EDTA blood (purple top tube) OR bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
RT-PCR: t(15;17) PML/RARA APL (Qualitative RNA test)	4 mL EDTA blood (purple top tube) OR bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
RT-PCR: t(4;11) MLL/AF4 (Qualitative RNA test)	4 mL EDTA blood (purple top tube) OR bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
RT-PCR: t(9;22) BCR/ABL1 p190 (Qualitative RNA test)	4 mL EDTA blood (purple top tube) OR bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
RT-PCR: t(9;22) BCR/ABL1 p210 (Qualitative RNA test)	4 mL EDTA blood (purple top tube) OR bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
RT-PCR: t(9;22) BCR/ABL1 p230 (Qualitative RNA test)	4 mL EDTA blood (purple top tube) OR bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Rubella virus IgG Antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Rubella virus IgG Antibodies avidity index	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Only done in suspected cases of congenital Rubella when both Rubella IgG and IgM are positive. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Rubella virus IgM Antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Rubella virus PCR	4 mL EDTA blood (purple top tube); respiratory tract specimen in viral transport medium (VTM); random urine specimen OR biopsy material from an amniocentesis or cordocentesis in a universal container	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Russell-Silver syndrome (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Ryanodine receptor for AR centronuclear myopathy (RYR1) common mutations (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
S100B protein	5 mL clotted blood (yellow top tube)	
Salicylate (Aspirin)	5 mL clotted blood (yellow top tube)	
Salmonella Typhi	8−10 mL blood/bone marrow aspirate in an aerobic blood culture bottle; 5 mL random urine specimen; random stool specimen OR rectal swab in transport medium	
Salmonella (non-typhoidal)	8−10 mL blood in an aerobic blood culture bottle; random stool specimen	
SARS-CoV-2 PCR	Respiratory tract specimens – Nasal/ nasopharyngeal/throat swab in or without viral transport medium, nasal washing, nasopharyngeal aspirate or bronchoalveolar lavage (BAL) fluid	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
SARS-CoV-2 Ag	Nasopharyngeal/oropharyngeal specimens	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
SARS-CoV-2 antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Antibodies are not used to diagnose SARS-CoV-2 infection, and not recommended to assess immunity (correlation of protection not determined). Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Selenium (serum)	5 mL clotted blood (yellow top tube)	
Selenium (urine)	25 mL random urine in a universal container	
Seq CML: t(9;22) BCR/ABL1 Mbcr (RNA test)		All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
Seq GIST: KIT and PDGFRA (DNA analysis)	FFPE tissue block OR 5−10 sections AND an H&E slide with the tumour area ringed	If sections are sent on slides, please use normal glass slides. Please ring tumour area on H&E slide so that only tumour tissue is dissected for DNA extraction.
Sequencing CEBPA (AML)	1 mL EDTA blood (purple top tube) OR bone marrow aspirate OR cytogenetic pellet	Deliver EDTA specimen at room temperature. Contact laboratory if using cytogenetic pellet.
Sequencing IDH1/2 (Gliomas)	FFPE tissue block OR fresh tissue biopsy OR 5−10 x 4 µm FFPE tissue sections on normal glass slides	Ringed tumour area on H&E slide and histopathology report to accompany tissue block.
Sequencing KIT (CBF-AML)	4−8 mL EDTA blood (purple top tube) OR bone marrow aspirate OR extracted genomic DNA >10 ng/µL cytogenetic pellet	Transport EDTA specimen at room temperature. Contact laboratory if using cytogenetic pellet.
Serotonin	Contact laboratory for tube type	
Sex hormone binding globulin (SHBG)	5 mL clotted blood (yellow top tube)	Used to determine free androgen index (see Testosterone).
Sexing / Y chromosome marker (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Shigella culture	Stool specimen in a sterile universal container	
Sickle Cell Anaemia (DNA analysis)	4 mL EDTA blood (purple top tube) OR 5 mL amniotic fluid in a universal container	Genetic testing for sickle cell anaemia is usually performed as part of a prenatal investigation. HPLC is the appropriate first line investigation for haemoglobinopathies.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Sickling test (sickle cell anaemia)	4 mL EDTA blood (purple top tube)	Arrange the test with the referral laboratory before collecting the specimen. Please contact the local laboratory to obtain the contact details for the referral laboratory.
Sirolimus (Rapamune)	2 x 4 mL EDTA blood (purple top tube)	Please write clearly on request form: DO NOT SPIN
Sodium (serum)	5 mL clotted blood (yellow top tube)	
Sodium (stool)	Watery stool specimen in a universal container	
Sodium (urine)	Random or timed urine	
Soluble transferrin receptor	5 mL clotted blood (yellow top tube)	
Specific gravity	25 mL random urine in a universal container	Deliver the specimen to the laboratory on ice within 4 hours of collection. Performed with dipsticks.
Spinal Muscular Atrophy (MLPA) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Spinal Muscular Atrophy (SMN1 exon 7 deletion) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Spinocerebellar Ataxias (SCA1, 2, 3, 6, 7, 12, 17) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Sputum for MC&S	Fresh sputum specimen in a sterile universal container	Please refer to Section 17.6.1.1 on pages 151–153 for guidelines on sputum specimen collection. Please submit separate specimens if TB-NAAT or PCP antigen/PCR detection is requested as well.
SQRT-PCR: t(15;17) PML/RARA APL (Semi-quantitative RNA test)	4 mL EDTA blood (purple top tube) OR Bone marrow	All specimens for RNA-based testing should reach the laboratory within 24 hours of collection. However, as methodologies and specimen requirements differ between the laboratories nationally, the specific referral laboratory should be contacted for information regarding the correct specimen type, volume, specimen container/tube and transport conditions.
Squamous cell cancer antigen	5 mL clotted blood (yellow top tube)	
Stargardt Disease (ABCA4) (Afrikaner) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Steatocrit	Random stool specimen in a universal container	Minimum 10 g of stool required.
Steroid-resistant Nephrotic syndrome (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Stool culture	Stool specimen in a sterile universal container	Routine culture includes *Salmonella* and *Shigella*. Culture for *Vibrio cholerae*, entero-haemorrhagic *E. coli* and any other stool pathogen is only performed if specifically requested and depending on patient demographics.
Stool microscopy	Stool specimen in a sterile universal container	Please indicate if patient is HIV-positive or has a travel history.
Subtelomeric deletions / duplications (MLPA) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Succinylacetone (tyrosinaemia type 1)	25 mL random urine in a universal container	Collect a urine specimen in a container with HCl, which is available from the laboratory.
Succinyl-CoA:3-ketoacid CoA transferase (SCOT) deficiency (OXCT1 gene) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Sucrose lysis test	2 x 4 mL EDTA blood (purple top tube)	Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory.
Sulfite (urine)	5 mL fresh urine in a universal container	Screening for molybdenum co-factor deficiency and sulfite oxidase deficiency. Deliver specimen to the laboratory on ice immediately after collection.
Sulfonylureas	4 mL EDTA blood (purple top tube)	Collect 1 x EDTA tube, wrap in foil, and transport to lab as soon as possible at room temperature. Assay detects chlorpropamide, gliclazide and glipizide.
Sweat test	Pre-arrange with laboratory where available	See Section 15.2.11 on pages 131–132 for detailed instructions and precautions.
Syphilis serology	5 mL clotted blood (yellow top tube) OR CSF in a clear tube without additives	Please contact the laboratory to determine if the traditional or reverse screening algorithm is followed.
Syphilis: Fluorescent treponemal antibody (FTA) IgG assay	5 mL clotted blood (yellow top tube) OR 1 mL CSF in a plain collection tube without additives	
Syphilis: Fluorescent treponemal antibody (FTA) IgM assay	5 mL clotted blood (yellow top tube) OR 1 mL CSF in a plain collection tube without additives	
Syphilis: Rapid plasma reagin (RPR)	5 mL clotted blood (yellow top tube)	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Syphilis: *Treponema pallidum* haemagglutination (TPHA) test	5 mL clotted blood (yellow top tube) OR 1 mL CSF in a plain collection tube without additives	
Syphilis: Venereal disease research laboratory (VDRL) test	1 mL CSF in a plain collection tube without additives	VDRL is the recommended non-treponemal serological test for CSF specimens.
Tacrolimus (FK506) levels	4 mL EDTA blood (purple top tube)	Please write clearly on request form: DO NOT SPIN.
Tay Sachs Disease (Ashkenazi Jewish) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information. Genetic testing for Tay Sachs disease is usually performed to identify the HEXA mutations. Enzyme testing is the appropriate first line investigation.
TB (Tuberculosis): Culture & sensitivity	8−10 mL blood or bone marrow aspirate in a BACTEC Myco/F Lytic bottle; 5−10 mL CSF in a plain collection tube without additives; FNA (rinse FNA residue in needle in TB transport medium or sterile saline); at least 1 mL fresh sputum specimen, 10−15 mL fluid aspirate, tissue specimen from potentially infected site.	TB transport medium for FNA specimens can be collected from the laboratory (if available).
TB (Tuberculosis): Drug resistant (DR) Reflex testing	Sputum specimen OR any sterile extra-pulmonary specimen	Only requested for all patients with Rifampicin resistance and/or Isoniazid resistance.
TB (Tuberculosis): Microscopy (Direct)	Fresh sputum specimen in a sterile universal container	Only to be requested as a follow-up test for response to treatment and not as a stand-alone primary diagnostic test. TB-NAAT is the primary diagnostic test for TB disease.
TB (Tuberculosis): Nucleic acid amplification test (TB-NAAT)	Sputum specimen in a sterile universal container OR any sterile extra-pulmonary specimen	Please refer to Section 17.6.1.1 on pages 151–153 for guidelines on sputum specimen collection.
TERC and TERT mutations in Aplastic Anaemia	4−20 mL peripheral EDTA blood (purple top tube)	Specimens must reach the Molecular Haematology laboratory within 72 hours of collection.
Testosterone	5 mL clotted blood (yellow top tube)	
Theophylline	5 mL clotted blood (yellow top tube)	Oral treatment: Peak level – 2 hours after rapid release preparation or 4 hours after slow-release preparation. IV treatment: Collect specimen 30 minutes after completion of IV dose. Specimen must be processed by the laboratory within 2 hours of collection.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Therapeutic Drugs	10 mL postmortem blood, urine, bile, stomach contents	If the drug(s) are known, specify the drug(s) name.
Throat and nose swab for MC&S	Throat or nose swab in Amies/Stuart's transport medium	Please refer to Sections 17.6.2.1 and 17.6.2.2 on page 158 for collection instructions. Refer to Section 17.6.2.5.1 on page 159 for specific instructions regarding testing for gonococcal pharyngitis.
Thrombin Time	5 mL blood in sodium citrate (blue top) tube	Specimens must reach the laboratory within 6 hours of collection or frozen plasma must be sent on dry ice. Drug history required. If delays are anticipated, contact the relevant laboratory for further instructions.
Thromboelastography (TEG)	5 mL blood in sodium citrate (blue top) tube	Do not refrigerate or transport specimen on ice. Specimen must reach the laboratory within 4 hours of collection.
Thymidine Kinase 2 (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Thyroglobulin	5 mL clotted blood (yellow top tube)	Anti-thyroglobulin antibodies assayed simultaneously to assess for potential assay interference.
Thyroid Cancer (*BRAF*) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Thyroid stimulating hormone (TSH)	5 mL clotted blood (yellow top tube)	For transport separate serum and send on ice.
Tissue specimen for MC&S	Tissue specimen in a sterile universal container	A small piece of tissue from the infected site should be submitted in sterile normal saline. Do not send the entire surgical specimen e.g. a leg. Please indicate on the request form if unusual or fastidious organisms are suspected.
Tobramycin	5 mL clotted blood (yellow top tube)	
Toxoplasma gondii IgG	5 mL clotted blood (yellow top tube)	Refrigerate specimen if transport is delayed.
Toxoplasma gondii IgM	5 mL clotted blood (yellow top tube)	Refrigerate specimen if transport is delayed.
TPMT (Thiopurine S-Methyltransferase) genotyping (TPMT*3A AND TPMT*3C) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Tracheal aspirate for MC&S	Tracheal aspirate in a sterile universal container	
Transferrin	5 mL clotted blood (yellow top tube)	For transferrin % saturation request iron and transferrin.
Tricyclic antidepressants (serum)	Contact laboratory for tube type	

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Tricyclic antidepressants (urine) (screen)	25 mL random urine specimen in a sterile universal container	
Triglyceride	5 mL clotted blood (yellow top tube)	Fasting for 8–12 hours is required.
Troponin I	Contact laboratory for tube type	Specimen must be processed by the laboratory within 2 hours of collection.
Troponin T	Contact laboratory for tube type	
Trypanosomes	4 mL EDTA blood (purple top tube)	Contact referral laboratory for instructions. In all patients who test positive for African trypanosomiasis, a CSF specimen must be submitted to exclude CNS involvement.
Tryptase (mast cell)	5 mL clotted blood (yellow top tube)	Recommended procedure for possible allergic reactions: 3 serial Tryptase tests: 1st specimen at 1−2 hours post-event, then 2−3 hours later and a baseline specimen >14 hours post-event.
Typhoid fever serology (Widal)		**THIS TEST IS NOT AVAILABLE ANYMORE.** The diagnosis of typhoid fever is best made by culture of blood, bone marrow, stool, or urine. Serological tests are imprecise and difficult to interpret.
Uniparental Disomy 14 (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Urea (serum)	5 mL clotted blood (yellow top tube)	
Urea (urine)	Random or timed urine	
Uric acid (serum)	5 mL clotted blood (yellow top tube)	
Uric acid (urine)	Random or timed urine	Urine specimen must be alkalinised with 1 M NaOH (urine pH >7).
Urinalysis (dipsticks)	25 mL random urine in a sterile universal container	Deliver the specimen to the laboratory on ice immediately after collection.
Urine culture	Midstream or catheter urine specimen in a sterile universal container	Transport specimen at 2−4ºC. Specimen must be refrigerated if transport to the laboratory is delayed. Please indicate how specimen was collected as this does affect specimen processing. Requests for parasites or casts must be clearly stated on the request form.
Urine microscopy	Midstream or catheter urine specimen in a sterile universal container	Collect a midstream specimen from a properly prepared patient. In patients who are catheterised, collect urine from port above the clamped catheter and not from the collection bag.
Urobilinogen (qualitative)	25 mL random urine in a sterile universal container	Deliver the specimen to the laboratory on ice immediately after collection. Performed with dipsticks.
Uronic acid/creatinine ratio (mucopolysaccharidosis screening)	25 mL random urine in a sterile universal container	Specimen must reach the laboratory within 24 hours of collection.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Vaccination studies: *Bordetella pertussis* Antibodies	5 mL clotted blood (yellow top tube)	
Vaccination studies: *Clostridium tetani* Antibodies	5 mL clotted blood (yellow top tube)	
Vaccination studies: *Corynebacterium diphtheriae* Antibodies	5 mL clotted blood (yellow top tube)	
Vaccination studies: *Haemophilus influenzae* type b Antibodies	5 mL clotted blood (yellow top tube)	
Vaccination studies: *Streptococcus pneumoniae* Antibodies	5 mL clotted blood (yellow top tube)	
Valproate, sodium (Convulex or Epilim)	5 mL clotted blood (yellow top tube)	Draw trough level just before next dose. State time of last dose on the request form.
Vancomycin	5 mL clotted blood (yellow top tube)	Trough levels to be collected 30 minutes prior to next dose. Please state the time of last dose on the request form.
Vanillyl mandelic acid (VMA) (quantitative)	24-hour urine collection	Collect a 24-hour urine specimen in a container with HCl, which is available from the laboratory. Restrict caffeine and nicotine 2 days before and during urine collection. See Section 15.2.6 on pages 129–130 for detailed instructions and precautions.
Varicella zoster virus (VZV) electron microscopy (EM)	Lesion fluid (between two glass slides)	On special request only: Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory. Test cannot distinguish between viruses of the Herpesviridae family.
Varicella zoster virus (VZV) IgG Antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Transport specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Varicella zoster virus (VZV) IgM Antibodies	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Transport specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Varicella zoster virus (VZV) isolation (culture)	Vesicle fluid in viral transport medium	Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Varicella zoster virus (VZV) PCR	1 mL CSF in a plain collection tube without additives; tissue biopsy material, fluid aspirate or vesicle fluid in a universal container and ulcer swab (sterile swab without gel) in viral transport medium (VTM)	Biopsy material must be sent in normal saline (never in formalin). Vesicle fluid must preferably be sent in VTM. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Very long chain fatty acids	Contact laboratory for tube type	Essential for diagnosis of X-ALD, pyridoxine responsive epilepsy and peroxisomal disorders. Please allow 6–8 weeks turnaround time. Deliver the specimen to the laboratory on ice immediately after collection.
Viral haemorrhagic fever (VHF) suspected	Specimens depend on specific VHF virus suspected. Specialist consultation needed.	Please see Section 21.8.2 on pages 219–221 for specific guidelines on this notifiable condition.
Virtual cross match	None	Before collecting the specimen, arrange the test with the referral laboratory, and obtain their contact details from the local laboratory. Donor HLA type must be supplied to the laboratory.
Virus Isolation	Respiratory tract specimen in viral transport medium (VTM); random urine specimen OR tissue biopsy material in a universal container	Please specify virus to be isolated on the request form. Deliver the specimen to the laboratory on ice. Refrigerate specimen if transport is delayed.
Vitamin A	5 mL clotted blood (yellow top tube)	Cover specimen with foil to protect from light.
Vitamin B1 (thiamine)	4 mL EDTA blood (purple top tube)	Cover specimen with foil to protect from light.
Vitamin B12	5 mL clotted blood (yellow top tube)	
Vitamin D (1,25-dihydroxy) (calcitriol)	5 mL clotted blood (red top tube)	Collection tubes without gel (red top tube) is preferred.
Vitamin D (25-hydroxy)	5 mL clotted (yellow top tube) OR 4 mL EDTA (purple top tube) blood	Collection tubes without gel (red top tube) is preferred.
Vitamin E (α-tocopherol)	5 mL clotted blood (yellow top tube)	Cover specimen with foil to protect from light.
Von Hippel-Lindau (VHL) syndrome	4 mL EDTA blood (purple top tube)	Special instructions: DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Von Willebrand Factor activity	5 mL blood in sodium citrate (blue top) tube	Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection.
Von Willebrand Factor antigen	5 mL blood in sodium citrate (blue top) tube	Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection.

TEST NAME	SPECIMEN TYPE	SPECIAL INSTRUCTIONS
Von Willebrand Factor – Collagen binding	5 mL blood in sodium citrate (blue top) tube	Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection.
Von Willebrand Factor – Multimeric analysis	5 mL blood in sodium citrate (blue top) tube	Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection.
Von Willebrand Factor – Propeptide	5 mL blood in sodium citrate (blue top) tube	Ensure timely transportation to the referral laboratory by contacting the local laboratory before specimen collection.
Volatiles	10 mL postmortem stomach contents	
Weil-Felix agglutination test	5 mL clotted blood (yellow top tube)	Non-specific test for detection of antibodies against several different Rickettsiae. Can also test positive in non-rickettsial diseases.
White cell count and white cell differential	4 mL EDTA blood (purple top tube)	Specimen must be tested within 24 hours of collection.
Whooping cough (Pertussis)	Please see *Bordetella pertussis* in this table	Please see *Bordetella pertussis* in this table.
Worm and tapeworm identification	Worm or proglottid in a universal container	Please submit proglottids in normal saline
XALD (X-linked adrenoleukodystrophy) (ABCD1) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Xanthochromia index	5 mL clotted blood (red top tube) AND 1.5 mL CSF in a red top tube	CSF not to be collected until at least 12 hours after possible haemorrhage. Minimum of 1.5 mL CSF required. Protect specimens from light and deliver to the laboratory immediately after collection.
X-linked mental retardation screen (non-syndromic) (MLPA) (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
X-linked pyruvate dehydrogenase complex deficiency (PDHA1 gene)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Y-Chromosome Microdeletion (DNA analysis)	4 mL EDTA blood (purple top tube)	DNA may be extracted from various specimen types, depending on the test, the patient and reason for testing. See Section 22 for additional information.
Yersinia enterocolitica serology	5 mL clotted blood (yellow top tube)	
Yersinia pseudotuberculosis serology	5 mL clotted blood (yellow top tube)	
Zinc (blood)	Contact laboratory for tube type	Avoid haemolysis during venesection.
Zinc (urine)	24-hour urine collection	No preservative required.

SECTIONS 26.0 – 28.0

26.0 RESULTS

- Test results are made available to users/clients by a variety of modes, not all of which are applicable to every test:
  - All results are available electronically to authorised registered users via the NHLS Results Portal
  - Telephonic enquiry
  - SMS (limited tests only)
  - Final results are printed in hard copy and delivered/posted to the requesting facility (unless the facility has requested not to receive hard copies).
- Electronic and hard copy reports include reference intervals and interpretations as relevant.
- Provisional results may be present on electronic and interim hard copy reports. Selected results may not be available whilst provisional, in particular but not limited to Histology, Cytology, Genetics and NICD results.
- Reports include results of tests whether analysed at the registering laboratory or at a referral laboratory. The laboratory details in the report (laboratory name, address, and contact numbers) are those of the registering laboratory. Each test referred to another NHLS laboratory is automatically flagged, and the name and contact number of the referral laboratory is provided.
- FCL reports are collected by the authorised personnel from FPS and SAPS.

Printed reports are delivered by the NHLS.

Should you require assistance to interpret any results, please contact your local Laboratory Manager.

Results are available at https://labresults.nhls.ac.za. A login name and password are required for this service and application forms are available on request. **NOTE:** To reset the WebView password, please contact the NHLS IT Helpdesk at (011) 386 6125 or email helpdesk1@nhls.ac.za.

27.0 TIME LIMITS FOR REQUESTING ADDITIONAL TESTS

- Additional tests can (if certain conditions are met) be requested after a specimen has been sent to the laboratory. The majority of the tests can only be done once, when originally requested. Should additional testing be needed on a specimen previously submitted to a laboratory, call the laboratory to determine whether or not the additional tests can be performed.

- FCL: An additional test can be requested within six months after a report has been issued.

28.0 REFERRAL OF SPECIMENS

- A list of tests offered by NHLS laboratories is found in Table 25-1 on pages 250–325. In rare cases where the NHLS cannot offer the tests requested, these will be sent to a referral laboratory. In order to ensure that good quality results are provided to our clients, the selection of the referral laboratory will be done according to the NHLS procedure number GPQ0054; performance of these laboratories is regularly reviewed.
- FCLs do not refer specimens to other laboratories.

References

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2. NHLS Quality Manual.
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6. National Health Act, 2003 (Act no. 61 of 2003).
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12. Diphtheria: NICD recommendations for diagnosis, management, and public health response. Centre for Respiratory Diseases and Meningitis, NICD. 2023.
13. South African National Department of Health. Guideline for the Prevention of Mother to Child Transmission of HIV and other Transmittable Infections. 2018.
14. National code of guidelines for Forensic Pathology Practice in South Africa (NFPSC) Academic Subcommittee workgroup edition – Johannesburg, 20 August 2007 (final draft).

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Version 1

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Changes to the Handbook

- This document will be printed once a year if needed or possible (depending on availability of resources).
- The document will be reviewed at least once a year according to Procedure number GPQ0003.
- Should there be no changes then printing will not be done even when resources are available.
- In cases where there are changes to the document in between prints, this will be done on Q Pulse and the laboratories will be notified of the changes.
- The laboratories will inform the clients of the changes and keep record of this until the next printing is done.

Acknowledgement of Reading Form

My signature confirms that I have read and understood the contents of this document and agree to abide by its contents.

Name	Signature	Date