NHS SOUTH WEST LONDON PATHOLOGY

MAKING EVERY TEST MATTER

PATHOLOGY SERVICES HANDBOOK

UKAS ACCREDITED LABORATORIES

Trust/Discipline	UKAS Reference Number
Cellular Pathology	9913
Clinical Blood Sciences	9085
Microbiology	9810
Immunology and Protein Reference Unit (PRU)	9745

For current accreditation status please see http://www.ukas.com

South West London Pathology website: http://www.swlpath.nhs.uk/

SWLP provides services to the following hospitals:

Hospital	**Address**
Croydon University Hospital	530 London Road, Croydon, CR7 7YE
Epsom Hospital	Dorking Rd, Epsom KT18 7EG
Kingston Hospital	Galsworthy Road, Kingston-upon-Thames KT2 7QB
Royal National Orthopaedic Hospital	Brockley Hill, Stanmore, Middlesex. HA7 4LP
St Helier Hospital	Wrythe Lane, Sutton, Carshalton SM5 1AA
St George's Hospital	Blackshaw Road, Tooting, London SW17 0QT
New Victoria Hospital	184 Coombe Lane West, Kingston upon Thames KT2 7EG

Preface

This handbook outlines the pathology service offered by South West London Pathology (SWLP), which is an NHS partnership of three London hospital trusts: St. George's University Hospitals NHS Foundation Trust, Kingston Hospital NHS Foundation Trust and Croydon Health Services NHS Trust.

It is intended to help hospital staff and local general practitioners to make the best use of the laboratory services. The information provided includes the types of specimen required, instructions for collecting specimens with particular emphasis on safety, the range of investigations offered, as well as reference values.

If you have questions about any aspect of the pathology service, staff members will be pleased to help you (see telephone numbers opposite and under the relevant department).

The most up to date version of this handbook is available at http://www.swlpath.nhs.uk/

and will be updated on a regular basis. The authors would be most grateful if any errors or amendments could be brought to their attention for correction as well as any suggestions for improvement.

A website containing information on South West London Pathology is also available at;

http://www.swlpath.nhs.uk/

Dr Timothy Planche
Clinical Director
South West London Pathology

Mr Simon Brewer
Managing Director
South West London Pathology

Table of contents

1. General introduction and guidance

1.1 Order Comms

Where available, Cerner Order Comms should be used by the requesting clinician to order tests and label specimens appropriately.

If you do not know how to use Cerner Order Comms, help is available at each Trust via the intranet.

If Cerner Order Comms is not available, or your test cannot be requested using this system, samples should be labelled by hand and a completed request form sent as detailed below.

1.2 Request forms (when Cerner Order Comms is unavailable/not used

Verbal request will not be accepted

Request forms need to be completed legibly and completed using a ballpoint pen. Of similar importance is the need to give the **correct location, ensuring this information appears on each individual form for the appropriate laboratory,** so that results arrive where they are needed.

It is the responsibility of the medical officer to ensure that all request forms and specimens carry **ALL** of the following information.

1. Patients surname and first name(s) or coded identifier (e.g. GUM patients)
2. Hospital number/NHS number
3. Date of birth and sex
4. Location
5. Consultant name/GP name
6. Tests requested
7. Name of requesting doctor (printed) together with bleep no
8. Relevant clinical information to justify the request
9. GP code

The SWLP requirements for completing a request form can be found on the SWLP website (Requests and labelling - South West London Pathology (swlpath.nhs.uk)), in the document, Policy for Completing/Making Requests and Labelling Specimens for Pathology Tests (SWLP-POL-004).

Current information is usually more relevant than an admission diagnosis. Without full information it is impossible to examine a specimen adequately or report on it constructively. This is the minimum dataset required; please see specific specialties for further details.

1.3 Sample labelling (when not using Cerner Order Comms)

Information on the sample container **MUST** include:

1. Patients surname and first name(s) or coded identifier (e.g. GUM patients)
2. Hospital number/NHS number (if available)
3. Sex
4. Date of birth
5. Time and date of sampling
6. Location
7. Specimen type

The SWLP requirements for labelling patients' specimens can be found on the SWLP website (Requests and labelling - South West London Pathology (swlpath.nhs.uk)), in the document, Policy for Completing/Making Requests and Labelling Specimens for Pathology Tests (SWLP-POL-004).

Forms and samples that omit the above information may not be analysed.

Inadequately/incorrectly labelled samples for the Transfusion department **will not** be processed. This measure is required both for the safety of patients and for the medico-legal protection of hospital staff.

1.4 Infection risk from blood or other body fluids

All biological specimens should be considered as potentially hazardous and handled accordingly. However, special precautions are necessary for obtaining and handling specimens from patients infected (or thought to be infected) with high-risk pathogens. It is important to remember that carriers may be asymptomatic. Infection may be acquired by spillage of blood and other body fluids on to recently broken skin, by accidental scratches, puncture wounds from needles, instruments or possibly by splashing into the eye, nostrils and lips of susceptible persons. Therefore take care with all specimens for your own safety and that of others.

Please remember that it is the responsibility of the person who requests laboratory examination of the specimen to ensure that both the form and the container are correctly labelled to indicate a danger of infection.

1.5 Phlebotomy procedures

SWLP does not manage the Phlebotomy services at any of the sites; these are managed by the local Trust. Information regarding the phlebotomy services can be obtained locally, contact information is shown below:

Croydon University Hospital

Contact the Phlebotomy Manager on 0208 401 3000 ext. 3420, or Bleep 877.

Kingston

Telephone 0208 546 7711 ext. 3294 or for more information visit;
https://www.kingstonhospital.nhs.uk/departments-services/support-services/blood-tests.aspx

St George's

Contact the Phlebotomy Manager on telephone number; 0208 725 0366 or Bleep number 886060

Royal National Orthopaedic Hospital

Phlebotomy can be contacted on 0208 909 5958 or Bleep number 81782

1.6 Pathology senior management

Simon Brewer	Managing Director	020 8725 0960
Timothy Planche	Clinical Director, Consultant Microbiologist	020 8725 2683
Jamie Laughlin	Director of Operations	020 8725 5698
Kurt Djemal	Microbiology General Manager	020 8725 5698
Robert Akutu	Cellular Pathology General Manager	020 8725 2840
Joanne Lam Wong	Histology Manager and Network Lead for Digital Pathology	0208 725 4943
Jayne Barmby	Clinical Blood Sciences General Manager	0208 296 2976
Judith Harper	Clinical Blood Sciences Laboratory Manager	0208 725 5920
Vincent Michael	Network Blood Transfusion Lead	0208 725 6220
David McIntyre	Spoke Manager, Kingston hospital	0208 934 2051
Fred Mpambire	Spoke Manager, Croydon hospital	0208 401 3599
Juliette Gevao	Laboratory Manager, RNOH	0208 909 5268

1.7 Laboratory opening hours

Department	Mon to Fri	Sat	Sun	BH
Clinical Blood Sciences (all sites): Chemical Pathology	The department provides a 24/7 service			
Clinical Blood Sciences (all sites): Haematology & Blood Transfusion	The department provides a 24/7 service			
Cellular Pathology	08.00 - 17.00	-	-	-
Medical Microbiology	Dept open to enquiries Mon – Fri 09:00 - 17:30			
	The department provides a 24/7 service			
PRU/Immunology	08:00 – 17.00	-	-	-

1.8 Emergency investigations

Department	Normal working hours	Out of hours
Clinical Blood Sciences (all sites): Chemical Pathology	Send specimens immediately to the laboratory Do not telephone the laboratory in advance	
Clinical Blood Sciences (all sites): Haematology & blood transfusion	Send specimens immediately to the laboratory Do not telephone the laboratory in advance	
Cellular Pathology	Telephone laboratory in advance (see page 14)	NO SERVICE
Medical Microbiology	Telephone laboratory in advance	Contact lab staff on call via switchboard
PRU/Immunology	Telephone laboratory in advance	NO SERVICE

Once the laboratory concerned has agreed that the specimen is an emergency, it should be forwarded as soon as possible either by using the pneumatic tube system or a porter and/or transport, as appropriate.

A doctor must make all requests for urgent analysis. Results of tests on all urgent requests will be telephoned to the requesting doctor, or a member of the ward staff, as soon as the results are available, provided the appropriate contact number is entered on the request form.

1.9 Out of hours

For out of hours service information, please check under relevant department.

IMPORTANT: Are you making proper use of the laboratories?

Please avoid sending samples outside of the core hours unless they are urgent and will dictate immediate clinical management.

Complete the request form legibly and fully; including a contact number (often we do not know where to phone the abnormal results). Samples which are inadequately identified may not be analysed. Please indicate clinical diagnosis and any drug therapy.

Only ask for tests you really need; remembering clinical budgets; be selective.

If the request is urgent, please see section headed "Emergency Investigations" on the previous page for actions required.

If you have clinical or analytical queries relating either to patients or the services, the on-call consultants/medical staff are always available to discuss these with you.

1.10 Specimens

In order to keep turnaround times to a minimum, send all specimens to the laboratory as quickly as possible by using either the pneumatic tube system (for operating guidelines see chapter 9) or a porter and/or transport, as appropriate.

1.11 Patient consent

In order to take a patient's blood or other bodily sample it is necessary to obtain the patient's consent.

It is the responsibility of the clinician to ensure the patient understands the reason for making the request for an examination and the range of tests that may be involved. The reasons for investigation should be explained clearly to the patient.

The initial consent is likely to involve a request to investigate what is wrong, rather than to perform a specific set of analyses. Clinicians must also consider whether or not to document the consent they have obtained.

General Medical Council guidance states that discussions with patients should be tailored according to:

- Their needs and wishes
- Their level of knowledge about, and understanding of, their condition, prognosis and the treatment options
- The nature of their condition
    - The complexity of the treatment, and
    - The nature and level of risk associated with the investigation or treatment.

Patients can give consent orally or in writing, or they may imply consent by complying with the proposed examination or treatment, for example, by rolling up their sleeve to have their blood sample taken.

1.12 Patient confidentiality

In the National Health Service (NHS), we aim to provide the highest quality healthcare. To do this we collect information about the patient, their medical conditions and the clinical care we have provided. This information is primarily maintained electronically on computer systems. All information is held in accordance with the Principles of the Data Protection Act 1998 and all staff are legally bound to maintain the patient's confidentiality.

1.13 Patient complaints

If you would like to contact us to give us feedback or to make a comment you can email us at stgh-tr.SWLPcomms@nhs.net or via our 'Contact Us' page on the SWLP website (http://www.swlpath.nhs.uk)

If patients would like to make a complaint the leaflet on the SWLP website tells them what to do before making a complaint and what will happen once they have complained. Please note the leaflet refers to St George's Hospital but can used if referring to any of the SWLP services including those based at Croydon and Kingston Hospitals.

2. Pathology reception

Each site has its own Specimen Reception area and their telephone numbers are shown in the table below:

St. George's Specimen Reception	Direct line 0208 725 2651
Croydon Specimen Reception	Direct line 0208 401 3025 Or via switchboard 0208 401 3000 ext. 4053
Kingston Specimen Reception	Direct line 0208 934 2052
RNOH Specimen Reception	Direct line 0208 909 5126

Please ensure samples reach the laboratories as early in the working day as possible.

2.1 Specimen collection and transport

Hospital Porters — Please refer to local intranet site for contact details

GP Surgeries — Specimens are generally collected from most of the local surgeries by a courier (ERS Medical) and delivered to the Pathology department at St George's.

If there are any problems with this service, please telephone 0208 266 6510 with details of the problem

2.2 Timetable for issuing of reports (see also specific departmental notes)

Most pathology reports are available via the electronic patient record (EPR) and Cerner as soon as they are authorised.

Telephone Results	**Please access EPR or Cerner to view result wherever possible.** This will minimise the risk of errors for numerical results and reduce depleting Pathology staff resources whilst handling unnecessary calls. **If results are requested by telephone,** include the full name (and hospital number) of the patient. Persons receiving messages should record them in the designated place and read results back to check for errors of transmission.

2.3 Phlebotomy services – times

Please refer to your local Trust for instructions relating to the collection of blood samples.

3. Cellular pathology

Cellular Pathology is located on the lower ground floor of Jenner Wing, St George's University Hospitals NHS Foundation Trust. Services are provided from this hub laboratory although OSNA , MOH's testing and Fine needle aspiration rapid onsite evaluation clinics are performed off site at Croydon Hospital.

3.1 Our team

Cellular Pathology staff comprises of Biomedical Scientists, Biomedical Support Workers, supported by clerical staff. Medical staff participates in our diagnostic service.

Mortuary Services remains part of St George's University Hospitals NHS Foundation Trust and is not within scope of SWLP.

3.2 Results

All results are posted on the EPR as soon as reporting is complete.

Results are best viewed via the EPR rather than phoning the laboratory.

3.3 Digital pathology

In addition to routine microscopy of histologic specimens, this department has undertaken the verification and validation of 'Digital Pathology'. Skin Pathology has successfully gone live with digital transformation and other specialties will be coming on board over the next few months.

The digital pathway involves whole slide imaging of histological specimens from glass slides into "virtual slides" for reporting by pathologists. This is expected to transform our service, enabling a streamlined process that is more efficient, the ease of sharing images via multidisciplinary meetings and the ability to get second opinions instantly.

The 'virtual slides' generate enormous digital data with high resolution from scanned glass slides that are backed up and retained as required.

3.4 Medical consultants and senior staff

Medical staff

Dr Charan Kaur (Clinical lead)	Consultant Pathologist	020 8725 5068
Dr Abed Arnaout	Consultant Pathologist	020 8725 4993
Dr Anjeline Teo	Consultant Pathologist	0208 725 5281
Dr Barry Newell	Consultant Pathologist	020 8725 4963
Dr Caitlin Beggan	Consultant Pathologist	020 8725 5282
Dr Benita Stevenson	Consultant Pathologist	0208 725 4552
Dr Colan HoYen	Consultant Pathologist	020 8725 6277
Dr Gayani Pitiyage	Consultant Pathologist	020 8725 2448
Dr Heung Chong	Consultant Pathologist	020 8725 4730
Dr Jayson Wang	Consultant Pathologist	020 8725 5277
Dr John du Parcq	Consultant Pathologist	020 8725 0012
Dr Jeremy Pryce	Paediatric Consultant Pathologist	020 8725 0651
Dr Jonathan Williams	Consultant Pathologist	020 8725 4995
Dr Leslie Bridges	Consultant Pathologist	0208 7254983
Dr Lida Alarcon	Consultant Pathologist	020 8725 4994
Dr Lorna Donovan	Consultant Pathologist	020 8725 3906
Dr Lorrette Ffolkes	Consultant Pathologist	020 8725 0055
Dr Mariam Masood	Consultant Pathologist	Email only
Dr Nancy (Athanasia) Vargiamidou	Consultant Pathologist	020 8725 5082
Dr Nicholas Archard	Consultant Pathologist	020 8725 0505
Dr Nick Tiffin	Consultant Pathologist	(020 8266) 6168
Dr Nilu Wijesuriya	Consultant Pathologist	0208 725 0505
Dr Paul Johns (Bleep 6021)	Consultant Pathologist	020 8725 5271
Dr Richard Griffiths	Consultant Pathologist	Email only
Dr Zoltan Szollosi	Consultant Pathologist	020 8725 4996
Dr Amelia Heaford	Paediatric Consultant Pathologist	0208725 5281
Dr Zoe Jane Avila	Consultant Pathologist	0208266 6535
Dr Jacqueline McDermott	Consultant Pathologist	0208725 5936

Senior non-medical staff

Robert Akutu	Cellular Pathology	020 8725 2840
Joanne Lam Wong	Histology Manager and	0208 725 4943
Stephen Rodgers	Cellular Pathology	0208 725 5254
Scott Johnson	Office Administrator	0208 725 5264
Sarah Lee	Interim Quality Lead	0208 725 4997

3.5 Enquiries – during working hours

Results & Enquiries	5267, 5269, 5264 or 5263
Cellular Pathology Fax	020 8767 7984
Perinatal Secretary Fax	020 8725 5261
Fine Needle Aspiration Bookings	5267, 5269 or 5263
Frozen Section Bookings	**5256 or 5257**
Histopathology consumables	0208 725 2651
OSNA Enquiries - Croydon Health Service	**0208 725 5256/5257**
MOHS Enquiries- Croydon Health Service	**208 5256/5257**

3.6 Out-of-hours advice and requests

There is no out-of-hours service for Histopathology or Cytopathology.

3.7 Histopathology

Location - St. George's Hospital, Basement - Jenner Wing Cellular Pathology, Histology Section

3.7.1 Histology laboratory opening hours

MON	TUE	WED	THU	FRI	SAT	SUN	BH
← 07:30 – 17:00 →					CLOSED		

3.7.2 Submission of histopathology specimens

If an URGENT report is required please state this on the request form. Always provide a contact or bleep number. Hand -deliver urgent specimens to Cellular Pathology.

Most specimens should be submitted in adequate 10% neutral buffered formalin - sufficient to fully cover the specimen with the exception of the samples listed below:

Exceptions - which should be immediately hand delivered fresh via theatre staff. These specimens should be booked with the laboratory.

- **Frozen section specimens** - send fresh immediately in a dry pot.
- **Lymph nodes** - send fresh immediately in a dry pot.
- **Muscle biopsies** - send fresh immediately in a dry pot (unless being sent from an outside hospital in which case they should be sent in a dry pot on 'wet' ice to keep cool).
- **Nerve biopsies** - send fresh immediately; wrapped in a slightly dampened saline gauze.
- **Paediatric GI biopsies for Hirschprung's disease** – send fresh immediately; on a swab slightly moistened with saline in a dry pot.
- **Renal biopsies** - send fresh immediately; on gauze slightly moistened with saline in a dry pot.
- **Skin biopsies for immunofluorescence** - send fresh immediately; on saline moistened gauze in a dry pot.

3.7.3 Request card

Each set of specimens from an individual patient must be accompanied by a fully completed Histopathology request card including a bleep or contact number.

3.7.4 Procedure for high-risk specimens

High-risk specimens are those that could, potentially contain category 3 or 4 pathogens (i.e. Hepatitis B or C, HIV etc.). For a comprehensive list of micro-organisms refer to the Advisory Committee on Dangerous Pathogens (ACDP).

All high-risk specimens must be clearly labelled with a yellow biohazard label on both the specimen pot and request form.

3.7.5 Specimen problems

- Unlabelled/unidentifiable specimens will not be processed
- Samples pots must be securely fastened prior to transportation.
- Leaking specimens may result in poor sample processing.

3.7.6 Histopathology turnaround times

The Histopathology laboratory aims to process and report 80% of cases within seven calendar days; and 90% of cases within 10 calendar days. Please note this process may take longer if further investigations such as immunocytochemistry / electron microscopy / molecular testing are necessary to achieve a diagnosis. All completed reports are available on EPR and copies of authorised reports are sent to the requesting Consultant. Please check on EPR before making enquiries through the Cellular Pathology Office.

Turnaround times are monitored on a continuous basis and detailed information is available to all of our users upon request.

Please contact Robert Akutu.

Please note stated turnaround times are based upon calendar days and will depend on the following variables:

- Date of receipt of tissue block or pre-cut slides
- Test with or without interpretation
- Arrival time in laboratory
- Courier or standard post

Stated turnaround times are based on receipt of sample in lab to sample/result leaving the laboratory and do not include postal/courier delivery times to and from the lab. A secure fax line, NHS.net and online reporting system are available if requested.

3.8 Frozen section rapid diagnostic service

- Service is not provided on infectious specimens (eg TB & HIV).
- Service available from 08.30 to 16:30- Monday to Friday.
- **Frozen section cases must be received in the laboratory by 4.30pm.**

Please Book Frozen Sections in advance, by calling ext. 5256 and providing the following details:

- Date Required
- Time Required
- Patient's Name
- D.O.B.
- Hospital Number
- Clinical Details
- Any Infection / Radiation Risk?
- Theatre
- Theatre Extension Number
- Surgeon

Advanced notice and pre-booking reduces the delays in processing and reporting of results

- The fresh specimen must be hand-delivered to Cellular Pathology Department – Basement, Jenner Wing.
- If the frozen section is no longer needed please phone the Histopathology laboratory on ex 5257 or ex 5256 to cancel the request.

Verbal frozen section results will only be given to MEDICALLY qualified staff.

3.8.1 Muscle and nerve biopsy diagnostic service

- Service is not provided on infectious specimens (eg TB & HIV).
- Service available from 08.30 to 16:30- Monday to Friday.
- **Cases must be received in the laboratory by 4.30pm**

Please Book muscle and nerve biopsies in advance, by calling ext. 5256 and providing the following details:

- Date Required
- Time Required
- Patient's Name
- D.O.B.
- Hospital Number
- Clinical Details
- Any Infection / Radiation Risk?
- Theatre
- Theatre Extension Number
- Surgeon

Advanced notice and pre-bookings reduces the delays in processing and reporting of results.

- **Muscle biopsies** - send fresh immediately in a dry pot (unless being sent from an outside hospital in which case they should be sent in a dry pot on 'wet' ice to keep cool).
- **Nerve biopsies** - send fresh immediately; wrapped in a slightly dampened saline gauze
- The muscle / nerve biopsy must be hand-delivered to Cellular Pathology Department – Basement Jenner Wing.
- If the biopsy is no longer being taken phone the Histopathology laboratory on ex 5257 or ex 5256 to cancel the request.

3.8.2 Intra-operative assessment of sentinel lymph nodes (OSNA)

OSNA specimens are performed on the Croydon Health Services Hospital site only – the agreed days for OSNA are Tuesday, Wednesday & Fridays.

Urgent requests will only be accepted, with prior agreement from The Technical Lead for Histology, Discipline Manager or a member of the OSNA team by calling St Georges Hospital (extension 5254, 2840 or 5257/5256).

Advanced bookings for OSNA specimens must be made via NHS.net shared calendar account which is routinely checked on Mondays by the OSNA team. The NHS.net shared

calendar account is managed by the Croydon Breast Surgical Team and can only is reviewed by the OSNA team and Technical Lead in Histology.

Theatre staff are instructed to contact OSNA lab prior to collections of ice. Before the lymph node is ready for submission to the laboratory, Theatre staff must telephone the OSNA laboratory (Croydon Health Services Hospital ext. 5245) to inform OSNA team. All specimens for OSNA must be transported without fixative and on ice.

If the result is available, this will be telephoned and emailed by the laboratory staff and given only to the Breast Surgeon who has requested the analysis.

3.8.3 Availability and clinical advice

Clinical advice from Consultant Histopathologists is available from Monday to Friday during office hours by phone; please see contact information detailed above.

3.8.4 Consumables available

Histology consumables should be ordered through SWLP website by its users.

Please follow the link provided: http://www.swlpath.nhs.uk/wp-content/uploads/2016/11/Pathology-Store-User-Instructions-October-2016.pdf

Internal users can use the following address to order : Pathology.consumables@stgeorges.nhs.uk.

- Empty specimen pots from 0.5L to 5L volume
- Pre-filled 10% neutral buffered formalin 50ml pots.
- Neutral buffered formalin is **not** provided by the Histopathology laboratory – please contact the Pharmacy Dept.
- Copies of histology request forms can be obtained from the laboratory or downloaded from the SWLP website provided above.

3.8.5 Reference centres

Histopathology samples are occasionally referred to external services for additional tests or second opinion. These referral centres should not be contacted directly. For further information please contact the SWLP Cellular Pathology Department.

The repertoire of tests and tissue type required may change in line with service developments and clinical need.

3.9 Molecular diagnostics

SWLP Cellular Pathology department use the LC480 RT-PCR platform for molecular diagnostic tests and have recently introduced the ABI-7500 platform for BRAF and NRAS.

The ABI 7500 is a real-time PCR system that is a versatile, leading-edge platform that provides enhanced performance capabilities and an upgrade path to high-speed thermal cycling, producing quantitative results immediately upon completion of PCR, without the need to run gels, purify PCR products, or perform any post PCR manipulation. Real-time PCR offers enormous time savings, greater sensitivity, superior precision, and a larger dynamic range

The following molecular tests are available:

- **EGFR:** mutational testing for lung cancer, on COBAS RT-PCR platform, for common actionable mutations, including L858R, T790M and Exon 19 deletions.
- **BRAF:** mutational testing for melanoma, on LC480 or ABI 7500 RT-PCR platforms, targeting the V600 mutations including V600E
- **HER2:** Marker is valid for breast specimens fixed in formalin
- **SOX 10:** Marker shows an increased specificity for soft tissue tumours of neural crest origin compared with S100.
- **P40:** Uses include the classification of non-small cell lung carcinoma
- **CD123:** Marker for plasmacytoid monocytes
- **CD117** Interstitial cell marker, haematopoietic progenitor cells, melanocytes, embryonic/foetal brain, endothelium, gonads, mast cells, breast epithelium and germ cells.
- **ALK (D5F3)** T/null cell anaplastic lymphomas (most), inflammatory myofibroblastic tumours
- **PDL1:** PDL1 expression is detected in most human cancers, including bladder, breast, cervical, oesophageal, gastric, kidney, lung, ovary and pancreatic cancers
- **C-Myc:** Burkitt's lymphoma (90%) or its variants
- **NRAS:** This marker is mostly mutually exclusive with mutations found in melanomas using the ABI 7500 or LC480 RT-PCR platforms.
- **HPV ISH:** This marker is used for High risk & Low Risk sub types

Electronic request forms are available from Cellular Pathology and can be accessed using the SWLP website: Request forms - South West London Pathology (swlpath.nhs.uk)

3.10 Cytopathology

Location - St. George's Hospital, Basement - Jenner Wing Cellular Pathology, Cytology Section

3.10.1 Opening hours

MON	TUE	WED	THU	FRI	SAT	SUN	BH
← 08:30 – 17:00 →					CLOSED		

3.10.2 Submission of specimens

Diagnostic cytology specimens MUST BE accompanied by a cytology request card. Samples without a request form will not be processed. All specimens must be sent immediately, so that the cells remain in good condition for analysis. Where several tests are required on a sample, the sample should be divided before being sent to the pathology department accompanied with all the form(s) appropriate for each pathology department. Where available, order comms may be used by requesting clinicians to order tests and label specimens.

SWLP does not process Cervical smear specimens as part of the NHS Cervical Screening Programme.

3.10.3 Procedure for high-risk specimens

All biological specimens should be considered as potentially hazardous and handled in accordance with universal precautions, for obtaining and handling specimens from patients infected (or thought to be infected) with high-risk pathogens.

3.10.4 Instructions for completing request forms

A request form must accompany all specimens to the laboratory. This should clearly show the patient's details, including:

- Name ie first name and surname
- Hospital number/NHS number
- Date of birth
- Ward/GP name and number
- Type of specimen
- Date and time of sample
- All relevant clinical data

3.10.5 Specimen labelling instructions

The minimum data required is the patient's name and date of birth and where applicable the NHS number must be on all specimen containers, using a ballpoint pen.

For slides a HB pencil is required as ink is removed during processing by various dyes and solvents.

Please be advised that air-dried slide preparations must be avoided on patients that are identified as 'danger of infection'. In such instances, these specimens should be put straight into Hanks solution for preparation under controlled conditions in the laboratory.

Mismatched or inappropriately labelled specimens or request forms will not be processed, as this constitutes a clinical risk. Hospital clinicians may be informed to take responsibility for any amendments.

3.10.6 Availability and clinical advice

Clinical advice from a Consultant Cytopathologist is available from Monday to Friday during working hours by phone; please see the contact information detailed in sections 3.3 & 3.4.

3.10.7 Out-of-hours advice and requests

There is no out-of-hours service for Cytopathology.

3.10.8 Consumables available

Cytology consumables should be ordered through SWLP website by its users. SWLP-Central Pathology Reception is responsible for distribution of laboratory consumables.

Please follow the link provide:http://www.swlpath.nhs.uk/wp-content/uploads/2016/11/Pathology-Store-User-Instructions-October-2016.pdf

- Empty specimen pots
- Balanced hanks salt solution for collection of needle rinse for cytological analysis.
- Copies of non-gynaecological request forms can be obtained from the laboratory or downloaded from the SWLP website provided above.

3.10.9 Exfoliative cytology

The term exfoliative cytology relates to all non FNA cytology specimens received within Cytology. This laboratory aims to report 80% of cytology specimens within 7 days of receipt and 90% within 10 days, in line with RCPath recommendations. Under certain circumstances, reports may be required by a certain day/time; this information must be stated on the request form.

In order to process specimens immediately, diagnostic specimens require sufficient and relevant clinical information. This should include the following:

- Clinical Information
- Symptoms
- Underlying conditions
- Previous history of neoplasia / pathological conditions
- Recent infections

This information will help in the interpretation of the specimen.

3.10.10 Fine needle aspiration cytology

A rapid on-site evaluation Fine Needle Aspiration service, for superficial masses and radiologically localised lesions, is available during working hours detailed below:

St Georges Hospital:

- Head & Neck Clinic St Georges Hospital Tuesday 9 – 12 and 1- 4 (as per request from radiology)
- Head & Neck Clinic St Georges Hospital 10 – 2 (as per request from radiology)
- Endobronchial Ultrasound Fine Needle Aspiration clinic Friday 2 – 4 (as per request from Lung team at St Georges Hospital)
- Melanoma clinic Friday mornings (as per request by plastic surgery)

Croydon University Hospital:

- Head & Neck Clinic Croydon University Hospital 9 – 12 (as per request from radiology team)
- Endobronchial Ultrasound Fine Needle Aspiration clinic at Croydon University Hospital Wednesdays 2- 4 (as per request from Lung team at Croydon)

3.10.11 Fine needle aspirate and brush specimens

Where the clinician prepares needle aspirates slides; please ensure these are fully labelled in pencil with patient demographics and placed into slide carriers. It is ideal to differentiate alcohol fixed slides from air dried slides by ensuring these can be identifiable. Needle rinses should be washed into hanks solution unless otherwise specified. Both slide carriers and Hanks medium can be obtained from the Cytology laboratory.

3.10.12 Table of specimens

Note: If a sample is required by more than one department; then the patients sample should be split into different aliquots for the respective locations accompanied with appropriate request forms.

Specimen Type	Collection information	Container
Ascitic Fluid	Minimum of 50-75mls as an ideal volume**	Send in sterile container.
Bronchial Brushings	Ensure the bronchial brushing is immediately placed into hanks solution.	Brush -Send in 10 ml of Hanks in a 25 ml sterile container.
Bronchial Washes		Send in sterile container.
Bronchoalveolar Lavage	If differential count, haemosiderin or fat laden macrophages analysis is required, please state this clearly on the request form.	Send in sterile l container. Please state on request form if haemosiderin or fat laden macrophages require identification. For differential cell counts; these must be sent immediately to the laboratory.
Biliary brushings	Ensure the biliary brushings are immediately placed into hanks solution.	Brush -Send in 10 ml of Hanks in a 25 ml sterile container.
CSF	Please send to laboratory immediately after taking specimen and before 4:30 pm If the specimen is taken outside of normal laboratory hours the specimen must be refrigerated in a fridge of temperature range of 4-8 degrees.	Send in a sterile container.
Fine Needle **Aspirates** from the head and neck.	Head and Neck FNAs are attended by Consultant Pathologists/Biomedical scientists. If Unattended Head and Neck; please contact	

Specimen Type	Collection information	Container
Ascitic Fluid	Minimum of 50-75mls as an ideal volume**	Send in sterile container.
Bronchial Brushings	Ensure the bronchial brushing is immediately placed into hanks solution.	Brush -Send in 10 ml of Hanks in a 25 ml sterile container.
Bronchial Washes		Send in sterile container.
Bronchoalveolar Lavage	If differential count, haemosiderin or fat laden macrophages analysis is required, please state this clearly on the request form.	Send in sterile l container. Please state on request form if haemosiderin or fat laden macrophages require identification. For differential cell counts; these must be sent immediately to the laboratory.
Biliary brushings	Ensure the biliary brushings are immediately placed into hanks solution.	Brush -Send in 10 ml of Hanks in a 25 ml sterile container.
	the cytology department for advice.	
Fine Needle **Aspirates** (not from head and neck eg breast, groin etc)	Spread directly onto a pre-labelled microscope slide Fix immediately in alcohol whilst the specimen is still wet. Air dry slides Place into a plastic slide transport box and send to the laboratory Rinse needle in Hanks medium	Rinse needle in Hanks* medium. Slides must be labelled in pencil with patient name and date of birth/ Hospital number. Please state on slides which are air dried (AD) and fixed Needle wash - send in 10 ml of Hanks in 25 ml sterile universal container.
Miscellaneous (cyst fluids)		Send in a sterile container.
Nipple discharge	Spread directly onto microscope slides and allow to air dry. Ensure	Place air dried slides in a slide mailer.

Specimen Type	Collection information	Container
Ascitic Fluid	Minimum of 50-75mls as an ideal volume**	Send in sterile container.
Bronchial Brushings	Ensure the bronchial brushing is immediately placed into hanks solution.	Brush -Send in 10 ml of Hanks in a 25 ml sterile container.
Bronchial Washes		Send in sterile container.
Bronchoalveolar Lavage	If differential count, haemosiderin or fat laden macrophages analysis is required, please state this clearly on the request form.	Send in sterile l container. Please state on request form if haemosiderin or fat laden macrophages require identification. For differential cell counts; these must be sent immediately to the laboratory.
Biliary brushings	Ensure the biliary brushings are immediately placed into hanks solution.	Brush -Send in 10 ml of Hanks in a 25 ml sterile container.
	slides are labelled with patient demographics using a pencil.	
Pericardial Fluid	Minimum of 50-75ml as an ideal **	Send in a sterile container.
Peritoneal Fluid	Minimum of 50-75ml as an ideal **	Send in a sterile container.
Pleural Fluid	Minimum of 50- 75ml as an ideal **	Send in a sterile container.
Sputum	Early morning deep cough prior to breakfast & washing teeth.	Sputum pot
Synovial fluid	Please split sample for both microbiology and cytology ensuring each aliquot is fully labelled with patient demographics.	Send in a sterile container.

Specimen Type	Collection information	Container
Ascitic Fluid	Minimum of 50-75mls as an ideal volume**	Send in sterile container.
Bronchial Brushings	Ensure the bronchial brushing is immediately placed into hanks solution.	Brush -Send in 10 ml of Hanks in a 25 ml sterile container.
Bronchial Washes		Send in sterile container.
Bronchoalveolar Lavage	If differential count, haemosiderin or fat laden macrophages analysis is required, please state this clearly on the request form.	Send in sterile l container. Please state on request form if haemosiderin or fat laden macrophages require identification. For differential cell counts; these must be sent immediately to the laboratory.
Biliary brushings	Ensure the biliary brushings are immediately placed into hanks solution.	Brush -Send in 10 ml of Hanks in a 25 ml sterile container.
Urine	Freshly voided urine preferably mid-morning Avoid early morning urine as cells are too degenerate for microscopy	Sterile universal container (25ml). Do not send these samples in containers containing Boric acid (red top) or any other additives.
EBUS-TBNA	ROSE clinics are available for adequacy assessments and to triage samples.	Needle rinse in formalin pot. 1 air dried and 1 wet fixed slide.
EUS FNA (liver or pancreas cyst)	Rinse needle in Hanks medium	Send in a sterile container.

* Hanks solution is available from the Cytology laboratory upon request.

** The Royal College of Pathologist advise that a minimum volume range of 50-75ml should be adopted in serous effusion cytology in order to diminish potential false negatives and optimise the test sensitivity. (*see “Tissue pathways for diagnostic cytopathology” October 2019). In cases where only a smaller volume of fluid can be drained safely, this should be submitted to the laboratory for analysis.

4. Clinical Blood Sciences: Biochemistry

The Clinical Blood Sciences department has laboratories on each of the three sites where Pathology Services are provided by South West London Pathology and also for the Royal National Orthopaedic Hospital.

A Biochemistry service is available at each site providing both clinical and laboratory support for in-patients and out-patients. Specimens collected from patients attending the local GP Practices are sent to the laboratory based at St George's for analysis.

Where possible information for users of these services are provided in this Handbook, however for some aspects of the service, additional information should be obtained from the SWLP website (http://www.swlpath.nhs.uk/) or from your local NHS Trust.

4.1 Consultants and senior staff

Dr S. Davie	Clinical Lead & Consultant Clinical Scientist (Kingston)	0208 934 2056
Dr J Wong	Consultant Chemical Pathologist (Kingston)	020 8934 3292
Dr M. Sharifi	Consultant Chemical Pathologist (St Georges)	0208 725 5934
Ms W. Armstrong	Consultant Clinical Scientist (Croydon)	0208 401 3024
Dr L. Perry	Consultant Clinical Scientist (Croydon)	0208 401 3548
Mr J. Laughlin	CBS Discipline Manager	0208 725 5355
Mrs J Harper	CBS Laboratory Manager (St Georges)	0208 725 1918
Ms K. Mendonca	Network Pathology Support Services Manager	0208 725 2391
Mr F. Mpambire	CBS Spoke Manager (Croydon)	0208 401 3000 x4682/3599
Mr D. McIntyre	CBS Spoke Manager (Kingston)	0208 934 2051
Mrs J. Gevao	CBS Laboratory Manager (RNOH)	0208 909 5268
Ms K. Brown	Automation Manager (SGH)	0208 725 5598
Mrs G. Hubbard	Blood Transfusion Quality Manager/Health and Safety Advisor	0208 725 2391
Mrs T Providence-Amir	CBS Quality Manager and Health & Safety Advisor	0208 725 2391

Clinical advice can be obtained by contacting the above clinical staff at each site. Staff from the RNOH wishing to speak to a Consultant Clinical Scientist should telephone the SGH number (020 8725 2941).

4.2 Laboratory working hours

All laboratories are open 24 hours each day, 7 days a week

4.3 Main laboratory numbers

Contact numbers for each of the Biochemistry laboratories are shown in the table below:

Croydon University Hospital	2nd Floor Woodcroft Wing
Specimen Reception	0208 401 3025
Chemistry Laboratory	0208 401 3000 ext. 4067
Out of Hours Bleep	Bleep 142
Kingston Foundation Trust	1st Floor Bernard Meade Wing
Specimen Reception	0208 934 2052
Chemistry Laboratory	0208 934 2050
Out of Hours Bleep	Bleep 540
St George's Foundation Trust	Ground Floor Jenner Wing
Specimen Reception	0208 725 5468
Chemistry Laboratory	0208 725 5859
Out of Hours Bleep	Bleep 6032
RNOH	The rear of Jubilee Rehabilitation Centre
Specimen Reception	0208 909 5126
Essential Services Laboratory	0208 909 5846
Out of Hours	Telephone laboratory

A Results Hotline is available if you are unable to find the results for your patient:

020 8725 5468

4.4 Enquiries – out of hours

Croydon	
Out of Hours laboratory staff	Bleep 142
Clinical staff	Via Switchboard
Kingston	
Out of Hours laboratory staff	Bleep 540
Clinical staff	Via Switchboard
St George's	
Out of Hours laboratory staff	Bleep 6032
Clinical staff	Via Switchboard, Air Call SG138
RNOH	
Out of Hours laboratory staff	0208 909 5846
Clinical staff (based at SGH)	SGH switchboard 0208 8672 1255, Air call SGH138

4.5 Laboratory services

The laboratories offer a **wide range of individual tests,** many of which are performed on site, with the results available on the same day. Some analyses are carried out less frequently, eg weekly, as indicated in the tables in Section 4.23. Information on the specimen requirement, reference range, turnaround time and any special precautions for each test, is listed in this table. Please refer to the specimen type, in the next section, for volume requirements.

More **specialised investigations** may be referred to laboratories elsewhere in the UK (see * in tables in Section 4.23). These are more costly and may have particular sample requirements and longer turnaround times. Contacting the Duty Biochemist is advisable to discuss any special specimen collection or patient preparation procedures. Other tests not listed may be available but prior discussion with the Duty Biochemist is essential before a specimen is sent to the laboratory. The details of the referral laboratory will be printed on the report, along with the appropriate reference range and any interpretive comments. Please contact the laboratory based on your hospital site for information about referral tests and laboratories.

The laboratory holds a small number of documents which may be useful for patients prior to them having specimens collected (24-hour urine collection). These can be obtained by telephoning the Specimen Reception department at St George's on 020 8725 5468.

4.6 Urgent requests (clinical emergency only)

As the laboratories provide a 24/7 service there is no need to contact the laboratory before sending urgent investigations.

Some non-routine investigations are available outside normal laboratory working hours after discussion with the Duty Consultant on-call.

4.7 Response times for urgent requests

The time between arrival in the laboratory and the reporting time of results for urgent electrolytes, urea, and glucose, should normally be within 2 hours.

Unexpected results outside critical limits will be telephoned as soon as they are available to the ward or contact number as indicated on the request form. It is a matter of patient safety that the contact details and location of the patient are current and correct to enable critical results to be communicated quickly and easily.

Note that all results are posted on Cerner as soon as analysis is complete.

Results are best viewed using Cerner or SWLP Clinical Portal rather than phoning the laboratory.

4.8 Additional requests

The general policy is that an addition of a test to a sample already analysed in the laboratory is the exception rather than the rule. This is because the sample may be unsuitable, insufficient, too old, or unavailable for the 'add-on' test.

Telephone numbers to request additional tests are:

Croydon University Hospital	0208 401 3000 ext.4067
Kingston Foundation Trust	Panada system
St George's Foundation Trust	At all times, Bleep 6032
RNOH	5846

4.9 Blood specimens

Serum should be sent as indicated in Table 1, unless otherwise indicated, eg unstable tests or those requiring whole blood**.**

> For details of type of samples and special procedures for certain tests, see the tables in Section 4.23.

For adults, one correctly filled serum gel tube will be sufficient* for electrolytes, liver function, bone, CRP, lipids, haematinics, thyroid function, and troponin T.

For paediatric patients, a 1mL filled serum tube will be sufficient* for electrolytes, liver function, bone, and CRP.

* = depending on haematocrit.

Table 1. Types of containers and volumes of blood samples

Biochemistry vacutainer tubes			
Label/Cap	Tube	Volume (mL)	Sample
Rust or Gold[1] Red Green Grey Lavender Royal Blue	Gel Plain Lithium heparin Fluoride oxalate EDTA Plain	5 5 5 5 6 5	Clotted Blood Serum SST Clotted Blood Serum Plasma (Lithium heparin) Plasma (Fluoride) Plasma (EDTA) Clotted Blood Serum
Paediatric bottles			
Label/Cap	Tube	Volume (mL)	Sample
Gold Red Green Lavender Grey	Gel Plain Lithium heparin EDTA Fluoride oxalate	1 1 1 1 1	Clotted Blood Serum SST Paed Clotted Blood Serum Paediatric Plasma (Lithium heparin paed) Plasma/whole blood Paediatric Plasma (Fluoride paediatric)

[1] Both tubes are acceptable, however the Gold cap has replaced the Rust capped tube

When uncertain, please contact the Duty Biochemist for advice.

4.10 Urine specimens

For qualitative analyses, a fresh random urine sample in a yellow urine Monovette (10 mL) or a plain silver-top container (10 – 25 mL) is required. **Please note that urine collected into a boric acid container (red-top) is unsuitable for biochemistry analyses.**

For quantitative analyses, a timed (24 hour) urine collection is required. The exception is albumin/creatinine ratios, which require a random or early morning urine (preferred).

The 24-hour urine collection container and patient instructions for performing a timed urine collection can be obtained from Pathology Reception in your Trust.

> Please record legibly on both the urine container and the request form the TIME and DATE of both the START and FINISH of the collection, and the patient's full NAME, WARD and Hospital Number. Forms and urine samples that omit the above information may not be analysed.

4.11 Creatinine clearance

For estimation of creatinine clearance, please ensure a blood sample is taken during the 24 hour urine collection period.

Urine samples should be taken to the laboratory as soon as possible after collection is completed.

4.12 Faeces

Small faecal samples ('walnut' sized is approximately 10g) should be sent in blue plastic screw-top container. After placing the sample in the container with the small plastic spoon, clean the outside if necessary and place the container in a plastic bag. Please ensure that these samples are properly labelled and are transported to the laboratory as soon as possible. Time and date of collection **MUST** be indicated on all specimens to avoid rejection.

4.13 Fluids

Cerebrospinal fluid (CSF), preferably a clean tap, blood free sample, should be collected into a plain silver top or white sterile container. CSF must be collected into a grey fluoride oxalate tube for labile tests such as CSF glucose and lactate measurement. A minimum volume of 0.5mL CSF (between 10-15 drops) is required for most investigations.

CSF samples for bilirubin analysis (Xanthochromia) in suspected subarachnoid haemorrhage must ideally be the last fraction taken, protected from light (e.g. foil wrapped around the container) and NOT transported by pneumatic tube system to the laboratory.

Other fluids (eg pleural fluid, amniotic fluid, ascites, nasal CSF) should be collected into a Monovette, which is clearly marked with the fluid type. A volume of 5mL is sufficient for analysis. Please contact the Duty Biochemist for further advice on the specimen requirements and arrangements for the biochemical investigation of fluids.

Do not send these specimens through the Vacuum/Pneumatic Tube System, due to the potential risk of contamination.

4.14 Labile tests

Specimens for labile tests require prompt handling and storage and must be transported to the laboratory as soon as possible. Please refer to table 4.23 – labile tests are indicated in bold in the “Comments” column.

If you are not sure of the stability and collection requirements of the analyte you wish to measure, please contact the Duty Biochemist for further information. **For any labile test you should always contact the laboratory ahead of sample collection to enable prompt handling and storage of the specimen(s).**

Please note that in some cases you may need to bring the specimen to the laboratory yourself as the phlebotomy service, the pneumatic tube system or the Portering services may not be available. **Any special collecting procedures are given in the specimen requirement tables in Section 4.23. Please contact the laboratory if ice is required for transport.**

4.15 Toxicology screening

For suspected drug overdose, screening tests for a number of drugs may be appropriate. Urine (8 mL) in a Monovette should be sent when the agent responsible for poisoning is uncertain or unknown. Serum is not accepted for screening purposes, but may be necessary for the assay of specific poisons. Where this is so, please discuss with the Duty Biochemist.

4.16 Guidelines to therapeutic drug monitoring

These guidelines should optimise the effectiveness of monitoring serum drug concentrations and reduce the risk of toxicity.

4.17 Indications for serum drug level measurement

1. Maintenance of therapy (steady state)
2. Inadequate clinical response
3. Compliance monitoring
4. Suspected toxicity
5. Combination therapy (when another drug alters the relationship between dose and serum concentration
6. Following dose change (in general dosage changes should be based on clinical assessment. Drug level measurement is not required each time)
7. Developing hepatic or renal disease

4.18 Monitoring therapy

Serum drug levels usually reach a steady state a few days after starting a regular oral dosage or making a dosage adjustment.

	Adults (oral dosage) Time to steady state days	**Usual dosage per day at steady state (mg)**
Carbamazepine	4 – 5[1]	400 - 1200
Digoxin	7[2]	0.125 - 0.5
Lithium	3 - 7	900 - 1500
Phenobarbitone	10 - 25	90 - 180
Phenytoin	7 - 35	300 - 400
Theophylline	2	100 - 400
Sodium Valproate	2 - 6	600 - 2000

[1] Start of therapy 2-4 weeks [2] Longer in renal disease

4.19 Sample collection procedure for therapeutic drugs

Record on Request Form:

1. Sample collection time and date
2. Time and date of last dose
3. Current dosage
4. Concurrent medication and relevant medical information

Time of sample in relation to dose is important.

The trough level, collected immediately before the next dose (at steady state), is most reproducible but the peak level may also be useful in some circumstances.

If Sodium Valproate is to be measured, the sample should be taken at a standard time, preferably before the morning dose (Note: the value of valproate monitoring is controversial and is rarely helpful, except when compliance is in doubt). Toxic effects show no clear relationship to serum concentration.

Pre-dose (trough)	Carbamazepine, Valproate (morning), Phenytoin (if given as one large dose), Theophylline (peak also useful)
6 hours post-dose	Digoxin
12 hours post-dose	Lithium

4.20 Usual therapeutic (target) ranges

Therapeutic ranges are only a guide. Some patients may be well controlled with serum concentrations below or above the therapeutic ranges given below. Factors affecting serum concentrations should also be taken into account.

	Adults	**Neonates**
Carbamazepine	4 - 12 mg/L (single therapy) 4 - 8 mg/L (multiple therapy)	-
Digoxin	0.5 - 2.0 µg/L	Up to 3.0 µg/L
Lithium	0.4 - 1.0 mmol/L	-
Phenobarbitone	10 - 40 mg/L	13 - 30 mg/L
Phenytoin	5 - 20 mg/L	6 - 14 mg/L
Theophylline	10 - 20 mg/L	5-11 mg/L
Sodium Valproate	50 - 100 mg/L*	-

4.21 Effect of age in therapeutic drug monitoring

Factor	Effect
Reduced drug metabolism	Serum Phenobarbitone, theophylline increased in the elderly
Decreased albumin	Serum phenytoin decreased in the elderly
Decreased GFR	Reduced dosage for digoxin, lithium required in neonates and the elderly
Hypokalaemia (e.g. diuretics)	Digoxin toxicity more likely
Variation in half life: e.g. neonates infants 1 month children 1-15 years adults	Phenytoin t ½: 30-60 hours 2-7 hours 2-29 hours 20-30 hours

4.22 Immunosuppressant drug monitoring

Tacrolimus and ciclosporin level monitoring is performed in Clinical Blood Sciences.

Both assays are available Monday-Friday. Weekend tacrolimus or ciclosporin analysis is available only by prior arrangement with the consultant or the Duty Biochemist.

An EDTA whole blood sample (6 mL) is required for tacrolimus and/or ciclosporin monitoring.

The recommended sampling time is the trough level immediately before the next dose (at steady state). The request form should include details of sample collection time and date, time and date of last dose, and current dosage.

Samples **must not** be taken from lines that have been used to administer drugs or close to an infusion site.

4.23 Antibiotic levels

Certain antibiotic levels (gentamicin, vancomycin, amikacin) are performed in Blood Sciences and clinical advice on specific patients is given by Medical Microbiology.

Full details on once daily gentamicin dosing will be provided by the local Trust.

Please also refer to the essential information given by Microbiology (Section 6.12.6 in this handbook).

4.24 Dynamic function tests/specialist tests

Croydon	Protocols for Dynamic Tests are available. These are usually undertaken by the Department of Endocrinology. Users must take care and be familiar with any protocol having a noted medical hazard. Before undertaking Dynamic Function tests it is important to inform the lab, particularly for the prolonged tests.
Kingston	Contact the laboratory at least 24 hours in advance
St George's	Dynamic function tests may be arranged by contacting the Sister in the Endocrine Investigation Unit (EIU), on ext. 0923. Specialist investigation of endocrine disorders should be discussed with the consultant Endocrinologists: Dr. Chan (air call SG127), Dr Bano, Dr Saha, or Dr Panahloo or Dr Seal. Sweat tests are arranged by contacting the Children's Respiratory Nurse Specialist Betty Jones or Joy Rowse on ext. 2272 or by air call SGC 102.

4.25 Estimated GFR

The estimated glomerular filtration rate (eGFR) is calculated in adults (>18 years). For guidance on the interpretation of eGFR, see www.emrn.org.uk.

4.26 Test profiles available for requesting

Profile	Other names	Consists of	Sample requirements
Renal profile (Blood)	Electrolytes, U and E's	Sodium, potassium, Urea, Creatinine & eGFR	Blood, Gold
Lipid profile		Cholesterol, Triglycerides, HDL, calculated LDL, total cholesterol/HDL ratio & VLDL	Blood, Gold
Liver Profile	LFTs	Bilirubin, ALT, Alkaline phosphatase & albumin	Blood, Gold
Bone Profile		Albumin, Alkaline phosphatase, Calcium, Adjusted Ca & Phosphate	Blood, Gold
Electrolytes (Urine)		Sodium & Potassium	Urine, Monovette

4.27 Chemical pathology specimen requirements, reference and therapeutic drug ranges

* = Test performed at a referral laboratory hours

Bold = test usually available out of routine

Test	Specimen and tube *(colour)*	Reference and therapeutic ranges *(units)* **Adults**	Comments *(reporting frequency)*
ACTH	EDTA Lavender	See report for interpretation	By arrangement. **Labile, to lab within 10 mins** 2 – 3 weeks
Acylcarnitine profile*	Blood spot (min 2 spots) Guthrie card	See report for interpretation	3-4 weeks
Adenosine deaminase CSF*	CSF Plain	0 – 6 IU/L	2 weeks
Adenosine deaminase*	Pleural Fluid Plain	0 – 45 IU/L	2 weeks
Alanine aminotransferase (ALT)	Serum Gold	<52 U/L Male <40 U/L Female	Daily Daily
Albumin	Blood Gold	35 – 50 g/L	Daily
Albumin (urine) Albumin / creatinine ratio (ACR)	Early morning urine	< 3.0 mg/mmol Creat.	Daily
Alcohol	Blood Gold	See report for interpretation	Daily
Aldosterone*	Blood Green	See report for interpretation	Overnight decumbency recommended 4 weeks
Alkaline phosphatase (ALP)	Blood Gold	30 - 130 U/L	Daily
Alkaline phosphatase isoenzymes	Blood Gold	See report	2 weeks
Alpha fetoprotein (AFP)	Blood Gold	< 10 KU/L	Daily
Aluminium*	Blood Royal blue No gel	< 0.37μmol/L	2 – 3 weeks
Amikacin	Blood Gold	See report for interpretation	Daily
Amino acids*	Blood Green	See report for interpretation	2 weeks

Test	Specimen and tube *(colour)*		Reference and therapeutic ranges *(units)* **Adults**	Comments *(reporting frequency)*
Amino acids (CSF)*	CSF	Plain	See report for interpretation	Matched Blood required. 2 weeks
Amino acids (urine)*	Random urine		See report for interpretation	2 – 3 weeks
Ammonia	Blood	Green	Adult <50μmol/L	Labile. Transport on ice to lab within 10 mins. Haemolysis invalidates assay. Urgent / Daily
Amylase	Blood	Gold	20 – 104 U/L	Urgent / Daily
Amylase isoenzymes*	Blood	Red	See report for interpretation	2 – 3 weeks
Androstenedione	Blood	Gold	See report for interpretation	2 – 3 weeks
Angiotensin converting enzyme (ACE)	Blood	Gold	16 – 85 U/L	Falsely low values found in patients on ACEI. Daily
Angiotensin converting enzyme (CSF)*	CSF (min vol 1mL)	Plain	0 – 1.2 IU/L	2 – 3 weeks
Anti-Thyroid-specific peroxidase	Blood	Gold	<35 kU/L – negative 35-50 kU/L – equivocal >50 kU/L - positive	Weekly
Apolipoprotein A1	Blood	Gold	1.04 – 2.02 g/L Male 1.08 – 2.25 g/L Female	Weekly
Apolipoprotein B	Blood	Gold	0.66 – 1.33 g/L Male 0.60 – 1.17 g/L Female	Weekly
Apolipoprotein E (genotyping)	Blood	Lavender	See report for interpretation	Monthly
Beta HCG				See hCG

Test	Specimen and tube *(colour)*		Reference and therapeutic ranges *(units)* Adults	Comments *(reporting frequency)*
β-CrossLaps (Bone marker CTX)	Blood	Gold	Men; (µg/L) 30- 50 Y 0 .10 - 0.58 50- 70 Y 0.10 - 0.70 > 70Y 0.10 - 0.85 Women: Pre-menopausal: 0.10 - 0.57 µg/L Post-menopausal: 0.10 - 1.01 µg/L	Daily
Beta hydroxybutyrate*	Blood	Green	See report for interpretation	Need paired glucose sample.
Bicarbonate	Blood	Gold	22 – 29 mmol/L	Urgent / daily Not part of U&E, request separately
Bile Acids	Blood	Gold	<14 µmol/L	Daily.
Bilirubin (conjugated)	Blood	Gold	< 10 µmol/L	Urgent / daily
Bilirubin (CSF) (CSF Xanthochromia)	CSF (min volume 0.5mL, 10 drops)	Plain Protect from light	Not detected Use CSF Bilirubin collection pack at Croydon	Available Monday – Friday during 0800 – 1900 h. Saturday and Sunday 0900 – 1200 h. Do not send by pneumatic tube system
Bilirubin (total)	Blood	Gold	< 21 µmol/L	Urgent / daily
Bilirubin (urine)	Random urine	Protect from light	Not detected	Fresh urine Daily
Biotinidase*	Blood	Green	See report for interpretation	2 weeks
BNP (NT-proBNP)	Blood	Gold	See report for interpretation	Daily
CA125	Blood	Gold	< 35 KU/L	Daily
CA15-3	Blood	Gold	< 30 KU/L	Daily
CA19-9	Blood	Gold	< 30 KU/L	Daily
Caeruloplasmin	Blood	Gold	0.2 – 0.6 g/L	Daily

Test	Specimen and tube *(colour)*		Reference and therapeutic ranges *(units)* **Adults**	Comments *(reporting frequency)*
Caffeine*	Blood	Red	25 – 77 μmol/L 25 – 100 μmol/L < 3 months	Weekly
Calcitonin*	Blood	Red	See report for interpretation	By arrangement. Labile. Collect on ice and transport to lab on ice. 2 – 3 weeks
Calcium	Blood	Gold	2.20 – 2.60 mmol/L	Urgent / daily
Adjusted Calcium (calculated)	Blood	Gold	2.20 – 2.60 mmol/L	Total calcium adjusted to an albumin of 40g/L
Calcium urine (total)	24h Urine	Plain (Acid at Croydon)	2.5 – 7.5 mmol/24h	Urgent/daily
Calprotectin	Faeces	Blue top	See report for details	10 days Above the age of 40, it is less common for IBS and IBD to present for the first time and alternative diagnosis should be considered
Carbamazepine	Blood	Gold	4 – 12 mg/L Single therapy. 4 – 8 mg/L Multiple AED therapy	Sample should be pre-dose, include dosage details on request form. Daily
Carcinoembryonic antigen (CEA)	Blood	Gold	< 0 - 5 μg/L	Daily
Carnitines*	Blood	Green	See report for interpretation	1 – 2 weeks
Catecholamines* Noradrenaline (NA) Adrenaline (ADR)	Blood	Green	See report for interpretation	By arrangement. 2 weeks

Test	Specimen and tube *(colour)*	Reference and therapeutic ranges *(units)* **Adults**	Comments *(reporting frequency)*
Catecholamines (urine) No longer routinely available, see urine Metadrenalines			
Chloride	Blood Gold	95 - 108 mmol/L	Urgent / daily
Chloride (sweat)	Special	See report for details	By arrangement. Contact CF nurse to arrange sweat test.
Cholesterol	Blood Gold	*Desirable:*< 5.2 mmol/L	Daily
Cholinesterase (For Phenotyping)* Dibucaine number Fluoride number Ro 02-0683 number Phenotype	Blood Red	See report for interpretation	By arrangement. Test for investigation of prolonged apnoea post anaesthesia or family studies 2 – 3 weeks
Chromium* and cobalt* (Hip replacements)	Blood Lavender	See report for interpretation	3 weeks
Citrate (urine)*	24h Urine Plain	See report for interpretation	2 weeks
Clobazam*	Blood Red	See report for interpretation	2 – 3 weeks
Copper*	Blood Royal blue	11 - 20 μmol/L	2 weeks
Copper (tissue)*	Liver biopsy on moistened filter paper	*<50 μg/g dry weight Normal* See report for interpretation	Biopsy specimen to weigh at least 5mg and ideally 15 mg. This corresponds to a tissue core 1-3 cm in length. 2 -3 weeks
Copper (urine)*	24h Urine Plain (Acid washed bottle at Croydon)	< 1 μmol/24h	By arrangement 2 – 3 weeks

Test	Specimen and tube *(colour)*		Reference and therapeutic ranges *(units)* Adults	Comments *(reporting frequency)*
Cortisol	Blood	Gold	170 - 490 nmol/L 6-10 am 74 – 280 nmol/L 4-8 pm	Daily Prednisolone significantly interferes with this assay
Cortisol (urine)*	24h Urine	Plain	60 – 260 nmol/24h	By arrangement 2 weeks
C-peptide*	Blood	Red (Gold at Croydon)	See report for interpretation	Labile. Transport to lab on ice. Patient must be hypoglycaemic (glucose <2.5 mmol/L). 2 – 3 weeks
C-peptide (urine)	Urine	Boric acid (red Lid)	See report for interpretation	Reported as C-peptide/creatinine ratio (nmol/mmol)
C-reactive protein	Blood	Gold	< 5 mg/L	Urgent / daily
Creatine kinase (CK)	Blood	Gold	40 – 320 U/L Male 25 – 200 U/L Female Values up to 2.5 – 3x ULN found in Afro-Caribbean	Urgent / daily
Creatinine	Blood	Gold	62 - 106 μmol/L Male 44 – 80 μmol/L Female	Urgent / daily
Creatinine (urine)	24h Urine	Plain	9 – 21 mmol/24h Male 7 – 14 mmol/24h Female	Daily
Creatinine clearance	24 h urine + Blood	Plain urine Gold	80 – 140 mL/min	Blood collected within one day of urine collection. Daily
Ciclosporin	Blood	Lavender	No reference range provided.	Every Mon, Wed & Fri. Weekends only by prior arrangement with consultant
Cystine urine (quantitative)*	24h Urine	Plain	See report for interpretation	2 weeks
Dehydroepiandrosterone sulphate (DHEAS)	Blood	Red	See report for interpretation	2 weeks

Test	Specimen and tube *(colour)*		Reference and therapeutic ranges *(units)* Adults		Comments *(reporting frequency)*
11-deoxycortisol*	Blood	Red	See report for interpretation		2 – 3 weeks
Digoxin	Blood	Red	0.5 – 2.0 μg/L therapeutic range		Sample should be 6 hours post dose. Include dosage details on request form. Daily
Dihydrotestosterone*	Blood	Red	See report for interpretation		3 - 4 weeks
Drug screen (toxicology/overdose)*	Random Urine	Monovette	See report for interpretation		Blood needed only for quantitative results 1 – 2 weeks
Drugs of abuse screen (urine)	Random Urine	Monovette	Negative		Qualitative results Daily
ELF score (comprises; P3NP, TIMP-1 and Hyaluronic acid)	Blood	Gold	See report for interpretation		Weekly
Erythropoietin*	Blood	Red	See report for interpretation		Include haemoglobin to aid interpretation of result 2 – 3 weeks
Faecal Elastase	Faeces	Blue top	See report for details		5 days
Faecal immunochemical testing (FIT)	Faeces	FIT collection devices which are available from the SWLP website	See report for details		4 days
Fat globule screen	*Faeces*	Plain	Normal		Weekly
Ferritin	Blood	Gold	30 – 400 μg/L Male 13 – 150 μg/L Female		Daily
Follicle stimulating hormone (FSH)	Blood	Gold	1 – 10 IU/L	Male	Daily

Test	Specimen and tube *(colour)*		Reference and therapeutic ranges *(units)* Adults		Comments *(reporting frequency)*
			Female 2 – 9 IU/L	Ranges Follicular	
			1 – 8 IU/L	Luteal	
			5 – 27 IU/L	Mid-cycle peak	
			> 30 IU/L	Post-menopausal	
Folate	Blood	Gold	5.0 - 10 μg/L		Daily
Free fatty acids*	Blood	Green	See report for interpretation.		By arrangement. Contact lab for specimen collection details 2 – 3 weeks
Free T3	Blood	Gold	3.1 – 6.8 pmol/L		Daily
Free T4	Blood	Gold	10.8 – 25.5 pmol/L		Daily
Fructosamine	Blood	Red	See report for interpretation		By arrangement 2 – 3 weeks
Galactose-1-phosphate uridyltransferase*	Blood	Green	20.2 – 46.4 μmol/h/gHb		Patient should not have been transfused red cells within the last 6 weeks. 2 – 3 weeks
Gamma glutamyltransferase (γGT)	Blood	Gold	< 64 U/L < 38 U/L	Males Females	Daily Not part of LFT, request separately
Gastrin* (see gut hormones)	Blood	Lavender			
Gentamicin	Blood	Gold	See report for interpretation		Daily

Test	Specimen and tube *(colour)*		Reference and therapeutic ranges *(units)* **Adults**	Comments *(reporting frequency)*
Glucose	Blood	Grey	3.5 – 6 mmol/L fasting	Urgent / Daily
Glucose (CSF)	CSF	Grey	Relates to Blood glucose (normal = 2/3 value)	Urgent/Daily
Glycosaminoglycans (urine)	Random Urine	Monovette	See report for interpretation	1 – 3 weeks
Growth Hormone	Blood	Gold	Requested as part of dynamic function test. See report for interpretation.	Daily
Gut Hormones* Vasoactive intestinal polypeptide (VIP) Pancreatic polypeptide (PP) Gastrin Glucagon Somatastain Chromogranin A Chromogranin B CART	Blood	Lavender	See report for interpretation	Labile. Transport to lab on ice immediately. Please state medication on form. Patient should be fasting 2 – 3 weeks

Test	Specimen and tube *(colour)*	Reference and therapeutic ranges *(units)* **Adults**	Comments *(reporting frequency)*
Haemoglobin A_{1c} (Hb-A_{1c})	Blood Lavender	22 – 42 mmol/mol Target for monitoring (NICE) <48 mmol/mol. Good Control 49-58 mmol/mol. Interpret in relation to individualised target >58 mmol/mol. Poor control. Target for diagnosis of Type 2 diabetes (WHO 2011) >48 mmol/mol. Diagnostic for diabetes if symptomatic 42-47 mmol/mol. High risk for diabetes <41 mmol/mol. Diabetes unlikely (but not excluded)	Daily (Mon-Fri)
HDL Cholesterol	Blood Gold	0.9 – 1.9 mmol/L Male 1.1 – 2.6 mmol/L Female	Daily
Homocysteine	Blood Lavender Fasting	5 – 15 µmol/L	Labile. Daily
Homovanillic acid (HVA)	Random Urine Monovette	See report for interpretation	By arrangement 1 -2 weeks
Human chorionic gonadotropin (Total)	Blood Gold	< 5 IU/L	Daily / urgent

Test	Specimen and tube *(colour)*	Reference and therapeutic ranges *(units)* Adults	Comments *(reporting frequency)*
5-Hydroxyindoleacetic acid 5HIAA (urine)	24h Urine Plain	<50 μmol/24h	By arrangement. Contact lab for dietary restrictions. 1 – 2 weeks
17-Hydroxyprogesterone	Blood Red	See report for interpretation	2 weeks
IGF binding protein 3*	Blood Red	Varies with age, See report for interpretation	2 – 3 weeks
Insulin-like growth factor IGF-I	Blood Gold	Varies with age, see report for interpretation	Weekly
IGF-II * IGF-II/IGF-I ratio*	Blood Red	See report for interpretation	By arrangement. 2 – 3 weeks
Insulin	Blood Gold	See report for interpretation	Daily
Iron	Blood Gold	14 – 30 μmol/L	Not routinely available. See ferritin Fasting sample
Iron-binding capacity % Iron saturation	Blood Gold	50 – 85 μmol/L 20 – 50 %	Daily
Ketones (urine) qualitative	Random urine Plain	Not detected	Daily
Lactate	Blood Grey CSF Grey	0.5 – 2.2 mmol/L	Urgent / Daily
Lactate dehydrogenase	Blood Gold	<250 U/L	Daily
Lamotrigine*	Blood Red	See report for interpretation	2 – 3 weeks

Test	Specimen and tube *(colour)*	Reference and therapeutic ranges *(units)* Adults	Comments *(reporting frequency)*
LDL (calculated)	Blood Gold	< 3.0 mmol/L *desirable* Ideally < 2.0 mmol/L in IHD	*Values calculated from total cholesterol and HDL cholesterol and triglyceride* Daily
Lead*	Blood Lavender	< 1.4 μmol/L Industrial < 0.5 μmol/L Environmental	1 – 2 weeks
Levetiracetam*	Blood Red	See report for interpretation	2 – 3 weeks
Lipase	Blood Gold	13 – 60 U/L	Daily
Lipoprotein (a)	Blood Gold	No reference range provided	Weekly
Lithium	Blood Gold	0.4 – 1.0 mmol/L (therapeutic range)	Sample should be 12 hours post dose Urgent/Daily
Luteinising hormone (LH)	Blood Gold	2 – 9 IU/L Male	Daily
		Female Ranges 2 – 9 IU/L Follicular 1 – 13 IU/L Luteal 14–90 IU/L Mid-cycle peak >15 IU/L Post-menopausal	
Lysosomal Enzymes* (see White Cell Enzymes)	Blood Green	See report for interpretation	By arrangement. Please do not take sample on Fridays. 6 – 8 weeks
Magnesium	Blood Gold	0.7 – 1.0 mmol/L	Daily

Test	Specimen and tube *(colour)*	Reference and therapeutic ranges *(units)* Adults	Comments *(reporting frequency)*
Manganese*	Blood Lavender MUST USE PLASTIC CANNULA	See report for interpretation	By arrangement. 3 - 4 weeks
Metadrenalines (Urine)	24h Urine Plain	See report for interpretation	2 weeks
Methaemalbumin	Blood Gold	Not detected	Daily
Methaemoglobin	Blood Gold	Not detected	Daily
Methotrexate*	Blood Red	See report for interpretation	1 week. Urgent by arrangement
Mucopolysaccharide (see Glycosaminoglycan)	Random Urine		
Microalbumin	Early morning urine	< 3.0 mg/mmol Creat	See albumin (urine)
Neurotransmitters (CSF)	CSF Special tubes	See report for interpretation	By arrangement. Contact lab to arrange collection
Oestradiol	Blood Gold	130 – 500 pmol/L Follicular 110– 620 pmol/L Luteal < 92 pmol/L Post-menopausal	Daily
Oligosaccharides (urine)*	Random Urine Plain	See report for interpretation	By arrangement 2 – 3 weeks
Opiate screen (urine)	Random Urine Plain	Negative	Daily
Organic acids(urine)*	Random Urine Plain	See report for interpretation	2 – 3 weeks
Orotic acid (urine)*	Random Urine Plain	See report for interpretation	By arrangement 2 – 3 weeks
Osmolality	Blood Gold	275 – 295 mmol/kg	Urgent / Daily
Osmolality (urine)	Random urine Plain	100 – 1400 mmol/kg	Urgent / Daily

Test	Specimen and tube *(colour)*		Reference and therapeutic ranges *(units)* **Adults**	Comments *(reporting frequency)*
Oxalate (urine)	24h Urine	Plain	0.14 – 0.46 mmol/24h	Send 24 hour collection to laboratory promptly. 2 – 3 weeks
Oxcarbazepine*	Blood	Red	See report for interpretation	2 – 3 weeks
P1NP	Blood	Gold	Male reference range: 15 – 65 ug/L 'Female reference ranges: Pre-menopausal: 15 – 59 ug/L Post-menopausal (on HRT): 14 – 59 ug/L Post-menopausal (no HRT): 20 – 76 ug/L	Weekly
P3NP	Blood	Gold	See report for interpretation	Weekly
Paracetamol	Blood	Gold	Not detected	Urgent / daily Refer to 'Grey book' for treatment guidelines
Parathyroid hormone (PTH)	Blood	Lavender	1.1 – 6.9 pmol/L	Labile Daily
PTH-related protein*	Blood	Special tube – contact Duty Biochemist	See report for interpretation	By arrangement. Labile. Transport to lab on ice immediately. Contact Duty Biochemist before collection.
Phenobarbitone	Blood	Gold	10 – 40 mg/L therapeutic range	Daily
Phenytoin	Blood	Red	5 – 20 mg/L	Daily
Phosphate	Blood	Gold	0.8 – 1.5 mmol/L	Daily
Pre-eclampsia markers (PlGF and sFlt-1)	Blood	Gold	sFlt-1/PLGF ratio reported for interpretation	Daily

Test	Specimen and tube *(colour)*		Reference and therapeutic ranges *(units)* Adults		Comments *(reporting frequency)*
Porphobilinogen (quantitative)*	Random Urine	Protect from light	Not detected		Ideally collect sample during episode. Contact Duty Biochemist if required urgently. 2 weeks
Porphyrins (faecal)*	Faeces (Liquid stool unsuitable)	Protect from light	Not detected		4 weeks
Porphyrins and PBG screen (urine)(qualitative)	Random Urine	Protect from light	Not detected		Very dilute samples are unsuitable. Weekly
Porphyrins (whole blood)*	Blood	Lavender Protect from light	Not detected		4 weeks
Potassium	Blood	Gold	3.5 – 5.3 mmol/L		Urgent / Daily
Potassium (urine)	Random or 24h Urine	Monovette or Black bottle	25 – 125 mmol/24h		Urgent / Daily
Procalcitonin	Blood	Gold	0-0.49 mg/L		Urgent / Daily
Progesterone	Blood	Gold	< 3 nmol/L 10 – 80 nmol/L	Follicular phase Luteal phase	Daily
Proinsulin*	Blood	Red	See report for interpretation		By arrangement. Labile Transport to lab on ice. Patient must be hypoglycaemic (glucose <2.5 mmol/L). 1 – 2 weeks
Prolactin	Blood	Gold	102 - 496 mU/L Female 86 – 324 mU/L Male		Daily

Test	Specimen and tube *(colour)*		Reference and therapeutic ranges *(units)* Adults	Comments *(reporting frequency)*
Prostate Specific Antigen	Blood	Gold	< 3.0 µg/L. Under 60 years < 4.0 µg/L. 60 - 70 years < 5.0 µg/L. Over 70 years	Daily
Protein (CSF)	CSF	Plain	0.15 – 0.45 g/L	Urgent / Daily
Protein (urine)	24h Urine	Plain	0.05 – 0.10 g/24h	Daily
Pyruvate*(blood)	Whole Blood	Special tube	See report for interpretation	By arrangement. Contact duty Biochemist to arrange collection 2 – 3 weeks
Pyruvate (CSF)*	CSF	Special tube	See report for interpretation	By arrangement. Contact duty Biochemist to arrange collection 2 – 3 weeks
Reducing substances (faecal)	Faeces		Not detected	Labile Daily
Reducing substances (urine)	Random Urine		Not detected	Labile Daily
Renin*	Blood	Green	See report for interpretation	By arrangement. 4 weeks
Salicylate	Blood	Gold	Not detected	Urgent/daily
Selenium*	Blood	Royal Blue	0.9 – 1.65 µmol/L	1 – 2 weeks
Sex hormone binding globulin (SHBG)	Blood	Gold	See report for interpretation	Daily
Sodium	Blood	Gold	133 - 146 mmol/L	Urgent / daily
Sodium (urine)	24h Urine	Plain	40 – 220 mmol/24h (varies with dietary sodium)	Urgent / daily
Steroid profile (urine)*	24h Urine	Plain	See report for interpretation	2 – 3 weeks

Test	Specimen and tube *(colour)*	Reference and therapeutic ranges *(units)* Adults	Comments *(reporting frequency)*
Sulphaemoglobin	Blood Green	Not detected	1 week
Tacrolimus	Blood Lavender	No reference range provided	Daily (Mon-Fri), weekends by prior arrangement with consultant
Testosterone	Blood Gold	See report for interpretation	Daily
Testosterone/SHBG ratio	Blood Gold	20 – 100 Male < 4 Female	Daily
Theophylline	Blood Gold	10 – 20 mg/L therapeutic range	Urgent / Daily Pre-dose but peak also useful. Record dosage details on request form.
Thioguanine nucleotides*	Blood Lavender	See report for interpretation	2 – 3 weeks
Thiopurinemethyltransferase*	Blood Lavender	See report for interpretation	2 – 3 weeks
Thyroglobulin*	Blood Gold	< 25μg/L	3 – 4 weeks
Thyroxine (T4) Triiodothyronine (T3)			See FT4 See FT3
Thyroid stimulating hormone (TSH)	Blood Gold	0.27 – 4.20 mU/L	Daily
Topiramate*	Blood Red	See report	2 – 3 weeks
Total protein	Blood Gold	60 – 80 g/L	Daily
Toxicology screen*	Random Monovette Urine		See Drug Screen
Triglyceride	Blood Gold	0.8 – 2.0 mmol/L	Daily
Troponin T	Blood Gold	<14 ng/L	Urgent / Daily

Test	Specimen and tube *(colour)*		Reference and therapeutic ranges *(units)* **Adults**	Comments *(reporting frequency)*
Troponin T (**RNOH only**)	Whole Blood	Purple	0-17 ng/L	Urgent / Daily **Sample rushed to lab**
Urate	Blood	Gold	200 - 430 µmol/L Male 140 - 360 µmol/L Female	Daily
Urate (urine)	24h Urine	Black bottle	1.5 – 4.5 mmol/24h	Daily
Urea	Blood	Gold	2.5 – 7.8 mmol/L	Urgent / Daily
Urea (urine)	Random or 24h Urine	Monovette or black bottle	250 – 500 mmol/L	Urgent / Daily
Valproate (sodium)	Blood	Gold		Daily For compliance only, no definitive data to support a therapeutic range. Sample should be taken pre-dose (morning).
Vancomycin	Blood	Gold		Daily
Vanillylmandelic acid (VMA) HMMA*	Random or 24h Urine	Monovette or black bottle	< 35 µmol/24h	2 weeks
Very long chain fatty acids*	Blood	Red	See report for interpretation	3 – 4 weeks
Vitamin A	Blood	Red	1.05 – 2.80 µmol/L	2 weeks Sample should be kept in dark
Vitamin B1* (Thiamine), Vitamin B6* and Vitamin B2*	Blood	Lavender	See report for interpretation	By arrangement. Transport to lab on ice. Keep protected from light. 3-4 weeks
Vitamin B12	Blood	Gold	190 – 660 ng/L	Daily

Test	Specimen and tube *(colour)*	Reference and therapeutic ranges *(units)* Adults	Comments *(reporting frequency)*
Vitamin D (25 OH cholecalciferol)	Blood Gold	50 – 174 nmol/L National Osteoporosis Society Guidelines < 25 nmol/L. Deficient 25 – 50 nmol/L. Adequate >50 nmol/L. Sufficient for whole population	Weekly
1,25 dihydroxyvitamin D*	Blood Red	40-150 nmol/L	2 weeks
Vitamin E	Blood Red	11.6 – 46.4 µmol/L	2 weeks
White cell enzymes* Arylsulphatase A Acid lipase Beta - glucocerebroside Sphingomyelinase Alpha - galactosidase	Blood Green	See report for interpretation	By arrangement. Specify the enzyme analysis required 6 – 8 weeks
Zinc*	Blood Royal Blue (for trace elements)	See report for interpretation	2 weeks

4.28 Paediatric reference ranges

Tests *(units)*	**Age range**	**Reference values / therapeutic ranges**
Alkaline phosphatase **	Neonate Infant – 16 years	70 – 380 U/L 60 – 425 U/L
Ammonia **	Sick or premature Neonate Infant – 16 years	<150 µmol/L <100 µmol/L < 50 µmol/L
Bilirubin **	2 – 7 days 14 days – 16 years	10 – 200 Should decrease to adult values by day 10 (breast–fed infants may take longer) < 21 µmol/L
Calcium **	Neonate Infant – 16 years	2.00 – 2.70 mmol/L (Actual not adjusted) 2.20 – 2.70 mmol/L

Tests *(units)*	**Age range**	**Reference values / therapeutic ranges**
Creatine kinase	1 year – 13 years	15 – 130 U/L
Creatinine	1 month – 12 months 1 year – 10 years 10 years – 16 years	18 – 35 µmol/L 7 – 62 µmol/L 44 – 88 µmol/L
Digoxin	neonates	up to 3.0 µg/L
17- hydroxyprogesterone	neonates	See report for interpretation
Free T3	12 years – 20 years	See report for interpretation
Free T4	0 day – 5 days 5 days – 4 weeks > 4 weeks	10 – 40 pmol/L 10 – 25 pmol/L 10 – 23 pmol/L
Insulin-like Growth Factor (IGF) -1 nmol/L	0 – 16 year	See report for interpretation
IGF Binding Protein-3	0-16 years	See report for interpretation
Lactate (plasma)**	No age-related differences	0.6 – 2.5 mmol/L
Mucopolysaccharide/creatinine ratio mg/mmol (urine)	1 month – 3 months months – 12 months 1 year – 3 years 3 years – 7 years 7 years – 15 years	9 – 41 4 – 35 2 – 22 6 – 16 2 – 11
Phenytoin	neonates	6 – 14 mg/L
Phenobarbitone	neonates	12 – 30 mg/L
Phosphate **	Neonate infant 1 – 16 years	1.3 – 2.6 mmol/L 1.3 – 2.4 mmol/L 0.9 – 1.8 mmol/L
Potassium**	Neonate Infant 1 – 16 years	3.4 – 6.0 mmol/L 3.5 – 5.7 mmol/L 3.5 – 5.0 mmol/L
Testosterone nmol/L Female	1 day – 10 days 1 month – 2 years	0.2 – 1.2 nmol/L 0.1 – 0.7 nmol/L
Testosterone nmol/L Male	1 day – 2 days 4 days – 10 days 1 month – 4 months 3 months – 12 months 1 year – 10 years	2.1 – 19.8 nmol/L 0.5 – 1.7 nmol/L 1.7 – 12.5 nmol/L 0.1– 1.6 nmol/L 0.1 – 0.7nmol/L
Theophylline	neonates	5 – 11 mg/L
TSH	10 days – 14 days 1 month – 18 years	<10 mU/L 0.5 – 4.0 mU/L

Tests *(units)*	Age range	Reference values / therapeutic ranges
Urea**	Neonate Infant 1 – 16 years	0.8 – 5.5 mmol/L 1.1 – 5.0 mmol/L 2.5 – 6.5 mmol/L

4.29 Reference ranges in pregnancy

	12 WEEKS	24 WEEKS	36 WEEKS
Albumin g/L	35 – 45	30 –38	22 – 37
Alkaline phosphatase U/L	27 – 90	32 – 108	82 - 274
Cholesterol mmol/L	3.3- 7.3	4.2 – 9.3	4.9 – 10.8
Creatinineμmol/L	48 – 78	41 – 78	47 – 87
Glucose mmol/L	2.9 – 5.9	2.7 – 5.3	2.7- 5.5
HDL cholesterol mmol/L	1.3 – 3.1	1.4 – 3.4	1.4 – 3.3
Triglycerides mmol/L	1.1 – 3.7	1.7 – 4.1	2.8 – 7.1
Uratemmol/L	0.10 – 0.27	0.12 – 0.31	0.16 – 0.42
Urea mmol/L	1.9 – 6.2	1.8 – 5.6	1.6 – 5.0

Reference ranges have been adapted from Handbook of Diagnostic Biochemistry and Haematology in Normal Pregnancy. Ed Lockitch, 1993

5. Clinical Blood Sciences: Haematology and Blood Transfusion

5.1 Consultants and senior staff

Key consultant and laboratory staff and their contact numbers, for each of the laboratories are shown in the table below:

Croydon University Hospital		
Dr B Cheung	Lead Haematology Consultant	0208 401 3026 (secretary)
Dr S Kotsiopoulou	Consultant Haematologist	
Dr S Solanki	Consultant Haematologist	
Mr F.Mpambire	CBS Spoke Manager, Croydon hospital	0208 401 3599
Matthew Free	CBS Deputy Spoke Manager	0208 401 3000 ext. 4056
Kingston Foundation Trust		
Dr Z Abboudi	Lead Haematology Consultant	Available via switchboard
Dr V Jayakar	Consultant Haematologist – Blood Transfusion	
Dr S Atwal	Clinical Lead/Consultant Haematologist	
Dr S Zebari	Consultant Haematologist	
Mr D McIntyre	CBS Spoke Manager	0208 934 2051
Haematology Medical Team	0208 934 2321, then select option 2	
St George's Foundation Trust		
Dr M Klammer	Consultant Haematologist	0208 725 3238
Dr J Uprichard	Consultant Haematologist – Blood Transfusion	0208 725 4282
Mr S Hyare	CBS Discipline Manager	0208 725 2391
Mr Kwaku Addo	CBS Quality Manager	0208 725 2391
Mr Ruth Mills	Section Head - Diagnostic Haematology	0208 725 5464

Ms F Doyley	Senior Scientist - Cell Markers	0208 725 5482
Ms B Onyeachom	Technical lead - Haemoglobinopathy Screening	0208 725 5520
Mr V Michael	Transfusion Network Lead	0208 934 2047
RNOH		
Mrs J. Gevao	Laboratory Manager (RNOH)	0208 909 5268

Clinical advice can be obtained by contacting the above clinical staff at each site.

RNOH issues only

Staff from the RNOH wishing to speak to a Consultant Haematologist should telephone the Kingston Hospital number (0208 8546 7711) and ask to be put through to the on-call Haematology Consultant.

The Haemophilia nurses at SGH, can be contacted directly on 0208 725 0763 during normal working hours. Out of hours, the Kingston Haematology team should be contacted.

5.2 Laboratory working hours

All laboratories are open 24 hours every day, 7 days a week.

5.3 Main laboratory contact numbers

Telephone numbers for the main laboratory areas are shown in the table below:

Croydon University Hospital	
Specimen Reception	0208 401 3025
Haematology Laboratory	0208 401 4071
Blood Transfusion Laboratory	0208 401 3466
Kingston Foundation Trust	
Specimen Reception	0208 934 2052
Haematology Laboratory	0208 934 2044
Blood Transfusion Laboratory	0208 934 2046
St George's Foundation Trust	
Specimen Reception	0208 725 5468
Haematology Laboratory	0208 725 5464
Blood Transfusion Laboratory	0208 725 5477

5.4 Enquiries – out of hours

Croydon	
Out of Hours laboratory staff	Bleep 141
Clinical staff	Via Switchboard
Kingston	
Out of Hours laboratory staff	Bleep 541
Clinical staff	Via Switchboard
St George's	
Out of Hours laboratory staff	Telephone laboratory
Clinical staff	Via Switchboard

5.5 Haematology tests: specimen requirements, special instructions, factors affecting test performance and turnaround time

Test	Specimen bottle, minimum volume and form	Special instructions	Factors that may affect performance of the test or interpretation of results	Usual turnaround times
Full Blood Count + platelets	Lavender EDTA 6 ml Or paediatric pink top bottle 0.5ml			FBC A&E 1 Hour Urgent 2Hours Routine 3Hours
Film/Differential	Minimum volume required is 1.5mL if taken in 6.0mL tube	Films (including malaria) can only be made on FBC samples on day of venepuncture		Film 2-3 Days (Mon – Fri)
Malarial Parasites	Multidisciplinary request form	Malaria requests must be accompanied with details of area travelled and prophylaxis taken		Malarial parasites 2 Hours

Test	Specimen bottle, minimum volume and form	Special instructions	Factors that may affect performance of the test or interpretation of results	Usual turnaround times
Reticulocytes	FBC sample will be used	Reticulocytes may be requested on samples up to 72 hours old.		
Glandular Fever screening test	Lavender EDTA 6ml	May be added to FBC requests on samples up to 72 hours old.		48 hours
Plasma Viscosity	*Lavender EDTA 6ml* (minimum volume) Multidisciplinary request form under 'other tests'	Separated plasma sent by laboratory on same day of venipuncture to; Haematology Dept. St Thomas' Hospital 4th Floor North Wing Lambeth Palace Road. LONDON SE1 7EH		7-10 days
Acidified Glycerol Lysis Test (AGLT)	*Lavender EDTA 6ml* Minimum volumes – see FBC Multidisciplinary request form under 'other tests'	By arrangement with Diagnostic Haematology laboratory Contact Ext 3920 The test can only be performed on samples less than 24hours old		24 hours
G6PD	*Lavender EDTA 6ml*			2 – 3 days Mon - Fri
Lymphocyte subsets, CD4 counts.	*Lavender EDTA 6ml* Minimum volume 2ml	Must be accompanied by a FBC request with additional		24hrs except for sample received on Friday

Test	Specimen bottle, minimum volume and form	Special instructions	Factors that may affect performance of the test or interpretation of results	Usual turnaround times
	Multidisciplinary request form under 'other tests'	Lavender EDTA 6ml. May be added to FBC request on samples up to 24hours old		
Immunophenotyping	Collection as advised by Leukaemia diagnosis laboratory ex 5482 Multidisciplinary request form under 'other tests'	By discussion and arrangement with Haematology SPR May be added to FBC request on samples up to 24hours old		Verbal 24hrs Formal report 5 working days
PNH screen	Lavender EDTA 6ml Minimum volume 1ml Multidisciplinary request form under 'other tests'	May be added to FBC request on samples up to 24hours old		Verbal 24hrs Formal report 5 working days
Paediatric lymphocyte subset	Lavender EDTA 1ml or paediatric pink top bottle 0.5ml Must be accompanied by a FBC request with **additional** paediatric pink top bottle 0.5ml	May be added to FBC request on samples up to 24hours old		24hrs except for samples received on Friday.
JAK2 mutation	Lavender EDTA 1 x 6ml	By discussion and arrangement with		Four weeks

Test	Specimen bottle, minimum volume and form	Special instructions	Factors that may affect performance of the test or interpretation of results	Usual turnaround times
	Multidisciplinary request form under 'other tests'	Haematology SPR or consultant. Cannot be added to existing requests		
TCR/IgH gene rearrangement studies	Lavender EDTA 2 x 6ml PB and BM samples. Paraffin Sections are also suitable Minimum volume 1 x 6ml subject to cell count Multidisciplinary request form under 'other tests'	May be added, after consultation with Haematology or Oncology SpR/Consultant, to FBC request on samples up to 48 hours old		4 Weeks
Sickle Solubility test	Lavender EDTA 1 x 6ml	Samples should NOT be older than 3 days.	Age of sample, haemolysis and blood clots.	3 days
Haemoglobinopathy Screen	Lavender EDTA 1 x 6ml	Samples should NOT be older than 3 days. Samples Must be labelled with the Patient's (1) First name, (2) Surname (3) DOB and (4) Hospital/NHS number or current Address	Age of sample, haemolysis and blood clots.	3 days
Platelet glycoprotein assay	Collection tube with special anticoagulant provided by cell markers lab.	By arrangement with Cell Markers lab Contact Ext 5482.		Verbal results within 24 hours. Formal reports 5 working days.

Test	Specimen bottle, minimum volume and form	Special instructions	Factors that may affect performance of the test or interpretation of results	Usual turnaround times
		By prior arrangement only.		
Coagulation screening tests, Anticoagulant control.	Blue Citrate 2.7ml Paediatric 1ml (minimum volume) Multidisciplinary request form	Samples **must** be filled to mark, taken with minimum stasis and analysed within 4 hours after venipuncture. May be added to samples less than 4 hours old.	Samples taken from lines may be contaminated with heparin which could affect results.	Urgent 60 – 90 minutes (dependent on extent of tests required) Routine 4 hours
Fibrinogen, D Dimer	Blue Citrate 2.7ml Paediatric 1ml (minimum volume) Multidisciplinary request form	May be added to samples less than 4 hours old.		Urgent 60 – 90 minutes (dependent on extent of tests required) Routine 4 hours
Coagulation factor assays	Blue Citrate 3 x 2.7ml (minimum volume Multidisciplinary request form under 'other tests'	*Samples must be filled to mark, taken with minimum stasis and sent to lab within 4 hours after venepuncture*.		*1 week*
Thrombophilia screening	Blue Citrate 3 x 2.7ml (minimum volume Multidisciplinary request form	Samples must be filled to mark, taken with minimum stasis and sent to lab within 4 hours after venipuncture.		1 week

Test	Specimen bottle, minimum volume and form	Special instructions	Factors that may affect performance of the test or interpretation of results	Usual turnaround times
	under 'other tests			
Prothrombin mutation & Factor V Leiden	Lavender EDTA 6ml Minimum volume 1ml Multidisciplinary request form under 'other tests''	By arrangement with Haemostasis laboratory. Contact ext. 5479 May be performed on FBC samples that are < 24 hours old		2 weeks
MTHFR	Lavender EDTA 6ml Minimum volume 1ml Multidisciplinary request form under 'other tests''	By arrangement with Haemostasis laboratory. Contact ext. 5479 Sent to Histopathology Royal Surrey County Hospital, Egerton Road, Guildford, GU2 5XX		4 weeks
ADAMT-13	Lavender EDTA 6ml Minimum volume 1ml Multidisciplinary request form under 'other tests''	By arrangement with Haemostasis laboratory. Contact ext. 5479 Sent to Dr I Mackie. Haemostasis Research Unit, University College Hospital London, 1st Floor, 51 Chenies Mews, London WC1E 6HX		3 weeks
Platelet Function Analysis/PFA100	Blue Citrate 2 x 2.7ml Minimum volume	By arrangement with Haemostasis laboratory. Contact ext. 5479	Platelet count must be >100 x 10^9, HCT >0.300	Same day

Test	Specimen bottle, minimum volume and form	Special instructions	Factors that may affect performance of the test or interpretation of results	Usual turnaround times
	Multidisciplinary request form under 'other tests''			
Platelet aggregometry	Blue Citrate 3 x 2.7ml Minimum volume Multidisciplinary request form under 'other tests''	By arrangement with Haemostasis laboratory. Contact ext. 5479	Platelet count must be >100 x 10^9, HCT >0.300	Same day
Blood Grouping and Antibody screening, .	Pink Cap EDTA 6 mL Minimum volume	Shelf life for additional tests will vary between 24 hours to 7 days depending on transfusion history. Contact lab for advice		24 hours
Cross match	Pink Cap EDTA 6 mL Minimum volume	See above		Urgent x match 1 hour
Direct Antiglobulin (Coombs) test	Lavender EDTA 6ml Or paediatric pink top bottle 0.5ml Multidisciplinary request form under 'other tests''	May be added to FBC or G&S requests on samples < 24 hours old		24 hours

Test	Specimen bottle, minimum volume and form	Special instructions	Factors that may affect performance of the test or interpretation of results	Usual turnaround times
Kleihauer	Lavender EDTA 6ml	Patient pregnancy status (in weeks or post delivery) must be detailed on request form. See 5.11.		24 hours
Red Cell Immunohaematology Referral tests. • Allo and autoantibody confirmation • Autoimmune Haemolytic Anaemia • Haemolytic disease of the Fetus and Newborn • Haemolytic Transfusion reactions • IgA Deficiency	Samples requirements detailed on NHSBT Request form 1A. (Available from Blood Transfusion) Minimum of 2x Pink Cap EDTA 6ml.	Discuss with Laboratory.		5 days
Histocompatibility and Immunogenetics Referral tests • Platelet refractoriness • Transfusion reactions (TRALI and TA-GvHD) • Solid organ transplantation • Haematopoietic stem cell transplantation • HLA disease association • Drug hypersensitivity	Samples requirements detailed on NHSBT Request forms 3A, 3B, 3C, 3F. (Available from Blood Transfusion)	Discuss with Laboratory.		7 – 15 days (depending on test)

Test	Specimen bottle, minimum volume and form	Special instructions	Factors that may affect performance of the test or interpretation of results	Usual turnaround times
Platelet Immunology Referral tests • Autoimmune Thrombocytopenia and Thrombasthenias • Fetal/neonatal alloimmune thrombocytopenia • Heparin induced thrombocytopenia • Other drug-related thrombocytopenia • Post Transfusion Purpura • HPA testing	Samples requirements detailed on NHSBT Request form 3D. (Available from Blood Transfusion)	Discuss with Laboratory.		3 – 20 days (depending on test)
Granulocyte Immunology Referral tests • Adult autoimmune neutropenia • Infant autoimmune neutropenia • Drug related neutropenia • Neonatal alloimmune neutropenia	Samples requirements detailed on NHSBT Request form 3E. (Available from Blood Transfusion)	Discuss with Laboratory.		21 days
Cold Agglutinin Titre	Red top 5ml Minimum volume	Discuss with laboratory. 5 ml clotted blood, which must be kept at 37°C.		48 hours

5.6 Reports

Copies of reports will be returned where appropriate.

5.7 Diagnostic haematology reference ranges

Adult reference range and normal values for age and sex printed on report form.

Test	Age/sex	Reference range
White cell count (WBC)		4.0 – 11.0 x 10^9/L
Red cell count (RBC)	M	4.5 – 6.0 x 10^{12}/L
	F	3.8 – 5.5
Haemoglobin	M	120 – 180 g/L
	F	115 – 165 g/L
Packed cell volume/haematocrit	M	0.40 – 0.52 L/L
	F	0.37 – 0.47 L/L
Mean cell volume (MCV)	M	80 – 97 fl
	F	78 – 97 fl
Mean cell haemoglobin (MCH)		27 – 34 pg
Platelets		150 – 450 x 10^9/L
Reticulocytes		30 – 100 x 10^9/L
Erythrocyte sedimentation rate (ESR)	<50 years	1 – 12 mm/hr
	>50 years	<20 mm/hr
Plasma Viscosity		1.1 – 1.35 mPa.s
Differential WBC Neutrophils		1.5 – 8.0 x 10^9/L
Eosinophils		0.2 – 0.4
Basophils		<0.3
Lymphocytes		1.1 – 4.0
Monocytes		0.2 – 1.1
Haemoglobin A2		2.1 – 3.5%
Haemoglobin F		<1.0
G6PD		Reported as normal or deficient. If deficient, assay will be performed.
Red cell volume*	M	30 $\pm$ 5 mL/Kg

	F	25 ± 5 mL/Kg
Plasma volume*		45 ± 5 mL/Kg
Total blood volume*		70 ± 10 mL/Kg

The laboratory staff are available to advise on the most suitable tests to confirm the nature of a blood disorder, such as bone marrow examination, tests for a suspected haemolytic process etc.

5.8 Haemostasis reference ranges

Screening	
Test	**Reference range**
INR	0.8 – 1.1
Activated Partial Thromboplastin time ratio APTTR	0.85 – 1.15
Thrombin time	11 – 18 secs
Fibrinogen	1.6 – 4.8 g/L
D-dimers - immunological	<300 ng/ml
Anticoagulant control	
Test	**Reference range**
INR (Warfarin)	See anticoagulant guidelines
APTT (unfractionated heparin iv)	APTTR 1.5 – 3.5
Anti-Xa (low molecular weight or unfractionated heparin)	Refer to haematologist

5.9 Blood Transfusion

Please note that for more detail on any aspect of the Blood Transfusion service, please refer to the local Blood Transfusion policy which is available on the respective Trust's intranet site.

The group and save policy will state our aim that two blood grouping samples, from discrete phlebotomy episodes, are tested before blood components are issued.

For blood grouping, antibody screening and cross matching please provide 6 mL in special Pink cap EDTA tube. If you wish to convert a "Group and Save" to a cross match, please telephone the laboratory to arrange. Plasma saved for 1 week.

Allow 1 clear working day for elective cross matching.

Cross matched blood is routinely returned to stock after 24/48hrs depending upon the Trust, unless discussed with the laboratory.

5.10 Blood products available (other than red cells or anti-D)

Fresh Frozen Plasma	Order by telephone, giving clinical disorder requiring the product.
Cryoprecipitate	Order by telephone, giving clinical disorder requiring the product.
Platelet concentrate	Platelets – usually available within 2 hours. Order by telephone: May require Clinical Haematology confirmation.
Human Albumin Solution (HAS) (4.5% and 20%)	Blood group not required.
Prothrombin Complex Concentrate (PCC)	Blood group not required

5.11 Anti-D immunoglobulin

Routine Antenatal prophylaxis is offered to all RhD Negative patients. 1500 iu Anti-D is given at 28 weeks.

For Rh D negative woman (or mother), post-delivery of RhD positive child, give 500/1500 iu dependant on trust. Kleihauer performed automatically. Ward informed if further Anti-D required and the need for a further Kleihauer examination, or referral of sample to National Blood Service for confirmatory testing.

Following spontaneous/therapeutic abortion, give 500/1500 iu **dependant on Trust.** Anti-D should be administered within 72 hours. A Kleihauer test should be requested where gestation is 20 weeks or more.

Addressograph labels, unclear or incorrectly labelled samples **will NOT be accepted**.

Both the request form and blood sample must be labelled with the following: First name, surname, hospital number, date of birth and gender, and samples must be signed and dated. It is Hospital policy to reject incorrectly labelled Transfusion samples. No changes are allowed to rejected samples.

6. Point of Care Testing (POCT)

The point of care testing department is based at the St George's Hospital site and operates across operates across all other SWLP sites. A POCT service is available at each site providing support to all departments including the emergency department and intensive care units on the provisions of rapid diagnostics that help inform the clinicians' decisions on the clinical management of the patient

The service covers a wide range of POCT devices and analysers including:

Blood gas analysers	Urinalysis	Activated prothrombin time
Glucometers	Ketone	Cardiac Biomarkers
Influenza A/B and RSV testing	C-reactive protein	D-Dimer
INR	Creatinine and eGFR	HbA1c
Thrombelastography	hCG	

6.1 The POCT clinical lead and senior staff

Dr S. Davies	Clinical Lead & Consultant Clinical Scientist	sarah.davie1@nhs.net	0208 934 2056
Haval Ozgun	SWLP POCT Manager	haval.ozgun@nhs.net	0208725 4450
Faye Browne	SWLP POCT coordinator	Faye.browne@nhs.net	0208725 4450

There is a POCT governance committee at each SWLP site with representation from medical and nursing staff and other departments. The committee meets quarterly and is accountable to the SWLP Clinical Governance Committee for ensuring the delivery of a high quality POCT service.

The POCT teams, contact details and working hours

St. George's Hospital	poct@stgeorges.nhs.uk	0208 725 4450
Croydon University Hospital	ch-tr.cuhpoct@nhs.net	0208 401 3599
Kingston Hospital	Khft.poct@nhs.net	0208 934 3299
Royal National Orthopaedic Hospital	rnoh.poct@nhs.net	0208 909 5613
New Victoria Hospital	poct@stgeorges.nhs.uk	0208 725 4450

The POCT department is open **Monday-Friday 09:00-17:30hrs** at all sites.

All enquires and requests for new POCT service should be sent to the POCT manager haval.ozgun@nhs.net.

6.2 POCT services

The POCT department offers a wide range of rapid tests that are used by the clinicians for the immediate clinical intervention and management of the patients.

6.2.1 Blood gas tests

Blood gases

The Radiometer ABL90 FLEX PLUS blood gas analyser is used across all SWLP sites. It is designed for POCT in busy clinical environments such as emergency departments (EDs) and intensive care units (ICUs), as well as theatres and labour wards, where obtaining timely and accurate laboratory data may allow rapid diagnostics and more appropriate patient management. The analyser can perform a range of critical care parameters, including blood gases, electrolytes, co-oximetry and metabolites, including (urea and) creatinine and automatic estimation of GFR (eGFR). As many as 19 parameters can be simultaneously analysed, using 65 µL of blood, with first results available in 35 seconds. The instrument also enables easy operation by means of automatic sampler aspiration, disposable reagent cartridges, full compatibility with laboratory information system (LIS) and electronic patients records (EPR), integrated automated calibration and quality control usage.

The measurement of ABGs provides valuable information in assessing and managing a patient's respiratory (ventilation) and metabolic (renal) acid-base and electrolyte homeostasis. It is also used to assess the adequacy of oxygenation. ABGs are used to monitor patients on ventilators, monitor clinically ill non-ventilated patients, establish pre-operative baseline parameters, and regulate electrolyte therapy. Repeat blood gases enables the assessment of oxygen pressure to guide therapy of patients on ventilators or

continuous positive airways pressure (CPAP) machines so that the treatment can be adapted to preserve the patient's normal physiological balance.

The measurement of pH and pCO2 (and subsequent calculation of HCO3-) enables the assessment of acid-base balance. This provides the means of identifying many diseases, especially when combined with determination of electrolytes.

Electrolytes

Sodium and Potassium

The electrolytes Na+ and K+ are measured as part of a routine laboratory evaluation of all patients. They are used to evaluate and monitor fluid and electrolyte balance and response to therapy. Sodium is the principal extracellular cation and determinant of extracellular fluid osmolality and volume, and its concentration is the result of a balance between dietary sodium intake and renal excretion. Potassium is the major intracellular cation, and is important in maintaining membrane electrical potential, especially in neuromuscular tissue (most notably, heart muscle). Potassium also contributes to the metabolic portion of acid-base balance. It is a very important test, but especially to those who take diuretics or heart medications.

Chloride

Chloride is the most important anion in bodily fluids and is located mainly in the extracellular area. Chloride is glomerularly filtered in the kidneys and is tubularly reabsorbed by passively following sodium. Chloride works with sodium to regulate the acid/base status and may be exchanged for bicarbonates during acid/base disturbances. Hypochloremic alkalosis may occur during extended periods of vomiting, in which chloride is lost in the gastric juices.

Ionised Calcium

Calcium in blood is distributed as free calcium ions (50%), bound to protein (mostly albumin, 40%), and 10% bound to anions such as bicarbonate, citrate, phosphate and lactate. However, only ionised calcium can be used by the body in such vital processes as muscular contraction, cardiac function, and transmission of nerve impulses and blood clotting. Patients with renal disease caused by glomerular failure often have altered concentrations of calcium, phosphate, albumin, magnesium and pH. Since these conditions tend to change the ionised calcium independently of total calcium, ionised calcium is the preferred method of accurately monitoring calcium in renal disease.

Haemoglobin Derivatives (Haemoximetry)

Haemoximetry is used for:

i) Investigation of the efficiency of haemoglobin oxygenation by the lungs (Hb saturation)

ii) Measurement of non-oxygen-carrying blood pigments (Carboxyhaemoglobin, Methaemoglobin and Sulphaemoglobin)

iii) Investigation of patients with likely abnormalities of oxygen carriage and release, e.g. acidosis, alkalosis, hypoxaemia.

Carboxyhaemoglobin is measured in the investigation of possible carbon monoxide exposure and poisoning. Methaemoglobin and Sulphaemoglobin are measured in the investigation of unexplained central cyanosis and possible oxidant drug haemolysis (e.g. sulphonamides, aniline dyes, nitrates and nitrites). Increased levels of Methaemoglobin are seen in patients with HbM haemoglobinopathy or Methaemoglobin-reductase deficiency and flowing oxidant drug exposure. Sulphaemoglobin may occur with exposure to certain drugs, especially sulphonamides.

Bilirubin (neonatal)

Bilirubin is formed in the reticuloendothelial system during the degradation of erythrocytes. The haem portion from haemoglobin and from other haem-containing proteins is removed, metabolised to bilirubin, and transported as a tightly bound complex with serum albumin to the liver. In the liver, bilirubin is conjugated with glucuronic acid for solubilisation and subsequent transport through the bile duct and elimination via the digestive tract.

The concentration of bilirubin in the plasma of an individual is determined by the balance between production and clearance. Any disease process which disrupts this balance will lead to an increase in plasma bilirubin.

In the newborn, the massive red cell destruction occurring in haemolytic disease of the newborn, coupled with the immature hepatic handling of bilirubin, can produce elevations of unconjugated bilirubin of 400 – 500 µmol/L or greater. Such elevations are associated with the risk of developing kernicterus (deposition in the brain with cerebral damage) and levels may be reduced by exchange transfusion.

Also, in premature infants, the poorly developed conjugating mechanism may result in so-called ‘physiological’ jaundice with markedly raised levels of unconjugated bilirubin, necessitating ultraviolet light treatment or exchange transfusion.

Some drugs can further influence the course and severity of neonatal unconjugated hyperbilirubinaemia caused by the immature hepatic handling of bilirubin by:

a. displacing bilirubin from plasma albumin
b. inhibiting the glucuronyl transferase system
c. causing haemolysis.

Another reason for measuring bilirubin in neonates is for the diagnosis of Crigler-Najjar syndrome. This harmful congenital disease presents in the first few days of life as jaundice, due to a rise in unconjugated bilirubin levels that may often be high enough to cause kernicterus and is caused by a deficiency of glucuronyl transferase. In infants who survive, the level of bilirubin tends to stabilise, suggesting the existence of alternative pathways of bilirubin excretion.

Rarely, a baby may be born with a congenital condition called biliary atresia, in which the bile ducts do not drain. It usually presents within the first few weeks of life, with jaundice that does not improve with time. This form of hyperbilirubinaemia is largely due to conjugated bilirubin and may be corrected by surgery. Delay in diagnosis of the condition can lead to irreversible liver damage.

Glucose

Glucose measurements are used in the diagnosis and treatment of carbohydrate metabolism disorders including diabetes mellitus and hypoglycaemia.

Glucose is the major carbohydrate present in the peripheral blood. Oxidation of glucose is the major source of cellular energy in the body. Glucose derived from dietary sources is converted to glycogen for storage in the liver or to fatty acids for storage in adipose tissue. The concentration of glucose in blood is controlled within narrow limits by many hormones, the most important of which is insulin produced by the pancreas. The most frequent cause of hyperglycaemia is diabetes mellitus, resulting from a deficiency in insulin secretion or action. A number of secondary factors also contribute to elevated blood glucose levels. These include pancreatitis, thyroid dysfunction, renal failure, and liver disease.

Hypoglycaemia is less frequently observed. A variety of conditions may cause low blood glucose levels such as insulinoma, hypopituitarism, or insulin-induced hypoglycaemia.

Lactate

Lactate acts as an early warning signal for hypoxic states in human tissues. Anaerobic glycolysis markedly increases blood lactate and causes some increase in pyruvate levels, especially with prolonged exercise. The common cause for increased blood lactate and pyruvate is anoxia resulting from such conditions as shock, pneumonia and congestive heart failure. Lactic acidosis may also occur in renal failure and leukaemia. Thiamine deficiency and diabetic ketoacidosis are associated with increased levels of lactate and pyruvate.

Lactate measurements that evaluate the acid-base status are used in the diagnosis and treatment of lactic acidosis.

Creatinine and eGFR

Creatinine is an endogenous waste product of muscle metabolism, derived from creatine, a molecule of major importance for energy production within muscle cells. Creatinine is removed from the body in urine and its concentration in blood reflects glomerular filtration and thereby kidney functions.

Creatinine is measured to assess kidney dysfunction, i.e. to detect and monitor chronic kidney disease (CKD) and/or acute kidney injury (AKI).

Creatinine should be measured:

- with clinical evidence or history of kidney disease/dysfunction
- acute/critical illness, i.e. patients assumed to be at risk of AKI
- in chronic conditions e.g. diabetes, associated with risk of renal impairment. Here creatinine is monitored at regular intervals
- before and after administration of nephrotoxic contrast agents, e.g. with computed tomography (CT) or magnetic resonance imaging (MRI)
- before and after prescription of any potentially nephrotoxic drug
- before and at intervals during prescription of drugs whose principal route of elimination is via the kidneys.

The process of urine formation begins with filtration of blood. The parameter glomerular filtration rate (GFR) reflects the rate at which blood is filtered in the kidneys and thus of major clinical significance. Kidney disease/dysfunction is associated with reduction in eGFR, and that is inversely correlated with the severity of the underlying condition.

6.2.2 Capillary Blood Glucose

The principal reason for measuring circulating glucose concentration is to diagnose and monitor diabetes mellitus, a very common chronic metabolic condition characterized by increased blood glucose concentration (hyperglycaemia), due to an absolute or relative deficiency of the pancreatic hormone insulin. The two main types of diabetes are referred to as type 1 (insulin-dependent) and type 2 (insulin-resistant). Diabetes treatment, which is

aimed at normalizing blood glucose concentration, is associated with constant risk of reduced blood glucose (hypoglycaemia), which can lead to impaired cerebral function, impaired cardiac performance, muscle weakness, and is associated with glycogen depletion and diminished glucose production.

It is therefore vital that the results of capillary blood glucose measurements are used to adjust treatment to achieve the recommended blood glucose targets.

The test is performed using a drop of capillary whole blood usually obtained via a finger prick.

6.3 POCT sample requirements

Venous and arterial blood gas	Venous or arterial whole blood
Capillary blood test	Capillary whole blood collected into a capillary tube
Capillary blood glucose	Capillary whole blood from a finger prick. Capillary blood collection involves puncturing the dermis layer of the skin to access the capillary beds that run through the subcutaneous layer of the skin.

6.3.1 Type of container and additives with storage and stability

Only electrolyte balanced syringes & capillaries should be used

Syringes

- Only Heparinised syringes are used for adult arterial and venous samples.
- From lines collect sample into Radiometer *safe*PICO syringes with a minimum sample volume of 0.7ml and analysed <30mins.
- For arterial stabs use the respective current self-fill syringe being used on the different sites with a minimum sample volume of 0.7ml and analysed <30mins.

Capillaries

- Only Heparinised capillaries are used for Neonatal heel prick samples and Respiratory Physiology patient arterialised earlobe samples.
- The samples are collected into Radiometer *safe*Clinitubes with a minimum sample volume of 65ul and analysed <10min.

Product codes: The consumables below are ordered by ward staff through Trust Supplies department.

Part no.	Description	Supplier
956-622	safePICO Aspirator arterial blood sampler	Radiometer Limited
942-898	safeClinitubes	Radiometer Limited
906-026	Clot catchers	Radiometer Limited

6.3.2 Collection and transport procedures

Correct pre analytical procedure	Why
Use the recommended sampler and clearly label with unique patient identification.	The sample must be run immediately to prevent mix up or loss of sample.
Use electrolyte balanced heparin syringes and capillaries.	Other anticoagulants are not suitable for use on these analysers.
Correct volume of blood. Syringe 0.7ml & capillary 65ul	The sampler must be filled to the correct volume that is recommended by the manufacturer, to ensure the correct volume of heparin to blood sample.
Samples must be taken away from flush lines.	This can result in the sample being diluted, therefore must be avoided.
The sampler must have all air bubbles removed and the sample must be capped prior to mixing and transportation.	Air bubbles and uncapped samples will affect the O^2 and CO^2 values.
The technique of manual mixing must be performed correctly.	Mixing ensures that the sample is more homogeneous, therefore if not done correctly it can result in increased sedimentation and haemolysis, affecting $K^+\uparrow$, $Na^+\downarrow$ and $Ca^{2+}\downarrow$.
The sample must be analysed within stated time.	If not analysed quickly, it will cause the following: $pO_2\downarrow$ - O_2 will be consumed. $pCO_2\uparrow$ - CO_2 will still be produced. $pH\downarrow$ - Due to change in CO_2. $cCa^{2+}\uparrow$ - The change in pH will influence the binding of Ca^{2+} to protein.

	cGlu↓ - Glucose will be metabolized. cLac↑ - Due to metabolism.
Follow correct procedure for sample analysis	To prevent analyser downtime.

6.4 Reference ranges

6.4.1 Arterial blood gases

pH	
Adult, child (arterial)	7.350 - 7.450
***p*CO2**	**kPa**
Adult (arterial)	4.30 – 6.40
***p*O_2**	**kPa**
Adult, child (arterial)	11.4 – 14.4
***ct*Hb**	**g/L**
Adult	120 - 175
***F*O2Hb**	
Adult	94 - 98 %
***F*COHb**	
Adult non-smoker	0.5 - 1.5%
***F*MetHb**	
Adult	0.0 - 1.5%
***s*O2**	
Adult,child (arterial)	95 - 98 %
***c*Na^+**	**mmol/L**
Adult,child	133 -146
***c*K^+**	**mmol/L**
Adult, child	3.5 – 5.3

cCl-	**mmol/L**
Adult	95 - 108
cCa^{2+}	**mmol/L**
Adult	1.15 - 1.29
cGlu	**mmol/L**
Adult	3.9 – 5.9
CLac	**mmol/L**
Adult, child	0.5 – 2.5
cBase(Ecf)c	**mmol/L**
Adult	-2 - +2
cHCO$_3^-$(P,st)$_c$	**mmol/L**
Adult	21 - 28

6.4.2 Capillary blood glucose

4.0 – 8.0 mmol/L

6.5 Results

All blood gas and capillary blood glucose results are electronically transferred to the patient's electronic records (EPR) at each site.

6.6 Technical tips and pre-analytics

It is vital that samples are collected correctly as per standard operating procedure to ensure the accuracy and reliability of the blood gas and capillary blood glucose results. Below is a list of common pre-analytical errors that affect the results.

6.6.1 Blood gases

Failure to identify the sample clearly and uniquely.
Failure to enter the patient details correctly on the analyser.
Samples taken from unsuitable sites. Blood taken from arterial lines or drip-arms may be contaminated with infused fluids. This is prevented by flushing the arterial line or by using the alternative arm if the patient is on a drip.

Incorrect sampling devices. Only the recommended sampling procedures using lithium heparin anticoagulants should be used, other anticoagulants may affect results and damage membranes within the analyser. Unsuitable anticoagulants include those in the following blood collection bottles:

- Sodium fluoride (yellow cap);
- Citrate (green cap);
- EDTA (red cap) - using blood containing EDTA will cause interference with potassium and calcium measurements and damage the sensor's subsequent measurement of calcium.

Haemolysis. Haemolysis in a specimen can result in high potassium and low ionised calcium results. The causes of haemolysis are likely to be due to squeezing during collection of capillary specimens or because excessive vigorous mixing has occurred.

Haemolysis cannot be detected visually in whole blood specimen's therefore unexpected potassium and/or ionised calcium results should be checked with a serum specimen sent to the laboratory.

Air in the sample. Air bubbles must be removed from syringe specimens as soon as possible. Prolonged contact in the specimen can significantly alter oxygen and carbon dioxide results.

Exposure to light. Specimens analysed for bilirubin concentration should not be exposed to excess artificial light, sunlight or phototherapy lights as this will reduce the bilirubin in the specimen prior to analysis.

Failure to analyse the sample promptly. Syringe samples must be analysed within 30 minutes of taking the sample, capillary samples within 10 minutes. Continued metabolism in the blood will lead to a rise in lactate and a fall in glucose levels. The gases in the sample are volatile and if left there will also be changes in the pO2 and pCO2 levels.

Insufficient sample volume. Insufficient sample volume will result in incorrect results or loss of the sample.

Failure to gently mix the sample after removing the air bubbles. The lithium heparin anticoagulant will not be evenly distributed through the sample and this could result in small fibrin clots forming. These clots could enter the analyser preventing results from being obtained and could cause the analyser to stop working.

Failure to remix the sample just before analysis. The sample needs to be homogeneous to get correct results. Poorly mixed specimens give false haemoglobin results therefore haemoglobin results must not be used to initiate patient management; unexpected results should be checked by sending an appropriate sample to Haematology for a full blood count.

6.6.2 Capillary blood glucose

- Ensure sampling site is not contaminated
- Avoid sampling near an intravenous infusion site.
- Capillary blood samples should not be used in patients with impaired peripheral circulation or hypotension. A venous sample should be used instead.
- This test is contraindicated in patients with Galactosemia, a rare genetic disorder that affects how your body metabolizes galactose.

7. Medical Microbiology

Hub Laboratory Location - First Floor, Jenner Wing, St George's Hospital

7.1 Consultants and senior staff

Based at Croydon University Hospital		
Dr I Qureshi	Consultant in Infection	020 8401 3453
Dr M Sahathevan	Consultant Microbiologist	020 8401 3383
Dr M Twagira	Consultant Microbiologist	020 8401 3383
Dr E. Wiley	Consultant Microbiologist	020 8401 4753
Based at Kingston Hospital		
Dr E Demertzi	Consultant Microbiologist	020 8934 3070
Dr S Furrows	Consultant Microbiologist	020 8934 2037
Dr S Patel	Consultant Microbiologist	020 8934 2036
Dr G Pichierri	Consultant Microbiologist	020 8934 2039
Based at St George's Hospital		
Dr A Arnold	Consultant in Infection	020 8725 5673
Dr M Basarab	Consultant in Infection	020 8725 5673
Dr A Breathnach	Consultant Microbiologist	020 8725 5735
Dr M Habibi	Consultant in Infection and SWLP Microbiology Clinical Lead	020 8725 5734
Dr A Houston	Consultant in Infection	020 8725 5673
Dr M Laundy	Consultant Microbiologist	020 8725 5678
Dr T Planche	Consultant Microbiologist and Clinical Director for SWLP	020 8725 2683
Dr C Pope	Consultant Clinical Scientist (Microbiology & Virology)	020 8725 5734
Dr P Riley	Consultant (Microbiology & Virology)	020 8725 5707

Senior laboratory staff – based at St George's Hospital		
Kurt Djemal	Microbiology General Manager Manager	020 8725 5698
Jokotade Alli-Balogun	Quality Manager and Safety Adviser	020 8725 5176
Carmel Prendergast	Technical Lead Bacteriology	020 8725 5175
Dawn Andrew	Technical Lead Virology	020 725 5176

7.2 Laboratory opening hours

MON	TUE	WED	THU	FRI	SAT	SUN	BH
Dept open to enquiries Mon – Fri 09:00 - 17:30							
The department provides a 24/7 service							

7.3 Contacting the laboratory

St George's Hospital is the hub laboratory processing all work received for Microbiology, including Microbiology specimens from the spoke sites at Kingston Hospital and Croydon University Hospitals.

The easiest way to contact the correct person is to dial 020 8725 5693 and select the appropriate option. Other contact details are shown below.

7.4 Enquiries during working hours

Microbiology General Enquiries	020 8725 5693 Option 1 MON TUE WED THU FRI: ← Available 9 – 5:30pm → SAT SUN BH: ← Available 9 – 12pm →
Microbiology Results line	020 8725 5468
Croydon Hospital Microbiology Consultants	Croydon Hospital switchboard 020 8401 3000 and ask for the duty microbiology consultant
Kingston Hospital Microbiology Consultants	Kingston Hospital switchboard 020 8546 7711 and ask for the duty microbiology consultant

St. George's Clinical Advice/ Microbiologist	020 8725 5693 Option 2
St. George's Clinical Advice/ Virologist	020 8725 5693 Option 2
Microbiology office email	stgh-tr.micro.office@nhs.net
RNOH	Microbiology registrar; via the Royal Free Hospital switchboard Clinical advice including results interpretation and treatment; Consultant via RNOH switchboard on RNOH bleep 801 020 7794 0500 Ext: 33973/33259 RNOH Multi-disciplinary Laboratory: 020 8909 5846 On-Site Laboratory Manager: Juliette Gevao: 020 8909 5846/5268 Oversight Manager: Dr Ghulam Qureshi: 0208 909 5470 ext 203

7.5 Enquiries out of hours

Medical Advice contact via Hospital Switchboard	St. George's Microbiology SpR SG 395 or mobile phone St. George's Microbiology Consultant SG 624 Kingston Micro consultant: Kingston hospital switchboard 020 8546 7711 and ask for duty microbiology consultant Croydon Microbiology consultant: Croydon hospital switchboard 020 8401 3000 and ask for duty microbiology consultant
RNOH	On-call service Microbiology Registrar on-call via the RFH Switchboard: 020 7794 0500
Biomedical Scientist contact via Hospital Switchboard	St. Georges switchboard 020 8672 1255 and air-call SG394

7.6 Cerner/GP OrderComms

Where available, Cerner and GP Order Comms should be used by the requesting clinician to order tests and label specimens appropriately.

If Cerner Order Comms are not available, or your test cannot be requested using this system, samples should be labelled and a Microbiology request form available on SWLP Website sent as detailed below.

7.7 Request forms

Request forms need to be completed legibly and completely using a ballpoint pen. Of similar importance is the need to give the **correct location, ensuring this information appears on each individual form for the appropriate laboratory,** so that results arrive where they are needed. **Providing the hospital number will minimise delays.**

It is the responsibility of the doctor requesting the test to ensure that all request forms and specimens carry **ALL** of the following information. Failure to do so may result in delays or the sample being rejected for testing.

For the safety of laboratory staff it is essential that specimens which are known or suspected to contain hazardous pathogens e.g. from patients with typhoid fever, tuberculosis, hepatitis or blood cultures where patients have had foreign travel outside of Northern Europe or North America should be labelled ”HIGH RISK” or with “DANGER OF INFECTION” stickers and placed in biohazard bags.

Completed forms MUST NOT be placed within the same bag/Pouch as the sample unless a separate pouch is unavailable.

1. Patients surname and first name(s)
2. Hospital number / NHS number
3. Date of birth and sex
4. Location
5. Date and time when specimen was taken
6. Specimen type
7. Consultant name/GP name
8. Tests requested
9. Name of requesting doctor (printed) together with bleep no
10. Clinical information / details to justify the request
11. Details of any recent foreign travel e.g.: where and when
12. GP code / name / address
13. Site of specimen (if applicable)

Current information is usually more relevant than an admission diagnosis. Without full information it is impossible to examine a specimen adequately or provide appropriate clinical interpretation.

7.8 Sample labelling (when not using electronic ordering or OrderComms

Information on the sample container MUST include:

Patients surname and first name(s)

Hospital number/NHS number

Sex

Date of birth

Time and date of sampling

Location

Sample type e.g. swab/urine/tissue/wound (site if applicable)

The policy for the Department of Microbiology is NOT to process unlabelled specimens. Occasionally unrepeatable unlabelled specimens may be processed with discretion of the duty microbiologist, but the results will be withheld and a comment will be added informing the requester to contact the Microbiologist to discuss the results.

7.9 Additional tests

Tests may be added to samples if a suitable and sufficient sample is available by contacting a consultant microbiologist (see section 6.8 for contact details). Samples are stored for varying times dependant on sample types. For additional tests, contact Medical Microbiology as soon as possible after the specimen has been sent.

Specimen type	Time limit	Note
Urine	2 days	
Swabs / Pus	5 days	
Aspirates / fluids	3 days	Usually deposit only
CSF	7 days	
Sputum	2 days	
Faeces	5 days	

Chlamydia /GC	5 days	Not suitable for other investigations
Serology (routine)	2 Weeks	Serum stored frozen

7.10 Urgent requests

Samples requiring urgent analysis during normal working hours require a prior telephone call to the laboratory on (Refer to section 7.4). During out of hours (Refer to section 7.5).

7.10.1 Procedure for requesting urgent microbiology tests at St George's Hospital

Microbiology laboratory services for St George's Hospital are provided by South West London Pathology. The SWLP microbiology laboratory is based on 1st floor, Jenner Wing. The laboratory operates 7 days a week and a member of staff is available 24 hours a day either via x5689 or pager SG394. The telephone is answered Monday to Friday 0900-1730 and Saturday 0900-1200. Contact with the laboratory is via the pager at all other times.

Normal laboratory hours for microbiology (excluding viral serology – see below) are:

0800-2030 Mon-Sun (including bank holidays)

During these times, routine work is carried out with results available within agreed turnaround times (see SWLP website https://www.swlpath.nhs.uk/tests-database/ or SWLP user guide available at https://www.swlpath.nhs.uk/about-us/our-pathology-services/). Processing of samples arriving outside these times or close to 2030 may not start until the following day unless the following procedure is completed.

Urgent and out-of-hours testing

For more urgent tests (i.e. same day results) or anything outside of these hours, the following tests are available on discussion with the laboratory:

- Cerebrospinal fluids (CSFs): microscopy and set up for culture
- CSF: Cryptococcal antigen
- Urine microscopy and set up for culture (paediatric)
- Pus samples (not swabs) for microscopy
- Tissues / fluids / aspirates (including ascitic, joint, and CAPD fluid microscopy)
- Corneal scrape
- Throat swabs from cases of possible meningococcal disease
- Rapid influenza testing (GeneXpert) for Infection Control purposes
- Rapid norovirus testing (GeneXpert) for Infection Control purposes

Viral serology is performed Monday-Friday 0900-1700 and 0900-1200 on Saturday. Certain viral serology is available outside these hours on discussion with virology medical staff (x5686/7 or duty microbiology registrar out-of-hours via hospital switchboard):

- Blood-borne virus serology (HIV, hepatitis B, hepatitis C), e.g. for unbooked pregnant mothers in labour
- VZV IgG (for determination of immunity to chickenpox following exposure)

Any other testing MUST be discussed and approved by microbiology medical staff (x5685 or duty registrar out-of-hours via switchboard). Certain tests e.g. those referred to external laboratories cannot be performed urgently.

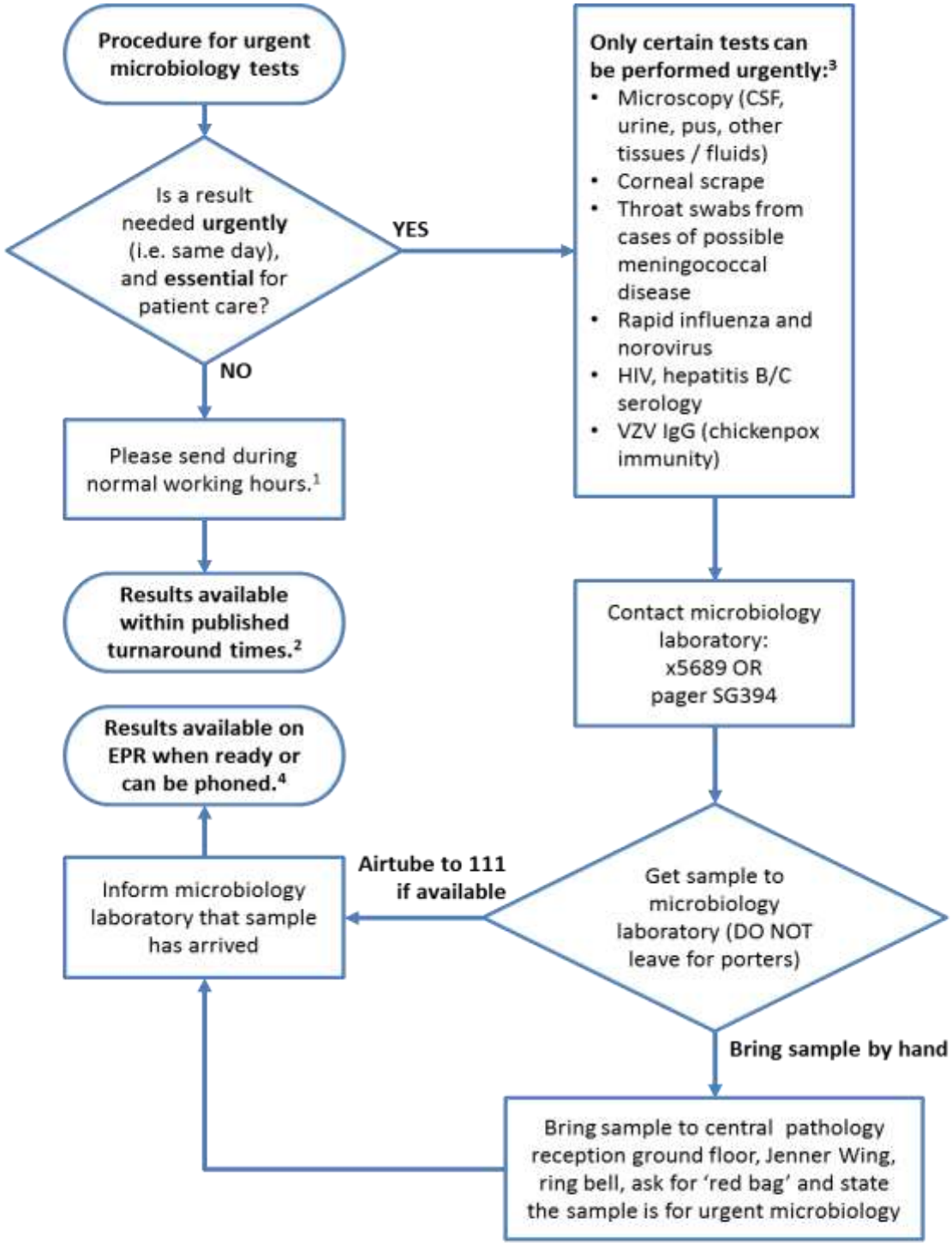
Procedure for any urgent and ALL out-of-hours microbiology testing

Please be aware that the laboratory is extremely busy and processes a high volume of samples 24 hours a day. There are only two members of staff available after 2030. Only send microbiology tests outside normal hours if it is essential for patient care.

For ALL urgent tests (i.e. same day results) or anything outside normal laboratory hours, samples must be either hand delivered directly to the central pathology reception or sent via the air tube system to 111 (preferred). In ALL cases, the duty microbiology biomedical scientist (BMS) MUST be informed (x5689 or pager SG394) about the sample and contact details of the requesting clinician for results should be provided.

If the sample is to be hand delivered, come to central pathology reception, ground floor, Jenner Wing (see photos) and ring the bell. DO NOT just leave the sample at reception. When a member of laboratory staff attends, politely state that the sample is urgent for microbiology and request a red bag (see photo). Place the labelled sample in the red bag and ask for it to be sent up to microbiology as soon as possible. If not already done, inform the duty microbiology BMS that the sample has been delivered to the laboratory.

The laboratory will endeavour to process the sample as quickly as possible.



1. Exception is blood cultures, which should be sent when clinically indicated. Normal laboratory working hours are 0800-2030 Monday-Sunday
2. Please see website www.swlpath.nhs.uk
3. For all other tests, please discuss with duty microbiologist on x5685 0900-1730 Mon-Fri or via switchboard out-of-hours
4. Telephoned results must be pre-arranged with the duty biomedical scientist on pager SG394

7.11 Reference laboratories

The microbiology laboratory has a procedure for referring specimens to other laboratories for some specialist tests, which includes records of all referred samples and of all reference laboratory facilities used. Information can be accessed by contacting Medical Microbiology. These referral centres should not be contacted directly.

7.12 Reporting results

Results are issued electronically and are available via EPR, Cerner, and The Portal. GP results are sent by GP electronic systems unless otherwise arranged. The emphasis is placed on such locations to clearly identify the requesting clinicians and ward or department source location. The status of the report should be considered **final** unless otherwise indicated i.e. Provisional or amended. Printed reports are only issued for the Royal Hospital for Neurodisability, Courtyard clinic, St. George's antenatal clinic and Chest clinic and other sites on request for specific GP practices.

7.13 Bacteriology

7.13.1 Blood cultures

The laboratory utilises the Becton Dickinson BACTEC™ FX400 and FX40 series systems. Inoculate 8-10 ml of blood into a single **BLUE** aerobic bottle. For Kingston hospital patients or on occasions where both an Aerobic and Anaerobic bottle are required, place the same amount of blood into both bottles. If only a small amount of blood is available; divide equally between both bottles. The blood culture bottles can be requested from the Central pathology Reception at Croydon, Kingston and St. George's hospital.

For paediatric patients inoculate a single paediatric bottle with 1-5 ml blood. Guidance on how to take blood cultures is available on the on the SWLP website: https://www.swlpath.nhs.uk/tests-database/blood-culture-adult-set/ and https://www.swlpath.nhs.uk/tests-database/blood-culture-paediatric-set/ . It is recognised that paediatric samples may be difficult to take. Please send any sample you manage to obtain regardless of volume.

Below is guidance for when to take an anaerobic blood culture bottle as well as an aerobic blood culture bottle.

- Likely severe anaerobic infections on ITU
  - Abdominal infections
  - Deep abdominal abscesses
  - Skin and soft tissue infections (particularly nec. Fasciitis)
  - Pelvic gynaecological infections
  - Severe throat infections - Lemierre's syndrome
- Immunosuppressed haem/onc patients
- Investigation of PUO

Preliminary positive blood culture results i.e. Gram stain and provisional identity (adult and paediatric) are telephoned to the Medical staff that requested the test. Blood cultures are incubated for 5 days before negative results are issued. On occasion incubation can be extended e.g. if brucellosis is suspected. If advice is needed for situations where extended incubation is needed, please contact the Microbiologist.

Venous catheters

If a venous catheter infection is suspected, send two blood culture samples – blood taken from the venous catheter and blood from venepuncture of a peripheral vein. Ensure that the time of the blood culture is recorded.

Blood cultures for *M. tuberculosis* and *M. avium intracellulare*

White top TB blood culture bottles must be requested and collected from Microbiology Reception – St. George's, Kingston and Croydon. Inoculate no more than 5 ml of blood per bottle. A single bottle is usually sufficient. TB investigations will not be performed on other blood culture bottle types.

All positive mycobacterial cultures are telephoned. Cultures are incubated for 42 days before negative results are issued. On occasion incubation can be extended. If advice is needed for situations where extended incubation is needed, please contact the Microbiologist.

It should be noted that these are NOT tests that can be left for phlebotomists to perform. They should be performed as a separate activity solely for the purpose of obtaining blood for culture and emphasis on strict aseptic techniques placed to avoid contamination. Blood culture bottles once inoculated must only be stored at room temperature prior to loading on the BC analyser.

7.13.2 Antibiotic and antifungal levels in blood

Guidance on dosing, assaying and interpretation is available on the St. George's Hospital, Kingston and Croydon intranet sites and on ICE at RNOH.

St. George's have recently, from the 1st May 2017 introduced a smartphone app to help its clinicians with antimicrobial prescribing. The app offers a readily available resource, with up-to-date guidelines specific to St. George's Trust.

The Microguide platform will ensure that all guidelines are current, and old versions not inadvertently used. Good antimicrobial prescribing is crucial to an effective antimicrobial stewardship programme.

Kingston Hospital antimicrobial prescribing guidance can be accessed on CRS; go to Powerchart and there is an “Antibiotic Guidelines” tab on the toolbar. It’s also available on the Kingston intranet site; on the Intranet: click on Clinical guidelines and Trust policies to go to PIMS (Policies Information Management System), then Medicines Management, then Prescribing Guidelines.

Croydon hospital antimicrobial prescribing guidance is on the Croydon hospital intranet site and there is an app available.

Access to the Croydon Hospital prescribing APP, is available through the following location (or app store / google play) – www.rx-guidelines.com. The user needs to select Croydon Health Services guidelines within the app itself.

For advice about other assay results or dosing queries please contact the Microbiologist on the associated Hospital site.

7.13.3 Cerebrospinal fluid

Take into at least two sterile universal containers, preferably 2-3 ml. Mark the containers with the order they were taken. If the Gram stain on a CSF is positive (organisms seen) it is always telephoned (day and night) to the duty microbiology registrar (St. George’s Hospital) or consultant (Kingston Hospital and Croydon University Hospital) for the requesting hospital. All positive culture results are routinely telephoned. In addition, all microscopy results are available on EPR, Cerner, The Portal or GP electronic systems as soon as specimens are processed.

Please remember that a separate sample should be sent to Blood Sciences for protein estimation and Blood Sciences will also require a sample taken into a fluoride tube with a yellow label, for glucose estimation.

If sample is taken out of hours, please inform the Biomedical Scientist once the samples have been taken.

CSF microscopy is performed on all specimens and a white cell differential is additionally done on specimens with a WBC count > 10/μl. All CSF specimens with a WBC count up to 5/μl would be considered to be within normal limits. Higher counts are seen in bacterial or viral meningitis and also in patients with extra-ventricular drains or V-P shunts in situ.

Viral meningitis PCR is available on request (see Virology section) but is done automatically in the following situations:

- All babies under 3 weeks of age regardless of WBC count
- All CSF WBC count ≥ 20/ml
- Clinical details of meningitis, encephalitis or neurological symptoms
- All CSFs with Virology requested

CSF samples older than 7 days are unlikely to be satisfactory for subsequent viral nucleic acid testing.

CSF received and stored at fridge temperature for more than 7 days but untested for viral nucleic acid is unlikely to be satisfactory for subsequent virus testing.

Cryptococcal antigen detection

Further tests can be performed in immunocompromised patients, such as Cryptococcal antigen in CSF, serum or whole blood.

The Cryptococcal Antigen (CrAg) Lateral Flow Assay is an immunochromatographic test system for the qualitative or semi – quantitative detection of the capsular polysaccharide antigens of Cryptococcus species complex (*Cryptococcus neoformans* and *Cryptococcus gattii* in serum, plasma, whole blood (venous and finger stick) and spinal fluid (CSF). The Turnaround time for results is ≤ 2 days.

Cultures are incubated for 48 hours before issue of negative results. If prolongation of culture is needed e.g. suspected fungal meningitis this should be discussed with the Microbiologist. All positive culture results will be telephoned as soon as they are available

It is recognised that paediatric samples may be difficult to take. Please send any sample you manage to obtain regardless of volume.

Meningococcal infection

In addition to culture of CSF and blood, a molecular diagnostic test (meningococcal PCR) is available from a reference laboratory. Please send CSF in a sterile container or blood in an EDTA tube (Lavender top). A throat swab (Charcoal swab) should also be obtained in all cases to detect pharyngeal carriage.

7.13.4 Lower respiratory tract infections

Sputum

Send routine specimens in 60 mL silver top sterile containers. Bronchial traps are acceptable – check that the specimen contains sputum (saliva alone will be discarded as unsuitable for culture). Containers with tubing still attached present a safety hazard, ensure specimen containers have an appropriate screw topped lid.

Cultures are incubated for at least 24 hours before issue of negative results.

Broncho-Alveolar Lavage (BAL)/Induced Sputum

All samples undergo routine bacteriology, Virology and TB culture.

PCP

The department has recently introduced a molecular diagnostic method for the detection of PCP. BAL and induced sputum for Pneumocystis jiroveci testing. This test will be available twice weekly, Tuesdays and Thursdays, with tests being run overnight and results available the following day.

If an urgent PCP result is required, please discuss with a Microbiologist. This test will only be done on induced sputum or bronchial alveolar lavage.

Nasopharyngeal Aspirates (NPA)

These specimens are processed for bacterial culture and respiratory viruses.

7.13.5 Mycobacterial culture, microscopy, and TB PCR

The Laboratory utilises a BACTEC MGIT 960 for culture of Mycobacteria on all specimens other than blood. Non-respiratory specimens and urine; culture will be performed either when requested or when clinical details indicate so. Cultures are incubated for 42 days before issue of negative results. Positive results are telephoned. Microscopy results are available within 24 hours of sample receipt. On occasion incubation can be extended. If advice is needed for situations where extended incubation is needed, please contact the Microbiologist.

Mycobacteria are Acid Fast Bacilli (AFB). Investigations for AFB are undertaken during normal working hours only. (In exceptional circumstances these investigations can be performed at other times with Microbiology Consultants agreement).

Collect specimens before antimicrobial therapy where possible.

Specimens should be marked as ‘high risk’ and sent in Biohazard bags.

Broncho-alveolar lavage (BAL)

The sample is divided in the laboratory for bacteriology, fungal and virology investigations. Pneumocystis jirovecii (PJP) (previously known as Pneumocystis. Carinii, (PCP) and AFB are undertaken during normal working hours only

Pulmonary tuberculosis

Sputum specimens should be relatively fresh (less than 1 day old) to minimise contamination. Purulent specimens are best. Three samples of ≥5mL should be collected approximately 8-24 hours apart with at least one from early morning.

Samples taken early morning (i.e. shortly after patient waking) have the greatest yield. When the cough is dry, physiotherapy, postural drainage or inhalation of nebulised saline (‘sputum induction’) before expectoration may be helpful.

If a patient cannot expectorate then a gastric aspirate should be sent in a plain universal container. Minimum sample size volume is preferably 5mL.

Gastric washings

Young children often swallow their respiratory secretions rather than cough them up. If the child is unable to cough and produce sputum consider sending induced sputum (preferable to gastric washings). If either sputum or induced sputum cannot be collected send gastric washings. Samples should be collected early in the morning (before breakfast) on 3 consecutive days. A minimum volume of 5mL should be collected. Aspirates should be

promptly delivered and processed to avoid acidic deterioration of organisms. Microscopy is NOT normally performed on these specimens

Renal tuberculosis

As the organisms are excreted intermittently, three consecutive early morning urines are required in large volume 250 ml sterile EMU containers; obtainable by order on the SWLP webpage “The Pathology Store”. This investigation should only be performed for patients with suspected renal tract tuberculosis. For other patients, please discuss with the Microbiologist before sending. Three consecutive early morning specimens are preferred – these are cultured; microscopy is NOT undertaken.

TB meningitis

Cerebrospinal fluid (CSF) collected aseptically should be submitted to the laboratory. If rapid testing is required please discuss with a Microbiologist – PCR can be done on these after agreement.

Tissue, Pus and aspirates inc. Fine Needle Aspirates (FNA)

Send in sterile universal containers.

It should be noted that mycobacteria are often not recovered from pleural or pericardial fluids; a concurrent pleural or pericardial biopsy taken with the fluid is more useful. A negative result on these fluids may not rule out the diagnosis.

Blood cultures may be helpful when looking for atypical mycobacteria - please discuss with the laboratory. Special Blood culture bottle are available.

Bone Marrow

A BACTEC FX 40 is used for the incubation of blood and Bone marrow samples. These should be inoculated into a TB Blood culture bottle (White top), LJ slopes (x2) and onto a frosted slide. These sets with instructions are available for collection from the Microbiology Department. Please contact the Department if required.

Faecal specimens

The isolation procedure is unreliable and has a low success rate due to the heavy contamination with other bacteria; hence culturing faecal samples for mycobacteria is not recommended.

Direct microscopy

In most cases acid-fast bacilli will be looked for by direct microscopy and a preliminary report issued. Microscopy of urine and faeces however is usually not helpful as non-pathogenic Mycobacteria may be present. Microscopy of swabs and gastric aspirates is also not helpful due to the small number of Mycobacteria which may be present.

Positive cultures for Mycobacteria

These may take several weeks to grow. When cultures are positive they are initially reported as AFB isolated. All atypical mycobacterial isolates are referred to the reference Laboratory for identification and susceptibility testing; only the first Mycobacteria Tuberculosis Complex, MTB complex isolates are referred, but also new positive samples from other sites are referred. If further sputum specimens taken within an 8 week period of being taken become positive; these specimens will not be referred. Please discuss any difficult or urgent cases with a microbiologist.

Three consecutive daily specimens are preferred. Positive results by microscopy or culture are telephoned. Further identification of AFB species and antibiotic sensitivities are carried out at a reference laboratory (takes at least two weeks). Cultures are incubated for 42 days before issue of negative results. On occasion incubation can be extended.

TB PCR

PCR that detects M. tuberculosis complex and rifampicin resistance mutations is performed in-house routinely on all samples that are newly positive by microscopy from any specimen site i.e. respiratory and non-respiratory specimens.

Any other requests for TB PCR must be first discussed with the Microbiologist.

PCR results are available in 1-2 days.

7.13.6 QuantiFERON® - TB LTBI (latent TB infection screening)

QuantiFERON Gold tests for diagnosis of infection due to *M tuberculosis*. The test detects if a person has been infected with *M tuberculosis*, but does NOT distinguish between active and latent tuberculosis. Please refer to the following algorithm when requesting the test/s.

7.13.7 Lithium heparin blood bottle for the QuantiFERON® - TB ELISA Assay

Contact details	If you have any enquiries, please contact Medical Microbiology at 020 8725 5689.
Ordering the test	This test can only be ordered manually and electronically.
Collection device details 	The test requires **6ml of whole blood collected in a 13mm x 100mm green-topped lithium heparin bottle**. Only one bottle is required - please ensure the correct volume is taken. For paediatrics, a minimum of 4ml of whole blood is required. Samples less than 4ml will not be processed.

How to collect samples  	1) Once the blood has been collected, carefully invert the bottle 8 times to prevent clotting. 2) Label the bottle appropriately (patient's name, surname, DoB, hospital number). 3) The date and time of blood collection must be made clear on the bottle. **Please note:** Samples without the collection date and/or time will not be processed and will be discarded immediately on receipt. 4) The sample should be kept at room temperature - **DO NOT REFRIGERATE**. 5) Samples must be placed into a bright blue SWLP LTBI testing bag (see left) and **must** be accompanied by a request form specifying the QuantiFERON test. 6) Use one patient sample per bag.
How to send samples to the laboratory	Send sample immediately at room temperature (17-27°C) to Central Pathology Reception. Ask Central Pathology Reception staff to send samples urgently to the hub laboratory. **Please note:** Samples **must** arrive at the Microbiology laboratory within 16 hour post venepuncture.
Turnaround time	QuantiFERON test is 5 working days.
Reordering green-top bottle	The green-topped lithium heparin bottle is standard and should be available in your unit, or can be ordered through Pathology Consumables by completing the pathology consumables form and sending back to pathology.consumables@stgeorges.nhs.uk Never use blood collection bottles beyond their expiry dates (printed on the label).
Reordering SWLP LTBI testing bag	The blue SWLP LTBI testing bag can be ordered through Pathology Consumables as described above for the green topped bottles.

7.13.8 Urine microscopy, culture and susceptibility

Routine mid-stream urine specimens: collect into boric acid urine containers (red lid). As boric acid is a preservative it is imperative that the container is filled to the correct volume as indicated by an arrow on the side of the universal. If only a small volume of urine is collected e.g. paediatrics, send the sample in a sterile 30 ml standard universal.

Do not use boric acid bottles for paediatrics or small volumes of urine <20 ml. Specimens that are not processed will be retained in the laboratory for up to 48 hours after the report is issued and you can contact the laboratory if you want the specimen to be processed.

Midstream urine (MSU)

The first part of voided urine is discarded and without interrupting the flow. Using the Boric acid container; fill to the mark and ensure the contents are mixed well.

Clean-catch urine (CCU)

Thorough periurethral cleaning is recommended. Again, ensure if boric acid universal used that the container is filled to the mark.

Suprapubic Aspirate (SPA)

Urine is obtained aseptically directly from the bladder by aspiration with a needle and syringe. The use of this invasive procedure is usually reserved for clarification of equivocal results from voided urines (e.g. in infants and small children). Please label as 'urine SPA'

Catheter Specimen Urine (CSU)

The samples may be obtained either from a transient ("in and out") catheterisation or from an indwelling catheter. In the latter case, the specimen is obtained aseptically from a sample port in the catheter tubing or by aseptic aspiration of the tubing. ***The specimens should not be obtained from the collection bag.*** Catheter specimens of urine should **NOT** be sent in the absence of systemic illness irrespective of Dipstick test findings unless this a pre-operative specimen.

Bag Urine

Used commonly for infants and young children. The sterile bags are taped over the freshly cleaned and dried genitalia, and the collected urine is transferred to a sterile leakproof container. There are frequent problems of contamination with this method of collection.

Pad Urine

This is an alternative collection method to bag urine for infants and young children. After washing the nappy area thoroughly, a pad is placed inside the nappy. As soon as the pad is wet with urine (but no faecal soiling), push the tip of a syringe into the pad and draw urine into the syringe. Transfer specimen to a sterile urine container. If difficulty is experienced in withdrawing urine, the wet fibres may be inserted into the syringe barrel and the urine squeezed directly into the container with the syringe plunger.

Ileal Conduit - Urostomy Urine

Urine is obtained via a catheter passed aseptically into the stomal opening after removal of the external appliance. Results from this type of specimen may be difficult to interpret.

Cystoscopy Urine

Urine is obtained directly from the bladder using a cystoscope.

Ureteric Urine

Paired urine samples are obtained from each ureter during a cystoscopy via ureteric catheters inserted from the bladder.

Urines may also be sent following nephrostomy, surgery or bladder washout. Surgically obtained specimens such as nephrostomy obtained samples should be requested as urgent samples with a call to the lab, informing Microbiology that such a specimen will be sent.

Clear clinical details identifying the type of specimen that has been taken are also required for correct processing of the specimen.

Prostatitis

Diagnosis is made by examining voided and midstream urine as well as expressed prostatic secretions. According to Meares & Stamey methods, the following samples should be sent:

- Urethral urine (VB1)
- Midstream urine (VB2)
- Prostatic secretions by massage (EPS)
- Urine voided after massage (VB3)

Specimens should be sent in a sterile universal container.

Microscopy results are available on day of receipt, culture results available in 2-3 days.

Schistosomiasis

Please send a terminal urine sample (void early stream of urine and pass final few ml into universal container. Send for microscopy no sooner than 4 weeks after exposure. Results are available weekdays Mon to Fri.

Early morning urine (EMU)

The entire early morning urine, collected on 3 successive days, should be submitted. A minimum volume of 150 - 300ml into each days container ONLY.

Clinical Indications**:** Suspected renal tuberculosis, often on the basis of a sterile pyuria.
Sample Required: Sterile 150 - 300ml containers ONLY (x3 early morning urine collections).
Available from Pathology Specimen reception

NB: Not MSU containers (30 or 60mls.)

Min. sample volume**:** The whole volume of the 1st void urine of the day

Specimen transport

Specimens should be transported and processed within 4 hours if possible. If transportation is delayed refrigeration is essential for non-boric acid urines.

Microscopy can be done urgently as a special request.

The culture results are usually ready within 24 to 72 hours.

It is recognised that paediatric samples may be difficult to take. Please send any sample you manage to obtain regardless of volume.

7.13.9 Urine antigen testing *Legionella pneumophila* and *Strep. Pneumoniae*

In cases of severe pneumonia, a urine sample should be sent for pneumococcal and legionella antigen testing, in in a 60 ml silver topped container. Tests for Urinary antigens are performed daily Monday to Sunday and as such results should be available within 24 hours of receipt. These tests are not performed routinely at weekends. Urgent requests for urinary antigens should be telephoned directly to Microbiology.

7.13.10 Faeces

Faeces specimens are primarily submitted to aid the investigation of diarrhoeal disease. This may be defined as unusual frequency of bowel action (usually at least three times in a 24hr period), passing loose, watery, unformed faeces. The consistency of the stools is more important than the frequency: frequently passed formed stools are not considered to be diarrhoea. It may be associated with symptoms such as abdominal cramps, nausea and malaise, and with vomiting, fever and consequent dehydration.

It is essential that full clinical details are provided with all stool samples to ensure appropriate testing is performed.

Gastroenteritis

The following gastrointestinal pathogens are routinely screened for:

- *Salmonella species*
- *Shigella species/*Enteroinvasive *E. coli* (EIEC)
- *Campylobacter species*
- VTEC (including *E. coli* 0157) (implicated in Haemorrhagic Colitis and Haemolytic Uraemic Syndrome)
- *Giardia lamblia*
- *Cryptosporidium species*

Further investigations may be indicated based upon clinical details provided and at the Microbiologist's discretion.

These include

- *Yersinia enterocolitica*
- *Vibrio cholera/parahaemolyticus*

- *Entamoeba histolytica*

Ova, Cysts & Parasites

Ova cysts and parasites investigations are performed when requested ***and*** fulfilling particular criteria such as recent travel to high risk areas or chronic diarrhoea (>1 month).

If amoebic dysentery is suspected please contact the Microbiologist to discuss the most appropriate investigation.

***Clostridium difficile* investigation**

Clostridium difficile testing is performed:

- On patients >2 years old ***and*** the stool is diarrhoeal (the specimen takes the shape of the container)

  Testing is only performed on diarrhoeal stool specimens (liquid or semi-formed faeces, Bristol stool type 5-7); this should be collected in an appropriate plain blue capped leak proof specimen container and should be of adequate volume (at least a quarter full, taking the shape of the container, please do not overfill).

If these criteria are fulfilled:

- Inpatients who have been in hospital for >3 days.
- All patients >65 years old (including the community and out-patients).
- Community patients on broad spectrum antibiotics *or* clinical details indicate *C. difficile* infection.
- When specifically requested by the clinician.

The testing algorithm involves up to three different tests including Glutamate dehydrogenase (GDH) antigen ELISA and *C. difficile* toxin detection

From the test results, patients can be categorised into one of three groups:

- *C. difficile* infection
- *C. difficile* carriage
- No evidence of *C. difficile* infection.

Interpretative comments indicating these categories are on all reports.

Repeat Clostridium difficile testing

Repeat toxin testing can be performed on previous toxin negative samples.

Positive *C.difficile* toxin patients are **not** retested within a 28 day period. This is in line with National Guidance.

Specimens from toxin positive patients can be retested after one month.

Toxin testing may on occasion be requested by medical staff if there is a clinical relapse after treatment in the period 14 – 28 days, after a previous positive toxin result. Such samples would be examined.

NB: Stool samples for *C.difficile* clearance are not required. 20 – 30% of patients with *C.difficile* may relapse following treatment. The Infection Prevention and Control team must

be contacted for advice before sending a repeat faecal specimen.

Gastritis

Helicobacter pylori investigation: Symptoms may include digestive upset, heartburn, epigastric pain, indigestion and/or gastric reflux.

A stool sample for antigen detection is the required sample for laboratory confirmation of current infection or treatment efficacy (*This test is not currently accredited by UKAS ISO15189:2012*).

Enteric Virus Screening

Rotavirus and Adenovirus EIA routinely performed on all samples from children <5 years of age

Norovirus infection

Refer to Molecular section 7.14.10.

Specimen collection

Faecal specimens should be submitted to the laboratory in leak-proof blue-lidded plastic universal container. Ensure that there is adequate specimen for all investigations required.as soon as possible after collection. Samples should fill at least a third of the container if possible, but please do not overfill the container. Patient should be given instructions on collecting a faecal specimen by the requesting clinician.

Negative results take a minimum 2 days. Faecal clearance results available within 2-3 days. Full identification of some pathogens may require reference laboratory tests.

Clinical details must be provided, including:

- Nature and duration of the illness
- Onset date
- Travel history (countries visited including dates)
- Antibiotic history, if relevant

In the case of outbreak or suspected food poisoning, notify the Medical Microbiologists and the Consultant in Communicable Disease Control (CCDC) immediately.

Direct Examination Parasites

For direct examination of parasites (worms), arthropods (insects, spiders), and suspect material passed in stool.

- Submit whole worms, worm segments or other objects in 70% alcohol or 10% formalin.
- Submit arthropods in a clean, dry container.

Threadworm (*Enterobius vermicularis* ova)

Collect with perianal swab Cotton-wool swab in dry container.

Spread buttocks apart, and rub the moistened cotton wool swab over the area around the anus, but do not insert into the anus. Place cotton wool swab back in its container (no transport medium required). Swab to be used is a dry swab (red lid) available to be ordered on consumables website.

Sample to be taken ideally between 10pm and midnight or early in the morning before defecation or bathing.

Occasionally, an adult worm may be collected from a patient and sent in saline or water for identification.

7.13.10 Fluid from normally sterile sites

Fluid samples

The detection of organisms in fluids that are normally sterile indicates significant infection, which can be life-threatening.

Amniotic fluid	Pericardial fluid
Synovial fluid	Peritoneal fluid
Joint fluid	Pleural fluid
Fine needle aspirate	Vesicle and Bulla fluid
Aspirate (other sites)	

Please note: for microscopy the absence of bacteria seen does not exclude infection.

Ascitic fluid

Tests performed typically include WBC count, Gram stain and culture. A WBC differential will be done on all ascitic fluid with a raised WBC > 250/ml.

TB cultures should be requested when risk factors are present.

Pleural and pericardial fluids

Tests: Gram stain and culture.

Indicate whether TB culture is required.

Joint fluids

Tests performed include Gram stain and culture. Currently crystal examination is performed for samples coming from Kingston hospital FT (*This test is not currently accredited by UKAS ISO15189:2012*).

If an examination for crystals is required, submit a separate sample to the Histopathology/Cytology department or indicate clearly in the request that the investigation for crystals is required.

CAPD Fluids

If CAPD peritonitis is suspected please send the whole cloudy CAPD bag to microbiology for processing. Clear bags should not be sent.

Gram stains are performed on all CAPD specimens, regardless of the cell count. Abnormal cell counts of more than 100 WBC/ml are telephoned to the clinical team. All microscopy results are available as soon as processed and positive microscopy and culture results are routinely telephoned out to the clinical team looking after the patient.

CAPD microscopy is available day of receipt of sample; culture results take to 2- 6 days.

All of the fluids should be submitted in an appropriate plain screw capped leak proof specimen container. Blood culture bottles may also be used, but a separate fluid sample should be sent if a WBC estimation and differential cell count is required.

Factors that may influence the recovery of organisms[1] are:

- large volume - specimens such as peritoneal fluid and ascitic fluid which may contain very low numbers of organisms are usually received in adequate quantities. This increases the likelihood of successful culture
- small volume - fluids such as synovial fluids may be received in inadequate volumes which may impede the recovery of organisms
    - broth cultures may become accidentally contaminated with organisms which overgrow the true infecting agent
    - previous antimicrobial therapy
    - presence of antimicrobial substances and cells in the fluid.

Blood cultures are often positive with the same infecting organism, and occasionally may be positive when culture of the fluid fails to reveal the organism.

Fluids will be sterile in the absence of infection, as will be "sympathetic effusions", those of immunological or traumatic origin, and those due to metabolic disease or heart failure.

[1] Fuller DD, Davis TE, Kibsey PC, Rosmus L, Ayers LW, Ott M, Saubolle MA and Sewell DL. Comparison of BACTEC Plus 26 and 27 with and without conventional methods for culture of sterile body fluids. J Clin Microbiol 1994; 32: No.6: 1488-91

7.13.11 Pus and aspirates

Send in a dry sterile bottle such as a universal or 60ml silver top container Microscopy results available same day as receipt, culture 2 - 3 days. Some specimens may have prolonged incubation in which case a result will be issued in 5 - 7 days.

All pus samples and joint aspirates will have a Gram stain performed. Avoid accidental injury to patient and operator when specimen is being aspirated and ensure the appropriate hazard labelling in accordance with local policy.

Care should be taken to avoid accidental injury when using "sharps".

Needles and syringes should not be sent to the laboratory

Specimens should be sent in a sterile leak proof container in a sealed plastic bag, stored at 4ºC if not able to transport immediately to the lab.

7.13.12 Tissue and biopsies

Send dry in a silver topped sterile container or in the case of small fragments, place in a few ml of sterile saline.

NEVER put specimens for microbiological investigations into fixatives i.e. formalin.

Microscopy results are available on the day of receipt, culture results 2 - 3 days. Some specimens may have prolonged incubation in which case a result will be issued in 5 - 7 days.

***Helicobacter pylori* culture**

Specimens of gastric biopsy should be collected into a sterile universal container and sent to the laboratory as soon as possible. If the specimen is small it should be placed in sterile water to prevent desiccation. Ensure that specimen is not placed in fixatives i.e. formalin.

Microscopy results are available on the day of receipt, culture results available in 4-10 days. It is advisable to contact the Microbiologist prior to sending specimens for this investigation.

For *H pylori* faecal antigen please see faeces section 7.13.10.

7.13.13 Revision tissues

Tissues and metal prosthesis are received in a sterile container aseptically taken. Between 5 - 8 pieces of tissue from each location are preferable. All metal prosthesis will undergo sonication, therefore should be placed into the E&O sonication containers provided; do avoid over handling of the tissue as this can result in unwanted contamination of the sample. These irradiated sterile double bagged containers are available from Microbiology reception. Please ensure that you have an adequate supply. Tissues are processed daily and Gram Film results are available within 24 hours.

Tissue samples are kept for up to 4 weeks. The sonicated metal prosthesis is discarded within 24 hours.

All revision tissue fluids are inoculated into blood culture bottles for 14 days.

7.13.14 Eye and ophthalmology specimens

Infections of the eye can be caused by a variety of microorganisms organisms and may be introduced to the eye via hands, fomites (e.g. contact lenses), traumatic injury, or following surgery

Molecular testing is available for Chlamydia trachomatis investigation. Please contact Microbiology for advice on specimen collection.

Samples of contact lens solution should be sent directly to the laboratory for analysis. If investigation for Acanthamoeba is required then please contact the Microbiologist. Specimens for Acanthamoeba culture are referred externally and results available within 7 days.

Corneal scrapings and intraocular fluids will be collected by an ophthalmic surgeon. Because of the small amounts of material involved, inoculation of plates and preparation of slides is usually done at the patients' side. Kits inclusive of blood agar, chocolate agar, Sabouraud agar and a slide box containing x2 frosted slides are supplied for this purpose when required. Please request from the Microbiology laboratory.

Any available pus should be sampled as well as the lesion of interest.

Collect specimens before antimicrobial therapy where possible

These samples should NEVER be placed in the fridge after collection. Please send to the laboratory as soon as possible. Microscopy results are available the same day as receipt, culture in 2 - 3 days.

7.13.15 Swabs (colour coded)

Guidance for swab sample collection

1. Wash hands with soap and water. Rinse and dry.
2. Pull the cap with attached swab from the tube. Do not touch the soft tip or lay the swab down. If you touch or drop the swab tip or the swab is laid down, discard the swab and request a new swab.
3. Hold the swab by the cap with one hand so that the swab tip is pointing toward you.
4. Rotate the swab for 10 – 15 s.
5. Withdraw the swab without touching the skin. Place the swab in the tube and cap securely.
6. After collection, wash hands with soap and water, rinse, and dry.
7. Label with patient information and date/time collected.
8. Transport to laboratory as soon as possible.

Transwabs (black tops with charcoal transport medium): for general use; results available 3 - 4 days.

ENT swabs (orange top, clear transport medium) fine wire swab for use in the ear; results available 3 - 4 days.

Pernasal swab (turquoise top, black transport medium) fine wire swab for possible whooping cough. Culture takes up to 7 days.

Guidance for swab sample collection

Throat swab for M,C&S

- Ask patient to sit upright facing a strong light, tilt head backwards, open mouth and stick out tongue.
- Depress tongue with a spatula.
- Ask patient to say 'Ah'.
- Quickly but gently roll the swab over any area of exudate or inflammation or over the tonsils and posterior pharynx.
- Carefully withdraw the swab, avoiding touching any other area of the mouth or tongue.

Eye swab for M,C&S

- Ask patient to look upwards.
- Using aseptic technique, hold the swab parallel to the cornea and gently rub the conjunctiva in the lower eyelids from nasal side outwards.
- Swab any pus or exudates as well as any lesion of interest.
- If both eyes are to be swabbed, label swabs 'right' and 'left' accordingly.
- NB: Separate samples must be collected into appropriate transport media for detection of viruses, chlamydia or *Neisseria gonorrhoea*.

Ear Swab for M,C&S

- Ensure no antibiotics or other therapeutic drops have been used in the aural region three hours before taking the swab.
- Using aseptic technique, rotate swab gently once at the entrance of the auditory meatus to collect any pus or exudates.

Nose swab for M,C&S

- Ask patient to tilt head backwards.
- Moisten swab with sterile saline.
- Insert swab inside the anterior nares with the tip directed upwards and gently rotate. Swab any pus or exudates.
- Repeat the procedure with the same swab in the other nostril.

Mouth swab for M,C&S

Sample pus if present, otherwise sample any lesions or inflamed areas. A tongue depressor or spatula may be helpful to aid vision and avoid contamination from other parts of the mouth.

7.13.16 Wound swab MC&S

This relates to the processing and bacteriological investigation of skin, superficial and non-surgical wound swabs. Viruses, such as Herpes simplex and Varicella-zoster, as well as non-microbial agents, may also cause skin lesions

Ulcers of the skin are most often due to vascular insufficiency from venous or arterial disease, pressure (decubitus ulcers or bedsores), neuropathic changes or some combination of these. Bacteria may be detected by culture but the clinical significance of such findings depends heavily on the precise nature of the lesions, the clinical situation prevailing at the time of sampling (stability, chronicity, presence of local and systemic signs and symptoms of infection), and sampling methodology.

Collect specimens before antimicrobial therapy where possible. Use aseptic technique and sample a representative part of the lesion. Swabbing dry crusted areas is unlikely to yield the causative pathogen.

If specimens are taken from ulcers, the debris on the ulcer should be removed and the ulcer should be cleaned with saline. A biopsy or, preferably, a needle aspiration of the edge of the wound should then be taken. A less invasive irrigation-aspiration method may be preferred. Place the tip of a small needleless syringe under the ulcer margin and irrigate gently with at least 1 mL sterile 0.85% NaCl without preservative. After massaging the ulcer margin, repeat the irrigation with a further 1 mL sterile saline. Massage the ulcer margin again, aspirate approximately 0.25 mL of the fluid and place in a leak proof container.

Wound swabs – please use Charcoal swabs (black lid).

Chronic leg ulcers with cellulitis – collect swabs after removing necrotic debris.

The turnaround time for culture is 3-4 days.

7.13.17 Ear, Nose and Throat swabs

Ear swabs

Swabs may be taken and submitted to the laboratory to aid the diagnosis of both otitis externa and otitis media. Results available within 3 - 4 days.

Nose swabs

Nose swabs are not a suitable sample type for the identification of sinusitis and should only be used for carriage detection. Results are available within 1 – 2 days.

Throat swabs

Please note that whilst the commonest form of bacterial throat infection is caused by β haemolytic Streptococci, the majority of sore throats are caused by viruses. Results for bacterial investigation are available within 2 - 3 days.

Mouth swabs

Candidiasis is the most frequent type of oral infection. Infection of the buccal mucosa, tongue or oropharynx is usually due to Candida albicans. Species of yeast other than C. albicans, such as Candida krusei and Candida glabrata, can also occasionally colonise the mouth but are rarely associated with infection. However, they are becoming increasingly important, particularly in patients who are immunocompromised.

7.13.18 Infections of the female/male genital tract

Genital swabs

Collect material on Charcoal swabs (black lid) place into transport medium.

Specimen Type

High vaginal swab (HVS), vaginal discharge, vulval swab, labial swab, cervical swab, endocervical swab, penile swab, urethral swab, genital ulcer swab, semen, screening swabs for N. gonorrhoeae, aspirates from bartholin's gland, fallopian tube, tubo-ovarian abscess, pouch of Douglas fluid, intra-uterine contraceptive device (IUCD), products of conception.

Collection

Collect specimens before antimicrobial therapy where possible.

High vaginal swabs (HVS)

HVS should be collected with the aid of a speculum to avoid perineal contamination. It is important also to avoid vulval contamination of the swab After the introduction of the speculum, the swab should be rolled firmly over the surface of the vaginal vault. If a speculum has NOT been used, please label the specimen as LVS or Vaginal Swab.

An HVS is suitable for the isolation of *Candida* species and organisms associated with vaginitis. Swabs should be placed in bacterial transport media.

Neisseria gonorrhoea

This investigation requires submission of endocervical swabs +/- urethral, rectal and throat swabs. An HVS is NOT suitable for the isolation of *Neisseria gonorrhoea*; please take a cervical swab if this is required. Culture reports are available within 3 - 4 days. Please see the Molecular Microbiology section 7.14.12 for molecular diagnostic tests for gonorrhoea.

Trichomonas vaginalis

Please refer to section 7.14.11 for sexually transmitted infection PCR.

Bacterial vaginosis

Bacterial vaginosis investigations of vaginal or cervical swabs are made only on request with clinical details suggestive of Bacterial vaginosis.

Cervical swabs

Always use a speculum to collect cervical swabs. Insert the swab approximately 1 cm into the cervical canal rotating it several times. Withdraw the swab without touching the vaginal wall and place the swab in bacterial transport media. Cervical swabs are suitable for the isolation of *Neisseria gonorrhoeae*.

Urethral swabs

The patient should not have passed urine for at least 1 hour. For males, if a discharge is not apparent, attempts should be made to "milk" exudate from the penis, or specimens should be collected using a fine wire pernasal swab. Insert the swab gently approximately 4 cm into the urethra, rotate several times and withdraw, place the swab into bacterial transport media.

Pre-inoculated GUM plates

Pre-inoculated agar plates are received from the various GUM clinics. Please ensure that the stock media prior to inoculation is stored at 2^0C to 8^0C. When ready for use, the plates must be brought to room temperature before inoculation and ensure that adequate material is placed on the plates to allow for a viable growth.

7.13.19 MRSA screening

Routine screening for MRSA is performed by culture. Please refer to the individual Trust's Infection Control Policy for specific protocols regarding screening on inpatient wards.

Nose and groin swabs are normally processed for MRSA culture for St George's Hospital patients.

Nose, throat and groin are normally processed for MRSA culture for Kingston Hospital patients.

Nose and groin swabs are normally processed for MRSA culture for Croydon Hospital patients.

Culture results are available within 24 – 72 hours.

A rapid GeneXpert Molecular test is performed at the RNOH on request with a turnaround time of 24 hours.

7.13.20 Endoscopy waters, Environmental screens and Breast milk

Environmental screening

- **Incubator/Port Hole Screens -** Swabs received from NNU incubators and port holes are taken to confirm the sterility of these areas after cleaning.
- **Air Sampling Plates -** Infection Control may be asked to carry out air sampling of specific areas e.g. commissioning new theatres, or after refurbishment of theatres. Utilisers air samplers with attached media; which is sent to the lab for incubation and colony count.
- **Pharmacy Sterility Checks-** Pharmacy carry out settle plate checks on their laminar flow cabinets on a weekly basis, Finger dab plates are also sent for sterility.

Endoscopy waters

Endoscopy waters are received from St. George's endoscopy unit, Queen Mary's Roehampton and the Nelson Hospital endoscopy unit daily Monday to Friday. Results are available within 5 days.

Formulae milk

Ready for consumption Formulae milk is also tested by the laboratory.

Expressed Breast Milk Samples

Donor breast milk is breast milk expressed that is then processed by a donor mile bank for use by a recipient who is not the mother's own baby.

Milk is sent for testing pre and post heat treatment. Growth is reported as Total Viable Colony count after ≤ 48 hours incubation on culture media.

Procedures are based on NICE Clinical guidance. Any colony count of TVC in heat treated or formulae milk will result in rejection of the sample for use.

7.13.21 Mycology

Specimens for Mycology investigation (skin, hair or nail clippings) should be sent to the Department in a sterile container.

It may be helpful to clean lesions on the skin or scalp, and sometimes nail with surgical spirit or 70% alcohol prior to the collection of the specimen as this improves the chances of detecting the fungus microscopically and reduces the likelihood of contamination. Prior cleaning is essential if greasy ointment or powders have been applied to the region.

Nail Clippings: should be taken from any discoloured, dystrophic or brittle parts of the nail. These should be cut as far back as possible from the free edge of the nail and include the full thickness, since some fungi are restricted to the lower parts. Where the nail is thickened, scrapings can also be taken from beneath the nail to supplement the clippings.

Fungus in the distal part of the nail is often non-viable and although still visible on microscopy it will fail to grow in between 40 and 50% of cases.

Skin: Material from skin lesions should be collected by scraping outward from the lesion edge. This is where the most viable fungi are likely to be found

Hair: Specimens from the scalp are best obtained by scraping with a blunt scalpel. The specimen should include hair stubs, the contents of plugged follicles and skin scales. Hairs may also be plucked from the scalp with forceps; infected hairs are easily removed this way. Hair cuttings are unsatisfactory as the focus of the infection is usually below or near the surface.

Microscopy results are available 48-72 hours after receipt. Culture results are available after 3 weeks or earlier if positive.

For Cryptococcal antigen detection testing; please refer to CSF section **7.13.3**.

Beta-D-Glucan assay

The (1-3)-beta-D-glucan assay is used in the laboratory diagnosis of invasive fungal infection (IFI) in at risk patients. (1-3)-β-D-glucan is the main cell wall component of most fungi such as *Candida, Aspergillus, Pneumocystis* and *Fusarium* sp., and does not exist in bacteria, virus or human cells. The test is a spectrophotometric assay for quantitative detection of (1-3)-β-D-glucan in human serum. Send 3-5 ml venous blood sample collected in a red top or gold top Vacutainer tube. Results are available in 3-5 days.

- This test requires a dedicated blood sample tube that cannot be used for other tests.
- The test is only performed on Tuesdays and Thursdays (excluding public holidays).
- Samples must reach the laboratory by 0900 on day of testing to be processed.
- Samples must be <48 hours old for testing – DO NOT attempt to request this test on Friday or Saturday.
- Please bring sample directly to laboratory and inform reception staff it is for ‘urgent microbiology’.

As part of the St. Georges Hospital NHS Trust Antifungal stewardship programme to reduce inappropriate use of antifungal agents and improve patient outcomes, the stewardship team has identified introduction of fungal biomarker tests in local laboratories with the aim of decreasing reference laboratory turnaround times (currently median 12 days) to at most 7 days. Early diagnosis of IFI is crucial for the clinical outcome of the patient. The compound (1-3)-β-D-glucan (BDG), a fungal cell wall component can be detected in the blood during invasive fungal infection potentially providing an early, rapid, laboratory diagnosis of IFIs. We hypothesised that bringing the biomarker test in house can enhance real-time clinical decisions to initiate pre-emptive fungal treatment or early stoppage of empiric treatment.

7.13.22 Resistance screen (other than MRSA)

Screening for multiple antibiotic Gram negatives are done routinely for some wards/organisms including, multidrug resistant pseudomonas on GICU and multidrug resistant coliforms on NNU. Other resistance screening such as VRE (GRE) are available.

Culture results are available within 24 - 48 hours.

7.13.23 Vascular catheter and other tips

All tips are cultured except urinary catheter tips. External Ventricular Drain tips and PD catheter tips are always processed. For advice regarding other tips please contact the Microbiologist. Culture results are available in 2 - 3 days.

7.13.24 Molecular request

Specimens for molecular diagnosis such as 16S ribosomal DNA detection or specific targeted PCR can be requested on discussion with the laboratory. These will be referred to the appropriate reference laboratory. Please contact the duty Microbiologist.

7.13.25 Invasive medical devices

Invasive medical devices such as IUCD, pacing wire, pacemakers etc. may be sent to the laboratory if an infection is suspected. Send in a sterile 60 ml universal container.

IUCDs

The entire device should be sent. IUCDs are cultured for *Actinomyces* species.

Microscopy if indicated will be available on day of receipt, culture will be available in 2-10 days.

For advice regarding other devices please contact the Microbiologist.

7.13.26 Bordetella investigation

Polymerase chain reaction (PCR)

Regional PHE laboratories offer a pertussis PCR service for patients in all age groups in both hospital and primary care settings.

PCR is usually more sensitive than culture as the organism does not need to be viable, however, PCR is less likely to be positive in patients with symptom duration of more than 3 weeks. A PHE pilot comparing the use of nasopharyngeal swabs (NPS) / pernasal swabs (PNS) and throat swabs in primary care for pertussis PCR found all swab types to be acceptable. While NPS are preferable for PCR testing, throat swabs may be used if NPS are not available, especially in community settings. Take samples for PCR as for culture, but send them “dry” if possible (that is, not in transport media). NPS/PNS for PCR sent in transport media will still be tested. The turnaround time from the referral laboratory is 10 days.

Culture

Take cultures by NPS / PNS / nasopharyngeal aspirates (NPA). **Do not** take throat swabs or anterior nasal swabs.

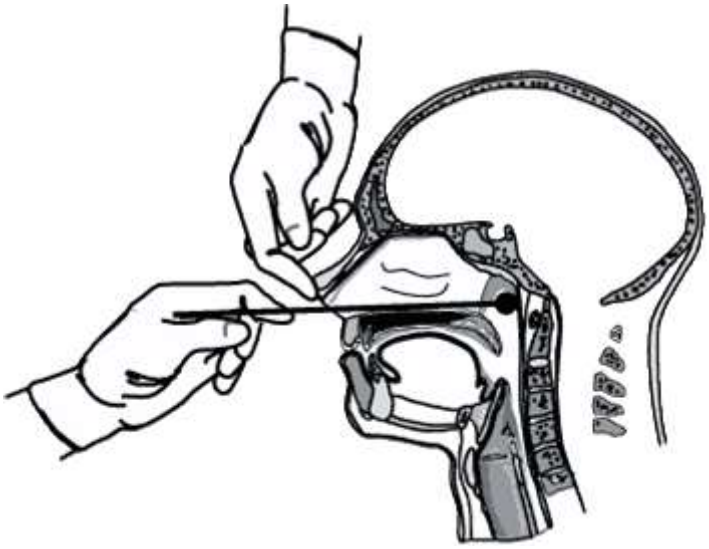
Sample the posterior nasopharynx using a NPS/PNS (typically flexible ultrafine twisted wire shaft with nylon/Rayon swab). The Copan-style swab is also acceptable for an NPA. The PNS needs to be gently pushed along the floor of the nasal cavity towards the posterior wall of the nasopharynx as this is where the *B. pertussis* bacteria are most likely to be found. Sampling of nasopharyngeal secretions in patients with whooping cough may precipitate a paroxysm of coughing and cause obstruction of the airways. Resuscitation equipment must be available if whooping cough is suspected. The specimen collector should avoid exposure to direct coughs from the patient.

After sampling, place the PNS for culture in transport media and transfer it without delay to the laboratory for processing.

The sensitivity of nasopharyngeal culture is affected by patient age (it decreases as people get older), vaccination status and length of illness. The sensitivity also decreases with time after onset and is highly dependent on specimen quality. Timing the specimen collection is important: sensitivity decreases substantially, from approximately 60% within 1 week of symptom onset to culture to 10% or less after 4 weeks. This means it is vital to have accurate details about the onset of symptoms on the patient request form.

Culture results are available within 7 days.

See diagram below.



Please see PHE guidance for further information:
https://www.gov.uk/government/collections/pertussis-guidance-data-and-analysis

Note: Charcoal swab is not suitable for PCR.

Serology testing (for detecting the anti-pertussis toxin IgG)

Serological testing is used to seek laboratory confirmation of cases where the date of onset of cough has been at least two weeks before specimen collection. It detects antibodies to pertussis toxin and a level (PT IgG) above 70 international units per millilitre (IU/ml) is considered evidence of recent infection (in the absence of vaccination within the past year). This method is predominantly used to confirm cases in older individuals (over 17 years old).

For serology tests the date of onset of symptoms and pertussis vaccination history must be included to aid interpretation of the result.

The South West London Health Protection Unit have introduced oral fluid testing for suspected pertussis infection in those aged 5 -16 years (<17 years) only.

An oral fluid test kit can be requested by GPs and others:

- where the onset of cough is more than 2 weeks AND
- has not already been testing for laboratory evidence of pertussis AND
- the person has no known pertussis vaccination in previous year

The test kit is available from the SWLHPU (0344 326 2052). There are instructions in the test kit on how to take the sample and how to return the swab for testing.

Tests are undertaken by Respiratory and Vaccine Preventable Bacteria Reference Unit (PHE Colindale). Swab results will go back to the GP usually within three weeks of receiving the sample and cases are requested to contact the GP surgery for the result.

7.14 Bacteriology and viral serology

Bacterial serology

Usually, two specimens of serum are required, taken 10-14 days apart, to look for rising titres. Please send two 5-10 ml large gold/yellow topped bottles of clotted blood. Some tests are sent to specialist laboratories, hence there may be some delay in receiving the results.

A second specimen 7-14 days after the first may be required for demonstrating sero-conversion or rising titres.

Inclusion of appropriate clinical details including **date of onset is vital**. Requests without such information may not be processed.

Test name (abbreviation)	Specimen type	Specimen Requirements	Container / Tube colour	Turnaround time	Comments
Streptococcal serology (anti-streptolysin (ASO) and anti-streptococcal DNAse B (ADB))	clotted blood	X 2 5-10ml	Yellow	1-7 days	
Syphilis (total antibody, TPPA, RPR, antibody) Syphilis screening and confirmation	clotted blood	X 2 5-10ml	Yellow	1-3 days	*Syphilis IgM (VirClia) is is not currently accredited by UKAS ISO15189:2012*
Toxoplasma (IgM, IgG)	clotted blood	X 2 5-10ml	Yellow	1-3 days	In pregnancy, please provide details and date of any exposure.
Borrelia serology (Lyme disease) - *Borrelia burgdorferi* antibody IgA/IgM	clotted blood	X 2 5-10ml	Yellow	1-3 days	Please provide details of any tick bite or exposure as well as date of symptom onset. Any sample found to be reactive in-house will be sent to the reference laboratory (Rare and Imported Pathogens Laboratory, PHE Porton Down) for confirmation.
Bordetella pertussis IgA/IgM	clotted blood	X 2 5-10ml	Yellow	1-3 days	
Lyme C6 peptide	clotted blood	X 1 5-10ml	Yellow	1-3 days	*This test is currently unavailable*
Measles virus (IgG) and IgM*	clotted blood	X 2 5-10ml	Yellow	1-3 days	These conditions are NOTIFIABLE on suspicion – if acute infection is suspected, please contact local health protection team.
Mumps virus (IgG) and IgM*	clotted blood	X 2 5-10ml	Yellow	1-3 days	
Rubella virus (IgM)	clotted blood	X 2 5-10ml	Yellow	1-5 days	
Rubella virus (IgG)	clotted blood	X 2 5-10ml	Yellow	1-3 days	For determination of prior immunity.
Parvovirus (IgM, IgG)	clotted blood	X 2 5-10ml	Yellow	1-7 days	In pregnancy, please provide details and date of any exposure.
HTLV type 1/2 IgG	clotted blood	X 2 5-10ml	Yellow	1-3 days	
HIV serology (HIV 1/2 antibody, HIV-1 p24 antigen)	clotted blood	X 2 5-10ml	Yellow	1-3 days	

Test name (abbreviation)	Specimen type	Specimen Requirements	Container / Tube colour	Turnaround time	Comments
Hepatitis A virus - total antibody (past exposure) - IgM (acute infection)	clotted blood	X 2 5-10ml	Yellow	1-3 days	
Hepatitis B virus - anti-HBc-IgM (acute infection) - HBsAg (acute and chronic infection) - HBeAg, anti-HBe (chronic infection status) - anti-HBc-total antibody (past infection) - anti-HBs (post-vaccine)	clotted blood	X 2 5-10ml	Yellow	1-3 days	
Hepatitis C virus antibody	clotted blood	X 2 5-10ml	Yellow	1-3 days	In immunosuppressed individuals or if acute HCV infection is suspected, please send X2 EDTA (purple) samples for HCV RNA PCR – see section 7.15.
Hepatitis D (Delta virus) antibody	clotted blood	X 2 5-10ml	Yellow	1-7 days	Batch tested weekly. Note HDV RNA is available on request – contact laboratory for details.
Hepatitis E virus (IgM, IgG)	clotted blood	X 2 5-10ml	Yellow	1-3 days	*This test is not currently accredited by UKAS ISO15189:2012*
Cytomegalovirus (IgM, IgG)	clotted blood	X 2 5-10ml	Yellow	1-3 days	
Cytomegalovirus IgG avidity	clotted blood	X 2 5-10ml	Yellow	5-10 days	Can help distinguish between primary (first) CMV infection and reactivation.
Epstein-Barr virus VCA (IgM, IgG)	clotted blood	X 2 5-10ml	Yellow	1-3 days	To evaluate recent EBV exposure
Epstein-Barr virus EBNA (IgG)	clotted blood	X 2 5-10ml	Yellow	1-3 days	To determine past EBV exposure
Herpes Simplex virus (type-specific IgG for HSV-1 and HSV-2)	clotted blood	X 2 5-10ml	Yellow	1-3 days	To differentiate between a current episode of HSV being primary (first infection) or a reactivation.

Test name (abbreviation)	Specimen type	Specimen Requirements	Container / Tube colour	Turnaround time	Comments
Varicella Zoster virus IgG	clotted blood	X 2 5-10ml	Yellow	1-5 days	Please provide details and date of any exposure.
Varicella Zoster virus IgM*	clotted blood	X 2 5-10ml	Yellow	1-5 days	For confirmation of chickenpox or zoster, please send a viral swab for VZV PCR – see section 7.15.
Mycoplasma serology (IgM)	clotted blood	X 2 5-10ml	Yellow	1-7 days	*This test is not currently accredited by UKAS ISO15189:2012*
SARS-CoV2 antibody	clotted blood/serum	X 1 5-10ml	Yellow	24-48 hrs	Daily - 'This test is designed to identify previous infection only and will not determine response to vaccine'. *(This test is not currently accredited by UKAS ISO15189:2012)*

* This CE marked assay is being used while undergoing verification studies. As the test samples required for this verification may take some time to acquire any results that are not in line with clinical suspicions should be repeated and a request made for 'urgent external testing of the sample to verify previous results'.

Urgent HIV, HBsAg, HCV and VZV results are usually available within 2 - 3 hours of receiving the specimen in the laboratory during normal working hours.

7.14.2 Requests for serology for human immunodeficiency virus (HIV)

Requests for serology for Human Immunodeficiency Virus (HIV) infection are accepted on the understanding that the patient has been properly counselled, and the result will be returned, under confidential cover, to the Consultant whose name is on the request form as having requested the test, or to a designated Counsellor.

Same day HIV testing is provided as a service to patients attending St. George's GUM clinic on Mondays and Thursdays. All other HIV test requests should have a result available within 24-48 hours after receipt of the sample in the lab.

7.14.3 Emergency procedures

Only certain tests are available out of normal laboratory hours – please discuss with the duty Consultant Virologist or Consultant Medical Microbiology.

7.14.4 Organ transplantation

The required tests for organ transplantation are:

Hepatitis B virus surface antigen (HBsAg)
Hepatitis C virus (HCV) serology
Human immunodeficiency virus (HIV) serology
HTLV serology
Cytomegalovirus (CMV) serology
Epstein-Barr virus (EBV) serology
Hepatitis E RNA

7.14.5 Patients on haemodialysis when the status is unknown

The tests required are:

HBsAg
HCV serology
HIV serology
For post-holiday dialysis we test HCV RNA PCR (please state post-holiday in clinical details)

7.14.6 Patients on labour ward/delivery suite when the status is unknown

The tests required are:

HBsAg
HIV antibody / antigen

7.14.7 Needle stick injuries

The tests required are:

The source patient is tested for **HBsAg, HCV and HIV serology: ALL with informed consent.**

For injured person (staff) – take blood for long-term storage in the laboratory.

7.14.8 Travel-related (imported) infection

Travel-related infection / imported infection / fever in the returned traveller: with the exception of malaria, Middle Eastern Coronavirus Syndrome (MERS-CoV), and avian influenza, this testing is performed at the Rare and Imported Pathogens Laboratory (RIPL) at PHE Porton Down. This includes (but is not limited to):

- Dengue virus
- Chikungunya virus

- Zika virus (please refer to PHE guidance on Zika virus testing https://www.gov.uk/guidance/zika-virus-sample-testing-advice)
- Phlebovirus (sandfly fever)
- Rickettsial infection

The exact details of testing vary and will be determined by RIPL according to the areas visited and symptoms. Thus, full clinical details are VITAL to ensure correct testing and samples will NOT be tested without these details and instead, a report indicating that the sample has been stored and requesting further details will be issued (see below). To provide this information, please contact the laboratory directly on 020 8725 5689 or following receipt of the sample in the laboratory, please print and fax the whole report (containing the patient identifiable information) updating the information requested to SWLP on 020 8725 5694.

Example report issued following receipt of sample for imported infection without sufficient clinical details

We have the following information:

Sample type:

Sample date:

Laboratory number:

Clinical details required before testing for flavivirus (includes zika and dengue), alphavirus (includes chikungunya), phlebovirus (includes sandfly fever) and Rickettsia is undertaken.

Symptoms:

Epidemiology: (required fields)

Country visited……

Date of travel to and return……..

Date of onset of symptoms……..

Duration of symptoms……...

Pregnancy related: (yes or no for required fields)

Pregnant…….

Pregnant Partner of symptomatic patient …….

If pregnant current gestational date (wks)……

7.14.9 Middle Eastern coronavirus syndrome (MERS-CoV) and avian influenza

These infections are notifiable on suspicion to local health protection teams. All testing is carried out at PHE – please contact the laboratory directly for sample requirements and procedures. Please see PHE website for up-to-date information:

https://www.gov.uk/government/collections/middle-east-respiratory-syndrome-coronavirus-mers-cov-clinical-management-and-guidance

https://www.gov.uk/government/collections/avian-influenza-guidance-data-and-analysis

7.14.10 Molecular microbiology and virology

Molecular tests are used for diagnosis of acute infection. Tests are very sensitive and have special sample requirements.

Please see below for details, including targets, test frequency and expected TAT.

Fresh tissue / biopsies

Please contact laboratory **1-2 days IN ADVANCE** to discuss requirements. Place specimens in a sterile container with saline (NOT formalin).

Amniocentesis and cordocentesis specimens

Notify the laboratory **1-2 days IN ADVANCE** if possible and send direct to the laboratory by the quickest means possible (by hand, taxi).

Test name (abbreviation) and targets	Specimen type	Specimen requirements	Container/ tube colour	Turnaround time	Comments
Norovirus PCR Norovirus genogroups I and II	Stool or rectal swab	Stool preferred: fill at least a third of the container	Leak-proof blue-lidded plastic universal container	Same day[2] (Oct – Mar)	For urgent testing at other times, please contact duty Microbiologist. Please contact Infection Control prior to submitting requests if an outbreak is suspected.

Test name (abbreviation) and targets	Specimen type	Specimen requirements	Container/ tube colour	Turnaround time	Comments
Respiratory PCR (RPCR) 21 targets[1] including *Mycoplasmsa pneumoniae*	NPA, BAL[4], ETT[4]	Washings or a nasopharyngeal aspirate in the case of infants are better than swabs for recovering viruses from the throat; ask the patient to gargle with about 5 mL of sterile water for 10-15 seconds then spit into a sterile container.	Universal or 60ml silver top container[4]	Same day[2]	
	Throat swabs		Virocult® green swabs	Same day[2]	
Influenza rapid testing (FPCR) geneXpert Flu/RSV	Throat swabs	For other sample types, please contact laboratory.	Virocult® green swabs	<4 hours[3]	
CSF Viral meningitis (VMPCR) Includes: HSV, VZV, Parechovirus, Enterovirus, Mumps	CSF	At least 0.5 mL (10-12 drops) is required.	Universal or 60ml silver top container	Same day[2]	Specimens routinely sent to Virology include: All babies under 3 weeks of age regardless of WBC count • All CSF WBC count ≥ 10/µl • Clinical details of meningitis or encephalitis • Any neurological symptoms (paralysis, stroke (SAH), neuritis/neuralgia) • All CSFs with Virology requested • Exclude CSF taken from shunts unless Virology specifically requested
Vesicular Skin (rash) (VSPCR) HSV-1, HSV-2 and VZV	Vesicle, ulcer, or blister swabs	Fluid and vesicle fluid (from a "deroofed" fresh lesion) samples are collected using Virocult® green swabs.	Virocult® green swabs	1-3 days	**Performed on Tues/Thurs** Tested swabs are then stored at 2-8ºC for 1 month. Aliquots of the virus transport medium are stored at -70°C for 6 months.

Test name (abbreviation) and targets	Specimen type	Specimen requirements	Container/ tube colour	Turnaround time	Comments
Viral Eye PCR (VEPCR) HSV, VZV, AdV, *Chlamydia trachomatis*	Eye swabs		Virocult® green swabs	1-3 days	**Performed on Mon/Wed/Fri** Tested swabs are then stored at 2-8°C for 1 month. Aliquots of the virus transport medium are stored at -70°C for 6 months.
Adenovirus/CMV/EBV (ACE PCR) Adenovirus, CMV, EBV quantitative (viral load)	EDTA Blood	5-10 mL fresh whole blood on EDTA	Lavender top	1-3 days	**Performed on Mon/Wed/Fri – samples must be received in the laboratory by 0930 for result same day** Reported as IU / mL.
Chlamydia trachomatis / Neisseria gonorrhoeae (CT/NG) Nucleic acid detection of *C. trachomatis* and *N. gonorrhoeae* in genital, rectal, throat and eye specimens *Trichomonas vaginalis* and *Mycoplasma genitalium(TV/MG)* Nucleic acid detection of *T. vaginalis and M. genitalium* in genital, and urine specimens.	cobas® PCR Dual Swab Sample Kit	See section 7.14.12	Roche swab collection device[5]	1-3 days	CTGC testing is performed daily, though TATs can vary depending on batch size and whether confirmatory tests are required. Specific testing for LGV is available on request – please contact laboratory *These tests are not currently accredited by UKAS ISO15189:2012*
	cobas® PCR Urine Sample Kit	See section 7.14.12 Fill to mark as indicated on tube	Roche urine collection device[5]	1-3 days	
	cobas® PCR Uni swab Sample Kit	See section 7.14.12	Roche swab collection device[5]	1-3 days	
HSV (genital)	Anogenital lesion swabs		Roche MSwab-Copan blue collection device[5]	1-3 days	**Performed daily** Aciclovir resistance testing available on request – please contact laboratory

Test name (abbreviation) and targets	Specimen type	Specimen requirements	Container/ tube colour	Turnaround time	Comments
Quantitative HIV, HCV, HBV viral loads	EDTA Blood	5-10 mL fresh whole blood on EDTA or stored plasma	Lavender top	1-3 days	
HCV genotyping	EDTA Blood	5-10 mL fresh whole blood on EDTA or stored plasma	Lavender top	1-3 days[6]	Certain samples require confirmatory testing at an external laboratory
HBV genotyping or resistance	EDTA Blood	Please send an additional tube if also requesting HBV viral load	Lavender top	1-3 weeks	This test is currently performed at an external laboratory
HIV resistance sequencing	EDTA Blood	Please send an additional tube if also requesting HIV viral load	Lavender top	1-3 weeks	This test is currently performed at an external laboratory
HDV (delta virus) viral load	EDTA Blood	5-10 mL fresh whole blood on EDTA or stored plasma	Lavender top	1-3 weeks	This test is currently performed at an external laboratory
Hepatitis E (HEV) RNA (viral load)	EDTA Blood	5-10 mL fresh whole blood on EDTA or stored plasma	Lavender top	1-3 weeks	This test is currently performed at an external laboratory
SARS-CoV2 PCR	Throat swab, Throat & Nose swab		Virocult® green swabs	24-48 hrs	*This test is not currently accredited by UKAS ISO15189:2012*

1. The Respiratory viral PCR includes Influenza A, Influenza A (H1N1), Influenza B; Coronaviruses NL63, 229E, OC43 and HKU1, Parainfluenza 1, 2, 3 and 4, Human Metapneumovirus A and B, Rhinovirus, Respiratory Syncytial Viruses A and B, Adenovirus, Enterovirus, Parechovirus, Bocavirus and *Mycoplasma pneumoniae*.
2. Same day results are available for samples received in the laboratory BEFORE 0930 for RPCR and 1100 for VMPCR and Norovirus Mon-Fri (excluding Bank Holidays).
3. 24/7 during influenza seasons or by arrangement at all other times.
4. Specimens collected by bronchoscopy or endotracheal suction must not be transported in containers with the suction tubes attached to the lid. Collection packs are available which include a second sealed lid - this should be applied to the container prior to transportation to the laboratory.
5. Please see the South West London Pathology website www.swlpath.nhs.uk under test information heading for further advice on specimen collection.
6. If confirmation by external reference laboratory is required, result may take 1-3 weeks.

Ensure the samples reach the laboratory within 24 hours of collection. Serum or plasma will be separated from the primary viral load sample within 24 hours of receipt.

Any other viruses for molecular testing please consult the laboratory to ensure appropriate samples are collected. Generally, EDTA blood is the sample of choice. Many of these additional tests are referred to the Reference Laboratories so may take up to 2-3 weeks for a result to come back.

The repertoire of tests and sample volumes required may change in line with service developments and clinical need.

7.14.12 Sexually transmitted infection PCR

The Cobas® 6800 CT/NG and TV/MG tests uses real-time PCR to test for Chlamydia, Gonorrhoea, *Trichomonas vaginalis* and *Mycoplasma genitalium* simultaneously in the same sample, with highly accurate results and rapid turnaround time.

This test is used as a diagnostic as well as a screening tool in both symptomatic and asymptomatic populations. Specimen requirements are endocervical swabs (flocked), vaginal/meatal swabs (woven) and urine, using the cobas® PCR Dual Swab Sample Kit (contains both flocked and woven swabs) and cobas® PCR Urine Sample Kit. Throat, rectal, and eye specimens can be collected using the cobas® PCR Uni Swab Sample Packet (contains only the woven swab).

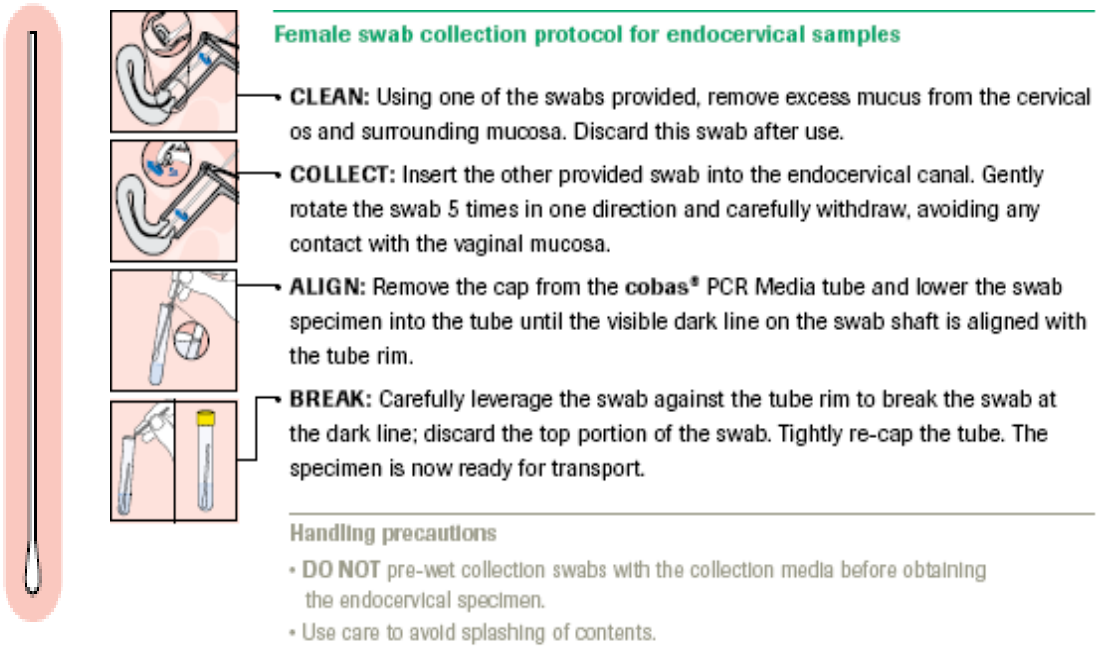
Note this test is not validated for eye specimens although testing is permitted – interpret results with caution.

For collection instructions, see next page.

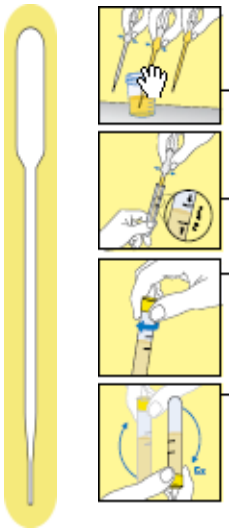
The new collection devices are available from the SWLP pathology consumables website.

	Chlamydia/GC/ TV/MG urine sample kit Cobas PCR.
	Dual Swab Sample Packet (previously Chlamydia/GC female swab sample kit) Cobas PCR The Dual Swab Sample contains a flocked swab and a woven swab. The flocked swab is for endocervical specimen collection only. The woven swab is for vaginal, meatal, rectal, eye and throat specimen collection.
	Uni Swab Sample Packet Cobas PCR: The Uni Swab Sample Packet only contains the woven swab (for vaginal, meatal, rectal, eye, and throat specimen collection).

cobas® PCR Dual Swab Sample Kit for endocervical samples



Cobas® PCR Urine Sample Kit



Urine collection protocol for male or female urine samples

PIPETTE: Transfer collected urine into the **cobas®** PCR Media tube using the provided disposable pipette. (Note: If the urine specimen cannot be transferred immediately, it can be stored at 2°C to 30°C for up to 24 hours.)

TRANSFER: The correct volume of urine has been added when the fluid level is between the two black lines on the tube label.

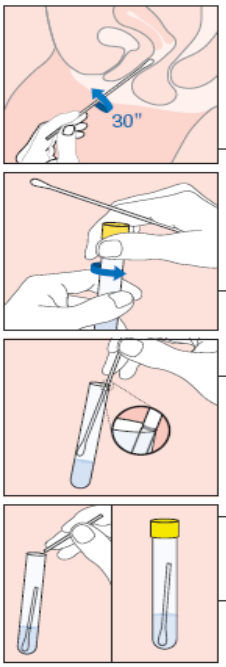
CAP: Tightly re-cap the **cobas®** PCR Media tube.

MIX: Invert the tube 5 times to mix. The specimen is now ready for transport.

Handling precautions

- Female patients should not cleanse the labial area prior to providing specimens.
- **DO NOT** collect specimen from patients who are menstruating.
- Female and male patients should not have urinated for at least one hour prior to sampling.
- Use care to avoid splashing of contents.

The cobas® PCR Dual Swab Sample Kit: for vaginal samples



How to self-collect a vaginal swab sample:

1 POSITION: Hold the swab in one hand and with the other hand separate the folds of skin around the vaginal opening (labia).

2 COLLECT: Insert the swab about 5 cm (2 inches) into the vaginal opening. Gently turn the swab for about 30 seconds while rubbing the swab against the wall of the vagina. Withdraw the swab carefully. Do not touch the swab to any surface before transfer to the collection tube.

3 OPEN TUBE: While holding the swab in the same hand unscrew the cap from the tube as shown in the diagram.

4 ALIGN: Remove the cap from the **cobas®** PCR Media tube and lower the swab specimen into the tube until the visible dark line on the swab shaft is lined up with the tube rim. The tip of the swab should be just above the liquid in the tube.

5 BREAK: Carefully lean the swab against the tube rim to break the swab shaft at the dark line; discard the top portion of the swab.

6 CAP: Tightly re-cap the **cobas®** PCR Media tube. The sample is now ready for testing.

8 Protein Reference Unit and Immunology Laboratory

8.1 Consultants and senior staff

Dr Rachel Wheeler	Consultant Clinical Scientist and Clinical Lead	0025
Aimee Rhodes	Immunology Manager	1918
Dr Sarah Linstead	Consultant Clinical Scientist	0025
Joanne Morris	Consultant Clinical Scientist	0025
Laura Kirsopp	Advanced Biomedical Scientist	0025
Dimitrios Pouris	Advanced Biomedical Scientist	0025

8.2 Laboratory working hours

MON	TUE	WED	THU	FRI	SAT	SUN	BH
← 0800 – 1700 →					-	-	-

Note that all results are posted on the EPR/Order Comms as soon as analysis is complete. Results are best viewed this way rather than phoning the laboratory.

8.3 Out of hours

No out-of-hours service is available.

8.4 Enquiries – working hours

Reception/Results	0025
Clinical Advice & Interpretation	5106

8.5 Enquiries – out of hours

No out-of-hours service is available.

8.6 Laboratory services

This unit provides both a local and a national service for the investigation of autoimmune diseases, immunodeficiency, B cell malignancy, allergy and hypersensitivity.

8.7 Results

Most pathology reports are available via the electronic patient record (EPR) and Cerner as soon as they are authorised. In addition, hard copy reports are distributed from Pathology on weekdays.

8.8 Specimen requirements

Most tests are done on serum, please use the PLAIN (no additive) tubes. One 7mL serum sample will usually do a number of tests but for advice on sample volume requirements please call the laboratory.

Urine specimens should preferably be EMU. Urine specimens should **NOT** be collected into Universal tubes containing **Boric Acid** as this will interfere in the analysis of protein concentrations.

Matched **serum and CSF** samples should be taken for oligoclonal bands.

Small **faecal** samples ('pea' sized is approximately 1g) should be sent in blue plastic screw-top container. After placing the sample in the container with the small plastic spoon, clean the outside if necessary and place the container in a plastic bag. Please ensure that these samples are properly labelled and are transported to the laboratory as soon as possible. Time and date of collection **MUST** be indicated on all specimens to avoid rejection. Samples should reach the laboratory within 24 hours of collection and if external, transported on dry ice.

Samples requiring **Tryptase** for the investigation of potential anaphylactic reaction should be taken at the time of reaction, 1-2 hours after onset of symptoms (no later than 4 hours post onset), and 24 hours later. The sample should be sent to the laboratory immediately (within 3hrs).

Samples for **Cryoprotein** investigation require collection of serum and plasma to be taken into warmed tubes which the laboratory will supply. Please contact the laboratory when this test is required and a member of staff will attend the ward/clinic/blood room as required. If taking blood on the ward it is imperative that the requesting doctor remains available to bleed the patient into the sample tubes provided.

CSF samples for TAU A/beta ratio should be arranged directly with the laboratory and should be taken before 3pm. The CSF samples must be taken into 30mL opaque polypropylene Universals.

8.9 Turnaround times

All common tests are run daily; less frequently requested tests are run at least weekly (see tables).

8.10 Urgent requests

Some investigations can be done urgently by arrangement with a senior member of the department staff. Samples for urgent analysis must reach the laboratory before 12 noon and discussed with a Consultants Clinical Scientist in advance. Investigations included in this context include:

- Anti-neutrophil antibody (ANCA)
- Glomerular Basement membrane antibody
- Paraprotein and Urine Bence Jones Protein investigation
- Tryptase
- TAU protein
- Myoglobin

A doctor must make all requests for urgent analysis. Results of tests on all urgent requests will be telephoned to the doctor as soon as they are available, provided the appropriate contact number is entered on the request form.

8.11 Additional tests

Tests may be added to outpatient, primary care, and paediatric samples if a suitable sample is available (samples are stored for approximately 1 month).

8.12 Repeat requests

Due to increasing numbers of inappropriate repeat requests for Immunology tests, the laboratory has implemented automatic blocking of repeat testing for the following tests on inpatients and outpatients:

Immunoglobulins (except monitoring B cell malignancy and immunodeficiency): No repeat within 1 month

IgG subclasses: No repeat

Thyroid antibodies: No repeat

CCP Antibodies: No repeat

Requests that are not immediately processed will be entered onto the computer with a comment describing the reason that the test has not been processed and asking the requesting physician to contact the laboratory if they have strong indications, clinical or otherwise for that request to be processed.

Samples are stored for approx. 4 weeks during which time a request can be reinstated with appropriate justification.

9 Immunology and Protein Reference Unit Tables

The following table lists the tests available and the main indications for their use.

Autoimmune rheumatic diseases e.g. SLE, Rheumatoid arthritis				
Test	**Possible clinical association**	**Assay frequency**	**Turnaround time (working days)**	**Comments**
Rheumatoid Factor	Rheumatoid arthritis	Daily	1 day	Low concentrations may be seen in the elderly and in patients with chronic infections. Lacks sensitivity for monitoring R.A. - use CRP
Anti-cyclic citrillunated peptide (CCP)	Early Rheumatoid Arthritis	Weekly	7 days	Used as a one-off marker for early stages of the disease.
Anti-nuclear antibodies (ANA)	Connective tissue disorders	Daily	2 days	Low titre ANA may be seen in the elderly and associated with viral infections AKA Hep2 screen
Specimens showing a positive ANA will be tested for antibodies to appropriate specific antigens; homogeneous patterns will typically be tested for antibodies to double stranded DNA and speckled patterns will typically be tested for antibodies to the extractable nuclear antigens (RNP, Sm, SSA, and SSB). Other antigen specificities will be tested depending upon the clinical details or if specifically requested.				

Double stranded DNA (dsDNA)	Diagnosis and monitoring of SLE	Weekly	7 days	Methodology includes ELISA, ELIA and Crithidia
Extractable nuclear antigen screen		x2/week	3 days	
Ribo-nuclear protein (RNP)	Mixed connective tissue disease	Weekly	7 days	
Sm	S.L.E.	Weekly	7 days	
SSA (Ro)	Sjogrens syndrome S.L.E.	Weekly	7 days	Associated with neonatal heart block
SSB (La)	Sjogrens syndrome S.L.E.	Weekly	7 days	
Scl-70	Systemic sclerosis	Weekly	7 days	
Jo-1	Polymyositis	Weekly	7 days	
Centromere pattern	CREST syndrome	Weekly	7 days	
Anti cardiolipin antibodies (IgG & IgM)	Antiphospholipid syndrome (recurrent thrombotic events,	Weekly	7 days	May be primary or secondary to disease e.g. SLE

	recurrent miscarriage)			
B2 glycoprotein antibodies		Weekly	5 days	
Complement C3 and C4	Immune complex diseases	Daily	2 days	May predict lupus nephritis

Autoimmune endocrine disease

Polyglandular autoimmune endocrine disease may show antibodies against more than one endocrine gland

Test	Possible clinical association	Assay frequency	Turnaround time (working days)	Comments
Adrenal antibody	Autoimmune Addison's Disease	Weekly	7 days	

Thyroid diseases (hyper- or hypo- thyroid)

Autoimmune thyroid diseases show marked overlap in their serum antibody patterns.

Test	Possible clinical association	Assay frequency	Turnaround time (working days)	Comments
Thyroid peroxidase antibodies	Autoimmune thyroiditis	Weekly	7 days	
TSH receptor antibodies	Thyrotoxicosis, Grave's disease	Weekly	7 days	Neonatal hyperthyroid

Liver diseases

Liver antibodies includes testing for mitochondrial antibodies**,** smooth muscle antibodies and liver-kidney microsomal antibodies. Low concentrations of these antibodies may be seen transiently post viral infection

Test	Possible clinical association	Assay frequency	Turnaround time (working days)	Comments
Mitochondrial antibodies	Primary biliary cirrhosis (PBC)	Daily	2 days	M2 subtype associated with PBC. This is a referred test for confirmation.
Smooth muscle antibodies	Chronic active hepatitis	Daily	2 days	
Liver-kidney microsomal antibodies	Chronic active hepatitis	Daily	2 days	
Caeruloplasmin	Wilsons disease	Daily	1 day	
α1 anti-trypsin concentration	Liver disease	Daily	1 day	
α1 anti-trypsin phenotype	Liver disease	Weekly	7 days	

Gut diseases				
Test	**Possible clinical association**	**Assay frequency**	**Turnaround time (working days)**	**Comments**
Gastric parietal cell antibodies (GPC)	Atrophic gastritis Pernicious anaemia	Daily	2 days	
Intrinsic factor antibodies	Additional test for pernicious anaemia	Weekly	7 days	
Endomysial antibodies (IgG& IgA)	Coeliac disease	Daily	5 days	In the presence of IgA deficiency only IgG antibodies may be present.
Tissue transglutaminase antibodies (IgG& IgA)	Coeliac disease	x3/week	3 days	In the presence of IgA deficiency only IgG antibodies may be present.

Skin diseases				
Test	**Possible clinical association**	**Assay frequency**	**Turnaround time (working days)**	**Comments**
Intercellular cement antibodies	Bullous pemphigus	Weekly	7 days	
Basement membrane antibodies	Bullous pemphigoid	Weekly	7 days	

Renal diseases (and vasculitis)				
Test	**Possible clinical association**	**Assay frequency**	**Turnaround time (working days)**	**Comments**
Glomerular basement membrane antibodies (GBM)	Goodpasture's syndrome	x2/week	3 days	Urgent requesting available with discussion
Anti-neutrophil cytoplasmic antibodies (ANCA)	Specimens showing a positive ANCA pattern will be tested for antibodies to specific antigens	Daily	1 day (negative) 2 days (follow on)	Urgent requesting available with discussion
Proteinase III antibodies	Wegener's	x2/week	1 day	Urgent requesting available with discussion. Confirmatory second line testing available on request by a second method: TAT is 7 days
Myeloperoxidase antibodies	Microscopic polyangiitis, Churg-Strauss syndrome, Polyarteritisnodosa	x2/week	1 day	Urgent requesting available with discussion. Confirmatory second line testing available on request by a second method: TAT is 7 days

Immunodeficiency and infection				
Test	**Possible clinical association**	**Assay frequency**	**Turnaround time (working days)**	**Comments**
Immunoglobulins and electrophoresis (IgG, IgA & IgM)	May be isolated immunoglobulin deficiency or affect all the immunoglobulin classes.	Daily	2 days	Used to monitor γ-globulin replacement therapy
IgG subclasses	Indicated in patients with recurrent infections.	Weekly	7 days	
Functional antibody titres (Haemophilus Influenza B, tetanus, pneumococcus – 23 valent) Pneumococcal serotypes*	Indicated in patients with recurrent infections particularly if IgG and IgG subclasses concentrations are within reference range.	Weekly	7 days	Pre- and post-vaccination (6 weeks)
Complement (CH50)	Used to exclude deficiencies of the classical complement cascade.	Weekly	7 days	

Allergy and hypersensitivity				
Test	**Possible clinical association**	**Assay frequency**	**Turnaround time (working days)**	**Comments**
Specific IgE		x3/week	3 days (routine requests) 7 days (non-routine requests)	We have a large number of allergens available on our website. Rare allergens may take longer.
Tryptase	Anaphylactic type reactions.	Weekly	7 days	Potential anaphylactic reactions; samples to be taken at the time of reaction, 1-2 hours after onset of symptoms (no later than 4 hours post onset), and 24 hours later. Can be arranged urgently if clinical need.
C1 esterase inhibitor Antigen concentration	Hereditary angioedema	Weekly	7 days	
C1 esterase inhibitor Functional activity	Hereditary angioedema	Weekly	7 days	Unless C3 and C4 results are provided with this request, this will be added on and processed
Total IgE		x3/week	3 days	

Neurology				
Test	**Possible clinical association**	**Assay frequency**	**Turnaround time (working days)**	**Comments**
Acetyl choline receptor Ab.	Associated with myasthenia gravis	Weekly	7 days	Correlates with disease and neonatal MG
Oligoclonal Bands	Associated with multiple sclerosis	Weekly	7 days	

B-cell Malignancy				
Test	**Possible clinical association**	**Assay frequency**	**Turnaround time (working days)**	**Comments**
Paraprotein studies: Immunoglobulins and electrophoresis (Serum)	B cell malignancies e.g. myeloma, Waldenstroms macroglobulinaemia, lymphoma.	Daily	2 days (no abnormality) 3 days (if further investigation)	Used for diagnosis and monitoring. Paraproteins can occur incidentally without associated B cell tumours, particularly in the elderly. May include capillary electrophoresis, immunofixation (including IgD/E) and immunotyping . Urgent analysis available on request
Bence Jones protein (urine)		Daily	3 days	May be the only marker of the malignancy (approx. 20% of

				myeloma). Urgent analysis available on request
β2 microglobulin	Prognostic marker in myeloma	x2/week	3 days	Urgent analysis available on request
Serum free light chains	B cell malignancies	x3/week	3 days	Urgent analysis available on request
Hydrashift for Daratumumab		Weekly	7 days	
Selection plate	Heavy chain disease	As required	12 days	

Miscellaneous				
Test	**Possible clinical association**	**Assay frequency**	**Turnaround time (working days)**	**Comments**
Cryoprotein investigation	Vasculitis, Raynauds	Daily	7 day (no abnormality) 10 days (full workup)	Please call laboratory - special specimen collection ESSENTIAL. Cryocrit available on request.
TAU protein	Investigation of CSF leakage	Daily	2 days	Same day analysis if received before midday
Myoglobin	Investigation of rhabdomyolysis	Daily	1 day	
Aspergillus fumigatus IgG	Aspergilloma	Weekly	7 days	ABPA

Alpha 1 acid glycoprotein	Inflammation of the gut	Weekly	7 days	Also known as Orosomucoid.
Faecal alpha 1 anti-trypsin	Protein losing enteropathy	Weekly	7 days	See sample requirements on page 106
Transferrin		Daily	1 day	
IgD	Periodic fever syndrome (hyper IgD)	Weekly	7 days	
Haptoglobin		Daily	1 day	

Referred work

Turnaround times available on request or are detailed on the referral laboratory website. Please note, 4 days are added on to the TAT advertised by the referral laboratory

Test	**Location**
Adalimumab concentration and Abs	Clinical Blood sciences, Royal Devon & Exeter
Alpha-1 antichymotrypsin	Protein Reference Unit, Sheffield
Alternative complement pathway activity	Protein Reference Unit, Cardiff
Aquaporin 4 Abs	Institute of Neurology, Queen Square, London
Avian precipitins (if our screen is positive)	Protein Reference Unit, Sheffield
Basal ganglia Abs	Institute of Neurology, Queen Square, London
Beta-Interferon Neutralising Abs	Institute of Neurology, Queen Square, London

C1Q Abs	Protein Reference Unit, Sheffield
C3 nephritic factor	Protein Reference Unit, Sheffield
Collagen Type II	Protein Reference Unit, Sheffield
Complement C1Q concentration	Protein Reference Unit, Cardiff
Complement C2 concentration	Protein Reference Unit, Cardiff
Complement C3D concentration	Protein Reference Unit, Cardiff
Complement activation studies	Protein Reference Unit, Cardiff
C1esterase inhibitor Abs (inc.IgG,A,M)	Protein Reference Unit, Cardiff
CSF neuronal antibodies	Immunology Department, Churchill Hospital, Oxford
Diabetes antibody testing (GAD, IA2, ZnT8)	Clinical Blood sciences, Royal Devon & Exeter
Diphtheria antibodies	Birmingham Heartlands Hospital
Endothelial cell Abs	Protein Reference Unit, Sheffield
Enterocyte antibodies	Protein Reference Unit, Sheffield
Eosinophil cationic protein	Protein Reference Unit, Sheffield
Etanercept concentration and Abs	St Thomas' Hospital, London
Factor H and Factor I	Protein Reference Unit, Cardiff
Ganglionic alpha 3 receptor Abs	Immunology Department, Churchill Hospital, Oxford
Ganglioside Abs	Neuroimmunology Department, Glasgow
Globoside Abs	Neuroimmunology Department, Glasgow
Golimumab	Protein Reference Unit, Sheffield

Glutamic acid decarboxylase Abs (Stiff Man)	Immunology Department, Churchill Hospital, Oxford
Glutamate Receptor Ab (GABA, AMP1, AMPA2)	Immunology Department, Churchill Hospital, Oxford
Glycine receptor Abs	Immunology Department, Churchill Hospital, Oxford
Heart muscle Abs	Protein Reference Unit, Sheffield
Histone Abs	Protein Reference Unit, Sheffield
HMG CoA reductase Ab	Immunology Department, Churchill Hospital, Oxford
Infliximab concentration and Abs	Clinical Blood sciences, Royal Devon & Exeter
Insulin Abs	Royal Surrey County Hospital
ISAC	Protein Reference Unit, Sheffield
LGI1 and CASPR2 antibodies	Immunology Department, Churchill Hospital, Oxford
M2 mitchondrial Abs	Clinical Immunology, Kings College Hospital
Mannose binding protein/lectin	Protein Reference Unit, Cardiff
Meningococcal C antibodies (IgG)	Meningococcal Reference Unit, Manchester
Mumps antibodies	Institute of Neurology, Queen Square, London
Muscle specific kinase (MuSK) Abs	Immunology Department, Churchill Hospital, Oxford

Myasthenia clustered antibody screen (ACHR, MuSK, LRP4 abs)	Immunology Department, Churchill Hospital, Oxford
Myelin associated glycoprotein Abs	Neuroimmunology Department, Glasgow
Myelin oligodendrocyte glycoprotein Ab	Institute of Neurology, Queen Square, London
Myositis Abs (OJ, EJ, PL-12, Pl-7, SRP, Jo-1, Pm-Scl75, Pm-Scl100, Ku, SAE, NXP-2, MDA5, TIF-1g, Mi-2 and Ro-52)	Royal United Hospitals Bath
NMDA receptor antibodies	Institute of Neurology, Queen Square, London
Neuronal antibodies (Hu, Yo, Ri, CV2.1, PNMA2 (MaTa2), amphiphysin, Recov, SOX1 and Titin)	Neuroimmunology Department, Glasgow
Orexin Abs (in serum or CSF)	Immunology Department, Churchill Hospital, Oxford
Parathyroid gland Abs	Protein Reference Unit, Sheffield
Phospolipase A2 Receptor Ab	Protein Reference Unit, Sheffield
Pituitary gland Abs	Protein Reference Unit, Sheffield
Pneumococcal serotypes	Meningococcal Reference Unit, Manchester
Rituximab	St Thomas' Hospital, London
RNA Polymerase III	Protein Reference Unit, Sheffield
S100b	Clinical Biochemistry, Kings
Saccharomyces cerevisiae Abs	Immunology, St Helier Hospital
Salivary gland Abs	Protein Reference Unit, Sheffield
Serum amyloid A	Neuroimmunology Department, Glasgow

Skin antibody studies	St John Institute of Dermatology, St Thomas' Hospital, London
Sperm Abs	Dept of Andrology, St Mary's Hospital, Manchester
Squamous cell carcinoma Ag	Protein Reference Unit, Sheffield
Sulphatide antibodies	Neuroimmunology Department, Glasgow
Tau Abeta ratio in CSF	Institute of Neurology, Queen Square, London
Testes antibodies	Protein Reference Unit, Sheffield
Tysabri (natalizumab)	Immunology Laboratory, Barts and the London Hospital
Vascualer Endotelial Growth factor	Institute of Neurology, Queen Square, London
Vedolizumab	Clinical Blood sciences, Royal Devon & Exeter
Voltage gated Calcium channel Abs	Immunology Department, Churchill Hospital, Oxford