The Dudley Group NHS
NHS Foundation Trust

THE DUDLEY GROUP
NHS FOUNDATION TRUST

DEPARTMENT OF PATHOLOGY

GUIDE TO PATHOLOGY SERVICES

CONTENTS

1 INTRODUCTION

Welcome to the Russells Hall Hospital Department of Pathology, which forms part of the Directorate of Diagnostic Services. Pathology comprises of 5 functional sections which provide a comprehensive range of clinical services and diagnostic investigations:

- Clinical Biochemistry
- Haematology and Blood Transfusion
- Cellular Pathology and Mortuary Services
- Immunology
- Microbiology

The department also provides a wide range of Phlebotomy and POCT services.
This guide is designed to provide practical information and guidance to help you make the best use of the services we provide.

2 GENERAL INFORMATION

2.1 LOCATION

The Department of Pathology is located on the 1st floor of the West wing of the hospital.
All visitors should report to Pathology Reception on arrival.
The postal address is: Department of Pathology
Russells Hall Hospital
Dudley
West Midlands
DY1 2HQ

2.2 OPENING HOURS

Department	Monday – Friday	Saturday	Sunday
Pathology Reception	09:00 – 17:30	Closed	Closed
Biochemistry	OPEN 24/7		
Haematology	OPEN 24/7		
Cellular Pathology	08:00 – 17:00	Closed	Closed
Immunology	08:00 – 16:30	Closed	Closed
Microbiology	08:00 – 20:00	08:00 – 16:00	08:00 – 16:00

An out of hours system operates for some departments outside of the above hours (see Section 3.5 below).

2.3 CONTACT DETAILS (GENERAL ENQUIRIES)

Department	Enquiry type	External number (01384)	Internal (extension only)
Main hospital (switch board)		456111	0
Pathology Reception	General enquiries **(not results / not extra tests)**	244055	2055
Blood Science	Blood results	244086	2086
	Antenatal results		
	Additional / extra Biochemistry test		
	Blood bank		
	Appointment with Haematology Consultant		
	To book a glucose tolerance test		
	Any other enquiry		
Blood bookings	For patients to book a blood test	244330	
Phlebotomy	Outpatient services	244091	2091
Biochemistry	Laboratory enquiries **(not results)**	244482	2482
Haematology	Laboratory enquiries **(not results)**	244487	2487
Blood Bank	Laboratory enquiries **(not results)**		2488
Cellular Pathology	All enquiries and results	244034	2034 / 2159
Immunology	All enquiries and results	456111 ext 2447	2447
Microbiology	Microbiology results	244019	2019
	General Microbiology enquiries		
	Semen analysis appointments		
	Head / Deputy Head BMS		
Point of care testing (POCT)	All enquiries (use blood sciences number and select option for Any other enquiry)	244086	2086
Pathology IT Support	All IT related enquiries	456111 ext 2896	2896

For other contact details, please refer to individual department and 'Key Contacts' sections in this guide.

2.4 CONCERNS, COMPLAINTS AND COMPLIMENTS

Whilst we take pride in the service we deliver and endeavor to make it the highest quality service we can, sometimes things can happen that are out of our control. We appreciate that our service users may want to inform us and the Trust of any poor service/treatment they receive, this is a useful process for us as it can enable us to identify ways to prevent recurrence of the same problem. Please be assured your care will not be affected adversely if you make a complaint. Let us know your comments as soon as possible and where necessary, we will do our best to put things right for you.

In addition, we want to know what you think of our services generally, what your suggestions are for the future and when you are pleased by the efforts of our staff. We are grateful when our service users take the time to send in compliments on good service, which we will pass onto the staff concerned who appreciate the feedback on their hard work.

There are a number of ways you can do this.

2.4.1 Resolving a concern

- You can speak to a member of the laboratory staff, whose contact numbers are at the end of this document – this is usually the quickest way to resolve any problems
- You can contact the Patient Advice and Liaison Service or PALS at pals@dgh.nhs.uk or by calling 0800 073 0510. PALS is here to support patients, relatives or carers when they have concerns or queries. Click here for more information about PALS.

2.4.2 Making a complaint

If we have not been able to resolve your concerns, you can make a formal complaint by:

- Writing to either the Complaints Department or Chief Executive at: Russells Hall Hospital, Dudley West Midlands, DY1 2HQ.
- Emailing the department directly at complaints@dgh.nhs.uk
- Calling the Complaints Department on 01384 321035 where a member of the team will talk to you
- You can contact the NHS Complaints Advocacy Service by calling 0300 456 2370

PALS can give you more information about the NHS Formal Complaints Procedure.

2.4.3 Sending us a compliment

We are always very happy to receive compliments about our services and we ensure the staff in question, and their managers, receive a copy so they know how much their hard work is appreciated.

You can write to either the:
PALS Department or Chief Executive at
Russells Hall Hospital,
Dudley,
West Midlands
DY1 2HQ.

You can email your compliment to PALS at pals@dgh.nhs.uk.
This information can be found on the Trust website at http://dudleygroup.nhs.uk/patients-and-visitors/advice-complaints-and-compliments/

2.5 INFORMATION GOVERNANCE

The Trust recognises the need for an appropriate balance between openness and confidentiality in the management and use of information. The Trust fully supports the principles of corporate governance and recognises its public accountability, but equally places importance on the confidentiality of and the security arrangements to safeguard both personal information about patients, staff and commercially sensitive information. The Trust also recognises the need to share patient's information with other health organisations and other agencies in a controlled manner consistent with the interests of the patient, and in some circumstances, the public interest. Any sharing will be done lawfully within Dudley's Information Sharing Protocols.

The Trust believes that accurate, timely and relevant information is essential to deliver the highest quality health care. As such it is the responsibility of all clinicians, managers and staff to ensure and promote the quality of information and to actively use information in decision making processes.

Information will be defined as, and where appropriate kept confidential, underpinning the principles of Information Governance and the provisions of the Data Protection Act 1998 and the Human Rights Act 1998.

Non-confidential information and services will be available to the public through a variety of means including the Trust's internet based Publication Scheme under the Freedom of Information Act 2000 and in line with the Trusts Freedom of Information Policy.

Patients will have access to information relating to their own health care, options for treatment and their rights as patients. There will be clear procedures and arrangements for handling queries from patients and the public. The Trust ensures compliance with the Data Protection Act 1998, Human Rights Act 1998, Access to medical records 1990 (deceased patients) and the Freedom of Information Act 2000.

The Trust has in place clear procedures and arrangements for liaison with the press and broadcasting media.

Integrity of information will be developed, monitored and maintained to ensure that it is appropriate for the purposes intended. Availability of information for operational purposes will be maintained and within set parameters relating to its importance via appropriate procedures and computer system resilience. Compliance with legal and regulatory framework will be achieved, monitored and maintained through the Information Governance Toolkit and the Caldicott and Information Governance Group.

The Trust undertakes risk assessment in conjunction with overall priority planning of organisational activity will be undertaken to determine appropriate, effective and affordable information governance controls are in place.

The Trust have established policies for the controlled and appropriate sharing of patient information with other agencies, taking into account relevant legislation (e.g. Health and Social Care Act, Crime and Disorder Act, Protection of Children Act). These policies are regularly updated to take account of new guidance such as the Climbié Report.

The Trust has in place regularly updated policies and procedures to ensure compliance with the Data Protection Act 1998, Human Rights Act 1998, the common law duty of confidentiality and the Freedom of Information Act 2000.

3 USE OF THE LABORATORY

3.1 REQUESTING

We provide a wide range of tests, details of which may be found in each particular section within this document. Please contact us if you require any specific advice or guidance regarding your requests.

To avoid any unnecessary delays, please ensure that:

- Request forms are completed accurately and legibly with enough information to definitively identify the patient (name, DOB, NHS number and address) and who requested the test (the GP and / or consultant).
- Specimens are clearly and accurately labelled, packed correctly and where applicable lids securely fastened.
- Separate specimens have been collected when the same specimen type is required for different tests (see 'Specimen Collection' below for further guidance)

Please note that in some circumstances the laboratory may not be able to accept mislabelled specimens or inaccurate request forms as this can lead to errors.

The provision of relevant clinical details is also encouraged wherever possible to ensure that the most appropriate tests are performed and to aid interpretation.

N.B. The date and time of collection must be entered clearly on all request forms. Results without a time of collection are displayed in Soarian with a time of 00:00 and may not appear in chronological order. This could result in the mismanagement of the patient and has already resulted in several critical incidents.

There is an electronic requesting system called 'TQuest'. Any enquiries regarding the use of this system should be made to PathologyIt@dgh.nhs.uk

3.1.1 Request forms

It is **essential** that correct and relevant information is provided on the request form. This includes:

- Patient's full name, date of birth and NHS or hospital number
- Clinical details where appropriate
- Specimen collection time / date
- Sufficient contact details for correct reporting of results, including name and bleep number where appropriate

Requests can be made using the following request forms:

- Haematology and Clinical Biochemistry use a single, combined request form. This form is split into colour-coded sections corresponding to each particular department – red, & green respectively.

- Blood Transfusion – red and white request form with integral specimen bag
- Immunology – light blue and white form
- Microbiology – blue and white request form with integral specimen bag
- Histology – A4 white form
- Cytology (non-gynaecological) – A4 white form

The use of printed (use an addressograph label) rather than hand-written information on forms is encouraged wherever possible. Forms must be signed by the requesting GP or consultant unless previously agreed. Exceptions would include specialised screening, such as urology pre-op assessments, and MRSA screens.

3.1.2 Specimen Labelling

Specimens must be clearly labelled, with details matching those on the associated request form, after confirmation with the patient. As a minimum requirement, specimens must be labelled with:

- Patient's full name – surname & first name
- Date of birth AND Hospital / NHS number (excluding Blood Transfusion requests)

3.1.3 Blood Transfusion Requests

Pre-printed labels are now acceptable on the request form providing the patient's full name is also **handwritten** on the label to confirm the patient identity. All request forms must include the following details: full name, date of birth, registration number, address, location of patient and signed by requesting MO. Sample collector details must also be filled in, sign and print name on the request form.

Pre-printed labels **must not be used** on the specimen. Specimens must be labelled by hand with details as above plus date and time of collection.

Specimens must be signed by person taking the blood. This person must check all patient details to ensure they are correct, by questioning the patient and checking the wrist-band.

3.1.4 Electronic Requesting

The facility to electronically request pathology tests is available to local GP surgeries for all routine Haematology, Biochemistry, Immunology, Serology and Microbiology requests.
For more information please contact our IT team at pathology.IT@dgoh.nhs.uk.

3.2 SPECIMEN COLLECTION

Where more than one blood specimen is to be taken, the order of collection must be as stated - failure to do so may result in specimen contamination:

1. Blood culture bottles
2. Blood tubes – in the order stated in the table below

Table 1: Order of collection and type of tubes for blood specimens

Volume	Cap colour	Cap ring colour	Tube type	Tests	Special instructions
3.5 mL	 Blue	 Black	Sodium citrate	All routine coagulation, prothrombin time, APTT, Fibrinogen, INR, D-Dimer, lupus anticoagulant (2 tubes)	Fill to the line and mix well (Smaller volume tubes available on request. Under/over filled tubes will be rejected).
6 mL	 Red	 Black	Clotting accelerator	All routine Microbiology – including antibiotic assays, rubella, viral studies, hepatitis, HIV Biochemistry: Calcitonin	Please use blue Microbiology form Send separate tube for Biochemistry
4 mL	 Ochre	 Ochre	Clotting accelerator and separation gel	All routine Biochemistry (except glucose) Haematology: B12, Folate, Ferritin, glandular fever screen and erythropoietin.	Fill to the line and mix well Send separate tube for Haematology and erythropoietin.
4 mL	 Ochre	 White	Clotting accelerator and separation gel	All routine Immunology	Send separate tube for Immunology
4 mL	 Green	 Black	Lithium heparin	Renin*, high potassium study Chromosome studies (separate tube required)	Fill to the line and mix *Plasma must be frozen within 10 minutes •Tube must contain Trasylol
4 mL	 Lavender	 Black	EDTA	Haematology: FBC, ESR, Retics, HbS, G6PD, Hb electrophoresis, Malarial parasites, RBC folate (+ 4ml gel (yellow)), Factor V Leiden, antenatal screening (+ 2 x 6ml EDTA (pink)), cord blood for Kleihauer. Biochemistry: PTH (+ 4ml gel (yellow)), ACTH*, Genetic tests, Gut hormones•.	Fill to the line and mix *Plasma must be frozen within 10 minutes Send separate tube for Biochemistry *Plasma must be frozen within 10 minutes
6 mL	 Pink	 Black	EDTA	All routine blood bank tests including group and antibody screen, crossmatch and maternal blood for Kleihauer Plasma viscosity (separate tube required)	Blood Bank tube must be handwritten and labelled with **Name**, **Date of birth**, **Unit number/NHS number, date & time of collection** and **signed.**
2 mL	 Grey	 White	Fluoride oxalate	Glucose, HbA1c, alcohol, lactate	Mix the tube well
6ml	 Dark Blue	 Black	Sodium Heparin	Trace elements (manganese, zinc, copper, selenium)	Mix the tube well

All tubes must be filled to the appropriate level. Once collected, specimens should be put into appropriate specimen bags, with the specimens and form in separate pockets.
More detailed guidance on specimen collection can be found in the relevant sections below.

3.2.1 Paediatric tubes

Paediatric tubes are the tubes of choice to be used in neonates and paediatrics when only a small amount of blood has been obtained. They are not intended to be used for adults with poor venous access.
Advice is available from the laboratory on volumes required for each test.

Table 2: Paediatric tubes

Cap colour	Tube type	Tests	Special instructions
 Pink	EDTA	Haematology: FBC, retics, HbS, G6PD, Hb electrophoresis, malarial parasites. Microbiology: Meningococcal PCR	Fill the tube and mix well.
 Red	Plain	Microbiology: all routine Microbiology including antibiotic assays, rubella, viral studies, hepatitis, HIV (not thumb prick). Immunology: all routine Immunology; for allergy testing please contact Immunology Haematology: Glandular fever screen, B12, folate, ferritin	Please use blue Microbiology request form. Fill the tube
 Green	Heparin	All routine Biochemistry (except glucose), including ammonia. Haematology: Chromosome studies.	Fill the tube and mix well.
 Yellow (with cone insert)	Fluoride Oxalate	Biochemistry: Glucose, HbA, alcohol, lactate.	Fill the tube and mix well.
 Pink	EDTA	Haematology: Group, cross match, antibody screen, DCT.	Tube must be hand-written labelled with **Name**, **Date of birth**, **Unit number/NHS number and signed.**

3.2.2 Avoiding sharps injuries

- Never place any sharps in specimen bags. All sharps must be discarded into sharps containers at the site of use
- Management of needle stick injuries should include immediate first aid, washing the injury in running water and encouragement of bleeding. Exposure to HIV must be dealt with urgently with post-exposure prophylaxis.
- All needle stick injuries involving DGOH staff must be dealt with in accordance with Trust infection control policies, including immediate referral to Occupational Health for consultation.

3.3 SPECIMEN TRANSPORTATION

There are a number of transport routes available via which specimens may be delivered to Pathology.
Please note that any specimens collected out of hours will need to be delivered directly to the laboratory.

3.3.1 Within Russells Hall Hospital

Porters collect specimens from wards and deliver them to the laboratory at Russells Hall Hospital on request to the Interserve Help Desk – extension 1234.

The **Pathology Air Tube Delivery System** links directly to the main specimen reception areas within the department, each of which has a unique 3 digit address. Use of the most appropriate address will avoid any unnecessary delays:

Biochemistry Haematology Immunology	**074**
Cytology	**051**
Microbiology	**075**

Specimens must be suitably bagged and placed into a carrier, taking care that the carrier is correctly closed. **Under no circumstances** must items be placed in the funnel without a carrier. The carrier is then placed into the despatch tube, and will be automatically sent as soon as the system is free – the status of the system is indicated by a series of lights:

Green	Carrier leaving your station
Yellow	Carrier arriving at your station
Red	System in use

Do not attempt to use the system without appropriate training, or if you are unsure of what to do. For training and help please contact the Interserve Helpdesk on extension 1234.
To ensure the safety of all staff, and in accordance with the DGOH Infection Control Policy, the air tube delivery system **must not be used for the transport of**:

- specimens from high risk patients
- blood cultures
- CSF (cerebro spinal fluid) specimens
- Histology specimens

3.3.2 From GP surgeries

Work from GP surgeries is transported to Russells Hall Hospital via the courier services (operated by Interserve and the CCG) which calls at practices once a day at an appointed time between 9.00 am and 3.15 pm.

3.3.3 From Corbett / Guest Hospitals

During normal working hours (Monday – Friday), routine work will be transported to Russells Hall Hospital by scheduled transport:

Corbett to Russells Hall		Guest to Russells Hall	
Depart	**Arrive**	**Depart**	**Arrive**
09:30	10:00	10:10	11:15

10:45	11:15	11:55	12:20
13:20	13:40	14:00	14:20
15:15	15:45	16:30	16:45
17:10	17:45		

3.3.4 General safety precautions for transporting specimens

- All specimens must be securely closed, clearly labelled and sealed into specimen bags.
- Specimens for transport to laboratory must be sealed in a separate outer bag. They must be kept separate from mail.
- All request forms and specimens from high-risk patients **MUST** be labelled with Special Precautions or Danger of Infection labels and details of the risk stated on the request form to enable appropriate tests to be performed and precautions taken. These include:
    - HIV
    - hepatitis B/C
    - iv drug user
    - Tuberculosis
    - Salmonella typhi
    - nV CJD and CJD
- Containers for tissue in formalin must be securely closed and labelled with appropriate COSHH stickers.

Unsafe specimens which have broken or leaked will not be processed.

3.4 URGENT REQUESTS

Arrangement and contact details for urgent work will vary depending on the test required and whether the request is made within normal working hours or during a period covered by an out of hours service. Please see the relevant sections below for more details.

3.5 OUT OF HOURS SERVICE

Each night and at weekends, an out of hour's service operates from Russells Hall Hospital for Biochemistry, Haematology, and Microbiology requests. This service is designed to provide results required for the immediate management and treatment of patients outside normal laboratory hours.

The Biomedical Scientist (BMS) on duty must be contacted via the Trust Switchboard and urgent requests discussed directly, giving the reasons for the degree of urgency, so that work can be prioritised.

In life-threatening situations, such as major trauma requiring blood transfusion, requests should be classed as "Immediate". The BMS on duty will then ensure priority is given to the immediate request. When making immediate requests, please provide all available details including patient's full name, date of birth and hospital or NHS number, as this can also save time. Due to the reduced staffing levels available during out of hours periods, please double-check that any immediate request is necessary prior to request to enable us to prioritise the most urgent specimens appropriately.
Please see the relevant sections below for more details.

3.6 REPORTING OF RESULTS

All results are available as paper reports and in an electronic format, either via Keystone or available on Soarian. In addition, users who request electronically also have access to a database of previous requests and results.

There are two main sources of uncertainty attached to the measurement of analytes. One area is uncertainty associated with pre-analytical processes and the second area is the variation (or imprecision) due to the analytical process in the laboratory and biological variation within and between individuals.

4 PHLEBOTOMY SERVICES

The Department of Pathology provides an extensive phlebotomy service for inpatients, outpatients, and out in the local community. This includes a limited domiciliary service.

4.1 INPATIENTS

Russells Hall Monday – Saturday
Request forms **must** be available on the ward at 07.00 hours.

Bushey Fields Tuesday & Thursday
Request forms from Bushey Fields are sent by porter to the laboratory.

4.2 OUTPATIENTS / GP PATIENTS

Blood test opening times

Corbett Outpatient Centre

Monday to Friday from 8am to 6pm

Guest Outpatient Centre

Monday to Friday from 8am to 1pm

Russells Hall Hospital

	Morning 8am-12 noon	Afternoon 12 noon-5pm	Evening 5pm-7.30pm
Monday	OPEN	OPEN	OPEN
Tuesday	CLOSED	CLOSED	OPEN
Wednesday	OPEN	OPEN	OPEN
Thursday	CLOSED	OPEN	OPEN
Friday	CLOSED	OPEN	OPEN
Saturday	OPEN 8am – 10am		

When the service is closed at Russells Hall Hospital you can still have a blood test at Corbett and Guest outpatient centres at the times indicated.

Please note:

- Children under the age of 10 cannot attend for a blood test after 5.30pm **and not on Saturdays**
- Oral glucose tolerance tests are **by appointment only** and undertaken only at Russells Hall. Appointments can be arranged by ringing 01384 456111 extension 2055.

4.3 LOCALLY-BASED SERVICES

We currently provide a number of practices with phlebotomy services, either to bleed patients at the surgery or to collect blood at the patient's home. Appointments are required and can be booked by contacting the appropriate practice.
Below are details of all the locally based phlebotomy services currently provided by the Department of Pathology.
For further details, or to enquire about setting up a phlebotomy service, please contact Susan Rides on 01384 244091.

Community Phlebotomy Clinic Locations

Wychbury Medical Centre (01384) 322300
Kingswinford Medical Practice (01384) 271241
Feldon Lane Surgery (01384) 244330
Hawne Lane Surgery (01384) 244330
The Limes Medical Centre (01384) 426929
Moss Grove Surgery (01384) 277377
Lion Health (01384) 322222
Three Villages Medical Practice (01384) 244330
St Margaret's Well Surgery (01384) 244330
Brierley Hill Health & Social Care Centre (01384) 244330
Cross Street Health Centre (01384) 459500
Ladies Walk Clinic (01902) 575957
Netherton Health Centre (01384) 244330

4.4 SURGERY-BASED CLINICS

We can also provide in-surgery Anticoagulant clinics to practices with sufficient patients on Warfarin. Patients can be seen, tested and dosed within the surgery.
For further details, or to enquire about setting up a clinic, please contact Susan Rides on 01384 244091.

5 POINT OF CARE TESTING (POCT)

The Department of Pathology is responsible for the co-ordination of all POCT processes across the DGNHSFT and certain outlying non-Trust locations, including staff training and technical support. POCT refers to a wide range of equipment and processes used outside the traditional laboratory setting to perform analytical testing, from simple urine dipstick tests to sophisticated desktop analysers.
Training sessions are designed to cover key issues such as Quality Control, External Quality Assessment, calibration and maintenance in addition to instructions for safe use.

We can also provide support to GPs in the use and management of POCT, from general advice to fully managed services.

6 CLINICAL BIOCHEMISTRY

6.1 SUMMARY OF SERVICE

The Department of Clinical Biochemistry offers an extensive range of tests including hormones, drugs, special proteins and genetic analysis.
The Consultant Chemical Pathologist, the Associate Specialist and the senior clinical scientific staff provide a clinical advisory service for both in-patients and out-patients. The medical team provide clinical advice during normal and out of hours both on the telephone and at the bedside. Facilities for 'day case' dynamic function tests for endocrine and other disorders are available and require written referral to the Consultant Chemical Pathologist.

6.1.1 Clinical Services

The Consultant Chemical Pathologist has four out-patient clinics per week for lipid, obesity and metabolic disorders. Referral to these clinics should be in writing to the Consultant or through the Choose and Book system. Referrals for dynamic function tests, other than oral glucose tolerance tests, should be in writing to the Consultant.

6.2 CONTACT DETAILS

	Internal extension	External (01384)
General enquiries and results	2086	244086
Dr Mourad Labib **Dr Helen Ashby** Consultant Chemical Pathologist	2079	244079
Secretary to Dr Labib	2078	244078
Dr Angela Haddon Associate Specialist	2078	244078
Dr Anna Sanders Principal Clinical Scientist	2081	244081

6.3 REQUESTING BIOCHEMISTRY

All requests require completion of the combined Biochemistry/Haematology request form. Please provide any details of drugs and IV therapy where appropriate. Drugs may interfere with laboratory tests and failure to appreciate this may not only affect the results obtained but also have legal consequences.

For suspected acute coronary syndromes, please collect a blood specimen for troponin I. The date / time of specimen collection must be stated on the request form.

For therapeutic drug monitoring the dose, date/time of last dose and date/time of specimen collection must be stated.

6.3.1 Adding on tests

When all requested tests are complete, blood samples are stored refrigerated for up to 4 days. Provided the correct specimen type was collected initially, certain tests can be added on after the initial investigations are complete. Please telephone the laboratory to discuss your requirements. If you wish to add tests on, please telephone 2482 or bleep the on call biochemist out of hours.

6.3.2 Urgent Requests

During working hours and out of hours up until midnight, there is no need to notify the laboratory unless results are required in less than 1 hour. After midnight, the duty BMS must be contacted by bleep via the hospital switchboard.

6.4 AVAILABLE TESTS

6.4.1 Turnaround times

Unless a test is available out of hours, the turnaround time includes only working days i.e. Monday to Friday.

The reproductive hormones, especially prolactin, and thyroid function tests may generate further tests depending on initial results. The turnaround time for these may then be slightly longer than stated.

A small number of tests are referred to other laboratories - please contact the laboratory for the expected turnaround time.

6.4.2 Reference ranges

These are reported with each result - details can also be found in the table below. If further information is required, please contact the laboratory.

6.4.3 Patient information sheets

These are available upon request for the following:

- Glucose tolerance tests
- 24 hour urine collection
- Sweat tests
- 5HIAA dietary instructions

6.4.4 Uncertainty of measurement

There are two main sources of uncertainty attached to the measurement of analytes. One area is uncertainty associated with pre-analytical processes and the second area is the variation (or imprecision) due to the analytical process in the laboratory and biological variation within and between individuals.

Pre-analytical sources of uncertainty include posture of the patient, tourniquet application time, bleeding the right patient, labelling blood tubes correctly, using the right preservatives and anti-coagulants if required and minimising transport delays.

The contribution to the uncertainty of measurement associated with biological variation is determined by the physiology of the subjects observed and this uncertainty is caused by the inherent biological variation around the homeostatic set point. Factors contributing to biological variation include biological rhythms, puberty, menopause, age and gender. Similarly, the analytical variation will be determined by a number of factors, for example the method of analysis and calibration of the analysers. Together, biological and analytical variation determines the ‘critical difference’ which is a measure of the value by which two consecutive measurements on the same patient of the same analyte must differ to be considered a statistically significant change in the results.

Therefore, the pre-analytical processes, biological and analytical variation together all contribute to the uncertainty of measurement. Please contact the laboratory if you require further information.

6.4.5 Available Tests

The table below details the main tests provided by the laboratory.
For any other tests not listed below, or for test specific information regarding specimen requirements, please contact the department directly.

Click a letter to navigate through the test list:

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Profiles

Renal Profile	Sodium, potassium, urea, creatinine and eGFR.
Liver Profile	ALT, alkaline phosphatase, albumin and bilirubin.
Bone Profile	Calcium, adjusted calcium, phosphate, alkaline phosphatase and albumin.

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
17-Hydroxy progesterone	Serum, yellow top	Neonates (2-10 days): 0.7-12.4 Females: follicular phase: 0.7-3.1; luteal phase: 4.2-17.4 Males: 0.9-4.1	nmol/L	Referred	
5HIAA	Urine, 24 hour with acid	0-45	µmol/24h	8 days	
ACE	Serum, yellow top	5-58	U/L	4 days	
ACTH	EDTA plasma	Please contact the laboratory	ng/L	Referred	
AFP	Serum, yellow top	0.7-6.3	kU/L	4 days	
Albumin	Serum, yellow top	35-50	g/L	Same day	Yes
Albumin/creatinine ratio (ACR)	Urine, random, plain	In diabetic nephropathy: proteinuria is defined as Females: >3.5 Males: >2.5 In CKD: proteinuria is defined as a protein excretion of >30.	mg/mmol creatinine	1 day	
Alcohol	Fluoride oxalate		mg/100 mL	Same day	Yes

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
Alkaline phosphatase					
Total	Serum, yellow top	Females up to 4 years: 145-320 up to 7 years: 150-380 up to 10 years: 175-420 up to 12 years: 130-560 up to 14 years: 105-420 up to 16 years: 70-230 up to 20 years: 50-130 over 20 years: 40-120 Males up to 4 years: 135-320 up to 7 years: 150-380 up to 10 years: 175-420 up to 12 years: 135-530 up to 14 years: 200-495 up to 16 years: 130-525 up to 20 years: 65-260 over 20 years: 40-120	IU/L	Same day	Yes
Bone alkaline phosphatase		Premenopausal females: 11-30 Male and postmenopausal females: 14-40	IU/L	8 days	
Alpha-1 acid glycoprotein	Serum, yellow top	0.45-1.10	g/L	1 day	
Alpha-1 antitrypsin	Serum, yellow top	0.9-2.0	g/L	1 day	

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
ALT (alanine transaminase)	Serum, yellow top	7-56	IU/L	Same day	Yes
Amino acids	Heparin plasma (green top)	Interpretation given on each report		Referred	
	Urine, random, plain				
Ammonia	Heparin plasma (green top)	Premature neonates: <150 Term neonates: <100 Infants and children: <40	µmol/L	Same day	Yes
Amylase	Serum, yellow top	25-125	IU/L	Same day	Yes
	Urine, 4 hour with no preservative	0-17	IU/h	Same day	Yes
Androstenedione	Serum, yellow top	Adult females: 1.0-11.5 Adult males: 2.1-10.8	nmol/L	8 days	
Antenatal screening	Serum, yellow top	Interpretation given on each report		Referred	
Apo E genotyping	EDTA	Interpretation given on each report		Contact laboratory	
AST	Serum, yellow top	15-45	IU/L	Same day	Yes
Beta-2 microglobulin	Serum, yellow top	0.6-2.6	mg/L	4 days	
Beta-hydroxy butyrate	Fluoride oxalate	Interpreted in relation to other results	mmol/L	Referred	

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
Bicarbonate	Serum, yellow top	22-29	mmol/L	Same day	Yes
Bile acids	Serum, yellow top	0-14 µmol/L in pregnancy	µmol/L	4 days	
<u>Bilirubin</u> Total	Serum, yellow top	>1 month: 3-22	µmol/L	Same day	Yes
Conjugated bilirubin		<1 month: 0-10 >1 month 0.6			
Bilirubin Urobilinogen	Urine, random, plain, protect from light	Interpretation given on each report		1 day	
<u>Blood Gases</u> Base excess	Heparinised gas syringe	±3	mmol/L	1 hour	Yes
Bicarbonate		22-28	µmol/L		
Hydrogen ion concentration		38-45	nmol/L		
pCO2		4.5-6.1	kPa		

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
pH		7.35-7.42			
pO2		12-15	kPa		
CA 15-3	Serum, yellow top	0-28	U/mL	4 days	
CA 19-9	Serum, yellow top	0-19	U/mL	4 days	
Caeruloplasmin	Serum, yellow top	0.2 - 0.6	g/L	Referred	
Calcium	Serum, yellow top	2.1-2.6	mmol/L	Same day	Yes
	Urine, 24 hour with acid	2.7-7.5	mmol/24h	1 day	
Carbamazepine	Serum, yellow top	4-12 pre-dose	mg/L	4 days	
Catecholamines	Urine, 24 hour with acid			8 days	
Normetadrenaline		0-3.3	µmol/24h		
Noradrenaline		100-600	nmol/24h		
Adrenaline		0-100	nmol/24h		
Metadrenaline		0-1.2	µmol/24h		

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
Dopamine		0-3500	nmol/24h		
CEA	Serum, yellow top	Non-smokers: up to 3.1 Smokers: up to 6.2	µg/L	4 days	
Chloride	Serum, yellow top	95-105	mmol/L	Same day	Yes
Cholesterol	Serum, yellow top	Based on current National guidelines	mmol/L	Same day	Yes
<u>Cholinesterase</u> Dibucaine Number	Serum, yellow top	70-100	%	Referred	
Fluoride Number		38-100	%		
Propranol Number		0-20	%		
Ro Number		94-100	%		
Chromium	EDTA	<40 (MHRA threshold [7ppb] = 135)	nmol/L	Referred	
Ciclosporin	EDTA	Please contact the laboratory. Collect immediately pre-dose.	µg/L	Referred	
CK	Serum, yellow top	0-170	IU/L	Same day	Yes
<u>Complement</u> C3	Serum, yellow top	0.75-1.65	g/L	1 day	

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
C4		0.2-0.65	g/L		
Cobalt	EDTA	<10 (MHRA threshold [7ppb] = 120)	nmol/L	Referred	
Connexin gene analysis	EDTA	Interpretation given on each report		Referred	
Copper	Plasma, dark blue top	<6 months: 5.9-16.3 <1 year: 3.8-23.8 females >1 year: 14.2-35.0 males >1 year: 12.1 - 25.8	µmol/L	Referred	
	Urine, 24 hour, no preservative	0-0.9	µmol/24h	Referred	
Cortisol	Serum, yellow top	09:00 hours 280-700 24:00 hours <280 In adults, if adrenal insufficiency is suspected and serum cortisol is less than 550 nmol/L suggest proceed to short synacthen test.	nmol/L	2 days	
	Urine, 24 hour, no preservative	22-230	nmol/24h	8 days	
C-reactive protein	Serum, yellow top	0-5	mg/L	Same day	Yes
Creatinine	Serum, yellow top	females: 50-90 males: 60-115	µmol/L	Same day	Yes
	Urine, random, plain	Please contact the laboratory	mmol/L	Same day	Yes

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
	Urine, 24 hour with thymol	Please contact the laboratory	mmol/24 h	1 day	
CSF glucose	Fluoride oxalate	Please contact the laboratory	mmol/L	Same day	Yes
CSF lactate	Fluoride oxalate	Please contact the laboratory	mmol/L	Same day	Yes
CSF protein	CSF in plain universal	0.12-0.6	g/L	Same day	Yes
Cystic Fibrosis gene analysis	EDTA	Interpretation given on each report		Referred	
DHEAS	Serum, yellow top	Adult females: 0.9-11.7 Adult males: 2.2-15.2	µmol/L	8 days	
Digoxin	Serum, yellow top	0.5-2.0, 6-8 hours post dose	µg/L	Same day	Yes
Drugs of abuse	Urine, random, plain	Please contact the laboratory		Referred	
Elastase	Faeces, random	Interpretation given on each report	µg/g	Referred	
Faecal occult blood	Hema-screen wipes (available from laboratory)	Interpretation given on each report		2 days	
FSH	Serum, yellow top	Adult females: follicular: 1-9; ovulatory: 6-26; luteal: 1-9; post-menopausal: 30-118. Adult males: 1-7	IU/L	2 days*	

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
GGT	Serum, yellow top	12-58	IU/L	Same day	Yes
Gilbert's syndrome genetics	EDTA	Interpretation given on each report		Contact lab	
<u>Glucose</u>					
Glucose, fasting or random	Fluoride oxalate	If fasting glucose >= 7.0 mmol/L or random >11.0 mmol/L consider diabetes. If random between 5.5 and 11.0 repeat after fasting.	mmol/L	Same day	Yes
Postprandial glucose		In pregnancy, if 2 hour postprandial glucose>=6.0 mmol/L please refer patient to antenatal clinic for GTT.			
Glucose tolerance test	Test by appointment only. Telephone 01384 244055 or contact the laboratory for information.	If standard protocol of 75g anhydrous glucose given: 2 Hour glucose 7.8-11.0 suggests impaired glucose tolerance 2 Hour glucose >11.0 suggests diabetes mellitus.		1 day	
Growth hormone	Serum, yellow top	0-1.8	µg/L	8 days	
Haemochromatosis gene analysis	EDTA	Interpretation given on each report		Referred	
Haptoglobin	Serum, yellow top	0.3-1.9	g/L	8 days	
HbA1c	Fluoride oxalate	DCCT aligned: 4.0-6.0 IFCC: 20-42	% mmol/mol	1 day	

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
HCG	Serum, yellow top	0-0.5	IU/L	4 days	
HDL	Serum, yellow top	Based on current National guidelines	mmol/L	Same day	Yes
IGF	Serum, yellow top	Please contact the laboratory	nmol/L	8 days	
Insulin	Serum, yellow top	Interpreted in relation to plasma glucose	pmol/L	Referred	
Iron	Serum, yellow top			1 day	
Iron		Females: 7-30 Males: 9-32	µmol/L		
Iron saturation		Females: 15-50 Males: 20-55	%		
TIBC		Females: 47-89 Males: 47-83	umol/L		
Lactate	Fluoride oxalate	0.7-2.1	nmol/L	Same day	Yes
Lamotrigine	Serum, yellow top	0-4	mg/L	Referred	
LDH	Serum, yellow top	225-550	IU/L	Same day	Yes
Lead	EDTA	Environmental exposure <10 (<0.48) Industrial exposure <30 (<1.45)	µg/100 mL (µmol/L)	Referred	

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
LH	Serum, yellow top	Adult females: follicular: 2.6-19.0; ovulatory: 22.6-114; luteal: 1.0-28; post-menopausal: 15.6-89 Adult males: 2.2-13.3	IU/L	2 days*	
Lithium	Serum, yellow top	0.4-1.0 at 12 hours post dose	mmol/L	Same day	Yes
Magnesium	Serum, yellow top	0.7-0.95	mmol/L	Same day	Yes
Manganese	Plasma, dark blue top	children < 1 year: 127-328 children > 1 year: adults: 73-218	nmol/L	Referred	
Oestradiol	Serum, yellow top	Adult females: follicular: 80-367; ovulatory: 727-2543; luteal: 697-990; post-menopausal: 117-268 Adult males: 35-275	pmol/L	2 days*	
Oligoclonal bands	CSF, plain	Simultaneous serum specimen required. Interpretation given on each report		Referred	
Organic Acids	Urine, random, plain	Interpretation given on each report		Referred	
Osmolality	Serum, yellow top	275-295	mmol/Kg	1 day	
	Urine, random, plain	Please contact the laboratory		1 day	
Ovarian tumour marker (CA 125)	Serum, yellow top	0-33	U/mL	4 days	

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
Oxalate	Urine, 24 hour with acid	females: 0.04-0.32 males: 0.08-0.49	mmol/24 h	Referred	
		<1 year: 4-98 <4 years: 4-72 <12 years: 3-71 >12 years:1-38	µmol/mmol creatinine		
Paracetamol	Serum, yellow top	Please contact the laboratory	mg/L	Same day	Yes
Phenobarbitone	Serum, yellow top	15-40	mg/L	Referred	
Phenytoin	Serum, yellow top	10-20, pre-dose	mg/L	4 days	
Phosphate	Serum, yellow top	0.8-1.4	mmol/L	Same day	Yes
	Urine, 24 hour with thymol	Please contact the laboratory	mmol/24 h	1 day	
Porphyrins Porphyrin	Urine, random, plain (protect from light)	Interpretation given on each report	nmol/L	2 days	
Porphobilinogen			µmol/L		
Potassium	Serum, yellow top	3.6-5.3	mmol/L	Same day	Yes
	Urine, 24 hour with thymol	Please contact the laboratory	mmol/24 h	1 day	

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
	Urine, random, plain	Please contact the laboratory	mmol/L	1 day	
Progesterone	Serum, yellow top	Adult females: follicular: 0.8-4.8; luteal: 12-89	nmol/L	2 days	
Prolactin	Serum, yellow top	Adults: 0-445	mU/L	2 days*	
Protein					
Total Protein	Serum, yellow top	65-83	g/L	Same day	Yes
Protein/creatinine ratio (PCR)	Urine, random, plain	In CKD, proteinuria is defined as a ratio of ≥45, on more than one occasion	mg/mmol creatinine	1 day	
Protein	Urine, 24 hour with thymol	In CKD, proteinuria is defined as a protein excretion of >0.5	g/24 h	1 day	
PSA	Serum, yellow top	0-4	µg/L	2 days	
PTH	EDTA plasma	1.68-9.16	pmol/L	4 days	
Reducing substances	Urine, random, plain	Interpretation given on each report		2 days	
Salicylate	Serum, yellow top	Please contact the laboratory	mg/L	Same day	Yes
Selenium	Plasma, dark blue top	0-30 days: 0.4-0.7 Up to 5 years: 0.6-1.1 Up to 16 years: 0.7-1.5 Adults: 0.9-1.7	µmol/L	Referred	

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
SHBG	Serum, yellow top	Females: 18-114 Males: 13-71	nmol/L	2 days*	
Sodium	Serum, yellow top	133-146	mmol/L	Same day	Yes
	Urine, random, plain	Please contact the laboratory	mmol/L		
	Urine, 24 hour with thymol	Please contact the laboratory	mmol/24 h	1 day	
Sweat test	By appointment only, please contact the laboratory	A sweat chloride of less than 40 is normal and there is a low probability of CF. Intermediate chloride concentrations of 40-60 are suggestive but not diagnostic of CF. A sweat chloride concentration of greater than 60 supports the diagnosis of CF.	mmol/L	1 day	
Tacrolimus	EDTA	Please contact the laboratory. Collect immediately pre-dose.	µg/L	Referred	
Testosterone	Serum, yellow top	Adult female: 0-2.8 Adult Males: 20-49 years: 9.1-55.2; over 49 years: 6.3-26.3	nmol/L	2 days*	
Theophylline	Serum, yellow top	0-5 years: 0-13 over 5 years: 10-20, pre-dose or 4 hour post- dose	mg/L	Same day	Yes

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
Thiopurine methyl transferase (TPMT)	EDTA	deficient: <10 low: 20-67 normal: 68-150 high: >150 NB recent blood transfusions may mask a deficient result.	mU/L	Referred	
<u>Thyroid (TSH front line)</u> FT3	Serum, yellow top	3.2-5.9	pmol/L	3 days	
FT4		10.6-21.0	pmol/L		
TSH		0.4-4.0	mIU/L		
Triglycerides	Serum, yellow top	0.2-2.0 (fasting)	mmol/L	Same day	Yes
Troponin I	Serum, yellow top	Check chest pain pathway for guidance	ng/L	1 hour	Yes
Urea	Serum, yellow top	2.5-7.5	mmol/L	Same day	Yes
	Urine, random, plain	Please contact the laboratory	mmol/L		
	Urine, 24 hour with thymol	Please contact the laboratory	mmol/24 h	1 day	
Uric Acid	Serum, yellow top	females: 150-400 males: 200-500	µmol/L	Same day	Yes

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
	Urine, 24 hour with thymol	Please contact the laboratory	µmol/24 h	1 day	
Valproate	Serum, yellow top	Collect pre-dose. Routine monitoring of serum sodium valproate is not recommended. The only clinical indications are suspected toxicity and non-compliance in uncontrolled patients.	mg/L	4 days	
Vitamin A	Serum, yellow top	up to 7 years: 0.70-1.50 up to 13 years: 0.90-1.70 up to 20 years: 0.90-2.50 Adult females: 0.99-3.35 Adult males: 0.77-3.95	µmol/L	Referred	
Vitamin D	Serum, yellow top	Deficient <25 Insufficient 25-75 Desirable >75	nmol/L	7 days	
Vitamin E	Serum, yellow top	up to 2 years: 11.5-24.4 up to 7 years: 7.0-21.0 up to 13 years: 10.0-21.0 up to 20 years: 13.0-24.0 Adults: 9.5-41.5	µmol/L	Referred	
Xanthochromia	CSF in plain universal, protect from light	Interpretation given on each report		1 day	

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
Zinc	Plasma, dark blue top	11-24	µmol/L	Referred	

⇧**Return to top of table**

7 HAEMATOLOGY

7.1 SUMMARY OF SERVICE

The Department of Haematology offers a comprehensive range of tests including Coagulation and Transfusion Services.
The Consultant Haematologists provide a clinical advisory service for both in-patients and out-patients.

7.2 CONTACT DETAILS

	Internal extension	External (01384)
General enquiries & results (including antenatal results)	2086	244086
Haematology & Blood Transfusion	2487 / 2488	
Mrs S Rides **Head BMS**	2091	244091
Mrs J Ford **Blood Transfusion Manager**	2758	
Mrs B Ironmonger **Assistant Head BMS (Haematology)**	2108	244108
Mrs C Tuckwell /Mrs M Wheeler **Transfusion Practitioners**	2758	
Anticoagulant Nursing Services	2380	
Anticoagulant Clinic Booking	2048	244048
Consultants:		
Dr S Jenkins Clinical Haematology	2158	
Dr S Fernandes Clinical Haematology	2581	
Dr P Harrison Clinical Haematology	2478	
Dr J Neilson Clinical Haematology	2478	
Dr R Hipkins Clinical Haematology	2478	
Dr C Taylor Transfusion Medicine	2144	

7.3 CLINICAL SERVICES

The Consultant Haematologists are always willing to discuss clinical problems and offer advice. In addition, the following clinical services are provided:

Anticoagulant Services	01384 244048
Anticoagulant Nursing Services	ext. 2380
Anticoagulant Clinic Booking	ext. 2048

7.3.1 In-Patient Anticoagulation services

The hospital in-patient dosing service provides comprehensive care for your patient. To refer a patient please complete an Anticoagulant In-reach Referral form, ensure the INR result is available on the day of referral and telephone 2380. This should be done as soon the patient comes into hospital or as soon as you wish to commence Warfarin treatment.

Following referral the Team will request INR tests and dose the patient accordingly. On discharge the Team will organise all anticoagulant follow up.

Any patient admitted to hospital already receiving anticoagulant therapy should be notified to the Team on ext. 2048 whether referred to In-Reach or not. Upon discharge a completed Anticoagulation Clinic Referral form should be sent to the Team and a discharge appointment booked by contacting ext 2048.
For anticoagulant therapy and advice contact the Anticoagulant Nursing Service on ext 2380.

7.3.2 Out-Patient Anticoagulation services

Hospital-based clinics are held at all 3 sites – appointments may be booked on 01384 244048.

Day	Time	Hospital
Monday	08:45 - 11:30	Corbett
Tuesday*	13:15 - 16:00	Russells Hall
Wednesday	08:45 - 11:30	Corbett
Thursday	09:30 - 11:30	Guest
Friday	09:00 - 11:30	Russells Hall
Saturday	10:30 - 12:30	Russells Hall

*An Anticoagulation Induction Clinic is available in the DVT suite at Russells Hall each Tuesday morning for patients new to Anticoagulant treatments.

Additional advice and dosage regimes for Warfarin and Heparin are available on the HUB.

Anticoagulant Clinics are currently provided for in thirteen GP surgeries throughout the district.
Non-ambulant patients only are catered for by a comprehensive domiciliary service, operated throughout the week.

For management of Anticoagulant Therapy please see full Anticoagulant Guidelines on The Hub.

We can also provide in-surgery Anticoagulant clinics to practices with sufficient patients on Warfarin. Patients can be seen, tested and dosed within the surgery.
For further details, or to enquire about setting up a clinic, please contact Susan Rides on 01384 244091.

7.4 CLINICAL HAEMATOLOGY

7.4.1 Out Patients

Patients can be referred to Drs Harrison, Hipkins, Neilson, Fernandes, Jenkins or Taylor. Clinics are held twice a week at Russells Hall:

Tuesday 13:30 – 17:30
Thursday 14:00 – 17:30

7.4.2 In Patients

Drs Jenkins, Harrison, Hipkins, Fernandes, Neilson and Taylor are available for consultation. They should be contacted to discuss individual cases where a haematological opinion is sought. There is a rota in place available from the secretaries.

In the first instance, contact should be made with the Specialist Registrar via the Switchboard.

7.5 REQUESTING HAEMATOLOGY

All requests require the completion of the combined Haematology/Biochemistry request form. Please provide relevant clinical details on all requests. These will be used to prioritise requests for testing.

Add-on tests Haematology:
Any additional test requests should be made to the laboratory within the following timescales:
Citrate samples within 4 hours of venepuncture.
EDTA samples within 24 hours venepuncture (request for Haemoglobinopathy screening can be made up to 72 hours from venepuncture).

7.5.1 Urgent Requests

During working hours and out of hours up until midnight, there is no need to notify the laboratory unless results are required in less than I hour. The Biomedical Scientist (BMS) on duty must be contacted via the Trust Switchboard and urgent requests discussed directly, giving the reasons for the degree of urgency, so that work can be prioritised also if blood products are required.

7.5.2 Uncertainty of measurement

There are two main sources of uncertainty attached to the measurement of analytes. One area is uncertainty associated with pre-analytical processes and the second area is the variation (or imprecision) due to the analytical process in the laboratory and biological variation within and between individuals.

Pre-analytical sources of uncertainty include posture of the patient, tourniquet application time, bleeding the right patient, labelling blood tubes correctly, using the right preservatives and anti-coagulants if required and minimising transport delays.

The contribution to the uncertainty of measurement associated with biological variation is determined by the physiology of the subjects observed and this uncertainty is caused by the inherent biological variation around the homeostatic set point. Factors contributing to biological variation include biological rhythms, puberty, menopause, age and gender. Similarly, the analytical variation will be determined by a number of factors, for example the method of analysis and calibration of the analysers. Together, biological and analytical variation determines the 'critical difference' which is a measure of the value by which two consecutive measurements on the same patient of the same analyte must differ to be considered a statistically significant change in the results.

Therefore, the pre-analytical processes, biological and analytical variation together all contribute to the uncertainty of measurement. Please contact the laboratory if you require further information.

7.5.3 Blood Bank

A separate form is required for blood-bank requests. This must be completed in full; the patient information **MUST** include full name, hospital/NHS number, date of birth and address. Even in emergency or lack of formal identification, an emergency registration number is available. Pre-printed labels are now acceptable on the request form providing the patient's full name is also **handwritten** on the label to confirm the patient identity. The

same details **MUST** be completed **BY HAND** on the patient's specimen including date and time of collection and signed by the collector, after confirming both the details with the patient and the wristband. Without this information, blood or blood products cannot be provided. Both the sample requestor and the sample collector must clearly fill in their details on the form.

Add-on tests Blood Bank:
If you have already made a Blood Bank request but wish to add on additional tests or request additional products please contact the Blood Bank for advice on extension 2488 or bleep via switchboard.

7.5.4 Antenatal blood grouping and serology requests

These specimens must be clearly labelled by hand – patient labels are NOT acceptable. The details MUST include full name, hospital/NHS number, date of birth, address, date of collection and initials of the person collecting the specimen. Without this information the blood group or any serology request cannot be provided. Pre-printed labels are now acceptable on the request form providing the patient's full name is also **handwritten** on the label to confirm the patient identity.

7.5.5 Thrombophilia Screen

When requesting thrombophilia screens, please give details of:

- reason for request
- patient's history including ALL thrombotic episodes, miscarriages, etc. and age at events
- family history including thrombotic history of close family members and dates at which thromboses occurred

BCSH Clinical Guidelines for testing for Heritable Thrombophilia are followed.
www.bcshguidelines.com

7.6 AVAILABLE TESTS

The table below details the main tests provided by the laboratory. For any other tests not listed below, please contact the department to discuss availability.

Click a heading to navigate through the test list:
Normal adult values
White cell differential
Haematinics
Coagulation studies
Factor assays
Thrombophilia screen
Blood transfusion
Haemoglobinopathy studies
Other Investigations

Please note:
* Urgent requests for these tests available within 4 hours from receipt of specimen
⬩ Urgent requests for these tests may be available within 1 hour from receipt of specimen – please discuss with the laboratory.
▫ Some tests have restricted availability

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
Normal Adult values Full Blood Count*	4 ml EDTA, purple top			4 hours	Y
Haemoglobin		Male 133 - 180 Female 120 - 160	g/l	4 hours	Y
White Cell Count		4.0 - 11.00	x 10^9/l	4 hours	Y
Red Cell Count		Male 4.62 - 6.20 Female 4.20 - 5.40	x 10^{12}/l	4 hours	Y
PCV		Male .40 - .52 Female .35 - .47	l/l	4 hours	Y
MCV		78 - 98	fl	4 hours	Y
MCH		27 - 32	pg	4 hours	Y
MCHC		320 - 360	l/l	4 hours	Y
Platelets		150 - 400	x 10^9/l	4 hours	Y
RDW		11.5 – 13.9	%	4 hours	Y

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
White cell differential					
Neutrophils		2.0 - 7.5	x 10^9/l	4 hours	Y
Lymphocytes		1.5 - 4.0	x 10^9/l	4 hours	Y
Monocytes		0.2 - 1.0	x 10^9/l	4 hours	Y
Eosinophils		0.04 - 0.44	x 10^9/l	4 hours	Y
Basophils		0.02 – 0.2	x 10^9/l	4 hours	Y
LUC (Large Unstained Cells)		0 - 0.6	x 10^9/l	4 hours	Y
ESR*	4 ml EDTA, purple top	Male 0 - 5 Female 0 - 7	mm/1st hour	4 hours	Y
Plasma viscosity	6 ml EDTA, pink top	1.5 - 1.72	M Pas	48 hours (referred)	N
Reticulocyte count*	4 ml EDTA, purple top	0.2 - 2.0 (20-100)	% (x 10^9/l)	4 hours	N
Heinz bodies	4 ml EDTA, purple top	Nil		24 hours	N
Malarial parasites blood film examination*	4 ml EDTA, purple top taken when pyrexial	Nil		24 hours	Y

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
Haematinics					
Vitamin B12	4 ml Serum, yellow top	180 – 650	ng/l	36 hours	N
Folate	4 ml Serum, yellow top	2.8 - 15.0	µg/l	36 hours	N
RBC Folate	4 ml Serum, yellow top + 4 ml EDTA, purple top	150 - 660	ng/ml	36 hours	N
Ferritin	4 ml Serum, yellow top	Male: 30 - 284 Eugonadal Female: 14 - 81 Post-menopausal female: 14 - 186	µg/l	36 hours	N
Coagulation Studies					
Prothrombin time INR	3.5 ml citrate, blue top	INR 0.8-1.2		4 hours	Y
Partial thromboplastin time (PTTK)	3.5 ml citrate, blue top	Control +/- 7 secs (ratio 0.8-1.2)		4 hours	Y
D-Dimer (for use in cases of ?PE & ?DVT)	3.5 ml citrate, blue top	Cut off for negative predictive value = 255	ng/ml	4 hours	Y
Fibrinogen	3.5 ml citrate, blue top	1.5 - 4.0	g/L	4 hours	Y

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
Factor Assays					
II	3.5 ml citrate, blue top	50 – 150	i.u/dl	28 days (referred)	N
V	3.5 ml citrate, blue top	50 – 150	i.u/dl	28 days (referred)	N
VII	3.5 ml citrate, blue top	50 – 150	i.u/dl	28 days (referred)	N
VIII	3.5 ml citrate, blue top	50 – 150	i.u/dl	7 days (referred)	N
IX	3.5 ml citrate, blue top	50 – 150	i.u/dl	7 days (referred)	N
XIII	3.5 ml citrate, blue top	50 – 150	i.u/dl	28 days (referred)	N
Ristocetin Co-factor Heparin Assay	3.5 ml citrate, blue top	Normal		28 days (referred)	N
Thrombophilia Screen					
Lupus anticoagulant (screen)	7 ml citrate (2 x blue top)	Negative		14 days	N

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
Antithrombin III	3.5 ml citrate, blue top	75 – 140	i.u/dl	28 days (referred)	N
Protein C Activity	3.5 ml citrate, blue top	66 – 122	µg/dl	28 days (referred)	N
Protein S Activity	3.5 ml citrate, blue top	70– 140	i.u/dl	28 days (referred)	N
FV Leiden	4 ml EDTA, purple top	Normal molecule		28 days (referred)	N
Prothombin 2020 Gene	4 ml EDTA, purple top	Normal molecule		28 days (referred)	N
MTHFR	4 ml EDTA, purple top	Normal molecule		28 days (referred)	N
Blood Transfusion Laboratory					
Estimation of Feto-maternal haemorrhage (Kleihauer)	6ml EDTA, pink top for maternal blood 4ml EDTA, purple top for cord blood (both hand-written, labelled with maternal details)	NA	Mls	48 hours	N
Baby Group, DAT and crossmatch	EDTA pink top microtainer	NA		24 hours	Y

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
Antenatal screening: Blood group and antibody screen, Full blood count and serology	6ml EDTA, pink top x 2 6ml serum, red top x 1 - (primary bloods only) 4ml EDTA, purple top x 1	NA		7 working days	N
Blood Group, antibody screen and hold•	6ml EDTA, pink top	N/A		24 hours	Y
Cross Match•	6ml EDTA, pink top	N/A		24 hours	Y
Direct Coombes Test•	6ml EDTA, pink top or 4 ml EDTA, purple top	N/A		24 hours	Y
Haemoglobinopathy Studies Sickle haemoglobin screen (solubility test)	4 ml EDTA, purple top	Negative		4 hours	Y
Hb electrophoresis	4 ml EDTA, purple top	A+A		72 hours	N
HbA_2 measurement	4 ml EDTA, purple top	1.8 - 3.5 (3.5 – 4.0 borderline)	%	72 hours	N
HbF measurement	4 ml EDTA, purple top	<1	%	72 hours	N
HbH preparation	4 ml EDTA, purple top	Negative		72 hours	N

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
Unstable Hb	4 ml EDTA, purple top	Negative		28 days (referred)	N
Other Investigations¨					
Glandular Fever Screening Test (and Paul Bunnell titre if positive)	4 ml Serum, yellow top + 4 ml EDTA, purple top	Negative (titre with GPK) <1/40		24 hours (+ 48 hours for PB test)	N
Cold agglutinins, including quantitation	6 ml Serum, red top collected and stored at 37°C until received in the laboratory	<1/64 @ 4°C		14 days	N
Glucose-6-phosphate dehydrogenase screen (and assay if low)	4 ml EDTA, purple top	Screen: normal activity Assay: 4.6 – 13.5	µg/Hb	24 hours (referred for assay)	N
Pyruvate Kinase Assay	4 ml EDTA, purple top	11-19	IU/gHb	21 days (referred)	N
PNH screen	4 ml EDTA, purple top	Negative		24 hours	N
Leucocyte Alkaline Phosphatase	4 ml EDTA, purple top	20-120/100 neutrophils		24 hours	N
Erythropoietin	4 ml Serum, yellow top	5-25	IU/L	28 days (referred)	N

Test	Specimen type	Reference range	Units	Turnaround time	Available out of hours?
JAK2	4 ml EDTA, purple top Separate sample to FBC.	Negative		2 months	N
Serum Light Chains	4 ml Serum, yellow top	Kappa/Lambda Ratio: 0.260 – 1.650		21 days (referred)	N
Cell Markers	4 ml EDTA, purple top Separate sample to FBC	Interpretation given on each report		14 days (referred)	N
Cytogenetics	4ml Lithium Heparin, Green top	Interpretation given on each report		Complex up to 3 months	N
Urine Haemosiderin	Universal, plain white top	Negative		48 hours	N
Vitamin B12 absorb test Schillings test part 1	Patient to Lab by appt	58Co without intrinsic factor 14-40% of dose excreted		To be arranged via Haematology Consultant	N
Bone Marrow Studies	Bone marrow aspirate/trephine biopsy is only performed where indicated following assessment by a Consultant Haematologist.				

⇧**Return to top of table**

8 CELLULAR PATHOLOGY & MORTUARY

8.1 CONTACT DETAILS

	Internal	External (01384)
Cellular Pathology results and General Enquiries	2159 / 2753 / 2034	244159 / 244033 / 244034
Technical Advice / Consumables orders	Non-Gynae Cytology: 2047 Histology: 2469 **Cervical Cytology (New Cross Hospital)**	244047 456111 x2469 **01902 695288**
Mortuary / Post-Mortem Enquiries	2387 / 2199	
Bereavement Services	2198	
Consultants:		
Dr A Youssef **Head of Department**	2465	
Dr S Ghosh	1003	
Dr S Batitang **HTA Designated Individual PM License**	2463	
Dr A Sherif	1715	
Dr V Shinde	2462	
Dr M Ahluwalia	2464	
Dr S Garai	2319	
Associate Specialist:		
Dr U Mohite	2802	
Head BMS:		
Debbie Walker	2217	244217
Secretaries:		
Claire Whitcombe **Senior Secretary Histology**	2159	244159
Support Secretaries	2034 / 2753 / 2033 2750	244034

8.2 TURNAROUND TIMES

Turnaround times for Cellular Pathology specimens are dependent on the individual requirements of each specimen.

For histology specimens the normal technical turnaround in the laboratory is within 48 hours. Additional to this is the reporting time which is dependent upon the complexity of the case and individual specimen requirements.

Sometimes, it may be appropriate to send samples away for a specialist opinion this inevitably delays the diagnosis. Usually in these circumstances, the clinician will be made aware of the delay.

For details of expected turnaround times see the table below:

Summary of Cellular Pathology & Post Mortem Turnaround Times

Test	Sample types	Turnaround times	Special considerations	Comments
Urgent Histology	Frozen Sections	Usually reported within 30 minutes of receipt of specimen	By request only. Pre-booked with laboratory and/or discussed with pathologist. Where possible 48 hours notice should be given	If there is a change to the operation time or the operation is cancelled then please notify the laboratory as soon as possible.
Urgent Histology	Various biopsies	Usually reported within 7 days of receipt	Labelled as 'Urgent' and must be discussed in advance with pathologist. Only label cases as urgent where there is a clinical requirement for the case to be prioritised.	KPI 95% within 7 days
Priority Histology 31/62 Cancer target	Various diagnostic biopsies	Usually reported within 8 days of receipt	Labelled with a 31/62 Cancer target yellow sticker. NB: Some cases labelled with the 31/62 cancer target can take longer to process where additional technical work is required, these include Prostate cores, lymph nodes and large specimens.	KPI 95% within 8 days
Routine Histology All specimens	Various	Usually reported within 21 days	Please indicate on the request form the date the report is required for i.e. patient follow up date. This allows for the appropriate prioritisation of cases.	KPI 95% within 21 days

Routine Histology Hospital Post Mortems	Various	Preliminary report usually available within 5 days of PM taking place Final PM reports generally available within 10 weeks of PM taking place.	As directed by consent of next of kin/nominated individual.	
Routine Histology Coroner's Post Mortems	Various	Preliminary report usually available within 3 days of PM taking place Final PM reports generally available within 10 weeks of PM taking place.	As directed by HM Coroner's Officer	
Urgent Non-gynaecological Cytology	FNA's Serous effusions CSF's	Usually reported within 48 hours of receipt of specimen	Discussed in advance with reporting pathologist	If there is a change to the expected time or the procedure is cancelled then please notify the laboratory
Routine Non-gynaecological Cytology	All specimen types	Usually reported within 10 days		KPI 95% within 10 days

8.3 SUBMISSION OF CELLULAR PATHOLOGY SPECIMENS

8.3.1 Completion of request forms

All sections of the request form must be completed.
When sending both Histology and Non-Gynae cytology specimens from the same patient, 2 request forms must be submitted. Information regarding both specimen types must be completed on both forms for Clinical Governance purposes.

This must include:

- Full surname
- Full first name
- Date of Birth
- Registration Number / NHS number
- Location
- Consultant
- Post code
- NHS Number

Adequate and relevant clinical information must be included. Without this information, appropriate examination may not be instituted and interpretation of results may be impossible or misleading.

When sending multiple specimens from the same patient ensure that the request form lists all specimens submitted and the number of pots and each separate specimen pot is identified clearly with the specimen type and location. For example, left breast biopsy and right breast biopsy.

The mandatory High Risk section of each form **must** be completed.

All products of conception sent for histological examination MUST be accompanied by a completed consent form or they will be returned to the sender.

8.3.2 Uncertainty of measurement

Histopathology differs in several ways from other types of laboratory testing and as such uncertainty of measurement cannot be measured for in the same way when formulating the descriptive results that comprise the histological/non-cervical diagnosis. This does not mean that uncertainty does not exist in this area, just that no methods exist which recognise it, yet alone measure it.
In histopathology, the essential initial step is the acquisition of visual information from all of the material submitted, a task which is easier in some cases than others because of the nature of the material. The diagnosis is then a judgment of that information in the context of all other information available to the pathologist, including clinical details interpreted against his or her knowledge and experience.
Reassurance as to the reliability of the diagnoses is provided by the following:

- All pathologists engage in internal audit of their diagnostic activities within their practice as well as participating in external quality assurance.
- Participation in External Quality Assurance schemes according to area of specialist activity.

- Cases tabled at MDTs undergo secondary review prior to presentation.
- Areas of work which are complex or pose diagnostic difficulty are double reported or assessed with by a number of pathologists to reach a consensus.
- An ongoing performance audit (Southampton Audit) is carried out whereby a case is selected for assessment from every MDT meeting.
- Adhoc secondary reviews.

Further information can be provided by histopathology.

8.3.3 Specimen Pots

Specimen containers must be clearly labelled and include the following information:

- full surname
- full first name
- registration number / NHS number
- location
- consultant
- tissue type and site of removal

In addition, ensure the following before sending specimens to the laboratory:

- All specimens and request forms are packaged correctly
- All specimen lids fit securely
- Specimen pots and request forms are clean externally (i.e., no blood stains)

When sending multiple specimens from the same patient, ensure that each specimen pot is labelled with the specimen type and correct site of removal. For example, left breast biopsy and right breast biopsy.

Unlabelled or inadequately labelled forms or specimen containers will not be examined and will be returned to the sender.

8.3.4 Identification of high risk Cellular Pathology specimens

If the specimen is high risk the specimen container and request form **MUST** be labelled with a "**BIOHAZARD**" label. The specimen must be transported in a plastic specimen bag which **MUST** be labelled with a "**BIOHAZARD**" label. The request form **MUST** be placed in the bag in the pocket separate to the specimen. Samples should be segregated from other samples.

The 'mandatory' high-risk section of the request form **MUST** be completed. Where not completed the request will be returned to source.

'High Risk' Histology specimens **MUST** be sent in 10% formalin. 'High Risk' Non-Gynaecological specimens **MUST NOT** be sent in formalin.

It is the responsibility of clinical staff to identify and label the specimen and complete the 'mandatory information' box on the request form to indicate a danger of infection to both transport / portering and laboratory staff to enable them to take the necessary precautions.

For the protection of laboratory workers the request form and any specimens collected from a patient with a known or suspected infection due to the following biological agents must be labelled as 'High Risk:

- HIV 1 & 2
- Hepatitis B Virus
- Hepatitis C Virus
- TB
- Brucella spp.
- Salmonella typhi & paratyphi
- HTLV 1 & 2

Cases of known or suspected Creutzfeldt-Jakob disease cannot be dissected, handled or processed at Russells Hall Hospital; such cases must be referred to a specialist centre with appropriate facilities. Contact a Consultant Histopathologist for advice where such cases are known or suspected.

For other Hazard Group 3 biological agents including:
Anthrax, Rabies, Plague, & Yellow Fever, contact a Histopathologist or Microbiologist for advice.

8.4 HISTOLOGY

8.4.1 Fixation of Specimens

The tissue fixative used routinely is formalin (10% neutral buffered formalin solution) *.

All routine tissue specimens should be placed in fixative as soon as possible after removal from the patient. With small biopsies in particular, it is important not to let the specimen dry out. The recommended volume of fixative is at least ten times the volume of the specimen - it is therefore important not to squeeze a specimen into an inadequately sized container as the fixative will not be able to penetrate the tissue. Poor fixation can hinder or prevent accurate histological diagnosis and will most likely result in a delay in specimen processing and reporting.

With most excised specimen types the temptation to slice open or dissect before it is sent to the Histopathology Department should be resisted. Subsequent fixation of a partly incised specimen may cause distortion and hinder anatomical orientation. In the case of excised tumours, it may then be impossible to identify surgical planes of excision.

Please contact Histology for advice regarding handling of any unusual specimen or tumour.

Containers of formalin must have tightly fitting lids and must also be labelled with appropriate COSHH labels. Specimen containers of various sizes can be collected from the laboratory. It is advisable to contact the laboratory to order the required numbers and sizes and to arrange a suitable collection time. For assistance or advice please contact the Histology laboratory (Ext. 2469).

Ensure that request forms are not put in the same compartment of the transport bag as the specimen.

COSHH information - Formaldehyde

Formaldehyde is a toxic chemical: it must be handled in accordance with COSHH regulations. Please ensure that the solution is used only as directed:

- Keep the container tightly closed in a cool, well ventilated area
- Keep away from sources of heat and ignition
- Return unwanted or out of date containers to the laboratory
- In case of contact with eyes irrigate immediately and obtain medical advice
- Formaldehyde vapour is a well-recognised respiratory irritant. Do not breath vapour / spray
- Harmful by ingestion
- Skin contact with formalin solution should be avoided, as repeated exposure has the potential in some individuals to cause dermatitis.
- Evidence of mutagenicity and teratogenicity is documented.

A safety data sheet relating to this chemical may be obtained by contacting the histology laboratory.

First Aid Measures:

Eye contact: Irrigate thoroughly with water for at least 10 minutes
Inhalation: Remove from exposure, rest and keep warm
Skin contact: Drench the skin thoroughly with water. Remove contaminated clothing and wash before re-use.
Ingestion: Wash out mouth with plenty of water and give plenty of water to drink
Information on the Control of Substances Hazardous to Health (COSHH) guidelines can be obtained from the department.

8.4.2 Special Techniques / Instructions

Specimen type	Guidance for submission
Breast Resections	• Immediately after removal of the specimen it must be immersed in 10% neutral buffered formalin • **The specimen must be covered with 10x the tissue volume of formalin** • The specimen must not be placed in an inadequately sized container. The specimen container must accommodate the specimen easily and it must not be forced in. • Ensure that the specimen pot is labelled with patient details. • Ensure that a fully completed histology request form accompanies the specimen. • Deliver the specimen to the laboratory **as soon as possible** to enable the pathologist to incise the specimen on the same day. • If the operation finishes later in the day and it is not possible to deliver to the laboratory before 5:00pm then please ensure that the specimen is submerged in 10x its volume of formalin and transported to the laboratory early the following morning. • The histology laboratory opening times are as follows: ○ **07:00 to 17:00 Monday to Friday.** • A variety of specimen pot sizes can be collected from the laboratory, to order them contact 2469. **REMEMBER:** To ensure the optimal preservation of the specimen it is always best to select a larger rather than smaller specimen pot.
Sentinel lymph node specimens	There is only a small uptake of the TC99M isotope in the sentinel node. The sentinel node must be fixed in 10% Formalin and transported to the laboratory in an appropriately labelled, designated container. Impression smears prepared from the sentinel node in theatre by the surgeon are also transported to the laboratory in an appropriately labelled, designated container. Breast specimens taken as part of the sentinel node procedure must be transported to the laboratory in an appropriately labelled metal container.
Lymph Nodes	All lymph nodes should be sent to the laboratory in formalin. They should be transported to the laboratory immediately so they can be dealt with by the lab staff on their receipt.
Products of Conception	All products of conception submitted to the laboratory must be accompanied by a POC consent form signed by the patient.
Renal Biopsy	Please contact the Histology laboratory in advance. Place specimen into formalin - this can be supplied by histology on request. Inform the histology department that the specimen is on its way when the specimen is being transported to the laboratory.

Specimen type	Guidance for submission
Skin Biopsy for immunofluorescence	Please contact histology ext. 2469 in advance. Place specimen into transport medium only - this can be supplied by histology on request. Inform histology of expected arrival
Muscle Biopsy	Cases of Polymyositis can be dealt with at Russells Hall. For cases of suspected myopathy or neuro-muscular disease, please contact Dr Martin Carey or Dr Peter Barber at Neuropathology Department, Queen Elizabeth Hospital, Birmingham.
Frozen Sections	At least 48 hours notice must be given for all urgent frozen sections to ensure that a pathologist will be available and that the cryostat is in service. The pathologist may wish to discuss the case with the requesting clinician regarding indication for frozen section and the limitations of the procedure. Tissue for examination by frozen section must NOT be placed in formalin, but should be placed in a fully labelled sterile universal container. Samples must be transported to the histology laboratory immediately and handed directly to a histology technician. ***Do Not deliver to pathology reception*** Some tissues are not suitable for frozen section e.g. High Risk specimens such as potential lesions of tuberculosis or viral hepatitis and HIV positive tissues. If in doubt, please contact the laboratory in advance and ask advice of a pathologist. Full contact details for the surgeon must be provided on the request form to enable the pathologist to contact the surgeon in theatre as soon as the report is available. Frozen section material will be subsequently processed to produce paraffin sections. These will be examined and a written report issued. **Important Note:** When a frozen section is booked the reporting pathologist and laboratory staff are on standby. ***It would therefore be appreciated if surgeons could inform the laboratory on Ext. 2469 of any changes to the time the operation is scheduled or if the operation is cancelled and there is no longer a requirement for the frozen section.***

Referral Centres & Specialist Referrals

Sometimes it is necessary to send samples away either for:

- Additional tests that are not part of our repertoire
- Where it is necessary to seek a specialist opinion

The following are the main referral centres the Department of cellular Pathology currently utilise:

Referral Centre	Test / Area of Specialist Opinion
Birmingham Heartlands	ICC & FISH for HER2
Birmingham University Hospitals	Molecular testing including: KRAS, EGFR, BRAF, MMR
Birmingham University Hospitals	Urology, Liver, Lymphoma
Royal Wolverhampton Hospital	Renal Biopsies
Walsall Hospital	Lymphoma cases
Birmingham Womens Hospital	Gynaecological Cancers
National Amyloid centre	Amyloid cases
University Hospital, Sheffield	Head and Neck
Birmingham Royal Orthopaedic Hospital	Bone and Soft tissue
London, St Thomas's Hospital	Skin pathology

Where a biopsy has to be sent away either for additional testing then the clinician will be notified.
Turnaround times for referral centre tests are available on request.

Specimens for Cytogenetics

Please do not send requests to Histology as this adds an unnecessary delay to the turnaround time.

To ensure a timely turnaround and prevent deterioration of the specimen, samples requiring cytogenetic analysis are sent directly from the Delivery Suite to the Cytogenetics Laboratory, at Birmingham Women's Healthcare NHS Trust, Birmingham.

All requests must be accompanied by a valid request form, supplies of which may be found in the Delivery Suite.

Please contact the Cytogenetics laboratory for advice: Cytogenetics Laboratory, Birmingham Women's Healthcare NHS Trust, Edgbaston, Birmingham, B15 2TG, Tel: 0121 627 2710, Fax 0121 627 2711.

Indications for chromosome analysis:

1. Recurrent abortions - at least 2 previous pregnancy loses or history of infertility (please also send parental blood specimens in lithium heparin).
2. Intrauterine death, unexplained stillbirth or miscarriage with one or more congenital abnormalities.
3. Previous chromosomally abnormal child.
4. Known familial chromosomal aberrations, e.g., Robertsonian translocations.
5. Abnormal ultrasound scan e.g., cystic hygroma etc.
6. Confirmation of prenatal diagnosis by CVS or amniocentesis.

Collection of specimens:

Products of conception	In transport medium or in a dry, sterile container
Whole foetus	Dry sterile container with a signed consent

	form
Placenta	Dry sterile container
Foetal tissues: Skin or muscle Placental biopsy (1 cm^3) at cord insertion site Cardiac blood or cord blood	 Transport medium or sterile saline (NOT DRY) Transport medium (NOT SALINE OR DRY) Lithium heparin

Please note:

- **DO NOT** use formalin.
- Refrigerate specimens until despatch.
- Despatch as soon as possible.
- Collect specimens as cleanly as possible; microbial contamination will compromise results.

Transport
Telephone ext: 3412 and arrange collection as soon as possible by hospital transport.

At the weekend, prepare the specimen, place in transport media and refrigerate and arrange transport to Cytogenetics at the earliest opportunity.

8.5 CYTOLOGY

Cytology specimens are split into Diagnostic specimens (Non-Gynaecological) and Cervical Cytology specimens.

PLEASE NOTE: As of 1st June 2013, **all** cervical cytology samples have been collected, processed and reported by The Royal Wolverhampton Hospitals NHS Trust.

All enquiries, result requests and requests for sock must be made to The Royal Wolverhampton Hospitals NHS Trust by calling 01902 695288.

8.5.1 Diagnostic Cytology (Non-Gynaecological)

The laboratory processes a wide variety of specimens, details of the requirements for individual specimen types can be found below.

Cytology **WILL NOT** accept specimens, slides or request forms which are inadequately labelled and will return these to the sender. This will result in deterioration of the quality of the specimen and will inevitably lead to a delay in reporting.

High Risk' Non-Gynaecological specimens **MUST NOT** be sent in formalin.

Diagnostic cytology specimens are in the main unfixed and need to be processed as soon as possible. Cytology specimens can be susceptible to rapid deterioration of the cells and so it is crucial that they are transported to the laboratory promptly.

If the specimen is collected after hours, store in a refrigerator at 4°C overnight and deliver to the laboratory at the earliest opportunity the following morning.

Further advice on any aspect of specimen collection, transport or suitability for examination can be obtained from the non-gynae cytology laboratory, direct number (01384) 244047 or internally ext 2047.

Specimen type	Guidance for submission
FNA (Fine Needle Aspiration)	A mix of prepared air-dried and alcohol fixed smears can be sent to the lab. It is advisable to rinse out any remaining material into transport medium after the slides have been prepared. **or** Rinse the aspirated material in transport medium (contact the Cytology laboratory (Ext: 2047 for supply) and send to laboratory for preparation. Advice on FNA preparation is available from Cytology (Ext. 2047). **DO NOT** send the syringe and / or needle to the laboratory, this must be disposed of where the procedure was carried out and in accordance with the Trust Sharps Policy. If an FNA report is requested as STAT this needs to be discussed with the Duty Histopathologist and booked in advance to ensure their availability. To book an FNA telephone one of the following extensions: 2159, 2034 or 2047 All urgent FNA requests must be discussed with the Consultant Histopathologist prior to sampling.
Sputum	Specimens of early morning 'deep cough' sputum should be submitted on 3 consecutive days. The specimens should be placed in a sterile plastic specimen container. Early morning specimens before eating are preferable to avoid contamination of specimen by food particles. Induced specimens are valuable.
Body fluids including: Pleural, Peritoneal (Ascites) and pericardial fluid.	Collect fluids in sterile white topped universal containers. ***Do not send full drain bottles / bags, decant a sample of the fluid into a sterile white topped universal container***

Specimen type	Guidance for submission
Urine	Collect the specimen in a sterile container. Ideally, collect the specimen after the first morning specimen has been discarded. A representative specimen of **up to** 50mL of urine should be sent to the Cytology laboratory.
CSF	Collect CSF specimens for cytology in a plastic sterile white topped universal container. **DO NOT** collect in a glass container as cells adhere to glass and can be lost in preparation. The specimen must reach the laboratory as soon as possible, preferably within 2 hours.
Other Cytology Specimens: Cyst Fluids, Synovial Aspirates and Hydrocele Fluids	Collect fluid in sterile white topped universal containers.

8.6 MORTUARY

8.6.1 Hospital Post Mortems

A hospital post mortem should only be requested where the cause of death is essentially known and is not in a category reportable to HM Coroner. To arrange for a hospital post mortem, the following are required:

- Medical Certificate of Death
- Signed Hospital Post Mortem Examination consent form.
- Completed autopsy request form/clinical summary.
- Case notes with cause of death as on death certificate

Consent for a hospital post mortem examination must be obtained in advance from the next of kin or nominated individual and by someone trained to take consent, usually the bereavement officer or a member of the mortuary team. For further information see the Trust Policy 'Consent for hospital Post Mortem Examination and Retention of Tissue and Use of Organs.

8.6.2 Foetal, Perinatal & Neonatal Autopsies

Abortuses up to 23 weeks

Send fresh to Russells Hall Hospital Mortuary with questionnaire/clinical summary form (available in Delivery Suite).

Stillbirths (from 24 weeks onwards)

Obtain consent for autopsy. Complete consent forms (available in Delivery Suite). Send the completed forms and the foetus with placenta, where available to the mortuary at Russells Hall Hospital for collection (even if the family are arranging the funeral with their own Funeral Director). Certification of cremation of stillbirth remains will also be required.

Perinatal & Neonatal Deaths

Obtain consent and complete questionnaire. Follow above procedure. A certificate of Cremation will be required if the baby is to be cremated after post mortem.

8.6.3 Death certificates

It is important that the death certificate is completed correctly otherwise problems are created when the family attempt to register the death.
The correct format is:

1. (a) the condition directly leading to the death (not mere mode of dying).

   (b) the condition(s) that caused 1 (a)

   (c) the condition (if anything) caused 1 (b).

2. Other significant condition actually contributing to death, but not part of 1 (a).

You cannot sign a certificate unless you have seen the patient within the last 14 days or have seen the deceased outside this period **AND** seen after death. It may still be possible to issue a certificate but only after consultation with HM Coroner's Office.

You can only issue death certificate if you were in attendance during the last illness (monitoring or treating). Before you issue a certificate, ask yourself the following questions:

- Do I know the cause of death?
- Was I in attendance on last illness?
- Have I seen the patient 14 days before, or after death?
- Is the death NATURAL CAUSES? (Refer to list)
- Has the death occurred MORE than 24hours after admission?

If the answer is YES to ALL of the questions, issue the certificate.

If the answer is NO to ANY of the questions, refer the death to the Coroner's Office (see below).

8.6.4 Reporting deaths to the HM Coroner's office

The following deaths **MUST** be reported to HM Coroner's Office:

- All deaths where no doctor has been in attendance within 14 days or during the last illness
- Where the cause of death is unknown.
- Deaths within 24 hours of admission to hospital, even if the cause of death is known or suspected.
- Death following accident or injury. This includes all deaths following fracture of the femur, cases of septicaemia if originating from injury, and hypothermia (cold injury).
- Deaths during or within 24 hours of operation (anaesthetic).
- Deaths related to drugs including therapeutic mishap, drugs of addiction. Also suspected transfusion reactions.
- Poisoning including self-poisoning, food poisoning, and acute alcoholic poisoning (but **not** chronic alcoholism).
- Industrial diseases including pneumoconioses, asbestosis with or without malignant mesothelioma, Weil's disease*****.

- Deaths in legal custody e.g. prisoners transferred from H.M. Prison, Bedford for treatment. Also patients **compulsorily detained** in psychiatric units under the provisions of the Mental Health Act.
- Stillbirths **only** if there are suspicious features.
- Sudden infant deaths and infant deaths, which are in any way obscure (to include suspected non-accidental injury).
- Ill-treatment (starvation, neglect).
- War pensioners if death connected to the pensionable disability.
- Crime or suspected crime, including suspected **criminal** abortion.
- Where it is known that the body is to be moved from England or Wales for burial or disposal abroad.

Weil's disease (Leptospirosis) is also a notifiable disease

The Black Country Coroner Zafar Siddique

H.M. Coroner's Office

Smethwick Council House, High Street, Smethwick, B66 3NT

Telephone 0845 352 7483 Fax 0845 352 7487

Office hours 8 am - 4 pm Monday to Thursday 8am to 3.30pm Friday

If you have any doubt as to whether or not to issue a death certificate, then contact the pathologist, coroner's office, the bereavement officer, or mortuary technicians for advice.

9 IMMUNOLOGY

9.1 CONTACT DETAILS

	Internal	External (01384)
General enquiries / results	2447	456111 ext 2447
Mr Mike Breese **Head BMS**	5802	244802
Dr M Bhole **Consultant Immunologist and Head of Department**	3070	
Dr C Tsakona **Locum Consultant**	1869	
Secretary	2755	244855

9.2 CLINICAL SERVICES

Both consultants are available for clinical consultations and advice on investigations and interpretation of laboratory results.

General Immunology & Allergy clinics for both adult and paediatric patients are held at the New Guest Hospital and at Russells Hall Hospital and attendance is by referral from General Practitioners or Hospital Specialists.

9.3 AVAILABLE ASSAYS AND SPECIMEN REQUIREMENTS

Daily assays

Serum immunoglobulin concentrations and electrophoresis, indirect immunofluorescence (ANA, autoantibody screen, ANCA) and cell marker assays are carried out daily and results are usually available the day following sample receipt. Some assays are used as screening tests and positive results may generate further testing which may take a few additional days.

Batched assays

Specific assays that are labour intensive, expensive or non-urgent, are batched for analysis and include autoantibodies to dsDNA, Intrinsic Factor as well as C1 inhibitor quantification by radial immunodiffusion.
Fortnightly assays include functional antibodies to *Haemophilus influenza B* and *Pneumococcus.*

Requesting Additional tests

The Immunology department keeps serum samples for approximately four weeks from the date of collection. To add tests to existing samples please contact the lab on ext 2447 for advice.

9.3.1 Requests for Urgent Results

All urgent requests must be first discussed with laboratory staff. Some assays such as, ANCA, dsDNA and GBM antibodies can be performed within a few hours. For assays that are performed in batches, the department will endeavour to perform the assay as soon as possible, if clinically relevant and indicated.

Special Services

Specialised assays such as lymphocyte subset markers and neutrophil function tests require specific specimens to be collected and to reach the laboratory within a certain

period after collection for the results to be valid. These assays are expensive in terms of reagents and laboratory staff time and must be discussed with laboratory staff prior to sample collection.

9.3.2 Uncertainty of measurement

There are two main sources of uncertainty attached to the measurement of analytes. One area is uncertainty associated with pre-analytical processes and the second area is the variation (or imprecision) due to the analytical process in the laboratory and biological variation within and between individuals.

Pre-analytical sources of uncertainty include posture of the patient, tourniquet application time, bleeding the right patient, labelling blood tubes correctly, using the right preservatives and anti-coagulants if required and minimising transport delays.

The contribution to the uncertainty of measurement associated with biological variation is determined by the physiology of the subjects observed and this uncertainty is caused by the inherent biological variation around the homeostatic set point. Factors contributing to biological variation include biological rhythms, puberty, menopause, age and gender. Similarly, the analytical variation will be determined by a number of factors, for example the method of analysis and calibration of the analysers. Together, biological and analytical variation determines the 'critical difference' which is a measure of the value by which two consecutive measurements on the same patient of the same analyte must differ to be considered a statistically significant change in the results.

Therefore, the pre-analytical processes, biological and analytical variation together all contribute to the uncertainty of measurement. Please contact the laboratory if you require further information.

9.3.3 Specimen Collection

Unless otherwise stated below, please use 1 full YELLOW (Ochre) top tube for all Immunology requests.
Please send appropriately completed Blue Immunology forms along with the request.

Request	Specimen required
Allergy (*paediatric specimens only*)	If using paediatric tubes, please use a red top tube and allow at least 1 full tube for every 4 allergens requested.
Cryoglobulins	Venous blood to be taken directly into a pre-warmed (37ºC) yellow top tube and kept at 37ºC until clotted and separated in a warm centrifuge.
Functional complement CH50	1 yellow top tube to reach the Immunology Department within 3 hours of collection
Functional C1 inhibitor	2mL blood in an EDTA tube to reach the Immunology department within 3-4 hours of collection.
Urine free light chain analysis	3mL random urine in preservative free container. **Specimens taken into boric or hydrochloric acid are not suitable.**
HLA-B27 Typing	3mL venous blood in EDTA to reach Immunology Department within 3-4 hours of collection
CD 4 counts	3mL venous blood in EDTA, to reach the Immunology Department within 3 hours of collection. **By prior arrangement with the Department only**

NBT Test (Neutrophil function)	3mL venous blood in EDTA, to reach the Immunology Department within 3 hours collection. **By prior arrangement with the Department only**
Tryptase & Specific IgE to drugs	2 clotted blood specimens; one taken at 1-2 hours post-reaction and a further sample at 24 hours.
Serum electrophoresis	If myeloma is suspected, urine should be submitted as well

9.3.4 Tests Available / Assay Frequency

The table below details the main tests provided by the laboratory. Assay frequency is denoted as follows:

D	Daily	W	Weekly	TW	Twice a week
TRW	Three time a week	FW	Fortnightly	AR	As Required
S	Sent away (usually 2-3 weeks for result)				

*These tests require an EDTA specimen

Click a heading to navigate through the assay list:

Autoantibodies Immunoproteins Complement Assays Cellular Studies

Investigation	Comments	Assay Frequency
Autoantibodies Antinuclear antibody (ANA)	Positive results from the screen are titred the following day	D
Centromere		D
Smooth muscle antibody		TW
Mitochondrial antibody		TW
Gastric parietal cell antibody (GPC)		TW
Liver Kidney Microsomal		TW
Antineutrophil Cytoplasmic Antibody (ANCA)	Positive results from the screen are titred the following day. All new Positive sera are tested for antibodies to PR3 and MPO which may take a further day or two.	D
Antibody to ds-DNA	All new Positive ds-DNA sera are tested on Crithidia which may take a further day or two	TW
Antibodies to Extractable Nuclear Antigens (ENA)	Positive results from the screen are run against known positives to confirm identity on the following run.	TW
Anti Sm		
Anti RNP		
Anti Jo-1		
Anti Ro/SSA		
Anti La/SSB		
Anti Scl-70		
Anti Cardiolipin Antibodies (ACA)		TRW
Anti B2 glycoprotein 1 Antibodies (B2GP1)		TRW

Investigation	Comments	Assay Frequency
Aspergillus Fumigates IgG Abs	Test for farmer's lung	FW
Avian IgG Abs – Pigeon Serum Protein	Test for Bird Fanciers lung	FW
Coeliac Disease:-		
Tissue Transglutaminase Abs (tTG)	Screening test for Coeliac Disease	TRW
Endomysial abs	Performed to confirm Positive tTG abs.	AR
Gliadin Abs	Only available by special request – use tTG abs for Coeliac disease	S
Specific Autoantibodies To: Acetylcholine Receptor (ACR)		S
Adrenal Cortex		2-3 days
Epidermal Basement Membrane		2-3 days
Epidermal Intercellular Substance		2-3 days
Cardiac Muscle		S
Glomerular Basement Membrane (GBM)		TRW - 2 days
Intrinsic Factor		W
Pancreatic Islet Cell		2-3 days
Thyroid :- Peroxidase (TPO)		W
Thyroglobulin (By Specific Request Only)		S
Neurological Antigens		S
Rheumatoid Factor	Positive results from the screen are run on a weekly quantitative assay	D
Anti-CCP Antibodies		TRW
Allergy	Total & Specific IgE (Allergy Testing). Please specify which allergens are required	TW
Tryptase	Required specimens taken at 1-2 hour & 24 hours post reaction	W
Immunoproteins Immunoglobulins IgG, IgA, IgM, Serum Protein Electrophoresis		D
Immunoelectrophoresis / Immunofixation		AR
Quantitation of Myeloma protein (Densitometry)		3-5 days
Urine Free Light chains		3-5 days
Functional antibodies (IgG) to Pneumococcus and Haemophilus Tetanus		FW S
IgG Subclasses	G subs will only be done after discussion with Immunology Consultant - functional IgG abs to *Pneumococcus*, *Haemophilus B* and *Tetanus* are more clinically relevant than IgG Subclasses to assess immune-competency.	S

Investigation	Comments	Assay Frequency
Cryoglobulins	Clotted specimen must be taken into a pre-warmed container and allowed to clot at 37ºC. The assay required an initial 7 days at 4ºC to allow any cryoprecipitate to form. Presence of cryoprecipitate will require further work for identification.	W
Complement Assays C1 Esterase Inhibitor	(Please request a separate C3/C4 levels from Biochemistry along with C1 Inhibitor in patients with suspected angioedema due to C1 INH deficiency. Serum C4 will be used as a screening test for C1 inhibitor deficiency. C1 inhibitory deficiency is unlikely in the presence of a normal serum C4 during an acute episode.)	W
*Functional C1 Esterase Inhibitor	FC1 inhibitor will only be done after discussion with Immunology Consultant	S
*Functional CH50 Classical Pathway Alternative Pathway	Functional Complement assays will only be done after discussion with Immunology Consultant	S
C3 Nephritic Factor (C3NeF)	C3NeF will only be done after discussion with Immunology Consultant	S
Angioedema Screening Panel: ANA Total IgE C3,C4 (performed by Biochemistry) Igs		
Cellular Studies All requests for Cellular analysis must be discussed with laboratory staff in advance, with the exception of HLA-B27. *Lymphocyte Surface Markers HIV Monitoring (CD4, CD8 etc) HLA-B27 Typing		AR
*Nitroblue Tetrazolium Test (NBT)	For Phagocytic Respiratory Burst	Same Day
Skin Prick Tests	Will be performed by Consultant Immunologist as part of Immunology Outpatients Consultation.	

⇧**Return to top of table**

9.3.5 Guide to the appropriate use of immunological assays

Diagnosis of SLE	ANA, dsDNA, ENA, Igs and C3/C4 *(please request C3/C4 from Biochemistry)* dsDNA and C34 are useful for monitoring disease progression.
SLE in pregnancy	include anti-Cardiolipin abs in above panels

Diagnosis of Myeloma	Igs and electrophoresis (immunofixation will be performed if indicated) Send both blood and urine
Autoimmune screen	ANA, Smooth Muscle, Igs and C3/C4 *(please request C3/C4 from Biochemistry)*
Arthritis screen	ANA and RF
Vasculitis screen	ANA, ANCA, Igs and C3/C4 *(please request C3/C4 from Biochemistry)* Secondary testing for anti- Cardiolipin and Cryoglobulin may be useful
Renal Screen	ANA, Smooth Muscle, ANCA, Igs and C3/C4 *(please request C3/C4 from Biochemistry)* Secondary testing for Cryoglobulin and GBM may be useful
Angioedema screen	Total IgE, ANA, Igs and C3/C4 *(please request C3/C4 from Biochemistry)*

9.3.6 Description of available assays

Assay	Description / Comments
Acetylcholine receptor ab's	Test for Myasthenia Gravis.
Adrenal ab's	Test for autoimmune adrenal disease.
Antinuclear ab's	This is used as a screening test for Lupus (SLE) and certain other connective tissue diseases. Strong positive results (titres of 1:320 and above) may be clinically significant, particularly with some staining patterns. For example: *Speckled pattern* – connective tissue disease, SLE; *Homogenous pattern* – SLE, and drug induced lupus; *Nucleolar pattern* – scleroderma or sicca syndrome.
Aspergillus Fumigates	Hypersensitivity pneumonitis, also known as Extrinsic Allergic Alveolitis (EAA), is an inflammatory lung disease resulting from an exaggerated immune response (hypersensitivity) to certain inhaled allergens, including moulds (aspergillus species- farmer's lung)
Avian IgG Abs – Pigeon Serum Protein	Hypersensitivity pneumonitis, also known as Extrinsic Allergic Alveolitis (EAA), is an inflammatory lung disease resulting from an exaggerated immune response (hypersensitivity) to certain inhaled allergens. Bird fanciers lung is the common syndrome associated with exposure to avian antigens. A Pigeon Serum Protein assay is used to screen for this condition as antigen epitopes in pigeon serum protein are shared across most common pet avian species.
Cardiolipin/Phospholipid ab's (B2GP1 abs)	persistent high levels of anti-cardiolipin antibodies are associated with anti-phospholipid syndrome, characterised by a risk of arterial or venous thrombosis. Please check lupus anticoagulant (Haematology) at the same time. Positive results should be repeated in 12 weeks time for confirmation.
CCP abs	are specific for and suggestive of RA in patients with early un-differentiated arthritis.
Centromere ab's	are strongly associated with the limited cutaneous form and the CREST variant of systemic sclerosis. In cases with Raynaud's, the presence of centromere antibody indicates an increased chance of developing connective tissue disease in the future.
Complement C3 and C4	measurements of both are of value in monitoring the activity of SLE and immune complex disease. C4 is of particular value in both SLE and angioedema when levels are well below normal. C4 levels are used as a screening test for patients with suspected angioedema due to C1 INH deficiency (See below). Please note that C3 and C4 are performed in the Clinical Chemistry department.
C1 esterase inhibitor	Antigenic and functional levels. Typically C1 INH deficiency, both hereditary and acquired, is associated with low C4 levels during acute episodes, which is therefore used as a screening test for suspected HAE or AAE – see below.

Assay	Description / Comments
Hereditary Angioedema (HAE)	Autosomal dominant disorder commonly due to C1INH deficiency. Most cases have reduced serum C1 INH levels (Type 1). One in ten cases may have normal C1 INH levels, but reduced function (Type 2).
Acquired angioedema (AAE)	reduced C1 INH levels, most commonly associated with B-cell lymphoproliferative disorders.
Cryoglobulins	These are immunoglobulins that precipitate on cooling of serum or plasma and are classified into three categories: Type 1: Typically monoclonal (commonly IgM) with rheumatoid factor activity. Clinical associations include Waldenströms macroglobulinaemia, myeloma or lymphoma. Type 2 and 3: These are mixed or polyclonal cryoglobulins resulting in the formation of immune complexes that can clinically present as vasculitis, synovitis or glomerulonephritis. (Sample must be collected into a pre-warmed tube and kept at 37ºC till clotted).
ds DNA abs	high levels are associated with active SLE. Low positive levels may be seen in quiescent SLE, RA, and other autoimmune conditions and must be correlated clinically.
Endomysial ab's	a positive result is strongly associated with coeliac disease. This assay is done by IIF and is used as a confirmatory laboratory test following a positive tTG antibody by ELISA. The gold standard for diagnosis of coeliac disease still remains a tissue diagnosis whilst on a gluten diet. Endomysial antibodies may be falsely negative in very mild gluten induced enteropathy or in patients on a gluten free diet.
ENA ab's	the department currently identifies six specificities:-
RNP	Highly specific for MCTD, also 25% of SLE and 15% of Myositis.
Sm.	Highly specific for SLE, with renal involvement and poor prognosis.
Ro (SS-A)	In 75% of Primary Sicca syndrome, 75% of annular LE, 25% of SLE, 20% of MCTD, 5% of Myositis and PBC.
La (SS-B)	In 50% of Primary Sjögrens syndrome, 10% of SLE and <5% in other CTD.
Jo1	In 20-40% of patients with aggressive Polymyositis, usually in association with interstitial lung disease and arthralgia.
Scl70	Positive in 20-40% of patients with progressive systemic sclerosis (PSS). These antibodies are considered to be specific for PSS, but may be also seen in some patients with MCTD or overlap syndromes.
Functional Antibodies	A typical antibody response to vaccination usually peaks around three to four weeks. Ideally a post vaccination sample to check response should be collected four weeks after vaccination.
Gliadin ab's	This assay is not currently recommended and not routinely offered for the diagnosis of coeliac disease. Serum tTG and Endomysial antibodies are more specific screening assays for coeliac disease than Gliadin (NICE guidelines) and should be used in preference. **All requests for Gliadin antibodies will be referred to the Immunology Consultant to establish the clinical relevance.**
Glomerular basement membrane ab's	are associated with rapidly progressive glomerulonephritis with or without lung involvement (Goodpastures or pulmonary renal syndrome). Immunosuppression or plasmapheresis may be indicated.

Assay	Description / Comments
Immunoglobulins (IgG,A,M)	Immunoglobulin levels and electrophoresis are useful screening tests in patients with severe, persistent, recurrent or unusual infections. Reduced Immunoglobulin levels may be seen in primary or secondary immunodeficiency disorders. Secondary causes for low Immunoglobulin levels commonly include:- Haematological malignancies (CLL, Myeloma) Nephrotic syndrome Other protein losing states (enteropathy, lymphangectasia) Drugs (anti convulsants, immunosuppressant's, biologics etc) All patients with persistent low Immunoglobulins should preferably be referred to and evaluated by an Immunology Consultant. Polyclonal increase of IgG can occur in chronic infection and inflammation, chronic liver disease and connective tissue disease. Monoclonal bands are significant in the diagnosis and monitoring of patients with myeloma. Monoclonal gammopathy of uncertain significance (MGUS) is found in 1% of the general population over the age of 50 years.
IgG Subclasses	IgG1 and IgG2 subclass deficiencies are the most clinically important in individuals who suffer recurrent infections. However, functional antibodies to tetanus (requiring the presence of IgG1) and pneumococcus (requiring the presence of IgG2) give a much clearer picture of the patient's ability to mount an appropriate antibody response and should be used in preference. **All requests for IgG Subclasses will be referred to an Immunology Consultant to establish the clinical relevance.**
IgE – Total and Specific	**Total IgE:** This assay is commonly requested in patients with atopy or suspected allergies. 'Atopy' is defined as the genetic predisposition to produce greater amounts of IGE. These individuals are more likely to have childhood eczema, asthma or hay fever. The results of total IgE must be interpreted in relation to the clinical history. High levels of total IgE may be seen in patients with personal or family history of atopy particularly atopic dermatitis (eczema), hay fever or asthma. **Allergen specific IgE:** A wide range of allergens are available to test for allergen specific IgE and it is **essential** that as much clinical information as possible is supplied by the clinician so the most appropriate testing can be performed. Allergen specific IgE testing **is not to be used** as a screening test for allergy. Raised allergen specific IgE (> 0.35KuA/L) can be found without any clinical history of allergic reactions, particularly in atopic individuals (See above). Positive or raised specific IgE is not a 100% proof of allergy and must be interpreted in the light of individual atopic status and clinical history. It is recommended that patients with strong clinical history **should to be referred** to the Allergy clinic for further evaluation irrespective of total and/or specific IgE levels.
Intrinsic factor ab's	are detected in 70% of patients with pernicious anaemia and are more disease-specific than antibodies to gastric parietal cells.
Liver kidney microsomal ab's (LKM)	are positive in autoimmune chronic active hepatitis.
Lymphocyte surface markers	must be discussed with a senior member of the laboratory staff prior to blood collection.

Assay	Description / Comments
Mast cell tryptase	Rapid mast cell degranulation during an anaphylactic reaction results in an immediate rise of serum tryptase levels within 1-2 hours. This reaches a peak at around 6 hours and returns to baseline by 24 hours. In order to reflect this please take 1 clotted blood sample as soon as possible after the onset of symptoms, and a second sample within 4 hours. A baseline sample should ideally be taken 24 hours after the reaction.
Mitochondrial ab's	M2 type is present in >95% of cases of primary biliary cirrhosis. Other types are associated with a wide range of conditions.
Neutrophil cytoplasmic ab's (ANCA)	This assay is useful in the diagnosis and management of patients with suspected pulmonary-renal syndrome or ANCA-associated small vessel vasculitis. There are 2 common staining patterns seen on immunofluorescence: cytoplasmic- ANCA (C-ANCA) and perinuclear-ANCA (p-ANCA). Other atypical patterns are sometimes seen, but may not have any clinical significance. C-ANCA pattern (IIF) directed against Proteinase 3 (PR3 – detected by ELISA) is strongly associated with Wegener's granulomatosis. . C-ANCA antibody levels may relate to disease activity and will fall to normal with effective treatment. P-ANCA pattern directed against myeloperoxidase (MPO- ELISA) is commonly associated with microscopic polyangiitis (MPA) and other ANCA-associated small vessel vasculitides, but may also be seen in non-vasculitic chronic inflammatory conditions, such as, ulcerative colitis, rheumatoid arthritis and chronic hepatitis. C-ANCA or p-ANCA pattern on IIF not directed against PR3/MPO are less likely to be clinically significant and may not reflect ANCA-related small vessel vasculitides.
Neutrophil function test (NBT)	Must be discussed with a senior member of the laboratory staff prior to blood collection.
Pancreatic islet cell ab's	Have a prevalence of 75% in IDDM at diagnosis and antibody levels will decrease and eventually disappear with the duration of the disease.
Rheumatoid factor	All RF requests are screened by a latex test which is very sensitive but less specific for RF. Positive sera are tested further using a quantitative ELISA that is less sensitive but more specific. A positive result to the RF latex and negative to the RF ELISA are frequently seen and do not indicate RA. Approximately 70% of patients with RA are sero-positive but a positive result can be seen in 15% of the general population without RA and should only be interpreted in the clinical context i.e. if there is evidence of active joint inflammation.
Serum electrophoresis	Serum electrophoresis is performed in all requests for immunoglobulin quantification (Serum IgG/A/M levels). Polyclonal increase in the gammaglobulin region can be seen in chronic infection and inflammation, chronic liver disease or connective tissue disease. Monoclonal bands, particularly in this region, are suggestive of possible lymphoproliferative process and require further confirmatory tests. All sera with monoclonal bands on serum electrophoresis will be followed up by immunofixation to type the paraprotein and quantify it wherever possible. In patients where myeloma is clinically suspected, it is strongly recommended that paired serum and urine samples (see below for urine electrophoresis) are sent together. Oligoclonal bands may sometimes be seen in severe infections, post bone marrow transplant patients and rarely in certain primary immunodeficiencies.

Assay	Description / Comments
Skin ab's	Antibodies to the intercellular substance of the epidermis (desmosome) are seen in patients with pemphigus. Antibodies to the dermal-epidermal basement membrane are highly specific for bullous pemphigoid and seen in 80% of cases, where the titre correlates with disease activity.
Smooth muscle ab's	These are present in high titres in 50-70% of patients with type 1 autoimmune hepatitis. They may also be seen in other types of autoimmune hepatitis, primary biliary cirrhosis and chronic viral hepatitis.
Striated muscle ab's	These antibodies are seen in almost all patients with Myasthenia gravis with thymoma; however, in patients without thymoma the antibodies are only present in a small proportion of cases.
Thyroid microsomal ab's (TPO)	These antibodies are present in high levels in 95% of patients with Hashimoto's thyroiditis, 20% of Grave's disease and 90% of patients with primary myxoedema. Persistently high levels in euthyroid individuals may indicate autoimmune thyroiditis and a predisposition to future thyroid failure.
Thyroglobulin ab's	They are of limited value, except where patients are presenting with the classical features of autoimmune thyroid disease but are TPO antibody negative, and as a tumour marker for patients with follicular carcinoma of the thyroid.
Urinary Electrophoresis	This test is performed in the investigation of patients with suspected multiple myeloma (either intact immunoglobulin or light chain myeloma), light chain deposition disease and primary AL amyloidosis. In all patients, particularly initial requests for diagnosis, it is recommended that a simultaneous paired serum sample is sent along with complete clinical details in order to facilitate accurate interpretation of the results. Free urinary light chains (Bence Jones protein) may be seen in all the above mentioned conditions. Subsequent monitoring of light chain only diseases (light chain myeloma, light chain deposition disease or primary AL amyloidosis) may be done with only urine electrophoresis (or serum free light chains if requested).

⇧**Return to top of table**

10 MICROBIOLOGY

10.1 SUMMARY OF SERVICE

The Microbiology Department at Russells Hall Hospital offers a comprehensive range of tests for the diagnosis of infections caused by bacteria, viruses, parasites, chlamydia and fungi. This includes an extensive range of serological tests for diagnosis and immune status. We have a developing Molecular diagnostic service and provide an andrology service.

Contact Details

	Internal	External (01384)
Enquiries	2019	244019
Main laboratory	2471	
Serology	2475	
Mr A Jackson/Mrs L Baker **Head BMS/Deputy Head BMS**	2472	
Consultants:		
Dr E Rees **Head of Department**	2473	
Dr Lakshmipriya Mohankumar	2817	
Secretaries:		
Mrs L White **Consultant's Secretary**	2056	
Mrs S Barton **Department Secretary**	2056	

Infection Control Department
Infection Control Team/Secretary ext: 2174

10.2 LABORATORY OPENING HOURS

Send routine specimens to arrive between 8:00hrs and 19:00hrs weekdays and 08:00hrs and 15:00hrs weekends.

10.2.1 Out of hours Microbiology investigations

Urgent investigations are undertaken by on-call staff, who must be contacted via Russells Hall Hospital switchboard before sending specimens. Advice from the **Medical Microbiologists** is available via switchboard. During weekday evenings contact Dr Rees or Dr Mohankumar. At weekends, a rota operates which includes Consultant Microbiologists at Dudley and Wolverhampton.
Please avoid requesting results outside laboratory opening hours. All authorised results are available 24 hrs on the Soarian system. All essential results (e.g., significant blood culture isolates) are notified to clinical staff immediately.

10.3 REQUEST FORMS

- All microbiology requests must be submitted on MICROBIOLOGY forms with integral specimen bags
- Requests must include all details specified on the form, legibly completed

Effective processing requires that forms include the following:

- The **name, date of birth** and **hospital number**
- exact description of specimen and site
- clinical summary
- antimicrobial therapy if relevant
- for serological tests, always state date of onset of symptoms.

- Patient identification labels should be applied to both forms.

Remember to include the ward or destination for the report.

- Medical staff should initiate and sign all requests, with the exception of MRSA screens, stool cultures for in-patients with diarrhoea which may be infectious and other investigations included in specialist policies (e.g., ITU screens).

Verbal requests for additional investigations on existing specimens will be accepted, provided that there is sufficient specimen remaining to perform the test and it falls within the acceptable time limits for testing. Specimens for serological testing must also have a further completed request form. Because of the differences in the microbiological investigation for certain specimens it is important to contact the laboratory before requesting additional tests to confirm that this is possible.

10.4 SPECIMEN COLLECTION TECHNIQUES

10.4.1 Collection Techniques

- Remember that satisfactory results may only be obtained from properly collected specimens delivered promptly to the laboratory - contamination can confuse culture results
- Ensure minimum delay in delivery of specimens to the laboratory
- Best results are obtained if adequate volumes of material are sampled
- Collect specimens before antibiotics are started whenever possible
- Refer to Infection Control Guideline-Standard (universal) Infection Control precautions for details about spillages of bodily fluids and dealing with breakages.

For further guidance, please refer to the 'Summary of Guidelines for Collection of Microbiology Specimens' at the end of this section.

10.4.2 Specimen Containers and Swabs

Hospital wards and departments obtain these from NHS logistics. They are supplied to GPs by Pathology reception.

The following are obtained from the Microbiology Laboratory:

- Chlamydia swabs and urine preservative tubes
- Containers for EMUs (Early Morning Urines - mycobacteria culture)
- Blood culture bottles
- Pernasal swabs (pertussis)
- Dermapaks for fungal investigations
- Semen analysis (infertility) pack

10.5 TESTS AVAILABLE

The table below details the main tests provided by the laboratory. Some tests are referred to reference laboratories for processing – these laboratories include:

- West Midlands Public Health Laboratory
  Heartlands Hospital
  Birmingham
- Health Protection Agency

  Centre for Infections
  Colindale
  London
- Antimicrobial Reference Lab.
  Southmead NHS Trust
  Bristol
- Meningococcal Reference Lab.
  Manchester Royal Infirmary
  Manchester

Turnaround times for reference laboratory tests are available on request.

Further guidance on sample requirements can be found in the guide at the end of this section.
Guidance on antibiotic prescribing and dosage within the Trust can be found in Antimicrobial Prescribing Guidelines available on the Hub.

Please note:
* These tests can also be performed urgently in consultation with the Consultant Microbiologist
† These tests can only be performed after consultation with the Consultant Microbiologist

Click a heading to navigate through the test list:

Microbiology Serology Assays

Type of specimen/investigation	Sample requirements	End result	90% completion in the following time frame
Microbiology			
AAFB microscopy	60ml sterile plain container	Positive or negative	24 hrs
Blood cultures	BD BACTEC bottles See collection Instructions below	Positive or negative **NB -** positive cultures are phoned as they are detected	7 days
CSF Routine microscopy and culture	Plain sterile universal container	Positive or negative	3 days

Type of specimen/investigation	Sample requirements	End result	90% completion in the following time frame
Faeces (C.difficile Screen)	Blue top container	Positive or negative	24 hrs
Faeces (Rota/Adenovirus)	Blue top container	Positive or negative	24 hrs
Faeces (routine culture)	Blue top container	Positive or negative	3 days
Fluid cell counts	Plain sterile universal container	Positive or negative	24 hrs
GUM cultures	See information below for GU users	Positive or negative	3 days
HVS	Blue top transwab	Positive or negative	3 days
Legionella/Strep.pneumoniae antigen screen	Urine in plain sterile universal container	Detected or not detected	24 hrs
MRSA screens	Blue top transwab	Negative	24hrs
MRSA screens	Blue top transwab	Positive	48 hrs
Mycobacteria culture	60ml sterile container	Positive or negative	42 days
Mycobacteria sensitivities		Final Report	15 days
Mycology	Plain universal or Dermanpak	Positive or negative	28 days
Pregnancy tests	Plain sterile universal container	Positive or negative	24hrs
Respiratory Syncitial Virus Screen	Naso-pharyngeal aspirate	Detected or not detected	24 hrs
Rotavirus/Adenovirus antigen screen	Faeces	Detected or not detected	24 hrs
Semen analysis-infertility investigations	60ml sterile container	Final Report	2 days
Semen analysis-post vasectomy	60ml sterile container	Final Report	24 hrs
Sputum (routine)	60ml sterile container	Positive or negative	3 days
Swabs/Fluids/Tissue cultures	Blue top transab or plain universal container	Positive or negative	3 days
Urine	Red top boric acid container	Negative flow cytometry	24 hrs
Urine culture	Red top boric acid container	Final Report	3 days

Type of specimen/investigation	Sample requirements	End result	90% completion in the following time frame
Serology			
Amoebic antibodies	Serum, red top tube	Final report	10 days
Aspergillus antibodies	Serum, red top tube	Positive or negative	7 days
Avian precipitins	Serum, red top tube	Positive or negative	7 days
Bartonella serology (cat scratch)	Serum, red top tube	Final report	10 days
Bordetella pertussis serology	Serum, red top tube	Final report	10 days
Brucella antibodies	Serum, red top tube	Final report	10 days
Campylobacter antibodies	Serum, red top tube	Final report	10 days
Candida antibodies	Serum, red top tube	Final report	10 days
Chikungunya	Serum, red top tube	Final report	10 days
Chlamydia antibodies (Respiratory)	Serum, red top tube	Final report	10 days
Cryptococcus antigen	Serum, red top tube	Final report	10 days
Cytomegalovirus IgG/IgM	Serum, red top tube	Positive or negative	3 days
Dengue fever	Serum, red top tube	Final report	10 days
E.Coli 0157 antibodies	Serum, red top tube	Final report	10 days
Enterovirus antibodies	Serum, red top tube	Final report	10 days
Epstein Barr Virus antibody screen	Serum, red top tube	Positive or negative	3 days
Farmers Lung antibodies	Serum, red top tube	Final report	10 days
Filarial antibodies	Serum, red top tube	Final report	10 days
Hantavirus antibodies	Serum, red top tube	Final report	10 days
Helicobacter pylori antibodies	Serum, red top tube	Positive or negative	7 days
Hepatitis A IgG/IgM	Serum, red top tube	Positive or negative	3 days
Hepatitis B DNA	2 x EDTA		Reference laboratory test
Hepatitis B markers	Serum, red top tube	Final Report	10 days
Hepatitis B screen*	Serum, red top tube	Positive or negative	3 days
Hepatitis B surface antibody	Serum, red top tube	Positive or negative	3 days
Hepatitis C antibody	Serum, red top tube	Positive or negative	3 days
Hepatitis E	Serum, red top tube	Final report	10 days

Type of specimen/investigation	Sample requirements	End result	90% completion in the following time frame
Herpes simplex	Serum, red top tube	Final report	10 days
HIV 1&2 antigen/antibody*	Serum, red top tube	Positive or negative	3 days
HIV Genotypic Resistance	2 x EDTA tubes	Final report	10 days
HIV p24 Antigen	Serum, red top tube	Final report	10 days
HIV Therapeutic Drug Monitoring	Trough and Peak, EDTA	Final report	10 days
HTLV1 antibodies	Serum, red top tube	Final report	10 days
Hydatid antibodies	Serum, red top tube	Final report	10 days
Influenza A&B	Serum, red top tube	Final report	10 days
Japanese encephalitis	Serum, red top tube	Final report	10 days
Leishmaniasis serology	Serum, red top tube	Final report	10 days
Leptospira serology	Serum, red top tube	Final report	10 days
Measles IgG	Serum, red top tube	Positive or negative	7 days
Mumps IgG	Serum, red top tube	Positive or negative	7 days
Mycoplasma antibodies	Serum, red top tube	Positive or negative	7 days
Parvovirus IgM	Serum, red top tube	Positive or negative	7 days
Q fever	Serum, red top tube	Final report	10 days
Rickettsial antibodies	Serum, red top tube	Final report	10 days
Rubella IgG/IgM	Serum, red top tube	Positive or negative	3 days
Schistosomal antibodies	Serum, red top tube	Final report	10 days
Streptococcal antibodies	Serum, red top tube	Positive or negative	7 days
Syphilis screen	Serum, red top tube	Negative	3 days
Tickborne encephalitis	Serum, red top tube	Final report	10 days
Toxocara antibodies	Serum, red top tube	Final report	10 days
Toxoplasma IgG/IgM	Serum, red top tube	Positive or negative	3 days
Treponemal serology	Serum, red top tube	Positive	7 days
T-Spot (TB)	2 x Heparin tubes	Final report	5 days
Varicella zoster IgG/IgM*	Serum, red top tube	Positive or negative	7 days
West Nile Virus	Serum, red top tube	Final report	10 days
Yellow Fever	Serum, red top tube	Final report	10 days
Yersinia antibodies	Serum, red top tube	Final report	10 days

Type of specimen/investigation	Sample requirements	End result	90% completion in the following time frame
Assays			
Antibiotic assays (Gentamicin/Vancomycin)	Serum, red top tube	Final Report	24 hrs
Antibiotic assays (various)	Serum, red top tube	Final report	10 days
Molecular			
Chlamydia PCR	BD Probetec collection swabs and tubes	Positive or negative	2 days
Herpes PCR	Dry swab in plain universal container or CSF	Positive or negative	7 days
HIV Viral load	2 x EDTA tubes	Positive or negative	7 days
Mycobacteria PCR†	Sputum or bronchial washing	Positive or negative	10 days
Adenovirus PCR	EDTA blood	Final Report	10 days
BK Virus PCR	EDTA or Urine in plain top universal container	Final Report	10 days
CMV DNA PCR	EDTA blood	Final Report	10 days
CMV DNA PCR Children < 6months	Plain top Urine	Final Report	10 days
EBV PCR	EDTA blood	Final Report	10 days
Hepatitis C Genotype	2 x EDTA tubes	Final Report	10 days
Hepatitis C RNA	2 x EDTA tubes	Final Report	10 days
HIV Pro Viral DNA	EDTA blood	Final Report	10 days
JC virus PCR	EDTA or CSF	Final report	10 days
Meningococcal PCR	EDTA	Final report	10 days

⇧**Return to top of table**

- **INFORMATION for GU Medicine Users**

  Prior to use, any culture plates should be kept at room temperature for a maximum of two hours to ensure there is no excess moisture on the surface of the agar

  Inoculation of culture plates:

  Subsequent to the identified swabs (cervical/urethral/vaginal etc) being taken, the sampled material is transferred to the relevant labelled culture plates. To ensure that the maximum amount of material is inoculated onto the plate the swab should be

applied firmly over the entire area of the agar whilst simultaneously rotating the tip. When inoculating the plate it is important not to break the surface of the agar.

Preparation of slides for Gram staining:

The material collected on the swab is applied to a labelled microscope slide with the aim of transferring a thin layer over the surface taking care to avoid the edges of the slide.

Preparation of a wet film:

Place a drop of saline onto a labelled microscope slide and gently press the tip of the swab into this drop to transfer the sampled material. Coverslip is the applied directly onto the fluid.

It is important to ensure that the amount of saline used is sufficient to make the preparation 'wet' without it being excessive and flooding the slide. Excess fluid can be removed using a clean dry swab.

- **INFORMATION for collecting samples from eyes for Acanthamoenba investigation**

  Scrape: the best sample is a scrape using a fine scalpel. Place the sample into a sterile universal container with a small volume (approx. 200 µl) of sterile saline or distilled water. Do not leave the blade in the container as it can rust and can have a detrimental effect on culture conditions.
  Punch biopsies: should be placed in a sterile universal container with a small amount of sterile saline or distilled water.
  Portions of excised cornea may also be used. Material from the blade can be rinsed into a sterile container with a small volume of sterile saline or distilled water.
  Please do not send needles. These can be flushed out with a small amount of sterile saline or distilled water into a sterile universal container.

  Swabs or washings will be less efficient in detecting the organism.

  Culture can also be performed from contact lenses or fluids; isolation from these specimens, whilst suggestive, does not necessarily implicate the amoeba as causing patient's symptoms. Amoebic genera (other than Acanthamoeba), flagellates, ciliates and other organisms may regularly be found in contaminated washing fluids and on lenses.
  Please make sure the sample is labelled with patient name, hospital or NHS number, date and time of collection. Complete a Microbiology request form and place the sample in the attached bag and seal.
  Please contact the Duty Microbiologist on extension 2056, before requesting Acanthamoeba PCR.

  Sterile saline and containers are available from Microbiology (ext 2471) if required.

10.6 REPORTS

- Telephone to request urgent or preliminary results. Cultures are reviewed daily by Medical Microbiologists and preliminary results are telephoned to clinical staff when appropriate. Notify the medical staff about patients with serious infections - it may be possible to expedite preliminary results.
- Reports are issued to comply with specified turnaround times as far as possible.

- Organisms interpreted as 'of doubtful significance' may be reported without antibiotic sensitivities. Following clinical discussion, it may be possible to provide this information.

  .

For any queries about microbiological investigations please do not hesitate to contact the laboratory.
For interpretation of results or antibiotic advice please contact the duty microbiologist.

10.6.1 Uncertainty of measurement

There are two main sources of uncertainty attached to the measurement of analytes. One area is uncertainty associated with pre-analytical processes and the second area is the variation (or imprecision) due to the analytical process in the laboratory and biological variation within and between individuals.

Pre-analytical sources of uncertainty include posture of the patient, tourniquet application time, bleeding the right patient, labelling blood tubes correctly, using the right preservatives and anti-coagulants if required and minimising transport delays.

The contribution to the uncertainty of measurement associated with biological variation is determined by the physiology of the subjects observed and this uncertainty is caused by the inherent biological variation around the homeostatic set point. Factors contributing to biological variation include biological rhythms, puberty, menopause, age and gender. Similarly, the analytical variation will be determined by a number of factors, for example the method of analysis and calibration of the analysers. Together, biological and analytical variation determines the 'critical difference' which is a measure of the value by which two consecutive measurements on the same patient of the same analyte must differ to be considered a statistically significant change in the results.

Therefore, the pre-analytical processes, biological and analytical variation together all contribute to the uncertainty of measurement. Please contact the laboratory if you require further information.

10.7 SUMMARY OF GUIDELINES FOR COLLECTION OF MICROBIOLOGY SPECIMENS

Click a heading to navigate through the tables:

VIRUS INVESTIGATION
SEMEN ANALYSIS

10.7.1 Cultures

Collection	Delivery	Comments
BLOOD CULTURES		
1. Wash hands well 2. Clean skin with a 2% chlorhexidine in 70% isopropyl alcohol impregnated swab and allow to dry 3. Clean tops of culture bottles with a 2% chlorhexidine in 70% isopropyl alcohol impregnated swab and allow to dry 4. Mark off 10ml on both culture bottles using the gauge on the side of the label. Keeping the bottle upright and below venepuncture site, collect 10ml of blood into each bottle. **NB** - aerobic must be collected before anaerobic. 5. Please refer to Trust guidance for full description	• Send to Microbiology without delay for incubation. • It is not necessary to notify on-call microbiology staff. • Do NOT refrigerate.	• Do not cover bar code with patient ID labels. • Do not remove barcode. • Paediatric bottles are available for children. • All significant results are notified to clinical staff • Take peripheral and line cultures from patients with IV lines • Take 3 blood cultures at 30 minute intervals for suspected endocarditis
BODY FLUIDS		
Synovial, Pleural, Peritoneal 1. Prepare hands as for aseptic procedure 2. Clean skin with a 2% chlorhexidine in 70% isopropyl alcohol impregnated swab and allow to dry 3. Collect specimen, at least 5 ml into sterile container	• Send to lab. without delay	• Request mycobacteria if relevant
CAPD fluids Send 20-25 ml dialysate in sterile container for cell counts and add 10 ml to each Bactec(blood culture) bottle for cultures	Send to lab without delay	

Collection	Delivery	Comments
CEREBROSPINAL FLUID		
1. Wash hands well (prepare as for aseptic procedure) 2. Clean skin over lumbar spine with a 2% chlorhexidine in 70% Isopropyl alcohol impregnated swab and allow to dry 3. Collect 2-3 ml CSF into each of 3 containers. Send first and third specimens to Microbiology, and second specimen to Biochemistry	Notify lab. and send without delay	• Request special investigations if clinically relevant e.g., mycobacteria, viruses, cryptococcus. • Sterile CSFs from patients with suspect meningococcal infection will be referred for PCR.
EYE		
Sample within the lower eyelids, collecting pus if available.	Transport medium (blue top).	• Avoid contamination by skin flora of eyelids. • Moistening swabs with sterile saline may make this test less irritant. • Chlamydia swabs are available if required (e.g. persistent neonatal conjunctivitis).
FAECES/ENTERIC PATHOGENS		
Collect FAECES using plastic spoon in blue-topped container.	Send to lab. as soon as possible. If necessary refrigerate for up to 24hrs.	• Give clinical details to allow selection of appropriate tests. • Routine tests will detect salmonella, shigella, E. coli 0157, campylobacter and cryptosporidia. • Request C. difficile if antibiotic colitis is suspected. • Describe any foreign travel, suspected food poisoning or association with outbreaks.

Collection	Delivery	Comments
Perianal swab for Threadworm Sample perianal skin well with swab on rising (eggs are laid during the night on perianal skin).	Place swab in sterile saline, break off tip and close container firmly.	
'Hot stool' for acute amoebic dysentery Freshly passed stool.	Send immediately to lab	Notify lab staff before sending specimen.
RESPIRATORY		
Sputum Send expectorated secretions, preferably collected by a physiotherapist.	Send to the laboratory without delay.	• Specimens which are largely saliva will be rejected.
If **tuberculosis** is suspected, send 3 specimens requesting microscopy and culture for mycobacteria.	If delay in transport is inevitable(e.g., weekends), refrigerate (≤ 24 hrs).	• Notify a microbiologist to arrange appropriate tests if investigating immuno-compromised patients. • If legionnaires disease is suspected. Legionella urinary antigen detection should be requested if relevant; sputum culture for legionella is available.
Throat swabs Use a tongue depressor and good light to examine pharynx. Sample fornices well, collecting pus if present.	Transport medium (blue top).	Refer to MRSA policy for MRSA investigation.
Nose swabs Moisten swab in transport medium. Use same swab to sample both nostrils.	Transport medium (blue top).	
Pernasal swabs for pertussis Ask parent or nurse to hold child's head firmly. Use special pernasal swab to sample posterior nasopharynx via nose.	Pertussis transport medium.	Swabs available from laboratory on request.
SKIN/SOFT TISSUE		
Abscess Clean skin with alcohol skin preparation. Aspirate pus if possible or pass swabs as deep into lesion as possible.	Send pus to laboratory within4 hours or swab in transport medium within 24 hours.	• Tissue or aspirated pus is always preferred to swabs. • Anaerobes die on exposure to air

Collection	Delivery	Comments
Decubitus ulcer Cleanse surface with sterile saline, removing slough if necessary. Swab base of lesion.	Transport medium (blue top).	Swabs should only be collected if there is clinical evidence of infection.
Wounds 1. Clean skin with sterile saline and sample infected tissue. 2. Dampen swab with sterile saline if wound is dry and rotate several times over lesion.	Transport medium (blue top).	• Superficial sampling may detect only contaminants. • Only sample infected wounds
Intravenous Catheter Tips 1. Cleanse skin surrounding exit site with a 2% chlorhexidine in 70% isopropyl alcohol impregnated swab. 2. Remove catheter aseptically and cut off 3. 5cm distal tip with sterile scissors. Place in sterile container.	Send to laboratory within 4 hrs	• Only send tips if clinical infection is suspected and blood cultures have also been submitted • Do not send swabs from IV exit sites unless inflamed and there is pus/exudate to sample.
URINE NOTE: To prevent specimen deterioration, urines must be submitted in red top boric acid containers which should be filled to the line, unless it is clear that only a low volume can be achieved e.g. Paediatrics, renal failure then a plain container can be used. Boric acid specimens should be delivered on day of collection unless refrigerated (up to 48hrs). Refrigerated specimens in plain containers should reach the lab within 24hrs.		
Midstream urine (MSU) 1. Clean urethral meatus with soap and water if there is any soiling 2. Females should hold labia apart and males retract the foreskin 3. Void the forestream (several ml) and collect the midstream directly into container or initially into receiver or 'multicup'. Transfer into boric acid specimen container which should be filled to the line. Very small volumes may be collected in plain sterile universals.	Send to the laboratory with minimum delay.	• Screening for UTI by leucocyte esterase and nitrite is worthwhile for simple cystitis, but is not acceptable for children, in pregnancy and repeated tests • GP's- consider dipstick tests for leucocyte esterase/nitrite if MSU's cannot be delivered to lab within 24hrs.

Collection	Delivery	Comments
Catheter urine (CSU) Disinfect collection port with a steret	As for MSU	Only collect CSU's when there is clinical evidence of infection e.g. Fever, suspected septicaemia, loin pain (except for Urology, ITU and units where consultants have advised otherwise.
Urinary catheter tips	**Do not send for culture**	
Urine collected from infants Wash baby's external genitalia with soap and water and dry. Apply self-adhesive collecting bag and remove when ≥ 15ml urine has been collected	Send directly to the laboratory as contaminants are almost invariably present.	
Early Morning Urines (EMUs) for Mycobacteria 1. Collect entire EMU (in large containers available from the laboratory) on 3 consecutive days 2. EMUs **must** be in a plain container. ***Boric acid must NOT be used.***	Send each specimen to the laboratory as soon as possible after collection.	
Urine collection for Chlamydia detection in males Collect urine in Urine Preservative Tube available from the laboratory.		
UROGENITAL		
High vaginal swab A speculum must be used for sampling the vaginal fornix to avoid contamination from the Introitus or perineum.		Please give adequate clinical summary so that a suitable range of tests may be undertaken.
Endocervical swab As above	Transport medium (blue top)	The endocervix must be sampled if gonorrhoea is suspected.
Urethral swab Insert swab 2-4 cm into urethra and rotate.	Transport medium (blue top)	Chlamydia swabs are available from the lab if sexually transmitted disease is possible
Chlamydia investigations FEMALES: rotate chlamydia swab to sample endocervix. MALES: sample urethra as above, Or send first pass urine in UPT container (see 'Urines' above)	Chlamydia transport medium	Chlamydia swabs and UPT containers are available from the laboratory

Collection	Delivery	Comments
ENVIRONMENTAL SPECIMENS Always consult one of the Medical Microbiologists or Infection Control Nurses before submitting environmental specimens.		

10.7.2 Antibiotic Assays

Collection	Delivery	Comments
5-10 ml clotted blood (plain, dark red topped tube).	Send to lab without delay	Always use Microbiology forms
Gentamicin Pre-dose specimen is taken immediately before dose. Post-dose specimen, 1 hour after IV/IM dose.		For once daily dosing regimens or Multiple dosing please refer to antimicrobial prescribing guidelines on The Hub
Vancomycin Pre-dose vancomycin levels immediately before dose.		• Pre-dose vancomycin levels should be 5-10 mg/l • A post dose specimen is not usually indicated unless patient is immunocompromised, or not responding. Collect 2 hrs after infusion is completed. • For once daily dosing regimens or Multiple dosing please refer to antimicrobial prescribing guidelines on The Hub

10.7.3 Serology

Collection	Delivery	Comments
Refer to the table in 'Serology Test' section above for appropriate specimen type and bottle	Ensure safe transport for all blood specimens.	Always use Microbiology request forms.
Serodiagnosis Collect acute (1-7 days after onset) and convalescent specimens, the latter usually 7-14 days later, although longer intervals may be indicated for community-acquired pneumonias.		• Always state date of onset. • Give full clinical details so that appropriate tests can be selected • Single acute specimens for CFT or respiratory screens or undated specimens will be stored awaiting second sera
Serious blood borne infections (HIV, hepatitis B, hepatitis C hepatitis E)	Wherever possible, patients' informed consent must be obtained before testing.	Repeat specimens must be tested for patients who test positive for HIV antibodies, to confirm the result

Collection	Delivery	Comments
Immunity		• State date of contact as relevant or immunisation status. • TORCH screening - this term is misleading and should be avoided. Serum can be tested for rubella, parvovirus and toxoplasma but is not useful for HSV or CMV. Please discuss problem cases with Microbiologist

10.7.4 Mycology

Collection	Delivery	Comments
Skin Scrape skin scales into Dermapak using a scalpel. Collect as much as possible from active margin of lesion to enhance the chance of positive microscopy.		Dermapaks are available from lab.
Hair 1. Collect 10-12 affected hairs with base of shafts intact, into Dermapak (available from lab) 2. Scrape scalp lesions as above.		
Nails Scrape from infected part of nail and nail bed and include infected nail clippings, into Dermapak		Avoid distal nail clippings. Cleaning with a Steret enhances the chance of positive microscopy.

10.7.5 Virus Investigations

Collection	Delivery	Comments
Vesicles, skin lesions, throat, eye Sample with swab and break off into plain universal container	Send to lab without delay. These tests are referred to the Regional Virus Reference Lab.	Sample well to ensure that exfoliated cells are collected.
Nasopharyngeal aspirates		Tests for RSV antigen are undertaken at RHH
Bronchoalveolar lavage	Send to lab without delay	Ref. Lab tests RSV, adenovirus, flu A & B paraflu, and CMV PCR
CSF	Send to lab without delay	• PCR for Herpes simplex is available • Varicella zoster and Enterovirus PCR is available from our Reference Lab.

Collection	Delivery	Comments
Faeces		• Rotavirus and adenovirus tests are routinely performed for in-patient children <5 years. • Other tests for Norovirus are indicated for outbreaks of gastroenteritis – consult Microbiologist
Genital swabs for Herpes 1 & 2 PCR Sample with a swab and break off into a plain universal container		

10.7.6 Semen Analysis

Collection	Delivery	Comments
Semen for Infertility There is an appointment system for semen analysis for infertility investigations. The patient must be provided with a sterile, screw topped, 60ml wide neck specimen container and a completed Microbiology request form. PATIENT INFORMATION LEAFLET: SEMEN FOR INFERTILITY	Sample must be produced within one hour of the given appointment time.	• Samples received without an appointment will not be examined.
Semen post vasectomy The patient must be provided with a sterile, screw topped, 60ml wide neck specimen container and a completed Microbiology request form. Patient Information Leaflet: Post vasectomy	Sample must be delivered to the laboratory within one hour of collection. Samples will only be accepted Monday to Friday 08:00hrs to 16:00 hrs. Samples will not be accepted on Bank Holidays	
Semen samples for culture Microbiological contamination from non-semen sources (e.g. commensal organisms from the skin) must be avoided. The man should pass urine first. The wash hands and penis with soap, to reduce the risk of contamination of the specimen with commensal organisms from the skin. Dry hands and penis with a fresh disposable towel. Ejaculate into a plain sterile container.	The sample must be delivered to the microbiology laboratory within 2 hours of collection.	

Collection	Delivery	Comments
RETROGRADE EJACULATION INVESTIGATIONS The patient is asked to have intercourse and then to empty his bladder into a specimen container large enough to hold 300-400 ml urine which can be collected from Pathology Reception on request.	• The urine may be brought to the laboratory the following morning. • Samples will only be accepted Monday-Friday 9.00hrs-16.00hrs	• Specimens in boric acid will be rejected. • Specimens that are unlabelled or labelled incorrectly will not be examined

⇧**Return to top of table**

11 KEY CONTACTS

Clinical Director - Diagnostics Dr AP Wolinski Linda.Wright@dgh.nhs.uk ☎01384 244299 Fax: 01384 321097
Medical Services Head – Dr E Rees Elizabeth.Rees@dgh.nhs.uk ☎01384 244056 Fax: 01384 244066

Biochemistry		
Head of Department Dr H Ashby Helen.Ashby@dgh.nhs.uk ☎01384244078 / Fax: 01384321097	**Principal Clinical Scientist** Dr Anna Sanders Anna.Sanders@dgh.nhs.uk ☎01384 244081 / internal ext 2081 Fax: 01384 321097	**Head BMS** Gary Varndell Gary.Varndell@dgh.nhs.uk ☎01384244081 / Fax: 01384321097

Haematology	
Head of Department Dr Craig Taylor Consultant Haematologist Craig.Taylor@dgh.nhs.uk ☎01384 244158	**Head BMS** Sue Rides Susan.Rides@dgh.nhs.uk ☎01384 244091

Cellular Pathology and Mortuary	
Head of Department Dr M Ahluwalia Consultant Histopathologist monica.ahluwalia@dgh.nhs.uk ☎01384 244464 Fax: 01384 244034	**Head BMS** Debbie Walker Debbie.Walker@dgh.nhs.uk ☎01384 244217

Immunology	
Head of Department Dr M Bhole malini.bhole@dgh.nhs.uk ☎01384 244755 Fax: 01384 244855	**Head BMS** Mike Breese Mike.Breese@dgh.nhs.uk ☎01384 244802

Microbiology	
Head of Department Dr E Rees Consultant Microbiologist Elizabeth.Rees@dgh.nhs.uk ☎01384 244056 Fax: 01384 244066	**Head BMS** Alan Jackson Alan.Jackson@dgh.nhs.uk ☎01384 244472

Quality Manager Vikki Banton Vikki.banton@dgh.nhs.uk ☎01384 244047
Out-Patient Phlebotomy / In-Patient Phlebotomy Sue Rides Susan.Rides@dgoh.nhs.uk ☎01384 244091
Point of Care Testing Sue Skorka susan.skorka@dgh.nhs.uk ☎01384 244086 (internal ext 2086)
Pathology IT Helen Townsend Pathology IT Support Manager Helen.townsend@dgh.nhs.uk ☎ 01384 456111 ext 2896