Division of Laboratory Medicine

Wythenshawe Hospital

Laboratory Medicine Handbook

How to use this document:

- *Do not print it. It may change, the most up-to-date version will always be available on the Trust internet/intranet*
- *Click on items in this table of contents to navigate to the required section*
- *Click to navigate between sections / open hyperlinks in a browser / email addresses to send a message*
- *Use bookmarks in the navigation pane in your PDF viewer to move around the document*
- *Ctrl +F to perform a word search*
- *Click for an A-Z list of tests*

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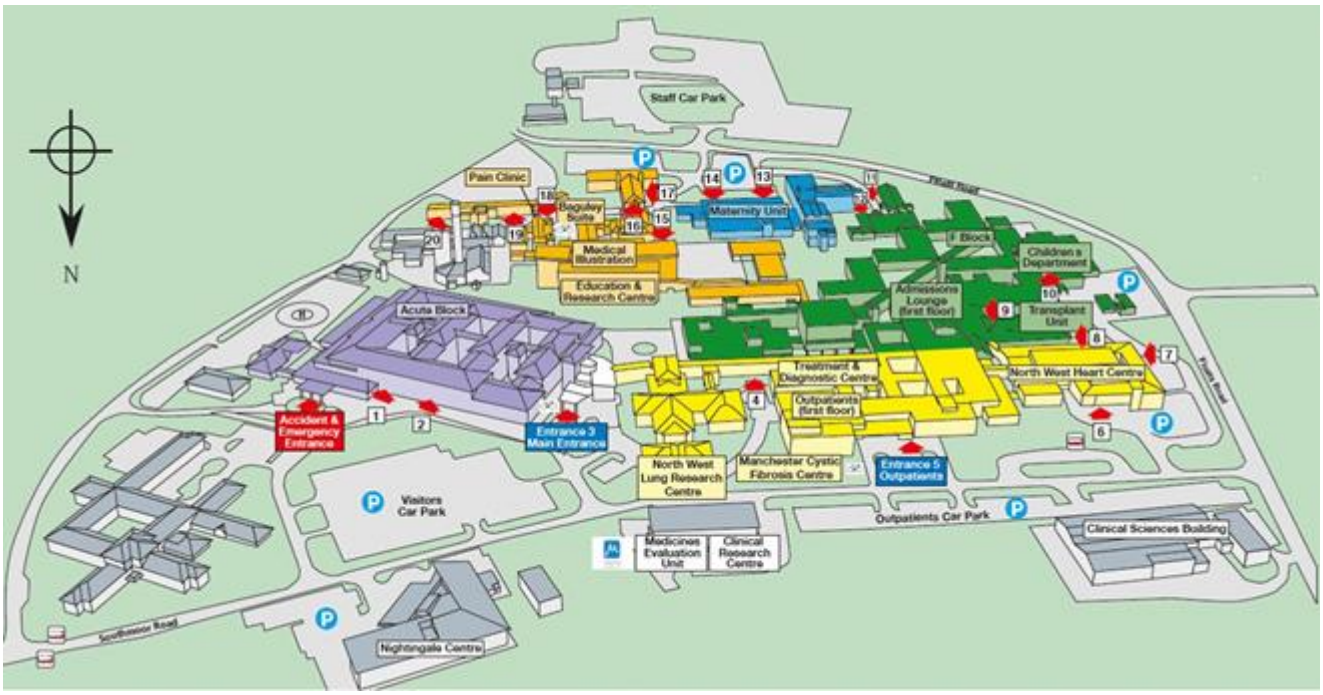
1 Introduction

The Division of Laboratory Medicine (DLM) at Manchester University NHS Foundation Trust (MFT) Wythenshawe Hospital provides diagnostic services to Wythenshawe and Withington Hospitals as well as General Practitioner surgeries in the South Manchester area and beyond. There are four departments within Division of Laboratory Medicine based at Wythenshawe Hospital; Biochemistry, Haematology, Cellular Pathology (including provision of mortuary services), and the Mycology Reference Centre Manchester (MRCM).

This handbook relates only to the Biochemistry and Mycology DLM services located at Wythenshawe Hospital. Links to information for the other services can be found on the relevant pages in this handbook. Information on laboratory medicine services located at the Oxford Road Campus can be found here.

Laboratory Medicine (except MRCM) is housed in the Clinical Sciences Building on the Wythenshawe Hospital site, shown in the bottom right corner of the map below. The Mycology Reference Centre is based in the Education and Research Centre; also shown below, in orange.



1.1 Accreditation

Each laboratory within Laboratory Medicine has undergone external accreditation by the United Kingdom Accreditation Service, UKAS. Current accreditation status can be checked on the UKAS website, using the UKAS numbers in the below table. The accreditation process requires annual inspection to ensure there is a system of quality management in place to give assurance that the results released and advice given by the laboratory are of a high standard.

Laboratory	UKAS Number
Biochemistry	9063
Mycology	10196

1.2 Quality assurance

Tests performed in the laboratories are enrolled either in a national/international External Quality Assurance (EQA) scheme or a similar local scheme where no national scheme is available. This ensures that our tests are performing well. We also use Internal Quality Assurance (IQA) and Internal Quality Control (IQC) to monitor the performance of our tests.

Our clinical and some scientific staff are also enrolled on proficiency testing EQA schemes, where they are tested on their interpretation of case studies involving pathology test results. This ensures that the reports issued are correctly interpreted and the right advice is given.

Each laboratory is approved by the Institute of Biomedical Science for training of Biomedical Scientists, which has its own quality assurance programme.

The Biochemistry at Wythenshawe Hospital are recognised for training Specialty Trainees (STs) in each discipline. The training programmes are recognised and approved by the Royal College of Pathologists (and the General Medical Council) and are quality-assured by Health Education England North West. The Biochemistry department is an approved training centres for the Scientific Trainee Programme (STP), which is accredited by the National School of Healthcare Science.

As part of this training approval we have comprehensive training programmes for all grades of staff to ensure that they have all the required knowledge and skills to perform their duties to the highest level. This includes the provision of expert clinical advice to our users and interpretive comments on reports.

We also have Quality Managers within the laboratories who are employed to oversee all aspects of quality and ensure that we meet the requirements of our accrediting and regulatory bodies.

1.3 Key performance indicators

We use Key Performance Indicators (KPIs) to monitor the quality of the service we provide. There is a Laboratory Medicine dashboard that contains all of these KPIs, which is reviewed monthly to ensure we are performing to the required standard.

1.4 Protection of personal information

The laboratory adheres to the Trust-wide Policies on information governance for the protection of patient information, including the Trust “Data Protection Policy”.

1.5 Patient information

The Pathology Handbook is available to patients online.

1.6 Sample acceptance

All samples must have a request form. We require **four** patient identifiers on all samples and request forms. All patient identifiers must match exactly between the sample and the request form. These identifiers and further requirements are detailed in the table below.

Mandatory Labelling Requirement
Samples MUST be labelled with four unique identifiers which are as follows: • District Number / NHS number • Surname • Forename • Date of birth Transfusion only – handwritten, signed and dated If this information is not provided, no analysis will be performed. The event will be reported as an incident on Ulysses if appropriate.
Date and time of sample collection **Must** be provided to support sample validity
Multiple samples taken at different times on a patient **MUST** be labelled on the sample container with the time (24 hr. clock) when the sample is taken.
Electronic ordering must be used were available unless there is downtime, to reduce manual forms and associated transcription risks
The **request form (if required)** information **MUST** match the information on the **sample.** **Request forms MUST** also contain: • the patient's location/destination for the report (or a location code) • Tests required • Name of Consultant or GP • Patient sex • Date and time of sample collection • Anatomical site and type of sample (where relevant) • **All relevant clinical information** • For Blood Transfusion – Form and sample **MUST** be signed by person collecting sample If the information is not provided where the sample is repeatable/ reproducible, no analysis will be performed, and the sample will be discarded. Where the sample is unrepeatable/ unreproducible, the risk to the patient of rejection of the sample must be weighed against the risk of acceptance of a wrongly labelled sample, local procedures will be followed. Laboratory Medicine will accept no responsibility for samples analysed which initially failed to meet the acceptance criteria and will issue a disclaimer on such reports.

1.6.1 Samples failing acceptance criteria

If samples fail to meet the acceptance criteria they will not be processed. A report will be issued stating why the sample was rejected. Only unrepeatable samples will be processed, but **not before** the requestor has attended the relevant laboratory to complete a "Specimen Labelling Amendment Form". This form becomes part of the patient's record.

Examples of unrepeatable samples:

- Sterile body fluids (i.e. peritoneal, CSF, pleural)
- Bone marrow
- Fine needle aspirates (FNA)
- Tissue biopsies/surgical specimens/cytology samples (with the exception of sputum, urine and andrology samples)
- Blood cultures
- Mycology isolates from any of the above specimens
- Bronchoscopy/endoscopy specimens
- Drug levels timed for treatment (peak and trough), as well as any from neonatal patients
- Blood samples from patients with no venous access (i.e. femoral stabs)
- Arterial samples

All other samples will be rejected if they fail to meet the acceptance criteria. It is in everyone's interest, particularly the patients', that all samples and forms are correctly labelled before they are sent to the laboratory.

Please **do not** use addressograph labels on blood tubes or other small containers. These stickers are too large and the extra bulk they add means the samples will not pass through the automated analysers in the laboratories. Small labels can be used, except for transfusion samples.

1.6.2 Exceptions

Emergency departments (EDs) often care for patients unable or unwilling to give their identity including people who are unconscious or who have a critical illness, people with a mental health condition or delirium, and people affected by drink or drugs. The MFT Temporary Identification Criteria for Unknown or Unidentified patients Policy will be used to assign temporary identification to ensure the patient is uniquely identifiable and fulfils the Specimen acceptance policy minimal identification criteria.
In certain circumstances, patient identification details are intentionally hidden or substituted with particular ID numbers (e.g. Sexual Health, Clinical trials, donor samples) in such instances, a properly coded identifier must be used.

In all cases, the patient identification information on the sample must match that on the request form.

1.6.3 Patient consent

It is important that as well as the above, patient and family information is provided on the request form, where relevant (e.g. for interpreting genetic examination results). We may have to refer samples for testing to other laboratories if we are unable to perform the testing in-house. In these cases, we will have to send patient identifiers, such as name, date of birth and the clinical details we

have been given to enable these laboratories to perform appropriate testing and interpret results correctly.

The patient presenting to the point of sample collection or providing a sample themselves to their healthcare provider implies consent. The individual requesting the tests has responsibility for obtaining informed consent for these tests. Informed consent should cover all the tests requested, the implications of any results and that personal details and clinical information will be shared with the requesting organisation and any other organisations involved in providing the tests and results.

1.7 Requesting and reporting of laboratory tests

Electronic requesting must be used to request pathology investigations where it is available. Handwritten requests are more prone to sample labelling errors, transcription errors, sample collection errors and reporting errors. Do not use handwritten requests unless absolutely necessary.

Each request accepted by the laboratory for examination(s) shall be considered an agreement.

1.8 What to do when there is an IT failure

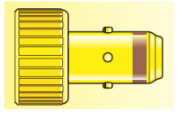
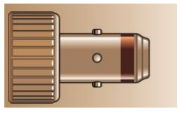
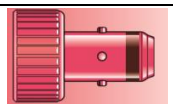
When there is a failure of the electronic requesting system and it is not possible to request pathology tests electronically, handwritten request forms can be used. Template downtime forms can be found on the Laboratory Medicine intranet pages.

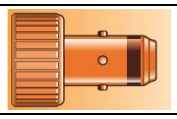
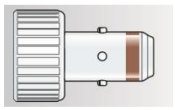
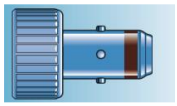
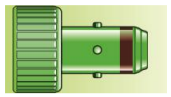
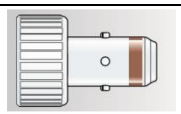
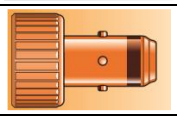
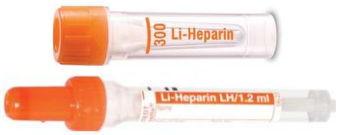
As part of the contingency process, all areas should store printed copies of the forms which can be photocopied as required. The laboratories will also hold a supply of printed forms for distribution if necessary.

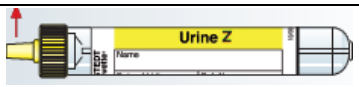
Critical/urgent results will be telephoned by Laboratory staff to the requesting departments. Please leave the Laboratory phone lines free for us to do this and do not contact us unnecessarily during these times.

1.9 Sample containers

Sarstedt sample collection tubes are used for adults and paediatric patients. The lid colours are shown in the table below.

Container type		Colour	Description	Use
Fluoride		Yellow	Fluoride EDTA	Blood glucose Ethanol Lactate
Serum gel		Brown	Serum gel	Routine biochemistry Immunology HIT Screens **Please note these tubes MUST NOT be used for mycology tests. The gel may reduce the drug level detected.**
EDTA (3.4ml tube for adults, 1.8ml		Red	EDTA	Full Blood Count ESR Plasma Viscosity

Container type		Colour	Description	Use
for paediatrics and 1.2ml for neonates)				Haemoglobinopathy screens Malaria Red Cell Enzymes HbA1c Immunology Ammonia Immunosuppressants Cobalt & chromium
Li Hep		Orange	Lithium heparin gel	
Serum (no gel)		White	Serum (no gel)	Bacteriology Viral serology Immunology Mycology Some transfusion tests Fluid samples
EDTA		Blue	EDTA	Blood group Cross match **Please note these tubes MUST NOT be used for routine haematology tests**
Citrate		Green	Citrate	PT APTT Factor assays Anticoagulant monitoring Thrombophilia Screens D-Dimer Fibrinogen
Trace metal		White	Trace metal serum	• Zinc and Selenium
Rapid Lithium Hep Gel plus		Orange	Thrombin-based clot activator	• Only for routine biochemistry samples from A&E department
Paediatric tubes (1.2ml):				
Glucose fluoride		Yellow	Fluoride EDTA	Blood glucose Ethanol Lactate
Li Hep		Orange	Lithium Heparin	Routine biochemistry
EDTA 1.8 ml For Paediatrics 1.2 ml for neonatal		Red	EDTA	Full Blood Count ESR Plasma Viscosity Haemoglobinopathy screens Malaria Red Cell Enzymes

Container type		Colour	Description	Use
EDTA 1.2 ml for Neonatal 3.4 ml for paediatrics		Blue	EDTA	Blood Group Crossmatch DAT **Please note these tubes MUST NOT be used for routine haematology tests**
Serum gel		Brown	Lithium Heparin	Immunology **Please note these tubes MUST NOT be used for mycology tests**
Citrate		Green	Citrate	PT APTT Factor assays Anticoagulant monitoring D-Dimer Fibrinogen
Other sample containers:				
Urine tube		Yellow	Plain	Biochemistry Microbiology
Plain universal		White	Sterile container	Microbiology CSF samples for biochemical analysis CSF samples for mycological analysis Cytology samples
Plain universal with scoop		Blue	Sterile container with scoop for collecting faeces	Microbiology culture Biochemical analysis
24 hour urine collection				24 hour urine

- *Return to Examinations offered by biochemistry*

1.10 Sample transportation

Each sample or set of samples must be placed in the plastic bag that accompanies the request form. This bag must be sealed to prevent any leakage or loss of samples in transit. Please do not

use staples to seal these bags. Please ensure that the request sticker is placed on the paper form that is attached to the sample bag and NOT placed directly on to the plastic bag.

Samples must NOT be stored but should be sent to the laboratory immediately via porter or air tube or, for off-site users, by the next available transport. Users must consider the time of the next transport as delays may compromise certain results - if unsure, contact the relevant department.

1.10.1 Hospital requirements

Delivery in person to laboratory:
Samples must be sealed in plastic bags and must also be placed in an appropriate carrier, e.g. sturdy carry box, sealed strong bag or another approved container whilst being carried to the laboratory.

Pneumatic tube:
Samples in sealed bags may be placed directly into the pods and sent through the system. See below for more information on sample types that can and cannot be sent in a pod.

1.10.2 GP requirements

Samples collected from GP practices are gathered into strong polythene bags which are sealed. The hospital transport drivers place these bags in the secure rigid sample transport boxes with sealable lids that they carry in their vans.

These boxes must be labelled as “Diagnostic Specimens – UN3373” and have the department and hospital name and contact telephone number.

1.10.3 Postal samples

Samples that are sent via the Royal Mail must be packed in special containers purchased from the Royal Mail that conform to regulation UN No 3373 – Packing instructions for Diagnostic specimens and Infectious substances (Packing instruction P650). This states that the ‘packaging must be of good quality, strong enough to withstand the shocks and loadings normally encountered during carriage’.

1.11 Requesting further tests on samples already in the laboratory (‘add-on’ tests)

1.11.1 Biochemistry

If you wish to request further tests on blood samples that you have already sent to us please call us on ext. 4765 with the patient identifiers and the tests you require.

1.11.2 Mycology Reference Centre

Please call us on ext. 2124 to request any additional tests, with patient identifiers. The addition of extra tests is dependent on sufficient sample volume and date of original sample collection.

1.12 Turnaround times

Turnaround times that appear in this handbook are from time of receipt into the laboratory information system (LIMS) to the time of reports being issued.

Where possible the time of receipt in the laboratory is recorded on the request form and corrected in the LIMS. This information is monitored monthly by each laboratory and is available on request.

1.13 Complaints or comments

We would hope that you do not have reason to complain about the service we provide. However, if you do, please use the contact details below or the specific departmental contact details to raise this with us in the first instance. Patient complaints can be made through the Trust website.

2 Phlebotomy

2.1 Inpatient service

A time limited service is provided to all medical and surgical wards Monday - Friday from between 8am and 12 noon for routine blood collection.

A restricted phlebotomy service is provided to the wards over the weekend and bank holidays to assist in the collection of routine blood samples between 7.30am and 11.30am.

All urgent blood requests must be taken by the doctor/nurse. Urgent requests should not be left for the phlebotomist's routine blood collection round.

2.2 Outpatient service

There is a drop-in phlebotomy service for out-patients. Please note this service is **not** for in-patient use.

Site	**Location**	**Days**	**Hours**
Wythenshawe Hospital	Phlebotomy suite opposite first floor Out-patient Department	Monday - Friday	09:00 am - 16:45 pm
Withington Community Hospital	Main Out-patients Department, ground floor	Monday - Thursday	08:30 am - 16:45 pm
		Friday	08:30 am - 16:00 pm

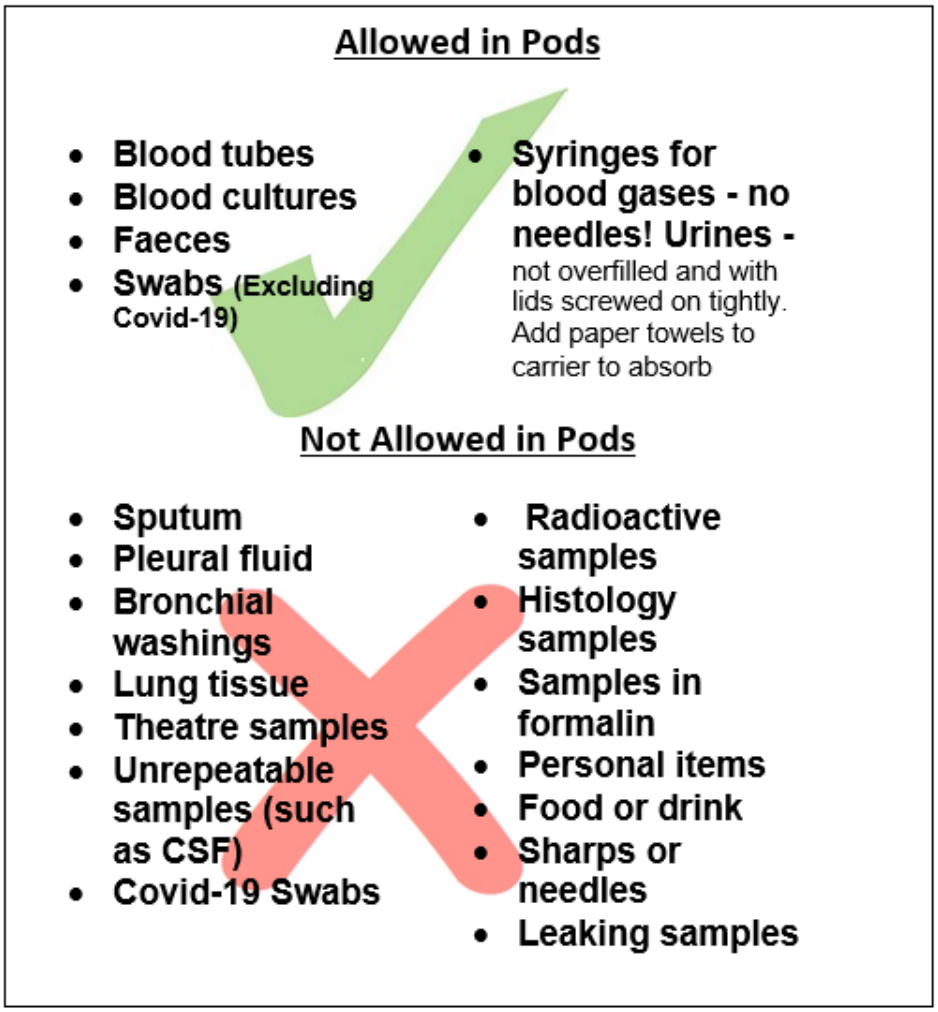
2.3 General Practitioner service

General Practitioner patients must use the appointment system and call 0800 092 4020 or 0161 947 0770 to book an appointment. **Please note -** patients must attend phlebotomy with a blood request form.

Site	**Location**	**Days**	**Hours**
Wythenshawe Hospital	Phlebotomy suite opposite first floor Out-patient Department	Monday - Friday	08:15am – 09:25am
Withington Community Hospital	Main Out-patients Department, ground floor	Monday - Friday	08:30 am – 12:25 pm
Burnage Health Centre	347 Burnage Ln, Manchester M19 1EW	Friday	09:00 am – 10.55 am

3 Sample reception

Pathology sample reception is open 24 hours a day, every day. Samples can be delivered directly to the hatch at specimen reception at the front of the Clinical Sciences Building or sent via the pneumatic tube. There are restrictions on samples that can be sent via the pneumatic tube, as detailed below:



This sign should be on every pod station. If your pod station does not have this sign please contact Sodexo on ext. 5430.

4 Cellular Pathology

For information on the Cellular Pathology service please click here.

5 Haematology

For information on the Haematology service please click here.

6 Immunology

For information on the Immunology service please click here.

7 Microbiology

The Microbiology Laboratory service for Wythenshawe Hospital is provided by the Manchester Medical Microbiology Partnership (MMMP), situated at the Oxford Road Campus. All information regarding the microbiology service is available on the MFT Laboratory Medicine website. Click on the MMMP User Manual link. The manual includes information on how to request samples out-of-hours and a list of contact details.

8 Biochemistry

Clinical Biochemistry is the study of the chemical and biochemical processes of the body in relation to disease. This is a laboratory-based service which exists to help clinicians in the prevention, diagnosis, treatment and management of disease. Diseases such as diabetes, thyroid problems, kidney disease, heart attacks and cystic fibrosis can be diagnosed and monitored by the analysis of body fluids such as blood, urine, saliva and CSF.

The department uses a fully automated analyser to analyse the majority of routine samples. This analyser has a sophisticated sample tracking system which incorporates online decapping, aliquotting, sealing and storage of samples within the analysing process. This system allows a high throughput of samples with fast turnaround times. The department is also a specialist centre for mass spectrometry, analysing samples from around the world for immunosuppressants, steroid hormones, and markers of neuroendocrine tumours on six state-of-the-art mass spectrometers.

The Biochemistry department also actively promotes and supports Point-of-Care Testing (POCT), managing blood gas analysers, blood glucose, ketone, urinalysis, haemoglobin, HbA1c and INR testing meters throughout the Trust.

The majority of routine biochemistry results are returned within 24 hours, with a high percentage being turned around within four hours. Exceptions include the more specialised tests which may require batching, manual preparation or periods of incubation. Turnaround times are recorded for each of the tests in the test library below. The test library is split into several sections:

Tests not available within the department are referred to specialist accredited laboratories. See Referred Tests.

8.1 Contact details

	Extension	Email address
Results/general enquiries	2126	
To add on tests to samples already in the laboratory	4765	
Clinical/Scientific advice - contact Duty Biochemist (DB)	2136	
GTT and sweat test appointments Biochemistry Secretary	4787	
Dr G Horsman Consultant Chemical Pathologist	4791	graham.horsman@mft.nhs.uk
Lead Biomedical Scientist	4783	
Professor A M Kelly Consultant Chemical Pathologist	2132	Anne-Marie.Kelly@mft.nhs.uk
Secretary to Professor Kelly	2122	
Professor B Keevil Consultant Clinical Scientist, Head of Biochemistry	2135	Brian.Keevil@mft.nhs.uk
Mrs J Adaway Consultant Clinical Scientist	5084	jo.adaway@mft.nhs.uk
Fax	2927	
Out of hours Biomedical Scientist (BMS)		Bleep 2023
For Point of Care Testing Enquiries:		
Dee Patel POCT Coordinator	4781	Deepika.Patel@mft.nhs.uk POCT.biochemistry@mft.nhs.uk
See also the Point of Care page on the Intranet		
All telephone extensions should be prefixed with 0161 291 when calling from outside the hospital unless otherwise stated		
Return to General contact details Examinations offered by biochemistry Sample information CSF Sweat test		

8.2 Working hours

The laboratory provides a 24-hour service. Routine throughput can vary throughout the day depending on demand.

Routine hours:	09:00 - 17:30 Monday-Friday
Non Routine hours:	17:30 - 09:00 Monday – Friday All day Saturday, Sunday and Bank Holidays

8.2.1 Outside routine hours

Only a limited number of staff are available to perform a restricted range of critical tests. Other tests may be performed but require prior discussion with the laboratory by bleeping the on-call BMS on **2023**, who may refer the request to the on-call Biochemist. For advice on result interpretation out of hours, ask the switchboard to contact the on-call Biochemist on the air-call bleep.

The following tests are available at all times without prior arrangement:

General Biochemistry	
U & E (Sodium, potassium, urea, creatinine, eGFR)	Lipase
LFT (Total protein, albumin, ALT, ALP, globulin & bilirubin), AST, conjugated bilirubin, GGT	Uric Acid
Bone profile (Total protein, albumin, globulin, calcium, phosphate)	Chloride
Arterial Blood gas (also available as point of care testing in the hospital)	Venous Bicarbonate
CRP	Lipids (Cholesterol, HDL, triglycerides, LDL)
Troponin T & cardiac enzymes (CK, LDH, AST)	
Glucose	Ethanol
Lactate	Vitamin B12 & folate
Ammonia	Iron studies (Fe, ferritin, transferrin)
Magnesium	
Bilirubin	

Endocrinology & Tumour markers	Drug monitoring	CSF/Fluid analysis
Thyroid function tests (TSH & fT4)	Paracetamol & Salicylate	Protein
Gonadotrophins (LH/FSH)	Antiepileptic drugs – carbamazepine & phenytoin, valproate	Glucose
Oestradiol	Theophylline	Lactate
hCG	Antibiotics – gentamicin, vancomycin, tobramycin & amikacin	
AFP	Digoxin	
PSA		
Progesterone		
Prolactin		

8.3 Urgent Requests

Urgent requests need to be marked clearly on the request form.

For A&E and samples marked urgent, the above tests that are available at all times will be available within 1 hour of receipt in sample reception 90% of the time. Please call the laboratory for results of urgent endocrinology tests or tumour markers out of routine hours as these require extra interpretation and may take longer to appear on EPR.

8.4 Examinations offered by Biochemistry

Please note: **separate blood samples** for each laboratory discipline are required – Mycology, Microbiology, Immunology, Biochemistry and Haematology.

All routine biochemistry tests can be analysed on one filled 4.9 ml tube (brown top). For non-routine tests please see the individual test information in the Test Library for sample type (or Appendix A for a full A-Z list of tests from all departments).

Further details for non-routine tests: contact the Duty Biochemist.

8.5 Sample transportation

CSF, precious samples and samples that must reach the laboratory within a set time **must not** be transported by pneumatic tube.

8.6 Add-on Tests

The majority of tests can be added onto an initial collection within 24 hours. Some tests are more stable and can be added on up to 5 days. Urine samples are stored for 2 days, all other samples are stored for a minimum of 5 days and then discarded. Please contact the add-on line on ext. 4765 to request any additional tests.

8.7 Sample Information

Age and sex related reference ranges are available from the laboratory and will be provided with reports, providing sufficient patient information is given when requesting.

Biochemistry samples should be filled to the line to allow enough sample for analysis.

Turnaround times are for routine samples. If tests are urgently required then please contact the Duty Biochemist during routine working hours or, outside these times, bleep the on-call BMS.

8.8 Test library

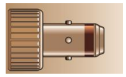
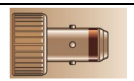
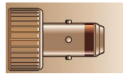
Arterial Blood Gases

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
pH	1 hour	 Heparinised syringe	7.38 - 7.42	
pCO2			4.7 - 6.0 kPa	
pO2			12.0 - 14.6 kPa	
Bicarbonate			21 - 25 mmol/L	
Methaemoglobin			<1.0% of total Hb	
Base Excess			-2 to +2 mmol/L	
Carboxyhaemoglobin			Non-smokers <5% Smokers 2 - 15%	

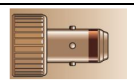
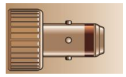
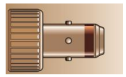
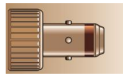
Routine Biochemistry

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Sodium	4 hours	 Serum gel	133 - 146 mmol/L	Guidelines for management of hyponatraemia can be found in the MFT Wythenshawe site formulary.
Potassium	4 hours	 Serum gel	3.5 - 5.3 mmol/L Neonate (1-3 weeks): 3.6 - 5.8 mmol/L	Guidelines for management of hypokalaemia / hyperkalaemia can be found in the MFT Wythenshawe site formulary.
Chloride	4 hours	 Serum gel	95 - 108 mmol/L	

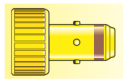
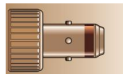
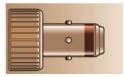
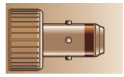
Routine Biochemistry

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Venous Bicarbonate	4 hours	 Serum gel	22 - 29 mmol/L	
Urea	4 hours	 Serum gel	2.5 - 7.8 mmol/L	
Creatinine	4 hours	 Serum gel	Female: 45 - 84 µmol/L Male: 59 - 104 µmol/L **0**: No evidence of AKI **1**: An increase of serum creatinine >26 umol/L from baseline in 48 hrs **OR** more than 1.5 to 2 fold from baseline **2**: An increase of serum creatinine of more than or equal to 2-3 fold from baseline **3**: An increase of serum creatinine more than 3 fold from baseline **OR** serum creatinine >355 umol/L with an acute rise of at least 45 umol/L	More details are available http://uhsm-intranet/imt/ICE/Pages/AKIAlerts.aspx Also from the think Kidneys website - https://www.thinkkidneys.nhs.uk/
eGFR	4 hours		≥60 mL/min/1.73m^2	Results above 90 will be reported as > 90 ml/min/1.73m^2

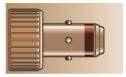
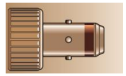
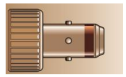
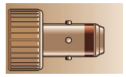
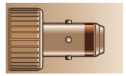
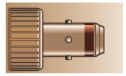
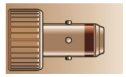
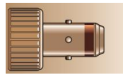
Routine Biochemistry

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
		Serum gel		eGFR is only an estimate and is not validated for use in the following: children, pregnancy, acute renal failure, oedematous states, muscle wasting disease states, amputees and malnourished patients. This measurement is for Caucasian patients only. There is a correction factor to be applied for Afro-Caribbean patients, and this will be published on the report form. Also refer to http://www.renal.org/information-resources/the-uk-eckd-guide or the Think Kidneys website
Glucose (fasting) *	4 hours	 Fluoride EDTA	3.0 - 6.0 mmol/L	*Low/High glucose measurements using Point of Care Testing equipment need to be verified by sending a specimen to the laboratory.
Bile Acids	24 hours	 Serum gel.	≤14 µmol/L	
Bilirubin (total)	4 hours	 Serum gel	<21 µmol/L	
Bilirubin (unconjugated)	4 hours	 Serum gel	Derived result Not available	
Calcium (Amended)	4 hours	 Serum gel	2.20 - 2.60 mmol/L	Amended calcium is calculated using a formula from local population data, and which is monitored and updated wherever required

Routine Biochemistry

Return to: Biochemistry Information
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
				Guidelines for management of hypercalcaemia and hypocalcaemia can be found in the MFT Wythenshawe site formulary.
Magnesium	4 hours	 Serum gel	0.7 - 1.0 mmol/L	Guidelines for management of hypomagnesaemia can be found in the MFT Wythenshawe site formulary.
Phosphate	4 hours	 Serum gel	0.80 - 1.50 mmol/L	Guidelines for management of hypophosphataemia can be found in the MFT Wythenshawe site formulary.
Total protein	4 hours	 Serum gel	60 - 80 g/L	
Albumin	4 hours	 Serum gel	35 - 50 g/L	
Globulin	4 hours	 Serum gel	25 - 42 g/L	
Iron	4 hours	 Serum gel	5.8 - 34.5 µmol/L	
Transferrin	4 hours	 Serum gel	2.0 - 3.6 g/L	
Urate	4 hours		Male: 200 - 430 µmol/L	

Routine Biochemistry

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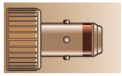
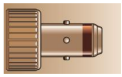
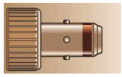
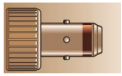
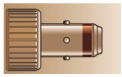
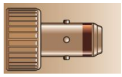
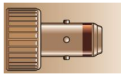
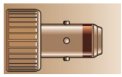
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
		Serum gel	Female: 140 - 360 µmol/L	
CRP	4 hours	 Serum gel	< 5 mg/L	
ALP	4 hours	 Serum gel	Adult: 30 - 130 IU/L	
Lipase	4 hours	 Serum gel	13 - 60 U/L	
AST	4 hours	 Serum gel	Male: <50 IU/L Female: <35 IU/L	
ALT	4 hours	 Serum gel	Male: <50 IU/L Female: <35 IU/L	
GGT	4 hours	 Serum gel	Male: 10 - 71 IU/L Female: 6 - 42 IU/L	
CK	4 hours	 Serum gel	Male: <320 IU/L Female: <200 IU/L	
LDH	4 hours	 Serum gel	≤250 U/L	

Routine Biochemistry

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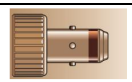
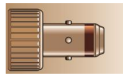
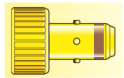
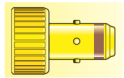
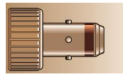
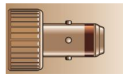
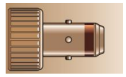
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Total cholesterol	4 hours	 Serum gel	Dependent on coronary risk factors. See BNF for details	
HDL cholesterol	4 hours	 Serum gel	Male: >1.0 mmol/L Female: >1.2 mmol/L	
Fasting triglycerides	4 hours	 Serum gel	<1.7 mmol/L	
Lactate	2 hours	 Fluoride EDTA	Age related Adult 0.6 - 2.5 mmol/L	
ACE (Angiotensin converting enzyme)	72 hours	 Serum gel	≤65 IU/L for patients above 14 years of age	
Alcohol (Ethanol)	4 hours	 Fluoride EDTA	Not detected	
Ammonia	4 hours	 EDTA	Adult: 10-50 µmol/L	**Ensure sample received in lab within 30 minutes of collection. Air tube transport is not suitable, deliver sample directly to lab**
Osmolality	36 hours	 Serum gel	275 - 295 mOsm/kg	

Routine Biochemistry

Return to: Biochemistry Information
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
HbA1c	96 hours	 EDTA	NON-DIABETIC: 25 - 36 mmol/mol IFCC (equivalent to 4.5 - 5.5% DCCT) GOOD Control: <49 mmol/mol IFCC (equivalent to 6.5% or less DCCT) POOR Control >64 mmol/mol IFCC (equivalent to 8.1% or above DCCT) BORDERLINE: 49 - 64 mmol/mol IFCC (equivalent to 6.6 - 8.0% DCCT) An HbA1c of 48 mmol/mol is recognised as the cut point for diagnosing diabetes mellitus (WHO 2011). Diabetes mellitus is not excluded by an HbA1c < 48 mmol/mol. An HbA1c of 42 - 47 mmol/mol indicates a high risk of diabetes mellitus.	HbA1c is not appropriate for the diagnosis of diabetes mellitus in some situations e.g increased red cell turnover.
High Sensitivity Troponin T	2 hours	 Serum gel	Reference range: ≤14 ng/L A change of 50% or more between the 0 and 3 hour samples is significant (increase or decrease) ICE will alert any change of 50% or more (whether increasing or decreasing) Click on the alert icon for details	The Chest Pain Pathway should be followed in all cases. Send blood for troponin T measurement at 0 and 3 hrs post admission if coming in to hospital or post chest pain if already an inpatient.
B12	24 hours	 Serum gel	197 - 771 ng/L	

Routine Biochemistry

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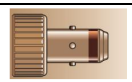
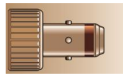
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Ferritin	24 hours	 Serum gel	Male: 30 - 400 µg/L Female: 13 - 150 µg/L	
Folate	24 hours	 Serum gel	3.9 - 20 µg/L	

Therapeutic Drug Monitoring

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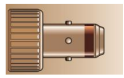
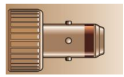
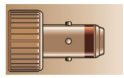
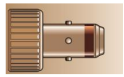
Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Paracetamol	4 hours	 Serum gel	Not detected	It is recommended to measure paracetamol 4 hour post suspected overdose if an accurate history is possible. Paracetamol levels may be falsely low when sample is taken after starting treatment with N-acetyl cysteine.
Salicylate	4 hours	 Serum gel	No reference range	If the patient has taken other drugs toxicity may be enhanced. For advice contact the local poisons information service: 0344 892 0111
Amikacin	4 hours	 Serum gel	See comments. (Ranges from microbiology)	**Antimicrobial interpretation should be directed to a consultant microbiologist** Once daily dosing: Trough <5mg/L Multiple daily dosing: Trough <10 mg/L Peak 25-30 mg/L
Carbamazepine	4 hours	 Serum gel	4.0 - 12.0 mgl/L concern level: 25 mgl/L	
Cyclosporin	24 hours		Variable Target ranges depend on specific use of the drug.	

Therapeutic Drug Monitoring

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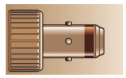
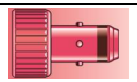
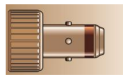
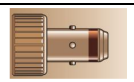
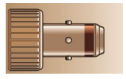
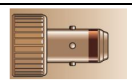
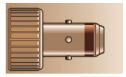
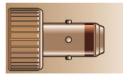
Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
		EDTA	Suggest consult local specialist for advice.	
Digoxin	4 hours	 Serum gel	0.6 - 1.2 µg/L; concern level: 3.0 µgl/L	Results are only meaningful if taken > 6 hours after previous dose. Hypokalaemia and/or hypothyroidism can potentiate toxicity.
Everolimus	24 hours	 EDTA	3 – 8 µg/L	
Gentamicin	4 hours	 Serum gel	See comments, reference ranges from microbiology	Once daily dosing: Trough level: < 1 mg/L Peak level: not required to assess therapy Multiple daily dosing Trough level: < 1 mg/L Peak level: not usually required to assess therapy
Lithium	24 hours	 Serum gel	0.4 - 1.0 mmol/L	pre-dose or >12 hrs post dose
Mycophenolate	192 hours	 EDTA	2.5-4.5 mg/L trough level for heart and lung transplant patients	Pre-dose
Phenytoin	4 hours	 Serum gel	5.0 - 20.0 mg/L	

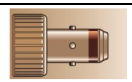
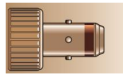
Therapeutic Drug Monitoring

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Prednisolone	192 hours	 Serum gel	Prednisolone should be detectable 1-8 hours post dose	
Sirolimus	24 hours	 EDTA	See comment (Ranges from transplant team)	Trade name Rapamycin Therapeutic range for heart and lung transplant only 4-12 µg/L initial therapy 12-20µg/L after cyclosporin elimination
FK506 (Tacrolimus)	24 hours	 EDTA	1.0 -12.0 µg/L This range applies to heart and lung transplant patients only. Consult local specialist for other uses.2.0 µg/L	pre-dose
Teicoplanin	5 Days	 Serum gel	Severe staph aureus infections pre-dose target range; 20-60 mg/l. Other severe infections target levels; 10-60 mg/l	BNF states: Teicoplanin not measured routinely as a relationship between plasma teicoplanin and toxicity has not been established. Plasma teicoplanin concentration may be used to optimise parental treatment in severe sepsis or burns, deep seated staph infection, endocarditis, renal impairment, elderly patients or iv drug users.
Tobramycin	4 hours	 Serum gel	See comments (Ranges from microbiology)	**Antimicrobial interpretation should be directed to a consultant microbiologist** Once daily dosing: Trough <1 mg/L. Peak levels not needed to assess therapy Multiple daily dosing: Trough <2 mg/L (< 1mg/L in CF) Peak 6-10 mg/L (8-12 mg/L in CF) Finger prick samples are also accepted.

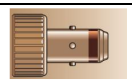
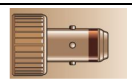
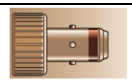
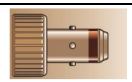
Therapeutic Drug Monitoring

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Theophylline	4 hours	 Serum gel	Adult: 10 - 20 mg/L	Pre-dose
Vancomycin	4 hours	 Serum gel	Trough level: 10 – 15 mg/L Trough level: 15 – 20 mg/L for severe MRSA infections.	**Antimicrobial interpretation should be directed to a consultant microbiologist** Pre-dose

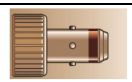
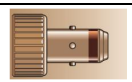
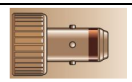
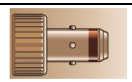
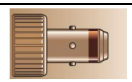
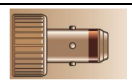
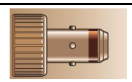
Endocrinology

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Free T4	4 hours	 Serum gel	10 - 25 pmol/L	
Free T3	72 hours	 Serum gel	3.1 - 6.8 pmol/L	
TSH	4 hours	 Serum gel	0.27 - 4.20 mU/L	
TPO	96 hours	 Serum gel	<34 IU/mL	

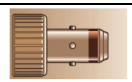
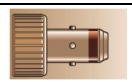
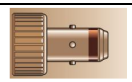
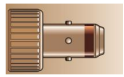
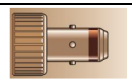
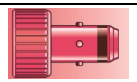
Endocrinology

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
LH	24 hours	 Serum gel	Variable. See report	
FSH	24 hours	 Serum gel	Variable. See report	
Progesterone	24 hours	 Serum gel	Variable. See report	
Oestradiol	24 hours	 Serum gel	Variable. See report	Mass spectrometry assay for oestradiol also available with TAT of 10 days . Contact 2136 for details
Prolactin	24 hours	 Serum gel	Variable. See report	
Testosterone	240 hours	 Serum gel	See report	
Salivary testosterone	744 hours	Saliva (passive drool). Contact lab	See report	Samples collected onto salivette swabs are NOT suitable.
SHBG	240 hours	 Serum gel	See report	

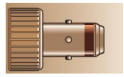
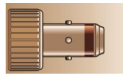
Endocrinology

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
17-hydroxyprogesterone	240 hours	 Serum gel	Variable. See report	Part of female testosterone profile
Androstenedione	240 hours	 Serum gel	0.8-4.7 nmol/L	Part of female testosterone profile
DHEAS	240 hours	 Serum gel	Variable. See report	Part of female testosterone profile
Metanephrines	240 hours	 EDTA	Metanephrine <510 pmol/L Normetanephrine <1180 pmol/L 3-methoxytyramine (3-MT) <180 pmol/L	Sample must reach lab and be separated & frozen within 1 hour of collection. Preferably take sample with patient recumbent after overnight fast.
Macroprolactin	5 days	 Serum gel	See report	Usually added to requests by laboratory staff as required
PTH	24 hours	 Serum gel	1.6 - 6.9 pmol/L for normocalcaemic patients	
Renin	240 hours	 EDTA	0.3-2.2 nmol/L/hr	
Aldosterone	240 hours	 EDTA	up to 630 pmol/L	

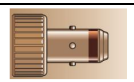
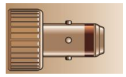
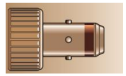
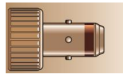
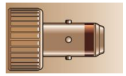
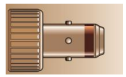
Endocrinology

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Cortisol by mass spec	36 hours	 Serum gel	Shows variation across day 0830-1130: 100-500 nmol/L	This test is for patients on prednisolone or metyrapone, Automatically chosen by ICE/HIVE depending on answers to requesting questions.
Cortisol by immunoassay		 Serum gel	Shows variation across day 6am-10am reference range 133-537 nmol/L	NOT for patients on prednisolone or metyrapone. Automatically chosen by ICE/HIVE depending on answers to requesting questions.
Salivary cortisol	240 hours	 (Contact lab)	See report	
Vitamin D	168 hours	 Serum gel	See report	
Dexamethasone	360 hours	 Serum gel	Dexamethasone concentrations <3.0 nmol/L suggest impaired absorption or excess metabolism of dexamethasone and an alternative biochemical screening test to investigate hypercortisolism should then be considered Conversely, dexamethasone concentrations ≥3.0 nmol/L suggest adequate absorption and metabolism of dexamethasone	Several drugs/medications have been identified as potential inducers or inhibitors of the CYP3A4 enzyme resulting in accelerated or impaired metabolism of dexamethasone. For further information contact the Duty Biochemist.
Human chorionic gonadotrophin (hCG)	24 hours	 Serum gel	Non-pregnant < 2.0 U/L	

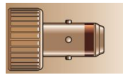
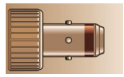
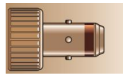
Specific Proteins

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Alpha-1-antitrypsin	96 hours	 Serum gel	0.9 - 2.0 g/L	Assay performed Tuesday and Friday. Low Alpha-1-antitrypsin results (< 1.1 g/L) and samples from patients < 1 years will be sent away for phenotyping.
IgA	72 hours	 Serum gel	See report	
IgG	72 hours	 Serum gel	See report	
IgM	72 hours	 Serum gel	See report	
Protein Electrophoresis	168 hours	 Serum gel	Qualitative interpretation	The main use of this test is to exclude the presence of a monoclonal protein, which may indicate myeloma, MGUS or a lymphoproliferative disorder. A urine sample for analysis of Bence Jones proteins is also required to exclude the above disorders. Polyclonal increases in immunoglobulins can be associated with infection, inflammation or connective tissue disease and do not indicate myeloma.
Rheumatoid factor	4 hours	 Serum gel	<14 IU/mL	

Tumour Markers

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
5HIAA, serum	240 hours	 Serum gel	<140 nmol/L	Sample should be taken after overnight fast Avoid serotonin containing foods
5HIAA, urine	240 hours	24 hr urine Acidified	Normal: <46 µmol/24hrs May be dietary: 46 – 90 µmol/24hrs Unlikely to be dietary: >90 µmol/24hrs	Avoid serotonin-containing foods (bananas, avocados, aubergine, pineapples, kiwi fruit, walnuts tomatoes) and cough medicines for 3-4 days prior to and during the collection
AFP	24 hours	 Serum gel	<6 IU/mL	
PSA	24 hours	 Serum gel	See report	
CEA	96 hours	 Serum gel	<5 µg/L	
CA19-9	96 hours	 Serum gel	<34 U/mL is considered normal	
CA-125	96 hours	 Serum gel	<35 U/mL is considered normal	

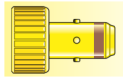
Tumour Markers

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Plasma Metanephrines	240 hours	 EDTA	See report	Separate plasma within 1 hour of collection Preferably take sample with patient recumbent after overnight fast.

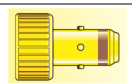
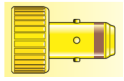
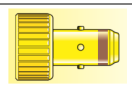
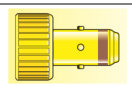
CSF

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
CSF protein	4 hours	Adult 2.7ml Fluoride EDTA tube a minimum volume of 0.5ml CSF is required  Fluoride EDTA CSF	Adults: 0.15 -0.45 g/L This reference range is not applicable to neonates and young children	Universal plain container also acceptable for CSF protein sample.  Plain container Min 5 drops (250 µl) of CSF Paediatric Fluoride EDTA (thumb prick) tube **not acceptable** due to falsely elevated results. Paediatric 1.2ml Fluoride EDTA tube is acceptable.

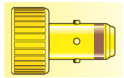
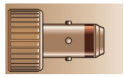
CSF

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
CSF glucose	4 hours	 Fluoride EDTA CSF  Fluoride EDTA Blood	CSF glucose is usually ~ 60% of plasma value (2.5 - 5.5 mmol/L).	Adult 2.7ml Fluoride EDTA tube a minimum volume of 0.5ml CSF is required Paediatric 1.2ml Fluoride EDTA tube is acceptable To interpret CSF glucose a plasma glucose sample is required.
CSF lactate	4 hours	 Fluoride EDTA CSF  Fluoride EDTA Blood	CSF lactate normally parallels plasma concentration.	Adult 2.7ml Fluoride EDTA tube a minimum volume of 0.5ml CSF is required Paediatric 1.2ml Fluoride EDTA tube is acceptable To interpret CSF lactate a plasma lactate sample is required.

CSF

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Xanthochromia	Analysed 8am-8pm*	 Plain container 4th sample of LP (min 0.5ml)  Fluoride EDTA CSF (total protein)  Serum gel Blood for bilirubin		Xanthochromia Collection packs are available from Biochemistry. Xanthochromia test should only be requested in CT-scan negative patients. Sample must be 12 h post-onset of symptoms and within 14 days of symptoms. CSF must be protected from light. *Samples received outside of these times can be sent to an external laboratory if result required urgently (minimum 700 µL of sample required). Please contact the lab on 2699 to arrange if this service is required.

Faeces

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Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Faecal elastase (pancreatic)	336 hours	 Faeces container Random faeces (minimum pea sized amount)	Severe insufficiency: < 100 µg/g Moderate insufficiency: 100-200 µg/g Normal: > 200 µg/g normal	Watery/runny or mucousy stool samples may have falsely low results due to dilution. Send a formed stool sample where possible.

Urinalysis

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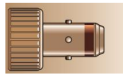
Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Bence-Jones protein	192 hours	 Plain container 10ml urine	Screening test, Pos or Neg	Early morning sample preferred
Calcium	4 hours	24 hr urine Acidified	2.5 - 7.5 mmol/24hrs	
Citrate	240 hours	24 hr urine Acidified	1680-6450 µmol/24hrs	

Urinalysis

Return to: Biochemistry Information
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Cortisol	192 hours	24 hr urine No preservative	Up to 165nmol/24 hours	
Cotinine	192 hours	 Plain container	See report	Nicotine metabolite – may also be positive if patient is on nicotine replacement therapy
Creatinine Clearance	24 hours	 24 hr urine No preservative  Serum gel Blood for U&E	Age dependent. See report	For most patients e-GFR is used to estimate glomerular filtration
Cystine	240 hours	 24 hr urine No preservative	<100 mg/24hrs	

Urinalysis

Return to: Biochemistry Information
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Magnesium	24 hours	24 hr urine Acidified	2.4 - 6.6 mmol/24hr	
Microalbumin (ACR)	24 hours	 Plain container 10 ml EMU	ACR >2.9 mg/mmol should be regarded as clinically important proteinuria in all patients (NICE CG182)	Also known as albumin:creatinine ratio (ACR)
Osmolality	24 hours	 Plain container 10 ml random	Relative to hydration status	
Oxalate	240 hours	24 hr urine Acidified	See report	Contact Duty Biochemist for paediatric reference ranges
Phosphate	24 hours	24 hr urine Acidified	15-50 mmol/24h	Random urine phosphate also available
Potassium	24 hours	 24 hr urine No preservative	25 - 125 mmol/L	Contact Duty Biochemist for further information Random urine phosphate also available
Protein	24 hours	24 hr urine No preservative	<140 mg/24hrs	Urine protein:creatinine ratio also available to detect proteinuria in pregnancy. Albumin:creatinine ratio (ACR) should be requested to detect proteinuria in all other

Urinalysis

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Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
				cases; protein:creatinine ratio will be added by the lab if ACR is above measurement limits of assay.
Sodium	24 hours	 24 hr urine No preservative	40 - 220 mmol/24 hr	Contact Duty Biochemist for further information Random urine sodium also available
Urate	24 hours	24 hr urine No preservative	1.5 - 4.5 mmol/24hr	

Pleural Fluid

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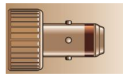
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Total protein	24 hours	 Plain container Fluid	Lights Criteria: Pleural fluid is suggestive of an exudate if any of the following apply: Fluid protein : Serum protein > 0.5 Fluid LDH : Serum LDH > 0.6 Fluid LDH > 2/3 of the upper reference limit	**ASSAY NOT VALIDATED FOR FLUIDS** In order to differentiate a transudate from an exudate please send fluid and serum samples for total protein and LDH. Analysis may not be possible on heavily blood stained samples
LDH		 Serum gel		
Glucose	24 hours	 Plain container	Glucose < 2.2 mmol/L is associated with empyema, rheumatoid arthritis, tuberculosis or malignancy. This cut off may not apply in patients with elevated plasma glucose.	**ASSAY NOT VALIDATED FOR FLUIDS**

Pleural Fluid

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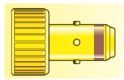
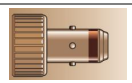
Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
		Fluid  Fluoride EDTA		To interpret fluid glucose a plasma glucose sample is required. Please contact the duty biochemist for further advice.
pH	24 hours	 Heparinised syringe	pH < 7.3 is associated with empyema, TB, malignancy, collagen vascular disease or haemothorax.	**ASSAY NOT VALIDATED FOR FLUIDS** Please REMOVE needle and cap syringe prior to sending sample to lab. Analysis may not be possible on heavily blood stained samples
Triglyceride	24 hours	 Plain container Fluid  Serum gel **Fasting**	> 1.26 mmol/L: Suggestive of a Chylous effusion < 0.57 mmol/L: Not suggestive of a Chylous effusion 0.57 – 1.26 mmol/L: equivocal	**ASSAY NOT VALIDATED FOR FLUIDS** To interpret fluid triglycerides a **fasting** serum sample is required. Interpret fluid triglycerides with caution in patients on TPN or those with hypertriglyceridemia. For further information contact the Consultant Chemical Pathologists. Analysis may not be possible on heavily blood stained samples
Lipase	24 hours		Fluid lipase higher than serum lipase may be suggestive of pancreatic involvement.	**ASSAY NOT VALIDATED FOR FLUIDS**

Pleural Fluid

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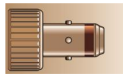
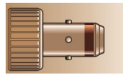
Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
		 Plain container Fluid  Serum gel Blood		This test should only be requested if a pancreatic cause of pleural effusion is suspected. To interpret fluid lipase a serum sample is required. NOT TO BE USED FOR PANCREATIC CYST FLUID. For further advice contact the duty biochemist
Albumin	24 hours	 Plain container Fluid  Serum gel	An albumin gradient (serum albumin – fluid albumin) < 12 g/L is suggestive of a transudate and > 12 g/L is suggestive of an exudate.	**ASSAY NOT VALIDATED FOR FLUIDS** In order to differentiate a transudate from an exudate please request a fluid and serum samples for total protein and LDH Analysis may not be possible on heavily blood stained samples

Other Fluids

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
For fluids other than CSF, Pleural effusions and urine please contact duty biochemist for advice on appropriate test selection.				

Specialist Tests

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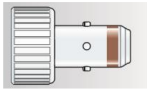
Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Cryoglobulins	192 hours	 Plain serum	Normal result – cryoglobulins NOT detected.	**Samples need to be sent to the laboratory at 37°C. Sample must be collected into a pre-warmed tube and transported to the laboratory in a vacuum flask containing warm sand.** Collect pre-warmed flask/tube from Specimen Reception (Clinical Sciences Building) or Out-patient phlebotomy.
Sweat test	34 hours	Sweat	**For child of 6 months of age or older:** Abnormal consistent with CF: Chloride > 60 mmol/L Equivocal: Chloride 40 - 60 mmol/L Normal: Chloride < 40 mmol/L For a child <6 months of age please contact the laboratory or refer to the report.	These are performed in the Paediatric Outpatients department on Thursday mornings. A prior appointment is needed. Please contact the Consultant Chemical Pathologists' secretary. A request form or referral letter with full patient details must be sent to the department.
Renal stone analysis	17 days	Stone (calculi)	See report	Please include information on the location the stone was removed from.

Check www.UKAS.com for up to date accreditation status of referral laboratories.

Referred Tests

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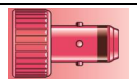
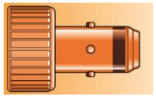
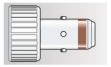
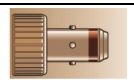
Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information	Referral Lab and Accreditation Number
ACTH	24 days	 EDTA	See report	**Must be received in lab within 15 minutes of collection.**	Clinical Biochemistry, The Christie Hospital (8697)

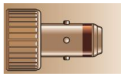
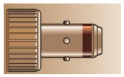
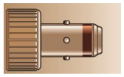
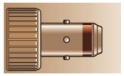
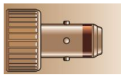
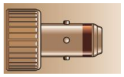
Referred Tests

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information	Referral Lab and Accreditation Number
Acyl carnitines/free carnitine/MCADD profile	2 weeks	Dried blood spot or  Lithium heparin	See report		Willink Laboratory (UKAS 9865)
Alkaline phosphatase isoenzymes	2 weeks	Serum 	See report		Biochemistry, MFT Oxford Road (UKAS 8651)
Amino acids (plasma)	35 days	 Lithium heparin	See report	CSF amino acids also available	Willink Laboratory (UKAS 9865)
Amino acids (urine)	35 days	 Plain container 5 mL random urine sample	See report		Willink Laboratory (UKAS 9865)
B2 microglobulin	14 days	 Serum gel	See report		Department of Immunology, MFT Oxford Road (UKAS 8195)
β-OH butyrate/free fatty acids	17 days	 Lithium heparin	See report	Separate sample required. Take at time of hypoglycaemia. **Must be received in the lab within 20 minutes of collection.**	Paediatric Biochemistry, MFT Oxford Road (UKAS 8651)

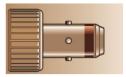
Referred Tests

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information	Referral Lab and Accreditation Number
Caeruloplasmin	10 days	 Serum gel	See report	Requested with copper for investigation of ?Wilson's disease	Biochemistry, MFT Oxford Road (UKAS 8651)
Cholinesterase/acetylcholinesterase	4-6 weeks	 Serum gel	See report	For investigation of suxamethonium/mivacurium sensitivity (scoline apnoea). Apnoea investigations should wait until patient is fully recovered.	Biochemistry, MFT Oxford Road (UKAS 8651)
Chromium and cobalt	5 weeks	 EDTA	See report	Take serum sample through needle first and discard. Then take sample into trace element tube through the same needle and send to lab.	Biochemistry, MFT Oxford Road (UKAS 8651)
Copper (serum)	10 days	 Serum gel	See report	Copper increases during the acute phase response, and should not be measured in patients with acute infection/inflammation. Fasting samples preferred.	Biochemistry, MFT Oxford Road (UKAS 8651)
Copper (urine)	4 weeks	24h urine collection	See report	No preservative or pre-treatment of the container required	Biochemistry, MFT Oxford Road (UKAS 8651)
Complement C3	7 days	 Serum gel	See report		Department of Immunology, MFT Oxford Road (UKAS 8195)
Complement C4	7 days	 Serum gel	See report		Department of Immunology, MFT Oxford Road (UKAS 8195)
Down's syndrome screening	5 days	 Serum gel	Risk factor provided. Refer to report.	Reports sent directly to requestor.	Blood Sciences, Royal Bolton Hospital (UKAS 9925)

Referred Tests

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information	Referral Lab and Accreditation Number
Drugs of abuse screen (urine)	14 days	 Plain container Random urine sample	See report	Indicate on request form if cannabis and/or urine ethanol are required.	Clinical Biochemistry, Manchester Royal Infirmary, (UKAS No. 8651)
Faecal reducing substances/faecal sugar chromatography	21 days	Faeces	See report	**Sample must be received in lab within 2 hours of collection.**	Paediatric Biochemistry, MFT Oxford Road (UKAS 8651)
Fluid amylase	4 days	Pancreatic cyst fluid ONLY	See report	Pancreatic cyst fluid ONLY.	Christie Pathology Partnership (UKAS 8697)
Galactosaemia screening test	14 days	 Lithium heparin	See report	Test not valid if patient has had recent blood transfusion.	Willink Laboratory (UKAS 9865)
Growth hormone	17 days	 Serum gel	See report	Random growth hormone may be difficult to interpret. IGF-1 more useful for patients with ?acromegaly. Consult Endocrinologist if further advice required.	Biochemistry, MFT Oxford Road (UKAS 8651)
Gut hormone profile (fasting)	28 days	 EDTA	See report	Patient must be fasting. **Sample must be received in lab within 15 minutes of collection.** Includes glucagon, VIP, pancreatic polypeptide, gastrin, somatostatin and chromogranin A and B. Where safe to do so, patient must be off omeprazole (& other proton pump inhibitors) for 2 weeks and H2 antagonists for 72 hours.	SAS Endocrine Laboratory, Charing Cross Hospital (UKAS 8673)

Referred Tests

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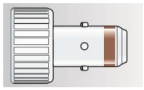
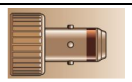
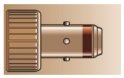
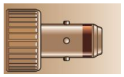
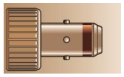
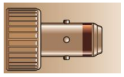
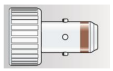
Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information	Referral Lab and Accreditation Number
Haptoglobin	10 days	 Plain serum	See report		Biochemistry Oldham (UKAS 8601)
IGF-1	17 days	 Serum gel	Reference range varies with age. See report		Biochemistry, MFT Oxford Road (UKAS 8651)
IgG subclasses (IgG4 can also be requested separately)	10 days	 Serum gel	See report	Investigation of suspected immunodeficiency, or autoimmune pancreatitis which can be associated with raised IgG4 levels.	Department of Immunology, MFT Oxford Road (UKAS 8195)
Insulin and c-peptide (adult patients >16 years of age, for investigation of hypoglycaemia)	17 days	 Serum gel	See report	Sample must be received in the lab within 20 minutes of collection. Collect at time of hypoglycaemia. Also send sample for glucose.	SAS Peptide Hormone Laboratory, Royal Surrey County Hospital (UKAS 9732)
Lamotrigine	1 working day	 Serum gel	See report	Pre-dose	Biochemistry, MFT Oxford Road (UKAS 8651)
Mannose binding lectin	17 days	 Serum gel	See report		Protein Reference Unit, Sheffield (UKAS 8494)
Methotrexate	2 working days	Serum 	See report		Biochemistry, MFT Oxford Road (UKAS 8651)

Referred Tests

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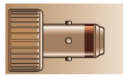
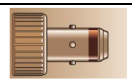
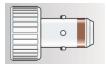
Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information	Referral Lab and Accreditation Number
Oligoclonal bands (CSF)	20 days	CSF with paired serum sample  Plain container CSF  Serum gel Blood	See report	For diagnosis of multiple sclerosis	Biochemistry, Salford Royal Hospital (UKAS 8331)
Organic acids (urine)	35 days	 Plain container 5 mL random urine sample	See report	Investigation of suspected inherited metabolic disorders	Willink Laboratory (UKAS 9865)
Orosomucoid (Alpha-1 acid glycoprotein)	17 days	 Serum gel	See report		Biochemistry, MFT Oxford Road (UKAS 8651)
Procollagen 1 intact N-terminal propeptide	2 weeks	Serum 	27 - 128 ug/L		Biochemistry, MFT Oxford Road (UKAS 8651)

Referred Tests

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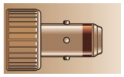
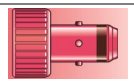
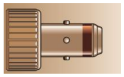
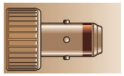
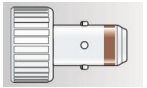
Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information	Referral Lab and Accreditation Number
Phenobarbital	48 hours	 Serum gel	See report	Pre dose.	Biochemistry, MFT Oxford Road (UKAS 8651)
Porphyrin screen	17 days	 Plain container Random urine  EDTA Blood	See report	**Samples must be protected from light immediately after collection. Provide full clinical details. If acute porphyria is suspected, sample should be collected at the time of symptoms.**	Porphyria Service, Medical Biochemistry, University Hospital of Wales, Cardiff (UKAS 8989)
Procalcitonin	14 days	 Serum gel	See report		Biochemistry, MFT Oxford Road (UKAS 8651)
PIIINP (Type III procollagen peptide)	35 days	 Serum gel	See report	**Sample must be received within 4 hours of collection.** For patients on methotrexate therapy.	Biochemistry, MFT Oxford Road (UKAS 8651)
Selenium	10 days	 Plain serum	See report	Selenium is decreased in the acute phase response, and should not be measured in patients with acute infection/inflammation. Results also affected by low albumin. Fasting samples preferred.	Biochemistry, MFT Oxford Road (UKAS 8651)

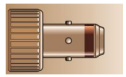
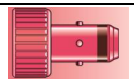
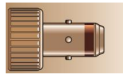
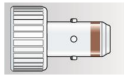
Referred Tests

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information	Referral Lab and Accreditation Number
Thiopurine metabolites	2 weeks	EDTA whole blood 	**6-TGN**: 235-450 pmol 6TGN/8x10^8 cells: maximum drug efficacy in IBD. **6-MMPN: >5700 pmol 6MMPN/8x10^8 cells:** Increased risk of hepatotoxicity.	Do not centrifuge - 3 days in the fridge	Biochemistry, MFT Oxford Road (UKAS 8651)
TPMT (Thiopurine S-methyltransferase)	192 hours	 EDTA	Deficient: <10 mU/L Low: 20-67 mU/L Normal: 68-150 mU/L High: >150 mU/L	Recent blood transfusions may mask a deficient TPMT result	Biochemistry, MFT Oxford Road (UKAS 8651)
Urine light chain quantification	15 days	24 hr urine No preservative	See report	Used in the monitoring of patients with myeloma	Protein Reference Unit, Sheffield (UKAS 8494)
Urine reducing substances	21 days	 Plain container Random urine	See report	Sample must be received in the lab within 2 hours of collection	Willink Laboratory (UKAS 9865)

Referred Tests

Return to: Biochemistry Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information	Referral Lab and Accreditation Number
Valproate	48 hours	 Serum gel	There are no evidence based therapeutic ranges for serum valproate concentrations. There is not a clear relationship between serum valproate concentration and efficacy and toxicity.	Pre-dose	Biochemistry, MFT Oxford Road (UKAS 8651)
Very long chain fatty acids (VLCFA)	35 days	 EDTA	See report		Willink Laboratory (UKAS 9865)
Vitamin A and E	10 days	 Serum gel	See report	Protect from natural light	Biochemistry, MFT Oxford Road (UKAS 8651)
Zinc	10 days	 Plain serum	See report	Zinc is decreased in the acute phase response, and should not be measured in patients with acute infection/inflammation. Results also affected by low albumin. Fasting samples preferred.	Biochemistry, MFT Oxford Road (UKAS 8651)

Protocols are available from the Department directly for the following dynamic tests. If these need to be discussed, please contact the Duty Biochemist.

8.9 Factors known to significantly affect performance of tests/interpretation of results

Problem	Common Causes	Affected Analyte
Delay in processing	• Overnight storage • >6 hour delay in separation	Increased potassium, phosphate, LDH, AST.

Problem	Common Causes	Affected Analyte
Incorrect storage	Storing unseparated sample in the fridge	• Increased phosphate and potassium • Decreased bicarbonate
Haemolysis	• Expelling blood through needle • Vigorous shaking • Extreme temperature	Increased potassium, phosphate, LDH, AST.
Inappropriate Collection Site	Sample taken from drip arm	• Increased drip analyte e.g. sodium, glucose • Decreased analytes - dilutional effect
Incorrect container or anticoagulant	No fluoride oxalate	Decreased glucose
	K-EDTA contamination	• Increased potassium • Decreased calcium, magnesium, alkaline phosphatase
	Lithium heparin tube	Increased lithium

8.10 Effect of haemolysis, lipaemia and icterus:

Haemolysis, lipaemia and icterus may cause false elevations or reductions in the measured concentrations of several biochemistry analytes. The presence of haemolysis, lipaemia or icterus will be detected in the laboratory and the affected analytes will be flagged. In cases where there is significant interference, the affected analyte will not be reported. Further information can be obtained from the Duty Biochemist.

8.11 Measurement uncertainty

All assays have a margin of error associated with the calculation of the numerical value. This is referred to as the measurement uncertainty and is usually expressed as a percentage of the reported figure. This calculation allows the user to understand the uncertainty of any numerical results and can be assured with 95% confidence that the true result lies plus or minus the measurement uncertainty around the reported value. Further information on the measurement of uncertainty for all our laboratory assays is available by contacting the Duty Biochemist within routine working hours.

8.12 Point of Care

The relationship between values obtained in the laboratory and POCT are established and available upon request.

9 Mycology Reference Centre, Manchester

The UK NHS Mycology Reference Centre Manchester (MRCM) is situated on the second floor of the Education & Research Centre at Wythenshawe Hospital. The MRCM provides specialist mycology diagnostic services for Manchester University NHS Foundation Trust, and hospitals throughout Greater Manchester and the UK.

Antifungal and mycological advice can be offered on the diagnosis of disease, clinical management and care of patients.

The MRCM laboratory is open from 08:30 to 17:00 hours Monday to Friday. Urgent medical advice can be obtained by contacting Wythenshawe Hospital switchboard and asking for the on-call Infectious Diseases Consultant.

9.1 Contact Details

Member of staff	Location	Extension	Email address
Dr R Richardson Clinical Lead and Head of Service	Office	5941	riina.richardson@mft.nhs.uk riina.richardson@nhs.net
	Secretary	5839	
	Mobile	07545 994 959	
Dr CB Moore Principal Clinical Scientist in Mycology and Deputy Head of Service	Office	4223	caroline.moore@mft.nhs.uk caroline.moore6@nhs.net
	Secretary	5839	
Professor MD Richardson Consultant Clinical Scientist in Mycology	Office	5914	malcolm.richardson@mft.nhs.uk
	Secretary	5839	
	Mobile	07545 994 936	
General enquiries	Office	5839	mrcm@mft.nhs.uk mft.mrcm@nhs.net
Test enquiries/results	Laboratory	2124	mrcm@mft.nhs.uk mft.mrcm@nhs.net
Website			www.mrcm.org.uk

All Wythenshawe Hospital samples should be sent to the Clinical Sciences Building, Wythenshawe Hospital where appropriate transportation to the Mycology Reference Centre Laboratory will be ensured.

External samples can be sent using the DX System. Our details are DX 332601 MANCHESTER 96M.

Alternatively, samples may be posted, ensuring appropriate packaging (see 1.10.3), to:

Mycology Reference Centre Manchester
2nd Floor Laboratories
Education and Research Centre
Wythenshawe Hospital
Southmoor Road
Manchester
M23 9LT

9.2 Additional Tests

Additional tests can be requested by contacting the laboratory, although it must be recognised that the archive sample available will have a limited volume. Furthermore, samples may be beyond the validation period for particular tests. Verbal requests for additional tests must be followed up in writing. The written request must include 3 patient identifiers, and the name of the requesting clinician.

9.3 Measurement Uncertainty

All assays have a margin of error associated with the calculation of the numerical value. This is referred to as the measurement uncertainty and is usually expressed as a percentage of the reported figure. This calculation allows the user to understand the uncertainty of any numerical results and can be assured with 95% confidence that the true result lies plus or minus the measurement uncertainty around the reported value. Further information on the measurement of uncertainty for our assays is available by contacting the laboratory.

9.4 Antifungal Drug Levels

Please ensure that details of **all** antifungal drugs the patient is receiving are given - this information is essential to ensure appropriate testing is performed.

Please record the date and time the specimen is taken, together with the time of last dose. These details ensure correct interpretation of results.

9.4.1 Indications for monitoring

- All patients receiving flucytosine
- Patients receiving itraconazole - to check drug absorption and to monitor compliance
- Patients receiving posaconazole - to check drug absorption and to monitor compliance
- Patients receiving isavuconazole – to check drug absorption and to monitor compliance
- All patients receiving voriconazole – a pre-dose sample is required
- Fluconazole in patients on dialysis/haemofiltration
- Patients failing azole therapy
- If drug interactions are suspected

10.4.2 References

- Richardson MD and Warnock DW. Fungal Infection: Diagnosis and Management. 4th Ed. Oxford, Wiley-Blackwell, 2012.
- Ashbee HR, Barnes RA, Johnson EM, Richardson MD, Gorton R, Hope WW. Therapeutic drug monitoring (TDM) of antifungal agents: guidelines from the British Society for Medical Mycology. J Antimicrob Chemother 2014; 69: 1162–1176.

9.5 Identification and susceptibility testing of medically important fungi

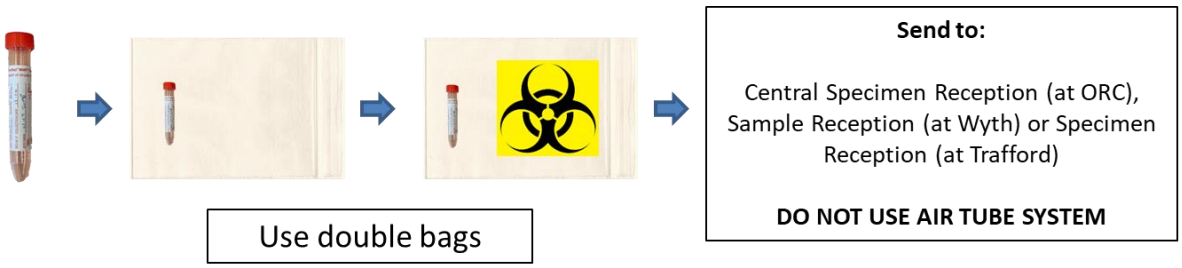
Genital, oral and wound swabs, along with respiratory and tissue specimens, will be cultured within our laboratory. Identification and/or susceptibility testing will be performed as appropriate.

10.5.1 Indications for testing

- All life-threatening fungal infections, to ensure that the optimal therapy is administered
- Isolates from patients at increased risk of fungal infection, such as those infected with HIV, immunosuppressed or on ICU, so that appropriate antifungal therapy can be given
- Mucosal candidosis not responding to therapy
- Clinically significant non-*Candida albicans* species due to increasing incidences of both infection and fluconazole resistance
- Rare pathogens because of an increased incidence of resistance and unpredictability of resistance patterns.

9.6 Sample collection and transportation

Sending respiratory samples from clinical areas:



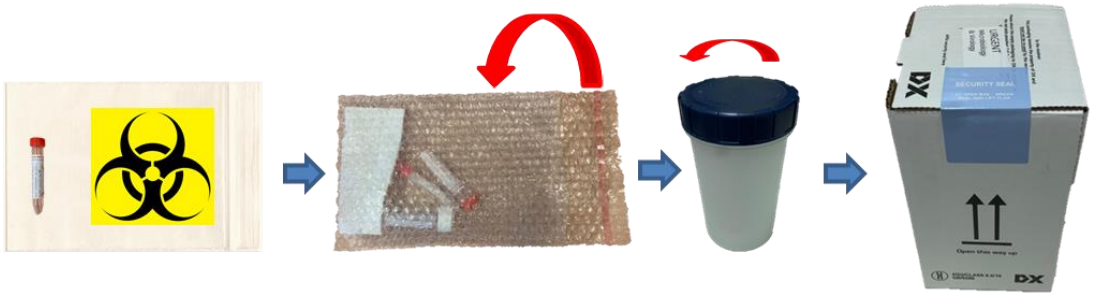
- Samples should be placed into a plastic Ziploc bag and then into another plastic Ziploc bag (preferably with a biohazard label on).

- All respiratory samples for mycology testing (e.g. *Aspergillus* galactomannan) must be packaged in double bags as described above. **Do not submit samples with trap tubing still attached.** These samples are prone to leaking. The trap tubing **must** be replaced with a secure screw cap lid prior to placing in the specimen bag.

- Category B transport boxes are no longer required for transport of clinical specimens from clinical areas to sample reception on the same hospital site. Samples being transported by road, between hospital sites, **MUST** either be placed into a Category B transport box or an appropriate

transport bag (i.e. one which adheres to regulations governing the transportation of diagnostic specimens.)

- Using the Cat B transport boxes:



Place single bagged sample into bubble wrap bag; seal and place into plastic cylinder; seal and place into cardboard box. Use supplied sticker to seal the box.

- Using the transport bags:

Place double bagged samples into the HCID transport bag. Multiple samples can be sent in the same bag.

10.7 Test library

Antifungal Drug Levels

Return to: Mycology Information
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Antifungal drug levels		See below		Specimens should be transported to the laboratory as soon as possible. If a delay is anticipated, samples should be refrigerated. Assays validated for transportation of samples at room temperature for up to and including 5 days. **For all drugs, the time of previous dose and time of sampling should be recorded accurately to allow correct interpretation.** Gel separation tubes should **not** be used as the gel may reduce the drug level detected. More accurate results will be obtained by using tubes with no additive.
Flucytosine	Generally next working day	 Adult 4.9 ml Neonate 0.5 ml	Adult: Pre-dose 30-40 mg/L; Post-dose 70-80 mg/L Neonate: (<3 months) Pre-dose 20-40 mg/L; Post-dose 50-80 mg/L Levels >100 mg/L are potentially toxic	**Therapeutic Drug Monitoring is essential for clinical management** Pre-dose: Oral and IV: Just before dose* Post dose: • Oral: 2 hours post dose* • IV: 30 minutes post dose* Commence: Around second/third dose Frequency: Twice weekly, or more often if renal function is changing Lab assay runs: Day of receipt as required. Samples must be notified or received before 1pm Please inform the laboratory if patient is on any other antifungal, in addition to flucytosine, as this may affect test result. * these samples are most useful for clinical management

Antifungal Drug Levels

Return to: Mycology Information
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Itraconazole	1-2 days	 Adult 4.9 ml Neonate 0.5 ml	• Target level: Prophylaxis: 0.5-1.0 mg/L Therapy: 1.0-2.0 mg/L • Commence monitoring only after steady state has been reached (1-2 weeks on oral therapy, little variation through the day)	**Therapeutic Drug Monitoring is essential for clinical management** Pre-dose: Oral: not needed Post dose: Oral: random* Commence: Only after steady state has been reached. Frequency: Dependent on patient - seek advice - usually monthly for the first three months and then every three months. Check levels two weeks after any dose change or if there might be a possible drug interaction. Repeat levels if concern about poor compliance / poor absorption. Lab assay runs: Each weekday * these samples are most useful for clinical management
Posaconazole	1-2 days	 Adult 4.9 ml Neonate 0.5 ml	• Target level: Prophylaxis: 0.7-1.5 mg/L Therapy: 1.0-3.75 mg/L • Consider reduction if > 3.0 mg/L • Commence monitoring only after steady state has been reached (1-2 weeks on oral therapy, little variation through the day)	**Therapeutic Drug Monitoring is essential for clinical management** Pre-dose: Oral: not needed Post dose: Oral: random* Commence: Only after steady state has been reached. Frequency: Dependent on patient - seek advice - usually monthly for the first three months and then every three months. Check levels a few weeks after any dose change or if there may be a drug interaction. Repeat levels if concern about poor compliance / poor absorption. Lab assay runs: Each weekday * these samples are most useful for clinical management

Antifungal Drug Levels

Return to: Mycology Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Voriconazole	1-2 days	 Adult 4.9 ml Neonate 0.5 ml	• **Pre-dose** level target range 1.3-5.7 mg/L • Dose escalation is advised for any level less than 1.3 mg/L • Due to the non-linear kinetics of the drug in adults, informed clinical judgement regarding target range is not possible on any sample except pre-dose samples	**Therapeutic Drug Monitoring is essential for clinical management** Pre-dose: Oral: 10-14 h post-dose window* (i.e. pre-dose as BD dosing) IV: Just before dose* Post dose: Not required Commence: after 3 days of therapy Frequency: Dependent on patient - seek advice. If patient has suspected invasive disease or very unwell, do a level at day 5 of treatment and repeat at least weekly until therapeutic levels obtained. If IV to oral switch done, repeat level about 5 days after switch. Once therapeutic levels achieved, repeat levels at 2, 4, 8 and 12 weeks, and every three months thereafter. For other diagnoses, do a level at week 2, 4, 8 and 12 of treatment and every three months thereafter. Repeat levels two weeks after any dose change or if a drug interaction is suspected. Repeat levels if concern about poor compliance / poor absorption. Lab assay runs: Each weekday * these samples are most useful for clinical management

Antifungal Drug Levels

Return to: Mycology Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Isavuconazole	1-2 days	 Adult 4.9 ml Neonate 0.5 ml	• Target levels not fully established and informed clinical judgement is required for dose adjustments. Consult Mycology Reference Centre for advice. • On normal isavuconazole dosing, most patients achieve levels between 2.0 and 4.0 mg/L. • Levels above 5.0 mg/L have been associated with an increase in GI side effects. • The mean half-life of isavuconazole in plasma is 130 hours and it has linear kinetics.	**Therapeutic Drug Monitoring is essential for clinical management** Pre-dose: Oral: 10-24 hours post-dose window* (ie pre-dose as BD dosing) IV: Just before dose* Post dose: Not required Commence: after 3 days of therapy Frequency: Dependent on patient - seek advice. If patient has suspected invasive disease or very unwell, do a level at day 5 of treatment and repeat at least weekly until therapeutic levels obtained. Once therapeutic levels achieved, repeat levels at 2, 4, 8 and 12 weeks, and every three months thereafter. For other diagnoses, do a level at week 2, 4, 8 and 12 of treatment and every three months thereafter. Repeat levels two weeks after any dose change or if a drug interaction is suspected. Repeat levels if concern about poor compliance / poor absorption. Lab assay runs: Each weekday * these samples are most useful for clinical management
Fluconazole levels can be assayed to test compliance or absorption. Contact the laboratory.				

Itraconazole, Posaconazole and Voriconazole TDM are performed by Department of Biochemistry, MFT Wythenshawe Hospital (UKAS 9063).

Isavuconazole TDM is performed by Antimicrobial Reference Laboratory, Bristol (UKAS 8099).
Check www.UKAS.com for up to date accreditation status of referral laboratories.

Fungal Culture

Return to: Mycology Information Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Oral swabs, including mouth and throat swabs	Culture result (positive or negative) available by 5 days. See 'Identification and Susceptibility Testing of Yeasts and Moulds' below for further information.	Swabs:  Collect with liquid eSwab and transport in sealed plastic bags. Specimens other than swabs:  Collect into appropriate UKCA/CE-marked sterile leakproof containers and	N/A	Use aseptic technique. Collect specimens before antifungal therapy is started, where possible. Mouth swabs: To ensure that preconditions of sampling for oral infections are comparable, it is advised that patients should not: 1. Eat or drink within 2 hours 2. Brush their teeth within 2 hours 3. Use any mouth rinse of disinfectant within 2 hours prior to sampling If possible, samples should be taken in the morning under fasting conditions. Sample pus if present otherwise sample any lesions or inflamed areas. A tongue depressor or spatula may be helpful to aid vision and avoid contamination from other parts of the mouth. Throat swabs: Throat swabs should be taken from the tonsillar area and/or posterior pharynx avoiding the tongue and uvula. Liquid eSwabs contain 1ml of liquid. No liquid should be discarded when collecting sample. Samples with insufficient liquid may be discarded.

Fungal Culture

Return to: Mycology Information
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
		transport in sealed plastic bags.		Specimens should be transported and processed as soon as possible. If processing is delayed, refrigeration is preferable to storage at ambient temperature. Delays of over 48 h are undesirable.
Genital tract swabs, including high vaginal swab (HVS), vaginal discharge, vulval swab, labial swab, cervical swab, endocervical swab, penile swab, urethral swab, and genital ulcer swab.	Culture result (positive or negative) available by 5 days. See 'Identification and Susceptibility Testing of Yeasts and Moulds' below for further information.	Swabs:  Collect into appropriate transport medium and transport in sealed plastic bags.	N/A	Use aseptic technique. Collect specimens before antifungal therapy is started, where possible. Cervical and high vaginal swabs should be taken with the aid of a speculum. It is important to avoid vulval contamination of the swab. High vaginal swabs: After the introduction of the speculum, the eSwab should be rolled firmly over the surface of the vaginal vault. Please use an eSwab and ensure the liquid remains in the tube. Cervical swabs: After introduction of the speculum to the vagina, the swab should be rotated inside the endocervix. Please use an eSwab and ensure the liquid remains in the tube. Urethral swabs: Contamination with micro-organisms from the vulva or the foreskin should be avoided. Thin swabs are available for collection of specimens. The patient should not have passed urine for at least one hour. For males, if a discharge is not apparent, attempts should be made to 'milk' exudate from the penis. The swab is gently passed

Fungal Culture

Return to: Mycology Information
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
				through the urethral meatus and rotated. Place the thin swab in Amies transport medium with charcoal. Liquid eSwabs contain 1 ml of liquid. No liquid should be discarded when collecting sample. Samples with insufficient liquid may be discarded. Specimens should be transported and processed as soon as possible. If processing is delayed, refrigeration is preferable to storage at ambient temperature. Delays of over 48hr are undesirable.
Wound swabs	Culture result (positive or negative) available by 5 days. See 'Identification and Susceptibility Testing of Yeasts and Moulds' below for further information.	Swabs:  Collect with liquid eSwab and transport in sealed plastic bags. Specimens other than swabs: 		Use aseptic technique. Collect specimens before antifungal therapy is started, where possible. Swabs for fungal culture should be taken using a liquid eSwab. Samples of pus/exudate, if present, are preferred to swabs. Sample a representative part of the lesion. Swabbing dry crusted areas is unlikely to yield the causative pathogen. If specimens are taken from ulcers, the debris on the ulcer should be removed and the ulcer should be cleaned with saline. If only a minute amount of pus or exudate is available, it is preferable to send a pus/exudate swab in transport medium to minimise the risk of desiccation during transport.

Fungal Culture

Return to: Mycology Information
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
		Collect into appropriate UKCA/CE-marked sterile leakproof containers and transport in sealed plastic bags.		Specimens should be transported and processed as soon as possible. If processing is delayed, refrigeration is preferable to storage at ambient temperature. Delays of over 48 h are undesirable.
Respiratory specimens, including bronchial aspirate, bronchoalveolar lavage, bronchial brushings, bronchial washings, endotracheal tube specimens, and expectorated or induced sputum.	Culture result (positive or negative) generally available by 14 days. Some specimens have extended culture up to 4 weeks. See 'Identification and Susceptibility Testing of Yeasts and Moulds' below for further information.	 Collect into appropriate UKCA/CE-marked sterile leakproof containers and transport in sealed plastic bags.	N/A	All specimens should be fresh and taken before antifungal treatment is started, where possible. Do not submit samples with Trap tubing still attached. These samples are prone to leaking and may be discarded. See Section 10.6 Sample collection and transportation for further details. Specimens should be transported and processed as soon as possible.
Tissue specimens	Culture result (positive or negative) available after extended culture of up to 4 weeks. See 'Identification and Susceptibility Testing of		N/A	Use aseptic technique. Collect specimens before antifungal therapy is started, where possible. Specimens received in formal-saline are not suitable for culture. If specimen is small, place it in sterile water to prevent desiccation.

Fungal Culture

Return to: Mycology Information
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
	Yeasts and Moulds' below for further information.	 Collect tissue or biopsy material in appropriate UKCA/CE-marked sterile leakproof container **without** formalin and transport in sealed plastic bags.		Specimens should be transported and processed as soon as possible. If processing is delayed, refrigeration is preferable to storage at ambient temperature. Delays of over 48 h are undesirable.

Identification and Susceptibility Testing of Yeasts and Moulds

Return to: Mycology Information
Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Full identification and susceptibility testing of all medically important yeasts and moulds	All TAT are calculated from when the **culture** is available for testing. Identification: Yeast: 2-5 days Mould: 2-7 days Longer if molecular sequence-based identification is required. Susceptibility testing: Yeast: 1-5 days Longer for some yeasts and drugs. Mould: 3-7 days Longer for some moulds and drugs, or if culture requires prior incubation.	As per Microbiology guidelines for individual sample types	N/A	The following susceptibility tests are routinely performed: **Yeasts**: Flucytosine, Fluconazole, Amphotericin, Itraconazole, Voriconazole, Micafungin, Anidulafungin, Posaconazole **Moulds**: Itraconazole, Amphotericin, Voriconazole, Posaconazole, Isavuconazole, Micafungin, Terbinafine Other drugs, including caspofungin, are available upon request

Cryptococcal antigen lateral flow test

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Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Lateral flow assay for cryptococcal antigen. Collection is not time dependent.	Generally same day	• CSF by lumbar puncture • Blood Minimum volume 500µl 	N/A	Indications for testing: • Testing for *Cryptococcus neoformans* capsular antigen is one of the most reliable methods for the diagnosis of cryptococcosis. • Suspected cryptococcosis, including cryptococcal meningitis, pulmonary and disseminated disease, in both immunocompromised, e.g. HIV-positive, and immunocompetent patients. With appropriate controls, a positive test is indicative of infection. Perform repeat lumbar puncture after 2 weeks of treatment. Repeated testing can be used to monitor response to treatment, monitor for duration of treatment course, especially in HIV-positive patients. Limitations The assay has not been evaluated for potential interference related to specimen pre-treatment with 2-mercaptoethanol, or with specimens including the following substances: vaginal cream, caffeine, ascorbic acid, itraconazole, amphotericin B, acetaminophen or acetylsalicylic acid.

Culture and identification of dermatophytes and non-dermatophytes from skin, nail and hair

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Culture	Direct microscopy: 1-4 days Culture and identification: 1-4 weeks. Longer for some unusual fungi.	Dermapaks, or similar envelopes, should be used. **Skin:** scrapings **Hair:** plucked hair roots and hair shaft **Nail:** nail clippings, scrapings of sub-ungual debris **Subcutaneous lesions:** scrapings, punch biopsies Adequate scrapings and clippings for direct microscopy and culture	N/A	No specific time of optimal collection, when patient presents with clinical presentation of superficial fungal infection and/or onychomycosis. Direct microscopy will be prioritised where there is insufficient material for full analysis.

Aspergillus galactomannan assay

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Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
PLATELIA assay for *Aspergillus* galactomannan circulating antigen in serum and other body fluids: this test is indicated for presumptive diagnosis of *Aspergillus* infection	This assay is performed every day, Monday-Friday. TAT: 95% within one weekday.	 4.9ml clotted blood  Respiratory samples – minimum 2 ml: Collect into appropriate UKCA/CE-marked sterile leakproof containers and transport in sealed plastic bags.	The Platelia galactomannan (GM) test results are expressed as an index value and are reported as negative, weak positive, or positive – with the index value given. Interpretation of values depends on the sample type: **Blood**: GM index values of >0.5 are interpreted as positive. Recent data suggests that Invasive Aspergillosis (IA) needs to be considered if serum or plasma value is ≥0.7, however a single value <1.0 does not support the diagnosis of IA. Repeat testing is recommended if the disease is suspected. **Bronchoalveolar lavage fluid**: GM index values >1.0 are interpreted as positive. Index values 0.5-1.0 have a lower predictive value than values >1.0 and are interpreted as weakly positive. Further sampling is recommended. Recent data suggests that Invasive Aspergillosis (IA) needs to be considered if the index value is ≥0.8, however a single value <1.0 does not support the diagnosis of IA. Repeat testing is recommended if the disease is suspected. **Sputum**: The test is **not** validated for sputum samples. The cut-off value for this sample type has not	No specific time of optimal collection. First clinical indication of pulmonary or invasive aspergillosis. Prospective screening twice weekly to monitor for evidence of elevated and rising levels of galactomannan which provides a convenient surrogate marker for invasive or pulmonary *Aspergillus* disease (depending on sample type tested). This test should be used in conjunction with other diagnostic procedures. Limitations The performance of the Platelia *Aspergillus* Ag assay has not been evaluated with neonatal samples. There is a higher incidence in the number of false positive galactomannan results reported in European literature in samples from the neonatal population. Platelia *Aspergillus* Ag assay may exhibit reduced detection of galactomannan in patients with chronic granulomatous disease and Job's syndrome. Specific factors should be taken into account when interpreting the test: Galactofuranose has been demonstrated in various foods, particularly cereals, cereal products, and

Aspergillus galactomannan assay

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Appendix A (list of tests)

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
			been established. In the presence of clinical suspicion, high values (>1) should trigger further investigations. Other respiratory samples can be processed but the test is **not** validated. Specificity of the test is improved if two or more consecutive specimens are positive.	cream desserts. Unlike human milk, cow's formulas frequently contain high concentrations of galactomannan. Dietary factors must therefore be taken into account in interpretation of the course of antigenemia in young children and more generally in all patients with an altered intestinal barrier. Positive test results in patients receiving piperacillin/tazobactam should be interpreted cautiously. In addition, semi-synthetic β-lactam treatments should be taken into account when interpreting the test. Administration of PLASMA-LYTE™ should be taken into account when interpreting results from serum and bronchoalveolar lavage fluid samples, since positive results have been observed in several studies.

Pan-fungal glucan assay

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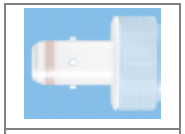
Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
FUNGITELL assay for (1-3)-β-D-glucan: the fungal glucan test is indicated for presumptive diagnosis of fungal infection	This assay is performed most days, Monday-Friday. TAT: 95% within two weekdays, generally available within one weekday.	 4.9 ml clotted blood **Samples are easily contaminated - it is recommended that blood is not separated before sending.**	The Fungitell test results are expressed in pg/ml of serum and range from undetectable (<31.25 pg/ml) to >500 pg/ml. Glucan values of <60 pg/ml are interpreted as negative results. Values ≥80 pg/ml are interpreted as positive. Values from 60 to 79 pg/ml are interpreted as indeterminate results and suggest possible fungal infection. Additional sampling is recommended. **The glucan test has a very high negative predictive value.** This is the possibility that patients with a negative screening test result do not have the disease (true negative). Test only validated for patients 18 years old and above.	No specific time of optimal collection. First clinical indication of invasive fungal infection. Prospective screening twice weekly to monitor for evidence of elevated and rising levels of glucan which provides a convenient surrogate marker for invasive fungal disease. This test should be used in conjunction with other diagnostic procedures. The Fungitell (1-3)-β-D Glucan assay does not detect certain fungal species such as the genus *Cryptococcus*, which produces very low levels of (1-3)-β-D-glucan. This assay also does not detect the Mucormycetes, such as *Lichtheimia*, *Mucor* and *Rhizopus*, which are not known to produce (1-3)-β-D-glucan. Limitations Positive results have been found in haemodialysis patients. Patients treated with certain fractionated blood products, such as serum albumin and immunoglobulins and in patients exposed to glucan containing gauze and surgical sponges, have been found to produce a positive result. Patients require 3-4 days for the restoration of baseline levels of serum 1-3-D glucan, after surgical exposure to 1-3-D glucan containing sponges and gauze. Interfering substances The following sample conditions can interfere with an accurate result:

Pan-fungal glucan assay

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Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
				• Haemolysis • Sample turbidity caused by lipemia • The presence of visually apparent bilirubin • Turbid serum • Elevated levels of immunoglobulin G

Aspergillus PCR on respiratory samples

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Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Elitech *Aspergillus* PCR	Seven days, performed twice weekly.	 Respiratory secretions (BAL, sputum) 1-2 ml minimum. Collect into appropriate UKCA/CE-marked sterile leakproof containers and transport in sealed plastic bags.	The Elitech *Aspergillus* PCR results are expressed as copies of *Aspergillus* spp. 18S rDNA; Ct values are also provided. Values of <120 copies are interpreted as negative results. Values >210 copies are interpreted as positive. Values from 120 to 210 copies are interpreted as indeterminate results and suggest possible fungal infection or colonisation.	No specific time of optimal collection. First clinical indication of pulmonary or invasive aspergillosis. False negative results may occur for a variety of reasons, for example inappropriate quality of sample and antifungal prophylaxis interference with assay. False positive results may occur if genera closely related to *Aspergillus* spp., e.g. *Penicillium* spp., are also present in the sample and detected due to the sequence similarity in the 18S rDNA. Assay for the quantitative detection of *Aspergillus* species genomic DNA extracted from respiratory specimens from the lower respiratory tract, as an aid to the diagnosis of pulmonary and invasive *Aspergillus* infection. The results need to be taken in context of the clinical condition of the patient and other diagnostic test results.

Aspergillus PCR on respiratory samples

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Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
				This test should be used in conjunction with other diagnostic procedures. Limitations Genomic DNA extracted from *Penicillium* spp, also generates positive results. Therefore, it must be noted that a positive result with this assay may be the result of infection by *Penicillium spp.,* rather than *Aspergillus* spp, Fungal culture may also be requested to aid diagnosis.

Aspergillus fumigatus cyp51A pyrosequencing

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Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Aspergillus fumigatus cyp51A pyrosequencing assay	Performed on demand – we aim for a TAT of 2 weeks. This may be up to 4 weeks, depending on the sample. .	 Respiratory secretions (BAL, sputum, 1-2 ml minimum). Collect into appropriate UKCA/CE-marked sterile	Sometimes DNA amplification fails, and no result is possible. Fifteen sites within the *cyp51A* gene of *Aspergillus fumigatus* are surveyed. Results are provided citing either no polymorphisms or resistance mutations in each site of *cyp51A* and an interpretation of the expected susceptibilities for itraconazole,	No specific time of optimal collection. Assay for the pyrosequencing-based detection of triazole resistance-associated polymorphisms of the *cyp51A* gene in *Aspergillus fumigatus*. All specimens are initially processed for *Aspergillus* PCR to determine suitability (>1000 copies 18S rDNA). The results need to be taken in context of the clinical condition of the patient and other diagnostic test results. Please contact MRCM for further information.

Aspergillus fumigatus cyp51A pyrosequencing

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Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
		leakproof containers and transport in sealed plastic bags. Culture of *Aspergillus fumigatus*.	voriconazole and posaconazole, according to published literature.	

Pneumocystis PCR

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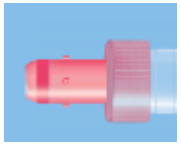
Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Pneumocystis PCR assay	4 days	 4.9 ml of EDTA blood	Threshold Cycle (CT) values are determined. Result is reported as positive or negative.	No specific time of optimal collection. First clinical indication of *Pneumocystis* infection. Specimens should be transported and processed as soon as possible. If processing is delayed, refrigeration is preferable to storage at ambient temperature. Delays of over 48 h are undesirable. False negative results may occur for a variety of reasons, for example inappropriate timing of sample collection, inappropriate sample, presence of virus below the

Pneumocystis PCR

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Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
		 BAL, sputum - collect into appropriate UKCA/CE-marked sterile leakproof containers and transport in sealed plastic bags. 500 µl minimum. Sample daily if *Pneumocystis* infection is suspected.		detectable limit of the assay, antifungal prophylaxis interference with assay. New and emerging variants may also occur which may not be detected by this assay. If *Pneumocystis* levels in the sample are close to the limit of detection of the assay, sampling variation will result in lower reproducibility. This test is performed by Department of Virology, MFT Oxford Road (UKAS 8393).

Molecular identification of fungi from culture negative, microscopy positive specimens

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Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Pan-fungal PCR: DNA extraction and molecular sequencing	2-4 weeks. Performed on demand.	 Original specimen – collect into appropriate UKCA/CE-marked sterile leakproof containers and transport in sealed plastic bags. If a fluid specimen, such as pus, BAL, pleural fluid, peritoneal fluid, transport at room temperature in sealed plastic bags. Fixed paraffin blocks (**preferable**): transported in a sterile container at room temperature. Fixed paraffin sections: 10x normal (5 µm) or 5x thick (10 µm) consecutive sections placed together in a sterile container and transported at room temperature.	Fungal identification provided. Sometimes DNA extraction fails, and no result is possible.	Indications for testing: clinically significant fungal infection, with negative culture and serology. Using sophisticated DNA extraction technology, fungal DNA can be obtained from most samples in which fungal hyphae are seen, including fixed paraffin sections. In some cases, no sample was submitted for culture; in other cases, culture is negative. Cases should be discussed with the MRCM staff, who will advise. Sanger sequencing is provided by Eurofins Genomics GmbH.

Surveillance of hospital environments, homes, public buildings, for Aspergillus species and allergenic moulds

Test	TAT	Sample type	Biological Interval / Clinical Decision Values	Special precautions/ Information
Culture of air samples, culture of dust and material samples.	Initial results: 5-7 days Final report: 14 days	Air samples, settled dust, surface samples, material samples	N/A	No specific time. Surveillance during hospital construction, maintenance, demolition and renovation, water damage, faulty air filtration and conditioning, and outbreaks. Minimum: one air sample and one dust sample each from patients' rooms and general hospital areas. More intensive sampling where reservoir of *Aspergillus* is most likely to occur. Sampling availability, processing of submitted samples, identification, and interpretation: please contact the laboratory for further information.

10 Appendix A – A-Z List of tests

Test	Department
5HIAA (urine)	Biochemistry
5HIAA (serum)	Biochemistry
17-hydroxyprogesterone	Biochemistry
HbA1c	Biochemistry
ACE (Angiotensin converting enzyme)	Biochemistry
ACTH	Biochemistry
Acyl carnitines/free carnitine/MCADD profile	Biochemistry
AFP	Biochemistry
Albumin (serum)	Biochemistry
Albumin (pleural fluid)	Biochemistry
Alcohol (Ethanol)	Biochemistry
Aldosterone	Biochemistry
ALP (adult)	Biochemistry
Alpha-1-antitrypsin	Biochemistry
ALT	Biochemistry
Amino acids (plasma)	Biochemistry
Amino acids (urine)	Biochemistry
Ammonia	Biochemistry
Lipase (serum)	Biochemistry
Lipase (fluid)	Biochemistry
Androstenedione	Biochemistry
Antifungal Drug Levels	Mycology
Arterial Blood Gases	Biochemistry
Aspergillus fumigatus cyp51A pyrosequencing	Mycology
Aspergillus galactomannan	Mycology
Aspergillus PCR	Mycology
Aspergillus precipitin test	Mycology
AST	Biochemistry
B12	Biochemistry
B2 microglobulin	Biochemistry
Base Excess	Biochemistry
Bence-Jones protein	Biochemistry
Bicarbonate (arterial blood gas)	Biochemistry
Bicarbonate (serum)	Biochemistry
Bilirubin	Biochemistry
CA-125	Biochemistry
CA19-9	Biochemistry
Caeruloplasmin	Biochemistry
Calcium	Biochemistry
Calcium (Amended)	Biochemistry
Carbamazepine	Biochemistry

Test	Department
Carboxyhaemoglobin	Biochemistry
Catecholamines	Biochemistry
CEA	Biochemistry
Chloride	Biochemistry
Cholinesterase/acetylcholinesterase	Biochemistry
Chromium and cobalt	Biochemistry
Citrate	Biochemistry
CK	Biochemistry
Combined pituitary function test	Biochemistry
Complement C3	Biochemistry
Complement C4	Biochemistry
Copper (serum)	Biochemistry
Copper (urine)	Biochemistry
Cortisol (blood)	Biochemistry
Cortisol (urine)	Biochemistry
Cotinine	Biochemistry
Creatinine	Biochemistry
Creatinine Clearance	Biochemistry
CRP	Biochemistry
Cryoglobulins	Biochemistry
Cryptococcal antigen lateral flow test	Mycology
CSF	Biochemistry
CSF glucose	Biochemistry
CSF lactate	Biochemistry
CSF protein	Biochemistry
Culture and identification of dermatophytes and non-dermatophytes from skin, nail and hair	Mycology
Cyclosporin	Biochemistry
Cystine	Biochemistry
Dexamethasone	Biochemistry
Dexamethasone suppression test	Biochemistry
DHEAS	Biochemistry
Digoxin	Biochemistry
Down's syndrome screening	Biochemistry
Drugs of abuse screen (urine)	Biochemistry
Dynamic Function Tests	Biochemistry
eGFR	Biochemistry
Endocrinology	Biochemistry
Everolimus	Biochemistry
Faecal elastase (pancreatic)	Biochemistry
Faecal reducing substances	Biochemistry
Faeces	Biochemistry
Fasting triglycerides	Biochemistry
Ferritin	Biochemistry
FK506 (Tacrolimus)	Biochemistry

Test	Department
Fluconazole	Mycology
Flucytosine	Mycology
Folate	Biochemistry
Free T3	Biochemistry
Free T4	Biochemistry
FSH	Biochemistry
Fungal Culture	Mycology
Galactosaemia screening test	Biochemistry
Gentamicin	Biochemistry
GGT	Biochemistry
Globulin	Biochemistry
Glucose	Biochemistry
Glucose (fasting)	Biochemistry
Glucose tolerance test	Biochemistry
Glucose tolerance test with GH suppression	Biochemistry
GnRH Stimulation test	Biochemistry
Growth hormone	Biochemistry
Gut hormone profile (fasting)	Biochemistry
Haptoglobin	Biochemistry
hCG	Biochemistry
HDL cholesterol	Biochemistry
High Sensitivity Troponin T	Biochemistry
Identification and Susceptibility Testing of Yeasts and Moulds	Mycology
IgA	Biochemistry
IGF-1	Biochemistry
IgG	Biochemistry
IgG subclasses (IgG4 can also be requested separately)	Biochemistry
IgM	Biochemistry
Insulin and c-peptide	Biochemistry
Insulin stimulation test	Biochemistry
Iron	Biochemistry
Isavuconazole	Mycology
Itraconazole	Mycology
Lactate	Biochemistry
Lamotrigine	Biochemistry
LDH (serum)	Biochemistry
LDH (pleural fluid)	Biochemistry
LH	Biochemistry
Bio_Urine_Light_chains	Biochemistry
Lithium	Biochemistry
Macroprolactin	Biochemistry
Magnesium (serum)	Biochemistry
Magnesium (urine)	Biochemistry
Mannose binding lectin	Biochemistry

Test	Department
Metanephrines	Biochemistry
Methaemoglobin	Biochemistry
Microalbumin (ACR)	Biochemistry
Molecular identification of fungi from culture negative, microscopy positive specimens	Mycology
Mycophenolate (MPA)	Biochemistry
Oestradiol	Biochemistry
Oligoclonal bands (CSF)	Biochemistry
Organic acids (urine)	Biochemistry
Orosomucoid (Alpha-1 acid glycoprotein)	Biochemistry
Osmolality (serum)	Biochemistry
Osmolality (urine)	Biochemistry
Other Fluids	Biochemistry
Oxalate	Biochemistry
Pan-fungal glucan assay	Mycology
Paracetamol	Biochemistry
pCO2	Biochemistry
pH (blood)	Biochemistry
pH (pleural fluid)	Biochemistry
Phenobarbital	Biochemistry
Phenytoin	Biochemistry
Phosphate (serum)	Biochemistry
Phosphate (urine)	Biochemistry
PIIINP (Type III procollagen peptide)	Biochemistry
Plasma Metanephrines	Biochemistry
Pleural Fluid	Biochemistry
Pneumocystis PCR	Mycology
pO2	Biochemistry
Porphobilinogen/ urobilinogen / Porphyria screen	Biochemistry
Porphyrin screen	Biochemistry
Posaconazole	Mycology
Potassium (serum)	Biochemistry
Potassium (urine)	Biochemistry
Prednisolone	Biochemistry
Procalcitonin	Biochemistry
Progesterone	Biochemistry
Prolactin	Biochemistry
Prolonged fasting test	Biochemistry
Protein	Biochemistry
Protein Electrophoresis	Biochemistry
PSA	Biochemistry
PTH	Biochemistry
Referred Tests	Biochemistry
Renal stone analysis	Biochemistry
Renin	Biochemistry

Test	Department
Rheumatoid Factor	Biochemistry
Routine Biochemistry	Biochemistry
Salicylate	Biochemistry
Salivary cortisol	Biochemistry
Salivary Testosterone	
Selenium	Biochemistry
SHBG	Biochemistry
Short Synacthen test	Biochemistry
Sirolimus	Biochemistry
Sodium (serum)	Biochemistry
Sodium (urine)	Biochemistry
Specialist Tests	Biochemistry
Specific Proteins	Biochemistry
Surveillance of hospital environments, homes, public buildings, for *Aspergillus* species and allergenic moulds	Mycology
Sweat test	Biochemistry
Teicoplanin	Biochemistry
Testosterone	Biochemistry
Theophylline	Biochemistry
Therapeutic Drug Monitoring	Biochemistry
Tobramycin	Biochemistry
Total cholesterol	Biochemistry
Total protein (serum)	Biochemistry
Total protein (pleural fluid)	Biochemistry
TPMT (Thiopurine S-methyltransferase)	Biochemistry
TPO	Biochemistry
Transferrin	Biochemistry
Triglyceride	Biochemistry
TSH	Biochemistry
Tumour Markers	Biochemistry
Urate (serum)	Biochemistry
Urate (urine)	Biochemistry
Urea	Biochemistry
Urinalysis	Biochemistry
Urine reducing substances	Biochemistry
Valproate	Biochemistry
Vancomycin	Biochemistry
Very long chain fatty acids (VLCFA)	Biochemistry
Vitamin A & E	Biochemistry
Vitamin D	Biochemistry
Voriconazole	Mycology
Water deprivation test	Biochemistry
Xanthochromia	Biochemistry
Zinc	Biochemistry
β-OH butyrate/free fatty acids	Biochemistry