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	Approval	P.Monaghan/ S.Thirkettle	Date of Issue	21/08/2026	
	Author	P.Monaghan	Frequency	Annually	

Date of Review	Signed By	Date of Review	Signed By	Date of Review	Signed By	Date of Review	Signed By

Biochemistry User Guide

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Contact details of key members of staff

Prof. Phillip Monaghan PhD, FRCPath EuSpLM (Consultant Clinical Scientist, Clinical Director of Laboratory Services)

Email: phillip.monaghan@nhs.net

Phone: 0161 918 2466

Mrs Deborah Seals (Blood Sciences Service Manager/Deputy General Manager)

Email: Deborah.seals@nhs.net

Phone: 0161 446 3167

The contact number for the biochemistry department is 0161 446 3298.

The full contact details of all laboratory personnel can be found on the staff directory.

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The location of the laboratory

The Biochemistry laboratory is situated within the Pathology Department (Department 45) located at the Wilmslow Road end of the 1st floor corridor, above main out-patients. Follow signs for Pathology.

Services offered by the laboratory

A comprehensive service is available for clinical biochemistry testing, including routine profiles, endocrinology, therapeutic drug monitoring, specialist proteins and tumour marker analyses. Full details of tests routinely available, sample requirements and expected turn-around times are detailed in the [Biochemistry Test Directory](#).

For any test not listed, please contact Biochemistry (ext 3298) to discuss test availability and specimen requirements.

Point of care testing (POCT) analysers are available on CCU, Surgical Theatres, Ward 2 and AAU. Two further analysers are also available on CRF and Christie Clinic 3rd Floor Ward in emergencies only Training for use of POCT devices is compulsory. Please contact Dr Sally Thirkettle (POCT Lead) to arrange training if required (ext 3298).

Glucose meters for POCT blood glucose are available on all wards and in certain departments. Support and training is provided by the biochemistry POCT co-ordinator (ext 3298)

Times of opening of the laboratory

Mon – Fri

07:00 – 08:30 – limited service

08:30 – 17:00 – routine service

17:00 – 21:00 – limited service

21:00 – 07:00 – urgent requests for the immediate management of the patient only

Sat/Sun

08:00-17:00 - limited service

17:00 – 08:00 - urgent requests for the immediate management of the patient only

Selected **urgent** Biochemistry, Haematology and Transfusion tests required for the immediate management of the patient are available from the on-site laboratory overnight:

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The test repertoire available from 21:00 – 07:00):

FBC	
Coagulation screen	
Crossmatch	Only if Hb < 8 and patient symptomatic (NB Transfusion policy discourages transfusion overnight unless essential)
Issue of platelets	
Issue of blood products	
Christie profile / U&E	
Glucose	
Magnesium	
Amylase	
ALT	
CRP	
Creatine Kinase	
Uric acid	
Lipase	
Ammonia	
Lipid profile	
CSF glucose	
CSF protein	
Urine U&E	
Vancomycin	
Gentamicin	
Troponin I	
Serum / Urine Osmolality	
Pregnancy Test	
Cortisol	
Amikacin	Not provided on site - Urgent requests for these tests will be referred to external hospital for processing.
Digoxin	
Ethanol	
Lithium	
Salicylate	
Paracetamol	
Theophylline	
Co-oximetry (methaemoglobin, carboxyhaemoglobin)	
Phenytoin	

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For Haematology/Biochemistry samples

After 21:00 all samples should be sent to the lab via POD 222. There is no need to ring to notify the lab unless your request requires immediate attention, in which case you should call the Biomedical Scientist on 07387140948 as staff may be occupied elsewhere.

Requests for Blood / Blood Products

The Biomedical Scientist must be contacted on 07387140948 if Blood / Blood Products are required between 21:00 – 07:00. Requests that are sent for provision of products outside of this time do not require pre-notification.

Point of Care (POCT) Testing

Four blood gas analysers are available permanently sited on CCU, Surgical Theatres, Ward 2 and AAU. Two further analysers are also available on CRF and Christie Clinic 3rd Floor Ward in emergencies only. Please use an alternative analyser if any one of these is not operating. Glucometers are in most clinical areas, and the majority of departments have additional analysers they can use in the event of breakdown.

Analysis can only be performed by staff that have completed the appropriate training.

Sodium, potassium, chloride, bicarbonate, calcium (ionised), glucose, lactate pH, pO₂ and pCO₂ and co-oximetry are available on the blood gas analysers. Glucose and ketones are available on the glucose/ketone meters.

The POCT team monitor the blood gas analysers daily during routine hours. In the unlikely event that all blood gas analysers are not working outside of routine hours, please contact the on-call BMS at Manchester Royal Infirmary (MRI) (0161 276 4375 or via MRI switchboard 0161 276 1234 and ask for bleep 2722) prior to taking the sample. To minimise the time delay between taking the sample and subsequent analysis at MRI, also ensure transport has been arranged via Christie switchboard prior to taking the sample. Ideally the sample should be transported on ice to minimise sample deterioration.

Result transmission is checked daily Monday-Friday. In the event there is no transmission of results to the CWP, please contact the laboratory on 3298 and retain your result print-outs from the blood gas analysers and document glucose and ketone results directly into a patient's notes.

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Consent

It is the responsibility of the requesting clinician to obtain consent from the patient for the collection of blood specimens. For certain tests (e.g. genetic testing) a consent form may be required in addition to the request form.

Privacy Policy

For details of the Synlab Group Privacy Policy – please click the following link - <https://www.synlab.com/privacy-policy>

Instructions for requesting tests

Patient preparation and blood sampling:

Trust I.V. policies managed by clinical skills team can be found on HIVE.

Any patient preparation requirements for tests are detailed in the A-Z [Biochemistry Test Directory](#).

Please contact the Duty Biochemist on ext 3298 to discuss patient preparation, specimen type and stability for infrequently requested tests.

Specimens will be accepted for analysis provided:

1. The patient is adequately identified on the request form (paper or electronic)
2. The specimen can be reliably matched to the request form.
3. The specimen is appropriate (correct container, anticoagulant, expiry date, sufficient sample etc)

Unacceptable samples will have an appropriate comment appended to the report.

Request form:

Required:

1. Forms should be labelled on both copies with an addressograph label showing.
 - a. Christie Hospital number
 - b. Full name
 - c. DOB
2. Handwritten forms must have the **hospital number and patient name**, plus date of birth needed.
3. Test required must be clearly indicated.

Desirable:

1. Consultant, location and date
2. Reason for request / clinical information

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3. Requestor's contact number.
4. The time the specimen was taken and signature of sample taker.

The specimen

Required:

1. Christie Hospital number
 2. Full name
 3. DOB
 4. Specimens from patients receiving GMOs as part of treatment must be identified with the 'GMO' label.
- 1-3 MUST be on both sample and request form (regardless of whether addressograph or handwritten request form) otherwise will be rejected.

NB. At no time should blood be transferred from one container to another. This may result in contamination of the specimen with inappropriate anticoagulant and will invalidate the results obtained.

Desirable:

1. Date and time specimens were taken
2. Location of patient
3. Signature of specimen taker.

Any samples taken from a radioactive should be dealt with as per the trust radioactive policy. These samples should be hand delivered to the laboratory, the pneumatic air tube system should not be used. Any queries regarding the collection and / or transportation process should be made directly with the relevant department, ideally prior to sample collection.

Rejected Samples:

Clinical users are notified via comment in LIMS and sample archived and disposed of through the standard process.

Instruction for transportation of samples

CPP have 8 hours as the time limit from collection to centrifugation of samples before analysis. Any samples which are received beyond this time frame would not be processed and a comment placed on LIMS/CWP.

Any samples which have been stuck in the POD >8 hrs are rejected and a comment placed on LIMS/CWP.

Various personnel within the Trust will be involved in transport of specimens to and from the laboratory either by hand or via the POD system. In order to protect theirs and others safety the following guidelines should be followed:

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Cover any cuts and grazes with a waterproof dressing. Touch specimen containers as little as possible, washing hands as soon as practicable afterwards. Diagnostic samples must be sealed in the plastic bag attached to the request form. Carry all specimens in the trays or boxes, where provided, never in pockets. If a specimen leaks into a tray or box, tell the laboratory reception staff and ask them to make it safe.

If a specimen is dropped or broken, do not touch it or try to clear up the mess. Stay with the specimen to prevent other people touching it and send someone to the laboratory for help. If you spill the specimen onto your overall, you must remove it at once and then wash your hands and put on a clean overall. Report the accident to a supervisor as soon as possible. Handle specimen containers gently at all times.

The use of the pneumatic tube system for the transport of specimens to the Biochemistry laboratory must be performed in accordance with Trust policy.

Do not send blood gas samples or samples on ice via the POD system.

Patient collected samples

A sticker is attached to the urine containers which contains advice on sample collection for patients/clinicians.

Reporting of Results

Some results are automatically validated if they fulfil stringent pre-set criteria; otherwise they are clinically validated by appropriately qualified laboratory personnel. Comments may be appended and additional analyses undertaken based on the clinical details provided and on previous results.

Results are transmitted to the Clinical Web Portal (CWP) and printed form. Interim and final results are flagged in the appropriate column. Please note: Interim results may be subject to change; therefore clinicians are advised to contact the laboratory before making any clinical decisions based on an interim result.

The laboratory will endeavour to telephone results when they have changed significantly from a previous episode or are grossly abnormal, to facilitate this please ensure the correct patient location is provided on the request form.

Telephoning Limits

The following results will be telephoned/Alertive by the laboratory to the requesting location under the following circumstances:

Acute Kidney Injury (AKI) alerts are automatically generated on the CWP using the

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NHS England AKI Algorithm based on the serum creatinine result.

Methotrexate results >10 umol/L will be phoned directly to the responsible Registrar or Consultant.

Please note that the primary method for transmission of all results is to the Clinical Web Portal (CWP). Whilst internal and external quality assurance programmes are in operation to ensure accuracy and precision of results, occasionally random errors may occur and escape detection. The clinician is often best placed to detect such errors. Therefore if there is any doubt about a result, it is vital the laboratory is contacted (ext 3298) at once to investigate and re-test samples where possible. Certain factors may affect and possibly invalidate some test results, causing potential biological and analytical interference. For example, blood transfusion and other intravenous fluids, antibiotics, anticoagulants, drugs, timing of specimen in relation to drug dose, type of tube. Please remember to give details of recent or current treatment on the request forms.

Action limits for the communication of critical and unexpected pathology results are informed by the Royal College of Pathologists (RCPATH) Best Practice Recommendations (unique document number G158) and local guidelines refined through discussion with relevant clinical stakeholders and approved by The Christie Patient Safety Committee. The AKI and serum potassium action limits for communication are aligned with the RCPATH and the Getting it Right First Time (GIRFT) national recommendations to standardise acute kidney injury detection and alerting.

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Test	Threshold for telephoning result to requester		Exceptions/notes
	<i>Lower limit</i>	<i>Upper limit</i>	
Adjusted Calcium (mmol/L)	≤1.80	≥3.00	Do not telephone result if the adjusted calcium is <1.8 but has been lower in last 7 days Do not telephone result if the adjusted calcium is ≥3.0 but has been higher in last 7 days
ALT and AST		>500 IU/L	Telephone all ALT and AST >500 IU/L in children up to the age of 16 years of age.
Ammonia (μmol/L)		>100	Telephone all ammonia results >100
Amylase/lipase		~ >5xULN (Amylase >500) (Lipase >250)	Do not telephone the result if it has been higher than the current result in the last 7 days (inpatient only)
Bicarbonate	<15		Telephone all bicarbonate results <15
Cortisol (nmol/L)	<50		Telephone all cortisol results <50 unless the cortisol is part of a dexamethasone suppression test When phoning result query whether patient is on dexamethasone which may cause suppression of the HPA axis.
Cortisol (nmol/L)	>1200		Telephone result and query whether patient is on prednisolone or hydrocortisone
Cortisol SST	<420		Telephone SST result if peak cortisol is <420. This shows a sub-optimal response to Synacthen.
COVID-19 Rapid test			Telephone all positive results to the clinical team and report the details to the Incident Control Room. the-christie.incidentcontrolroom@nhs.net
Creatinine (μmol/L)		≥354 (>16 years) ≥200 (16 years and under)	Telephone all paediatric results ≥200 Do not telephone result if creatinine has been higher in last 7 days.

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		and under)	Do not telephone if the result is expected clinically, e.g. – known CKD, renal dialysis or the patient has had a higher result in past 6 weeks. Telephone all new AKI Stage 2 alerts Telephone all AKI Stage 3 alerts Telephone all AKI Stage 1 alerts with a Potassium >6.0 mmol/L. (AKI stage can be found on CWP).
CRP		≥300	Do not telephone the result if it has been higher than the current result in the last 48 hours
Cyclosporin		≥ 500	
Digoxin (µg/L)		≥2.5	Do not telephone the result if it has been higher than the current result in the last 7 days. Telephone any digoxin ≥2.5 if the potassium <3 mmol/L.
Ferritin		> 5000	
Gentamicin (mg/L)		Trough ≥1.0	Telephone all gentamicin results ≥1.0
Glucose (mmol/L)	≤3	≥20 (>16 years) ≥15 (16 and under)	Consider glucose results as part of a dynamic function test (e.g. OGTT, ITT) on a case-by-case basis. Check that the glucose result has been repeated on the analyser before telephoning result.
HbA1c		≥120	Always phone HbA1c ≥120 to the requester and Louise Hopewell DM Nurse Specialist (07990530161)
Lactate		≥2.0	Telephone all results ≥2.0. Sample must be analysed ASAP (within 20 minutes)
Lithium (mmol/L)		≥1.5	Telephone all lithium results ≥1.5
Methotrexate (µmol/L)		>10	Telephone all methotrexate results >10 to the responsible Registrar or Consultant. Methotrexate should not be measured post treatment with glucarpidase.
Magnesium	≤0.3		Do not telephone result if previous results have been <0.4 in the last 2

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			days.
Paracetamol (mg/L)	If detectable Or less than 4 hours since ingestion (if time of ingestion known)		Do not telephone the result is if it has been higher than the current result in the last 24 hours
Phenytoin (mg/L)		≥ 25	Telephone all phenytoin results ≥ 25
Phosphate	≤ 0.30		Telephone all phosphate results ≤ 0.3
Potassium (mmol/L)	≤ 2.5	≥ 6.5	Telephone all potassium results outside of these limits
Salicylate (mg/L)	If detectable		Do not telephone the result is if it has been higher than the current result in the last 24 hours
Sodium (mmol/L)	≤ 125 (>16 years) ≤ 130 (16 and under)	≥ 160	Telephone all paediatric sodium results ≤ 130 Do not telephone result if the sodium has been < 125 in the last 7 days and the current result is ≥ 120 (inpatient only) Do not telephone sodium result if sodium has been > 160 in last 7 days and current result ≤ 165 (inpatient only) Telephone result if sodium rises greater than 8 mmol/litre in 12 hours
Theophylline (mg/L)		≥ 25	Telephone all theophylline results ≥ 25
Total CK (IU/L)		> 2000	Do not telephone the result is if it has been higher than the current result in the last 7 days
Troponin I		> 45	Telephone all Troponin I results > 45 ng/L
Urea (mmol/L)	NA	≥ 30 (>16 years) ≥ 10 (16 and under)	Telephone all paediatric urea results ≥ 10 Do not telephone results ≥ 30 if the result is expected clinically, e.g. – known CKD, renal dialysis or the patient has had a higher result in past 6 weeks.

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Uric Acid		~ >2xULN (>700 U/L).	Telephone all uric acid results >700
Vancomycin (mg/L)		Trough >20.0	Telephone all vancomycin results >20.0
Telephone all tumour markers (CA series) from external labs >1000 U/mL (except Bolton where linked via Labgnostic). Results for Manchester Royal Infirmary can be emailed from an nhs.net account to mft.dutybiochemistenquiries-cmft@nhs.net			

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Uncertainty of measurement

All biochemical results are subject to a degree of uncertainty of measurement. This may be due to a range of factors, including:

- Biological variation within individuals
- Analytical measurement imprecision
- Pre-analytical factors

If you require more information regarding the effects of these factors on the outcome of an individual test result please contact the Duty Biochemist on ext 3298.

Clinical advice and interpretation

Clinical advice on examinations and interpretation of results is available by contacting the Clinical Scientist in the laboratory (ext 3298). Interpretative comments are included in the laboratory reports of a number of specialist tests.

Interpreting elevated glucose results

Diagnosis of diabetes should be based on two independent glucose measurements, unless the patient has symptoms of diabetes. Patients may develop a temporary diabetic state or have impaired glucose metabolism if they are unwell and on certain medication, particularly high dose steroids.

Venous plasma glucose concentration 4.1 - 6.0 mmol/L (fasting) or 4.1 – 7.7 (non-fasting) is normal; 11.1 mmol/L or greater is diagnostic for diabetes mellitus.

Between these levels it is possible that the patient has impaired glucose metabolism which can be classified according to the WHO guidelines for interpretation of Oral Glucose Tolerance Test and diagnosis of diabetes as either:

1. Impaired Fasting Glycaemia:

Fasting venous plasma glucose of 6.1 - 6.9 mmol/L *and* (if measured)

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2 hr post 75g glucose load <7.8 mmol/L

2. Impaired Glucose Tolerance:

Fasting venous plasma glucose <7.0 mmol/L *and*
2 hr post 75g glucose load of 7.8 - 11.0 mmol/L.

3. Diabetes Mellitus:

Venous plasma glucose of 11.1 mmol/L or greater, at any time *or*
Fasting venous plasma glucose of 7.0 mmol/L or greater *or*
2 hr post 75g glucose load $\geq$ 11.1 mmol/L

Guidance on Diabetes Mellitus

For further details regarding management see:

- NICE NG17 (2016) - Type 1 diabetes in adults: diagnosis and management;
- NICE NG28 (2017) - Type 2 diabetes in adults: management;
- NICE NG18 (2016) - Diabetes (type 1 and type 2) in children and young people: diagnosis and management.

Interpreting pleural fluid results

Light's Criteria are the most frequently used criteria for differentiating an exudate from a transudate; a fluid is deemed an exudate if any of the following apply:

- The ratio of pleural fluid protein to serum total protein is greater than 0.5
- The ratio of pleural fluid LDH to serum LDH greater than 0.6
- The pleural fluid LDH is greater than 2/3 of the upper reference limit for serum LDH

Light's criteria are highly sensitive in identifying an exudate; however their specificity is low particularly in patients with heart failure. Patients are more likely to have a false positive if they have received intravenous diuretics within the 24 hours preceding the pleural tap.

Normal pH of pleural fluid is approximately 7.6. A pH < 7.3 is associated with inflammatory states. If a pleural effusion is infected, the British Thoracic Society guidelines recommend that if the pH <7.2, tube drainage may be required.

Guidance on Lipids

For details regarding guidance on lipid disorders and their management refer to NICE CG181 - Cardiovascular disease (CVD): risk assessment and reduction, including lipid modification (July 2014) and European Guidelines on cardiovascular disease prevention in clinical practice (European Heart Journal 2016; 37:2315–2381).

Targets for the General population (based on Heart UK)

- Total cholesterol (TC) – ideally should be <5 mmol/L

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- LDL-Cholesterol (LDL-C) - ideally it should be <3 mmol/L.
- HDL-Cholesterol (HDL-C) - ideally it should be >1 mmol/L (men)
- TC:HDL ratio – a ratio >6 is considered high risk - the lower this figure, the better.
- Triglyceride (TG) - ideally it should be <1.7 mmol/L on a fasting sample or <2.3 mmol/L on a non-fasting sample.

Familial hypercholesterolaemia (FH)

- If cholesterol >7.5 mmol/L or there is a family history of premature coronary heart disease consider diagnosis of FH.
- Diagnosis of FH is based on the Simon Broome criteria;

Definite FH:

a) Total cholesterol > 6.7 mmol/L or LDL-C >4.0 mmol/L in a child <16 years or Total cholesterol >7.5mmol/L or LDL-C > 4.9 mmol/L in an adult (levels either pre-treatment or highest on treatment).

PLUS

b) Tendon xanthomas in patient, or in 1st degree relative (parent, sibling, child), or in 2nd degree relative (grandparent, uncle, aunt)

OR

c) DNA-based evidence of an LDL receptor, apo B-100 or PCSK-9 mutation.

Possible FH:

a) Total cholesterol or LDL-C as above

PLUS

b) Family history of myocardial infarction below age of 50 in 2nd degree relative or below age 60 in 1st degree relative

OR

c) Family history of raised cholesterol: >7.5 mmol/L in adult 1st or 2nd degree relative or > 6.7 mmol/L in child or sibling under 16.

- For FH the target is 50% reduction of original LDL-C using high-intensity statins.

When to refer to a specialist:

Exclude possible common secondary causes of dyslipidaemia (such as excess alcohol, uncontrolled diabetes, hypothyroidism, liver disease and nephrotic syndrome) before referring for specialist review.

- Arrange for specialist assessment of people with a total cholesterol concentration of more than 9.0 mmol/L or a non-HDL cholesterol concentration of more than 7.5 mmol/L even in the absence of a first-degree family history of premature coronary heart disease.
- Refer for urgent specialist review if a person has a triglyceride concentration of more than 20 mmol/L that is not a result of excess alcohol or poor glycaemic control.

Monitoring patients on statins

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- If patients report muscle pain or weakness while taking a statin, explore other possible causes of muscle pain or weakness and raised CK if they have previously tolerated statin therapy for more than 3 months.
- Do not measure CK levels in asymptomatic people who are being treated with a statin.
- Measure baseline liver transaminase enzymes (ALT). Measure liver transaminase within 3 months of starting treatment and at 12 months.

Common causes of secondary hyperlipidaemia

Hypercholesterolaemia: hypothyroidism; anorexia nervosa, drugs e.g. cyclosporin

Low HDL-C: smoking, obesity, insulin resistant conditions (type 2 DM, metabolic syndrome), and specific genetic mutations such as Tangier disease. Medications which can reduce HDL levels include beta blockers, thiazide diuretics, androgens, progestogens and anabolic steroids.

High HDL-C: can be due to secondary causes such as excessive alcohol intake, exercise and medication such as oral oestrogen replacement.

Hypertriglyceridaemia: liver disease; diabetes mellitus; alcohol abuse; calorie excess/ obesity; chronic kidney disease; autoimmune conditions; pregnancy especially in third trimester; rarely hypothyroidism.

Mixed hyperlipidaemia: nephrotic syndrome; cholestatic jaundice; obesity; drugs e.g. corticosteroids, high dose thiazides, cyclosporin, tacrolimus.

Common interferences in biochemistry tests

Sample should ideally be tested as fresh as possible. For biochemistry, a delay in separation of serum separator tubes (SST) can result in haemolysis or red cell leakage which can influence the concentration of biomarkers and lead to a risk in misinterpreting results.

Interferent	Analyte affected	Effect
Haemolysis	Potassium	Increase
	Urea	Decrease
	Phosphate	Increase
	Magnesium	Increase
	AST	Increase
	ALP	Decrease
	CK	Increase
	LDH	Increase
	Triglycerides	Increase
	Ammonia	Increase
EDTA contamination (e.g. FBC tube used)	Potassium	Increase
	Calcium	Decrease
	ALP	Decrease
	Magnesium	Decrease

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Interferent	Analyte affected	Effect
Prolonged delay in transport to laboratory	Potassium	Increase
	Phosphate	Increase
	LDH	Increase
	Bicarbonate	Decrease
	Ammonia	Increase
Inappropriate sampling site, e.g. sample taken from drip arm	Increase in drip analyte (e.g. sodium, glucose). Dilutional effect on other analytes.	

Demand Management

The laboratory has a number of automated rules to demand-manage tumour marker requests, including CA125, CA19-9, CEA (no repeat within 14 days) and serum 5HIAA (no repeat within 11 weeks of previous result). However, if more frequent monitoring of these tests is required, to guide clinical management of the patient or for clinical trial purposes, then please make it clear on the request form that an override of the demand management rule is required (e.g. write 'CA125 override' on the request form), or contact the lab for advice.

Time limits for requesting additional examinations

For most biochemistry requests it may be possible to add on additional tests, details on time limits which apply to various analytes can be found in the [Biochemistry Test Directory](#).

Names and addresses of referral laboratories

Some specialised or low volume assays are referred to external laboratories for analysis. In line with UKAS requirements we endeavour to use accredited laboratories whenever possible. A full list of the tests referred out and the laboratories that are used is available from the department; however the more common ones can be found in [the list of referral laboratories](#).

Comments/Complaints Procedure

Any complaints or concerns about any aspect of the service should be raised initially with the Blood Sciences Service Manager/Deputy General Manager, Deborah Seals, Deborah.seals@nhs.net Phone: 0161 446 3167

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We are keen to know about any problems arising from the laboratory service. Feedback from our users will help in our constant efforts to improve our service.

Data Protection

All staff comply with The Trust Information Governance Policy for handling of patient confidential information.

Quality assurance and Accreditation

The department participates in internal quality control (IQC) and external quality assurance (EQA) for all the tests undertaken within the laboratory. Performance is monitored and subject to rigorous control, to ensure that analyses are accurate, precise and results are comparable with other laboratories.

Details of the laboratory UKAS accreditation status can be found at the link below by searching our customer number **8697**:

<https://www.ukas.com/search-accredited-organisations/>

The lab also regularly monitors the accreditation status of the referral laboratories used for specialist testing.

Biochemistry Test Directory (listed alphabetically)

Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
17-OH Progesterone	Serum 1mL	0-6 nmol/L	Sent to referral lab for analysis	3 days	2-4 weeks
5-HIAA	Serum 0.5mL	0-140 nmol/L	Sent to referral lab for analysis	3 days	1-2 weeks
5-HIAA	24 hour Urine	<45 µmol/24 hours	24 hour urine bottle containing acid (available from lab). Sent to referral laboratory for analysis	2 days	1-2 weeks
ACE	CSF 0.5mL	<1.2 IU/L	Sent to referral lab for analysis	Not applicable	<21 days
ACE	Serum 0.5 mL	20-70 IU/L	Sent to referral lab for analysis	3 days	7 days
ACTH	Plasma (EDTA) 1mL	0-46 ng/L at 09:00hrs	Take to lab on ice immediately after collection.	Not applicable	7 days

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Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
ACTH precursors	Plasma (EDTA) 2mL	<100 pmol/L	Take to lab on ice immediately after collection. Sent to referral laboratory for analysis.	Not applicable	2 weeks
AFP	Serum 0.5mL	0-7 IU/mL		3 days	24 hours (Mon-Fri)
Albumin	Serum 0.5mL	35 – 50 g/L		3 days	60 mins
Aldosterone	Plasma (EDTA) 1mL	0-630 pmol/L	Take to lab immediately. Sent to referral lab for analysis.	Not applicable	2 weeks
Alkaline Phosphatase	Serum 0.5mL	Adult: 30 - 130 IU/L Infant-16 Years: 60 - 425 IU/L		3 days	60 mins
ALP Isoenzymes	Serum 1mL	Qualitative interpretation	Sent to referral lab for analysis	3 days	2 weeks
Alpha subunit (TSH)	Serum 1mL	Reference range dependant on gender and menopausal status. Refer to result report.	Sent to referral lab for analysis	2 days	2-4 weeks
Alpha-1-antitrypsin	Serum 2mL	1.10-2.10 g/L	Sent to referral lab for analysis	3 days	1-2 weeks
ALT	Serum 0.5mL	10 – 49 IU/L		3 days	60 mins
Amikacin	Serum 1mL	For all patients on multiple daily dosing target levels pre dose are <10mg/L and target levels 1 hour post dose are <30mg/L. all patients on once daily (extended interval) dosing target levels pre dose <5mg/L	Include time and amount of last dose on request form. Sent to referral laboratory for analysis.	Not applicable	Within 4 hours of receipt at referral laboratory
Ammonia	Plasma (EDTA) 1mL	Adult: 11 - 35 µmol/L Infant-16 Years: <50 µmol/L	Contact laboratory prior to taking sample for non-trial patients. Take to lab on ice immediately after collection.	Not applicable	60 mins

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Amylase	Fluid 1mL	Interpret with reference to serum levels	Collect into 60 mL screw top container	1 day	60mins
Amylase	Serum 0.5mL	30 – 118 IU/L		3 days	60 mins
Androstenedione	Serum 1.5mL	Male: 0.9-7.2 nmol/L, Female: 0-6.0 nmol/L	Sent to referral lab for analysis	3 days	2-4 weeks
Apo-E genotyping	Whole blood (EDTA) 1mL	E2/E2 homozygosity associated with Type III Hyperlipidaemia	EDTA sample Sent to referral lab for analysis	3 days	2-4 weeks
Asialotransferrin/ Tau-protein	CSF 0.5mL	DETECTED, NOT DETECTED or EQUIVOCAL	Sent to referral lab for analysis		If sample reaches referral lab before 12:00 it will be analysed same day. Otherwise next day analysis (Mon-Fri).
AST	Serum 0.5mL	0-33 IU/L		3 days	60 mins
B12	Serum 0.75mL	211 – 911 ng/L		Day of request	24 hours (Mon-Fri)
Bence Jones Protein	Urine (random) 2mL	Normal: negative	Qualitative test - no quantification carried out. 60 mL screw top container.	3 days	1-2 weeks
Beta-2-microglobulin	Serum 2mL	1.0-2.4 mg/L		3 days	60 mins
Bicarbonate	Serum 0.5mL	22 – 29 mmol/L		Day of request	4 Hours
Blood Gases	Arterial Blood Gas 0.5mL	pH 7.35-7.45 pCO ₂ 4.6-6.0 kPa pO ₂ 9.98-13.3 kPa Base Excess –2.0 to +3.0	Collect in ABG syringe, ensure no air spaces, mix thoroughly and analyse immediately. Do not use POD	Not Applicable	20 mins
CA125	Serum 0.5mL	0-30 U/mL	For monitoring only, inappropriate for diagnosis	3 days	24 hours (Mon-Fri)
CA15-3	Serum 0.5mL	0-32 U/mL	For monitoring only, inappropriate for diagnosis	3 days	7 days

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CA19-9	Serum 0.5mL	0-37 U/mL	For monitoring only, inappropriate for diagnosis	3 days	24 hours (Mon-Fri)
Caeruloplasmin	Serum 1mL	200-600 mg/L	Sent to referral lab for analysis	3 days	2-4 weeks
Calcitonin	Serum 2mL	Male: 0-8.4 ng/L Female: 0-5.0 ng/L	Take to lab on ice immediately after collection.	Up to 60 minutes	7 days
Calcium	Serum 0.5mL	2.20 - 2.60 mmol/L		3 days	60 mins
Calcium	Urine (24 hour)	2.5 - 7.5 mmol/24 hours	Collect into plain 24 hour urine bottle if sample to be analysed same day.	Day of request	60 mins
Calcium (ionised)	Venous or arterial sample (Blood Gas Syringe)	1.09-1.3 mmol/L		3 days	60 mins
Calcium:Creatinine Ratio	Urine (random/ 2 hour) 1mL	0.3 - 0.7 mmol/mmol (assuming normal renal function)	Collect into 60 mL screw top container.	Day of request	60 mins
Carbamazepine	Serum 0.5mL	4-12 mg/L	Pre-dose sample. Sent to referral laboratory for analysis.	3 days	Within 2 hrs of receipt at referral lab
Carbohydrate Deficient Transferrin (CDT)	Serum 2mL	To be interpreted with clinical history	Sent to referral lab for analysis	Not applicable	7 days
CEA.	Serum 0.5mL	0-5 µg/L (non-smokers) <11 µg/L (smokers)	For monitoring only, inappropriate for diagnosis	3 days	24 hours (Mon-Fri)
Chloride	Serum 0.5mL	95-108 mmol/L		3 days	60 mins
Chloride	Urine (random) 0.5mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	Day of request	60 mins
Chloride	Urine (24 hour)	110 – 250 mmol/24 hours	Collect into plain 24 hour urine bottle if sample to be analysed same day.	Day of request	60 mins
Cholesterol	Fluid 0.5mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	Day of request	4 Hours

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Cholesterol	Serum 0.5mL	<5.0. Primary prevention treatment decisions should be based on overall cardiovascular risk. Secondary prevention optimal treatment target is total Cholesterol <4 mmol/L and LDL-Cholesterol <2 mmol/L. Audit treatment target is TC <5 mmol/L & LDL-C <3 mmol/L).	Total cholesterol can be measured on non-fasting sample	3 days	4 Hours
Chromogranin A	Serum 0.5mL	Normal: 0-91 ng/mL Borderline: 92-218 ng/mL Abnormal >218 ng/mL	Take to lab immediately after collection. Elevated CgA seen with proton-pump inhibitors.	3 days	1 weeks
Citrate	24 hour Urine	1680-6450 µmol/24hr	24 hour urine bottle containing acid (available from lab). Sent to referral laboratory for analysis	Not applicable	1-2 weeks
CK	Serum 0.5mL	Male: 40–320 IU/L Female: 25–200 IU/L.		3 days	4 Hours
CK MB	Serum 0.5mL	0-5 ng/mL Female 0-6 ng/mL Male	Sent to referral lab for analysis	3 days	Within 2 hrs of receipt at referral lab
Copper	Serum 1mL	13.0-26.0 µmol/L	Sent to referral lab for analysis	3 days	2-4 weeks
Cortisol	Saliva 1 salivette	9am: 5-46 nmol/L Midnight: <2.6 nmol/L Adequate response to synacthen: an increment >10 nmol/L from 0-30min >22 nmol/L from 0-60min	Collect into Cortisol Salivette. Patient removes synthetic swab from tube, chews it for approx 45 seconds then returns it to tube and replaces stopper.	Not applicable	1-2 weeks

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Cortisol	Serum 0.5mL	119 – 618 nmol/L at 09:00hrs	Used in dynamic function tests and day curves.	3 days	24 hours (Mon-Fri)
Cortisol	Urine (24 hour)	<165 nmol/24 hours	24 hour urine bottle plain (available from lab). Sent to referral lab for analysis	3 days	2-4 weeks
Cortisone	Saliva 1 salivette	9am: 18-47 nmol/L Late night: <18 nmol/L Adequate response to synacthen: an increment >14 nmol/L from 0-30min >22 nmol/L from 0-60min	Collect into Cortisol Salivette. Patient removes synthetic swab from tube, chews it for approx 45 seconds then returns it to tube and replaces stopper.	Not applicable	1-2 weeks
COVID-19 rapid test (swab test). RSV/Flu A/B/COVID rapid panel test (swab test)	Nose & throat swab	Detected. Not detected. Equivocal Invalid	Samples must be delivered to the lab within 7 hours of being taken.	Not applicable	4 hours
C-Peptide	Serum 2mL	Interpret with reference to glucose and insulin result.	Take to lab on ice immediately after collection. Sent to referral laboratory for analysis.	3 days	2-4 weeks
Creatinine	Fluid 1mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	Day of request	60 mins
Creatinine	Serum 0.5mL	Male: 62 – 115 µmol/L Female 44 – 97 µmol/L Paediatrics:	Enzymatic method is used to measure creatinine for all patients <18yrs. Paediatric reference ranges are aligned to those proposed by the Paediatric Laboratory Medicine Network (PaLMnet). Please refer to results report.	3 days	60 mins

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Creatinine	Urine (24 hour)	Male: 7.1 - 17.7 mmol/24hours Female: 5.3 - 15.9 mmol/24hours	Plain 24 hour urine bottle (available from lab)	3 days	60 mins
Creatinine Clearance	Urine (24 hour)	80-120mL/min	Plain 24 hour urine bottle (available from lab) Must have a serum sample for serum creatinine measurement.	3 days	60 mins
CRP	Serum 0.5mL	0 - 5 mg/L		3 days	60 mins
Cryoglobulins	Serum & plasma (Fill tubes provided by lab fully)	Normal - not detected	Collect thermos flask and warmed tubes from Biochemistry before collection. Return samples to pathology immediately in thermos flask	Not applicable	1-2 weeks
CSF Oligoclonal banding	CSF 0.5mL & 2ml serum	Normal - not detected	Sent to referral lab for analysis	Not applicable	2-4 weeks

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CSF Xanthochromia	CSF 1mL	Absence of bilirubin excludes sub arachnoid haemorrhage. Presence of haemoglobin and CSF total protein contact affects result. False negative results if sample taken too early. See interpretative comments on report.	Contact laboratory prior to collection. Must not be collected <12 hours after onset of headache. To reduce blood contamination, collect CSF for xanthochromia in the last tube in a series. It should be protected from light by placing in a brown envelope. A simultaneous blood sample is required for LFT to help interpretation of the bilirubin level in CSF. A fluoride oxalate blood sample is also required for glucose for general examination. Sent to referral laboratory for analysis. Lab to provide referral laboratory with serum bilirubin and CSF Total Protein results to aid interpretation.	Not applicable	Same day if received at referral laboratory before 17:00
CTx	Plasma (EDTA) 3mL	0.1-0.5µg/L No reference range for under 16 years of age.	Fasting morning sample preferred. Sent to referral lab for analysis	3 days	2-4 weeks
Cyclosporin	Whole blood (EDTA) 2mL	see local protocol	Pre dose sample will be analysed the same day if it reaches the lab before 2pm	3 days	Daily batch analysis
DHEA Sulphate	Serum 1.5mL	Male: 2.2-15.2 µmol/L Female: 1.0-12.0 µmol/L	Sent to referral lab for analysis	3 days	2-4 weeks
Digoxin	Serum 0.5mL	1.0-2.0 µg/L	Samples for digoxin should be collected as trough levels just prior to the next drug dose or at least 12 hours post last dose	3 days	Within 2 hrs of receipt at referral lab
Direct Bilirubin	Serum 0.5mL	0-5 µmol/L		3 days	4 Hours

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DPD - 5FU toxicity	Whole blood (EDTA) 3mL	See report for comment	Sent to referral lab for analysis	3 days	1 week
eGFR	Serum 0.5mL	Refer to NICE NG203	CKD-EPI equation.	3 days	60 mins
Erythropoietin	Serum 1mL	5.0-25.0 IU/L	Sent to referral lab for analysis	3 days	2-4 weeks
Ethanol	Plasma (Fluoride Oxalate) 2mL	No reference range	Sent to referral lab for analysis. (Serum sample may be acceptable if analysed immediately after collection)	Not applicable	Within 2 hrs of receipt at referral lab
Faecal Elastase	Faecal 2g	>200µg/g	Fresh sample must arrive at referral laboratory on day of collection. Collect into faecal pot	Not applicable	1-2 weeks
Ferritin	Serum 0.5mL	Males 22 – 322 µg/L Females 10 – 291 µg/L		3 days	24 hours
Folate	Serum 0.75mL	>5.4 µg/L		Day of request	24 hours (Mon-Fri)
Free T3	Serum 1.5mL	3.5-6.5 pmol/L		3 days	24 hours (Mon-Fri)
Free T4	Serum 1.5mL	10-22 pmol/L		3 days (as for TSH for first-line TFT)	24 hours (Mon-Fri)
Fructosamine	Serum 1mL	1.70-2.80 mmol/L	Sent to referral lab for analysis	Not applicable	7 days

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FSH	Serum 0.5mL	Male: 1.4-18.1 IU/L, Female: Early Follicular phase 2.5-10.2 IU/L, Ovulation peak 3.4-33.4 IU/L, Luteal phase 1.5-9.1 IU/L Post menopausal 23-116		3 days	24 hours (Mon-Fri)
Gamma-GT	Serum 0.5mL	Male: < 73 IU/L Female: < 38 IU/L		3 days	60 mins
Gentamicin	Serum 0.5mL	Trough target level <1 mg/L. Contact ward pharmacist for further information about result interpretation.	Samples should be taken in the two hour pre-dose period.	Not applicable	60 mins
Gilberts genotyping	Whole blood (EDTA) 2mL	See report for comment	Sent to referral lab for analysis	3 days	2-3 weeks
Glucose	CSF 5 drops	2.2 – 3.9 mmol/L	5 drops suffice. Collect into Fluoride Oxalate tube	Not applicable	60 mins
Glucose	Fluid 0.5mL	Interpret with serum results and clinical history	Collect into Fluoride Oxalate tube	Not applicable	60 mins
Glucose	Plasma (Fluoride Oxalate) 0.5mL	Fasting 4.1-6.0 mmol/L. Non-fasting 4.1 - 7.7 mmol/L Please see laboratory handbook for interpretation of elevated glucose results diagnosis of diabetes	Collect into Fluoride Oxalate tube	Not applicable	60 mins
Growth Hormone	Serum 0.5mL	Adult Normal basal GH 0-9.9 ug/L	Basal values not suitable for diagnosis of acromegaly/GH deficiency; dynamic function tests required. Please contact lab on 3298 to discuss.	3 days	1 week

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GUT Hormones	Plasma (EDTAx3) 12mL	VIP 0-30 pmol/L, PP 0-300 pmol/L, Gastrin 0-40 pmol/L, Glucagon 0-50 pmol/L, Somatostatin 0-150 pmol/L	Patient must be fasted. 3x EDTA tubes must be taken to the laboratory immediately after collection. Sent to referral laboratory for analysis.	Not applicable	4-6 weeks
Haptoglobin & Haemopexin	Serum 2mL	Male Haptoglobin 0.5-2.0 g/L, Haemopexin 0.5-1.1 g/L Female Haptoglobin 0.4-1.6 g/L, Haemopexin 0.6-1.3 g/L	Sent to referral lab for analysis	3 days	1-2 weeks
HbA1c	Whole blood (EDTA) 2mL	Diagnostic cut-off ≥ 48 mmol/mol	Results are IFCC aligned.	3 days	3 days
HCG	Serum 0.5mL	0-9 IU/L		3 days	24 hours (Mon-Fri)
HCG Rapid test (rapid pregnancy test)	Serum 0.5mL	NEGATIVE or POSITIVE	Contact lab prior to sending if result required urgently	2 days	24 hours (Mon-Fri)
HDL-Cholesterol	Serum 0.5mL	> 1.0 mmol/L	Fasting sample preferred	3 days	4 Hours
HFE genotyping	Whole blood (EDTA) 4mL	Not applicable: DNA test	Sent to referral lab for analysis	Not applicable	3 Weeks
Homocysteine	Plasma (EDTA) 1mL	< 18 μ mol/L	Ideally fasting sample. Sent to referral lab for analysis	Not applicable	3 Weeks
IgA	Serum 0.5mL	0.40 – 3.50 g/L		3 days	4 Hours
IGF-1	Serum 0.5mL	Age dependent. Contact lab (ext 3298)		3 days	1 week
IgG	Serum 0.5mL	6.50 – 16.00 g/L		3 days	4 Hours
IgM	Serum 0.5mL	0.50 – 3.00 g/L		3 days	4 hours

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Igs & electrophoresis	Serum 1mL	See interpretative comments for electrophoresis		3 days	4 Hrs for Igs, 1 week for EPS
Inhibin A	Serum 0.5mL	Post menopausal female 0-3.6 pg/mL. Values in the pre-menopausal female vary with the stage of the cycle 5-160 pg/mL	Sent to referral lab for analysis	3 days	2-3 weeks
Inhibin B	Serum 0.5mL	Post menopausal female 0-5 pg/mL. Values in the pre-menopausal female vary with the stage of the cycle 5-200 pg/mL	Sent to referral lab for analysis	3 days	2-3 weeks
Insulin	Serum 2mL	Interpret with reference to glucose and c-peptide result	Sample must be taken to laboratory on ice immediately after collection. Sent to referral laboratory for analysis.	Not applicable	2-4 weeks
Insulin antibodies	Serum 2mL	NEGATIVE or POSITIVE	Sent to referral lab for analysis	Not applicable	2-4 weeks
Iron	Serum 0.5mL	Male:12 – 31 μ mol/L Female:9 – 30 μ mol/L		3 days	4 Hours
Itraconazole	Non-gel separated serum 1mL	Trough target level 5.0-17.1 mg/L	Steady state reached after 1-2 weeks on oral therapy with little variation throughout the day. Sent to referral lab for analysis	Not applicable	Within 24 hrs of receipt at referral lab
Lactate	Venous or arterial sample (Blood Gas Syringe)	0.5-1.6 mmol/L	Collect in ABG syringe, ensure no air spaces, mix thoroughly and analyse immediately. Do not use POD.	Not applicable	20 mins
Lamotrigine	Serum 2mL	3.0-15.0 mg/L	Pre-dose sample. Sent to referral laboratory for analysis.	Not applicable	1 week
LDH	CSF 5 drops	Interpret with serum results and clinical history	5 drops suffice	Not applicable	60 mins

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LDH	Fluid 0.5mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	3 days	60 mins
LDH	Serum 0.5mL	120 - 246 IU/L		3 days	60 mins
LDL-Cholesterol	Serum 1mL	< 3.0mmol/L	Fasting sample preferred	3 days	60 mins
Lead	Whole blood (EDTA) 2mL	< 0.5 µmol/L	Sent to referral lab for analysis	3 days	2-4 weeks
LH	Serum 0.5mL	Adult males - 20 - 70yrs 1.5 - 9.3 IU/L >70 yrs 3.1 - 34.6 IU/L Female adults - Follicular phase 1.9 - 12.5 IU/L Mid cycle peak 8.7 - 76.3 IU/L Luteal phase 0.5 - 16.9 IU/L Pregnant <0.1 - 1.5 IU/L Post menopausal 15.9 - 54.0 IU/L Contraceptives 0.7 - 5.6 IU/L Children <0. 1- 6.0 IU/L.		3 days	24 hours (Mon-Fri)
Lipase	Serum 0.5mL	12 - 53 U/L		3 days	60 mins
Lithium	Serum 0.5mL	0.4-1.0 mmol/L	12 hours post dose. Sent to referral laboratory for analysis.	3 days	Within 12hrs of receipt at referral lab
Macroprolactin	Serum 0.5mL	Macroprolactin: Detected / Not-detected. Recovery (given as a %). Post-PEG prolactin: Male: 61-196 mU/L, Female: 66-278 mU/L		3 days	14 days

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Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
Magnesium	Serum 0.5mL	0.7 - 1.0 mmol/L		3 days	60 mins
Magnesium	Urine (24 hour)	2.4 - 6.5 mmol/24 hours	24 hour urine bottle containing acid (available from lab)	3 days	60 mins
Magnesium	Urine (random) 0.5mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	3 days	60 mins
Metanephrines	Urine (24 hour)	Urine Metadrenaline excretion: Male & Female: 0.0-2.0 µmol/24hr, Urine Normetadrenaline Male: 0.0-5.3 µmol/24hr, Female: 0.0-4.3 µmol/24hr, Urine Noradrenaline: 0.0-1.0 µmol/24 hr, Urine Adrenaline: 0.0- 0.2 µmol/24 hr	24 hour urine bottle containing acid (available from lab). Sent to referral laboratory for analysis	3 days	2-4 weeks
Metanephrines	Plasma (EDTA) 1mL	Plasma Metanephrine: 0-510 pmol/L, Plasma Normetanephrine: 0-1180 pmol/L 3MT: 0-180 pmol/L	Take to lab immediately. Initial screening test can be taken non-fasting and sitting. If elevated confirm with a fasting sample taken after 30 minutes lying down	Not applicable	2-4 weeks
Methotrexate	Serum 1mL	Refer to local protocol	State dose timing on request form. Sample will be analysed on the same day if it reaches the laboratory before 8pm	3 days	Samples will be analysed on the same day if received in the laboratory between 08:30-20:00. Samples received after 8pm will be analysed next day.

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	Author	P.Monaghan	Frequency	Annually	

Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
Microalbumin (Urine ACR)	Urine (random) 1mL	<3mg/mmol (NICE NG203)	Sent to referral lab for analysis	3 days	Within 24 hrs of receipt at referral lab
Mitotane	Plasma (2x EDTA) 4mL	14-20 mg/L	Contact lab for specific request form. Analysis available for patients on lysodren. Sent to specialist laboratory for analysis.	Not applicable	2-4 weeks
Neuron Specific Enolase	Serum 2mL	0-12.5 µg/L	Sent to referral lab for analysis	3 days	7 days
NT-proBNP	Serum 1mL	<400 ng/L	If screening for carcinoid heart disease, patients with NTproBNP >260 ng/L should be referred for echo (NETs guidelines, Gut 2012). If NTproBNP is <400 ng/L in untreated patients with a normal ECG then heart failure (HF) is unlikely. If result is between 400-2000 ng/L HF cannot be excluded and a routine referral for echo is required. If result is >2000 ng/L HF is very likely and urgent referral (within 2 weeks) is required. N.B. Some drugs e.g. diuretics, ACE inhibitors, ARBs and beta-blockers can decrease NTproBNP levels. (Nice Clinical Guideline 108, Aug 2010) Sent to referral lab for analysis	Day of request	3 days

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Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
Oestradiol	Serum 0.5mL	Males: <146pmol/L Follicular phase: 72 – 529 pmol/L Ovulation/midcycle peak: 234 – 1309 pmol/L Luteal phase: 205 – 786 pmol/L Post-menopausal females: <118 pmol/L		20 hours	24 hours (Mon-Fri)
High sensitivity oestradiol	Serum 1mL	Oestradiol (MS) reference range: Pre-menopausal adult female: 11-969 pmol/L Post-menopausal adult female: 7-77 pmol/L Oestrone (MS) reference range: Pre-menopausal adult female: 15-418 pmol/L Post-menopausal adult female: 11-118 pmol/L	Sent to referral lab for analysis	3 days	2 weeks
Orosomucoid	Serum 1mL	Male 0-50yrs: 0.6 – 1.2 g/L >50 yrs: 0.8 – 2.0 g/L Female 0-50yrs: 0.4 – 1.0 g/L >50yrs: 0.8 – 2.0 g/L	Sent to referral lab for analysis	3 days	2-4 weeks
Osmolality	Serum 0.5mL	275-295 mOsm/kg		24 hours	24 hours

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Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
Osmolality	Urine (random) 1mL	100-1200 mOsm/kg	Result dependent on hydration status. Early morning urines most helpful	3 days	24 hours
Oxalate	Urine (24 hour)	Male: 80-490 µmol/24hr, Female: 40-32 µmol/24hr	24 hour urine bottle containing acid (available from lab). Sent to referral laboratory for analysis	4 hours	1-2 weeks
P1NP	Plasma (EDTA) 2mL	Pre-menopausal female 30-78 µg/L, Post-menopausal female 26-110 µg/L, Males 20-76 µg/L No reference range for under 16 years of age.	Sent to referral lab for analysis	3 days	1-2 weeks
Paracetamol	Serum 2mL	in overdose refer to BNF nomogram	Sent to referral laboratory for analysis. At least 4 hours after overdose.	3 days	Within 2 hrs of receipt at referral lab
pH	Pleural Fluid 1mL	Normal: approx pH 7.6 Inflammatory state: <7.3	Collect into ABG syringe with all air expelled. Send to laboratory immediately. Do not use POD	Not applicable	60 mins
Phenobarbitone	Serum 1mL	10-30 mg/L	Pre-dose sample. Sent to referral laboratory for analysis.	3 days	1 week
Phenytoin	Serum 2mL	5-20 mg/L	Pre-dose sample. Sent to referral laboratory for analysis.	3 days	1 week
Phosphate	Serum 0.5mL	Adult: 0.80 - 1.50 mmol/L 1-16 Years: 0.90 - 1.80 mmol/L		3 days	60 mins
Phosphate	Urine (24 hour)	15-50 mmol/24 hours	24 hour urine bottle containing acid (available from lab)	2 days	60 mins
Phosphate	Urine (random) 1mL	Results dependent on hydration status	Collect into 60 mL screw top container	2 days	60 mins
Potassium	Fluid 1mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	3 days	60 mins
Potassium	Serum 0.5mL	3.5-5.3 mmol/L		3 days	60 mins

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Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
Potassium	Urine (24 hour)	25 – 125 mmol/24hr Interpret with serum results and clinical history	Plain 24 hour urine bottle (available from lab)	3 days	60 mins
Potassium	Urine (random) 1mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	3 days	60 mins
Procalcitonin	Serum	no reference range - autocomment "Consider stopping antibiotics if procalcitonin concentration has decreased by more than or equal to 80% from the PEAK concentration or is less than 0.5ug/L. Review of antibiotics is STRONGLY encouraged if procalcitonin concentration is increasing AND >0.5ug/L. Refer to microbiology for further advice on interpretation & antibiotic dosing."	Sent to referral lab for analysis		24 hours (Mon-Fri)
Progesterone	Serum 0.5mL	Adult Males 0.9 - 3.9 nmol/L Adult females - Follicular phase <4.6 nmol/L Luteal phase 10.6 - 81.3 nmol/L Mid Luteal 14.1 - 89.1 nmol/L Post menopausal <2.4 nmol/L		3 days	24 hours (Mon-Fri)
Proinsulin	Serum 2mL	0-10 pmol/L	Sample must be taken to laboratory on ice immediately after collection. Sent to referral laboratory for analysis	Not applicable	2-4 weeks

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Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
Prolactin	Serum 0.5mL	Males 45 - 375 mU/L Females - Non-pregnant 59 - 619 mU/L Pregnant 206 - 4420 mU/L Post-menopausal 38 - 430 mU/L		3 days	24 hours (Mon-Fri)
Protein (Total)	CSF 5 drops	0.15 – 0.45 g/L	5 drops suffice	Not applicable	60 mins
Protein (Total)	Fluid 1mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	3 days	60 mins
Protein (Total)	Serum 0.5mL	60-80 g/L		3 days	60 mins
Protein (Total)	Urine (24 hour)	0.05 – 0.08 g/24 hours	Plain 24 hour urine bottle (available from lab)	3 days	60 mins
Protein:creatinine ratio	Urine (random) 1mL	0-45 mg/mmol	Collect into 60 mL screw top container.	3 days	60 mins
PSA	Serum 0.5mL	0.00 – 4.00 ug/L		5 days	24 hours (Mon-Fri)
PTH	Plasma (EDTA) 2mL (send a primary tube specifically for PTH)	1.5-7.6 pmol/L	Please send a primary EDTA sample specifically for PTH. PTH result must be interpreted in relation to calcium level.	2 days	1 week
PTHrP	Plasma (EDTA) 2mL	< 1.8 pmol/L	Sample must be taken to laboratory immediately after collection. Sent to referral lab for analysis.	Not applicable	4 weeks
Renin	Plasma (EDTA) 1mL	Random: 0.3-2.2 nmol/L/hr	Sample must be taken to laboratory immediately after collection. Sample should NOT be transported on ice. Sent to referral laboratory for analysis.	Not applicable	2 weeks
Selenium	Serum 5mL	0.6-1.5 µmol/L	Sent to referral lab for analysis	3 days	1 week

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Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
Serum Free Light Chains	Serum 2mL	Kappa: 3.30-19.40 mg/L Lambda: 5.71-26.30 mg/L K:L ratio 0.26-1.65		3 days	7 days
Serum immunofixation	Serum 2mL	See report for interpretative comments		3 days	1-2 weeks
SHBG	Serum 1mL	Male: 13-71 nmol/L, Female: 18-114 nmol/L	Sent to referral lab for analysis	3 days	1 week
Sirolimus	Whole blood (EDTA) 0.5 mL	4-12 µg/L	Pre dose sample required. Sent to referral lab for analysis.	Not applicable	Within 24 hrs of receipt at referral lab
Sodium	Fluid 1mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	3 days	60 mins
Sodium	Serum 0.5mL	133 - 146 mmol/L		3 days	60 mins
Sodium	Urine (24 hour)	40 – 220 mmol/24hr To be interpreted with serum results and clinical history	Plain 24 hour urine bottle (available from lab)	3 days	60 mins
Sodium	Urine (random) 1mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	3 days	60 mins
Tacrolimus	Whole blood (EDTA) 0.5mL	3.0-8.0µg/L	Pre-dose sample. Sent to referral laboratory for analysis.	Not applicable	Within 24 hrs of receipt at referral lab
Tau protein	CSF 0.5mL	NEGATIVE or POSITIVE	Samples with microbial contamination can give false positives. Sent to referral laboratory for analysis.	Not applicable	7 days
Teicoplanin	Serum 0.5mL		Pre dose sample only required. Sent to referral lab for analysis	Not applicable	7 days
Testosterone	Serum 0.5mL	Males: 8.4 – 28.7 nmol/L Females: 0.5 – 2.6 nmol/L		3 days	24 hours (Mon-Fri)
Testosterone (extracted/ LC-MS)	Serum 1mL	Female: 0-1.5 nmol/L	Sent to referral lab for analysis	3 days	1-2 weeks

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Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
Theophylline	Serum 0.5mL	10-20 mg/L	Pre-dose sample. Sent to referral laboratory for analysis.	3 days	Within 2 hrs of receipt at referral lab
Thyroglobulin +Tg autoabs	Serum 1mL	Thyroglobulin 1.82-111.0 ng/mL Tg antibodies <1.3 IU/mL	Presence of Tg antibodies will lead to a falsely low TG result. Storage: up to 7 days at 2-8°C	3 days	7 days
TIBC	Serum 0.5mL	45-70 µmol/L		3 days	4 Hours
Total Bilirubin	Serum 0.5mL	0-20 µmol/L		3 days	60 mins
TPO Abs	Serum 0.5mL	0-59 IU/L	Sent to referral lab for analysis	3 days	5 days
Transferrin	Serum 0.5mL	Male: 2.2 – 3.7 g/L Female: 2.5 - 3.8 g/L		3 days	4 Hours
Triglyceride	Fluid 1mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	3 days	4 Hours
Triglyceride	Serum 0.5mL	0.0 - 2.3 mmol/L	Fasting sample preferred	3 days	4 Hours
Troponin I	Serum 0.5mL	0-45 ng/L	Serial samples may help distinguish chronic mild elevations (such as in kidney disease) from acute MI. Accept samples from MFT as the add-on limit is 24 hours for MFT based on IFU sample storage 2-8degC fridge temperature.	8 hours	60 mins
Troponin T	Serum 0.5mL	0-14 ng/L	Trial samples only. Sent to referral lab for analysis	24 hours	Within 24 hrs of receipt at referral lab

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Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
TSH	Serum 1.5mL	Infants (1-23 months) = 0.87-6.15, Children (2-12 years) = 0.67-4.16, Adolescents (13-20 years) = 0.48-4.17, > 20years (Adults) 0.55 - 4.78 mU/L		3 days	24 hours (Mon-Fri)
TSH rec Ab	Serum 0.5mL	0-0.9 U/mL	Sent to referral lab for analysis	Not applicable	2-3 weeks
Urea	Fluid 1mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	Not applicable	60 mins
Urea	Serum 0.5mL	Adult: 2.5 - 7.8 1-16 Years: 2.5 - 6.5mmol/L		3 days	60 mins
Urea	Urine (24 hour)	430 – 710 mmol/24hours	Plain 24 hour urine bottle (available from lab)	3 days	60 mins
Urea	Urine (random) 1mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	3 days	60 mins

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Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
Uric acid	Serum 0.5mL	Male 200 - 430 μmol/L Female 140 – 360 μmol/L	Measurement of uric acid in patients on rasburicase therapy for tumour lysis syndrome. Rasburicase is used in the treatment of hyperuricemia in patients with leukemia, lymphoma, and solid tumour malignancies receiving anticancer therapy. Rasburicase catalyses the conversion of uric acid to allantoin, which is more soluble than uric acid so can be excreted rapidly. Breakdown of uric acid by rasburicase continues in the blood collection tube, resulting in unmeasurable levels of uric acid under normal laboratory conditions. If a uric acid measurement is required and a patient has received rasburicase within 24 hours please follow the procedure below: 1) Telephone the lab to inform that a sample will be arriving 2) Pre-chill a lithium heparin blood bottle on ice 3) Take sample to uric acid into the pre-chilled lithium heparin blood bottle 4) Immediately take the sample to the laboratory on ice.	3 days	60 mins

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Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
Uric acid	Urine (24 hour)	1.5 - 4.5 mmol/24 hr	Plain 24 hour urine bottle (available from lab)	3 days	60 mins
Uric acid	Urine (random) 1mL	Interpret with serum results and clinical history	Collect into 60 mL screw top container	3 days	60 mins
Urine Densitometry	Urine (24 hour)	Normal: no Bence Jones protein detected	Plain 24 hour urine bottle (available from lab).	3 days	1-2 weeks
Urine Electrophoresis	Urine (random) 2mL	Normal: no Bence Jones protein detected	Collect into 60 mL screw top container	3 days	1-2 weeks
Urine Immunofixation	Urine (random or 24 hour)	Normal: no Bence Jones protein detected	Plain 24 hour urine bottle (available from lab)	3 days	1-2 weeks
Valproate	Serum 0.5mL	50-100 mg/L	Pre-dose sample. Sent to referral laboratory for analysis.	3 days	1 week
Vancomycin	Serum 0.5mL	Trough target level 15 – 20 mg/L. Contact ward pharmacist for further information about result interpretation.	Samples should be taken in the two hour pre-dose period and sent with a biochemistry form.	2 days	60 mins
Vitamin A	Serum 1mL	See table below	Sent to referral lab for analysis	3 days	2-3 weeks
Vitamin D	Serum 1mL	50-250 nmol/L	See interpretative comments.	3 days	1 week
Vitamin E	Serum 1mL	See table below	Sent to referral lab for analysis	3 days	2-3 weeks
Vitamin E:Cholesterol ratio	Serum 1mL	3.50-9.50	Sent to referral lab for analysis	3 days	2-3 weeks
Voriconazole	Non-gel separated serum 0.5mL	1.3-5.7 mg/L (pre-dose level)	Include time and amount of last dose on request form. Sent to referral laboratory for analysis.	Not applicable	Within 4 day of receipt at referral lab

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Test Name	Sample Type and min volume	Reference Range and units	Special requirements/comments	Time limit for add-on test	Turnaround time
Zinc	Serum 4mL	12-22 µmol/L	Reference range only applies if patient has a normal serum albumin. Sent to referral laboratory for analysis.	3 days	1-2 weeks

This table covers the most frequently requested tests; please contact the duty biochemist (ext 3298) regarding any test not listed

Vitamin A			
Lower age limit (years)	Upper age limit (years)	Lower limit (µmol/L)	Upper limit (µmol/L)
0	≤1	0.50	1.50
>1	≤7	0.70	1.40
>7	≤13	0.91	1.71
>13	≤20	0.91	2.51
>20	≤120	1.05	2.80

Vitamin E			
Lower age limit	Upper age limit	Lower limit (µmol/L)	Upper limit (µmol/L)
0 weeks	≤4 weeks	2.3	11.6
>4 weeks	≤13 years	7.0	21.0
>13 years	≤20 years	14.0	23.0
>20 years	≤120 years	12.0	42.0

Vitamin E:cholesterol ratio			
Lower age limit (years)	Upper age limit (years)	Lower limit (µmol/mmol)	Upper limit (µmol/mmol)
0	120	3.5	9.5

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Names and addresses of referral laboratories

Referral laboratory	Analyte referred	Sample
Dept of Clinical Biochemistry, City Hospital Birmingham, Dudley Road, Birmingham, B18 7QH Tel: 0121 507 5162	Gilbert's (UGT1A1*28) TPMT	EDTA Blood EDTA Blood
Sandwell and West Birmingham Hospital NHS FT Haematology City Hospital Dudley Road Birmingham West Midlands B18 7QH	Erythropoietin	Serum
Endocrinology lab, Division of Investigative Sciences Imperial College London Charing Cross Hospital London W6 8RF Tel: 020 3313 3949	Fasting Gut Hormones Cortisol-BG	EDTA x3 Serum
Biochemistry Department Manchester Royal Infirmary Oxford Road Manchester M13 9WH Tel: 0161 276 5180	Caeruloplasmin Copper Carbamazepine Digoxin Paracetamol Phenobarbitone Phenytoin Pro-calcitonin Salicylate Selenium Theophylline Troponin T Drug screen Valproate Zinc TPO HFE Genotyping	Serum Serum Serum Serum Serum Serum Serum Serum or LiHep Serum Serum Serum Serum Urine Serum Serum Serum EDTA whole blood

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Walton Centre NHS Foundation Trust Lower Lans Fazakerley Liverpool L9 7LJ 0151 556 3262		
SYNLAB MVZ Leinfelden-Echterdingen GmbH SYNLAB International Services Nikolaus-Otto-Str. 6 70771 Leinfelden-Echterdingen	PTHrp	EDTA plasma
Clinical lab services Queen Elizabeth Hospital Birmingham Mindlesohn Way Edgebaston Birmingham B15 2WB Tel: 0121 371 6544	Alpha subunit (TSH)	Serum
Liverpool Clinical Laboratories Department of Clinical Biochemistry & Metabolic Medicine 4th Floor Duncan Building Royal Liverpool University Hospital Liverpool L7 8XP Tel: 0151 706 4230	CTX P1NP CKMB Manganese Lead NTpro-BNP	EDTA plasma EDTA plasma Serum EDTA blood EDTA blood Serum
Paediatric Specimen Reception Ground Floor CSB III Royal Manchester Children's Hospital Oxford Road Manchester M13 9WL Tel: 0161 901 2233/ 0161 276 8766	17-OH Progesterone Amikacin Lamotrigine	Serum Serum Serum

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SAS Peptide Hormones Section Clinical Laboratory Royal Surrey County Hospital Egerton Road Guildford Surrey GU2 7XX Tel: 01483 406 715	Insulin & C-peptide Insulin autoantibodies Proinsulin IGF binding protein 3	Serum Serum Serum Serum
Biochemistry Dept Salford Royal Hospital Stott Lane Salford M6 8HD Tel: 0161 206 4958	SHBG Androstenedione DHEAS Extracted Testosterone Urine Metanephries Porphyrins Catecholamines CSF Tau- protein/asialotransferrin Oligoclonal bands CSF Xanthochromia	Serum Serum Serum Serum Urine Urine Serum Urine CSF Paired CSF/Serum CSF
Protein Reference Unit Supraregional Protein Reference Unit Department of Immunology Sheffield Teaching Hospitals NHSFT Northern General Hospital Herries Road Sheffield S5 7YT Tel: 0114 271 5552	TSH receptor antibody Orosomuroid Haptoglobin/Haemopexin Alpha 1 Antitrypsin CDT Inhibin A & B Neurone specific enolase Urine Myoglobin	Serum Serum Serum Serum Serum Serum Serum Urine
Dept of Chemical pathology St George's Healthcare NHST Blackshaw Road Tooting London SW17 0QT Tel: 020 8725 5843	Apo-E genotyping	EDTA blood

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Biochemical Genetics Block 46 St James' University Hospital Leeds LS9 7TF Tel: 0113 206 4256	Homocysteine	EDTA plasma
Department of Biochemistry Stepping Hill Hospital Poplar Grove Stockport SK2 7JE Tel: 0161 419 4919	Ethanol	EDTA plasma Fluoride Ox. Plasma
University of Manchester Department of Medicine Dept. Medicine (ESRG) University of Manchester Room 3.825 Stopford Building Oxford Road Manchester M13 9PT Tel: 0161 275 5178 or 0161 306 0641	ACTH precursors	EDTA plasma
Clinical Biochemistry Department Clinical Sciences Building Wythenshawe Hospital Southmoor Road Wythenshawe Manchester M23 9LT Tel 0161 291 2136	Vitamin A & E HS Oestradiol Serum 5HIAA Urine 5HIAA Metanephrines ACE Aldosterone Faecal Elastase Microalbumin Renin Salivary Testosterone Salivary Cortisol Serolimus Tacrolimus Tobramycin U. Citrate U. Free Cortisol U. Oxalate	Serum Serum Serum Urine EDTA plasma Serum EDTA plasma Faecal Urine EDTA plasma Saliva Saliva EDTA blood EDTA blood Serum Urine Urine Urine

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Regional Mycology Lab Wythenshawe Hospital Southmoor Road Wythenshawe Manchester M23 9LT Tel: 0161-291-2142	Fluconazole Itraconazole Posaconazole Voriconazole Beta-glucan Galactomannan	Non-gel serum separated Non-gel serum separated Non-gel serum separated Non-gel separated serum *Serum *Serum Please send additional serum sample for beta-glucan and galactomannan requests.
Addenbrookes - UKAS 9814 Clinical Biochemistry and Immunology Hills Road Cambridge CB2 0QQ Tel: 01223 217 781 (3781)	Thyroxine Binding Globulin	Serum
Neurometabolic Unit Box 105 National Hospital Queen Square London WC1N 3BG Tel: 02034483818	CSF ACE	CSF

Useful Links

Lab Tests Online: [Lab Tests Online.org.uk](http://LabTestsOnline.org.uk)

11. Document Locations

Hard copies are issued to the following locations:	1. Biochemistry
Electronic Version	1. Biochemistry Intranet Site
Any other printed copies of this document are unauthorised.	

12. Procedure Amendments

Page 5: POCT section updated:

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Four blood gas analysers are available permanently sited on CCU, Surgical Theatres, Ward 2 and AAU. Two further analysers are also available on CRF and Christie Clinic 3rd Floor Ward in emergencies only. Please use an alternative analyser if any one of these is not operating. Glucometers are in most clinical areas, and the majority of departments have additional analysers they can use in the event of breakdown.

Analysis can only be performed by staff that have completed the appropriate training.

Sodium, potassium, chloride, bicarbonate, calcium (ionised), glucose, lactate pH, pO₂ and pCO₂ and co-oximetry are available on the blood gas analysers. Glucose and ketones are available on the glucose/ketone meters.

The POCT team monitor the blood gas analysers daily during routine hours. In the unlikely event that all blood gas analysers are not working outside of routine hours, please contact the on-call BMS at Manchester Royal Infirmary (MRI) (0161 276 4375 or via MRI switchboard 0161 276 1234 and ask for bleep 2722) prior to taking the sample. To minimise the time delay between taking the sample and subsequent analysis at MRI, also ensure transport has been arranged via Christie switchboard prior to taking the sample. Ideally the sample should be transported on ice to minimise sample deterioration.

Result transmission is checked daily Monday-Friday. In the event there is no transmission of results to the CWP, please contact the laboratory on 3298 and retain your result print-outs from the blood gas analysers and document glucose and ketone results directly into a patient's notes.

Page 8: paragraph added

Action limits for the communication of critical and unexpected pathology results are informed by the Royal College of Pathologists (RCPATH) Best Practice Recommendations (unique document number G158) and local guidelines refined through discussion with relevant clinical stakeholders and approved by The Christie Patient Safety Committee. The AKI and serum potassium action limits for communication are aligned with the RCPATH and the Getting it Right First Time (GIRFT) national recommendations to standardise acute kidney injury detection and alerting.

Page 35: send a primary tube specifically for PTH

Page 36: Teicoplanin. Serum 0.5mL. Pre dose sample only required.

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