



**East Lancashire Hospitals**  
NHS Trust  
A University Teaching Trust

# Blood Sciences: Information for users

# Contents

<b>Contents .....</b>	<b>1</b>
<b>Section 1: General Information .....</b>	<b>3</b>
Laboratory Locations.....	3
Blood Sciences Opening Hours.....	3
Key Personnel & Contact Information .....	4
Request forms and identification policy.....	5
Specimen Transport .....	5
Packaging and Transport of Specimens .....	6
High Risk Specimens .....	7
Ward Based Results Access.....	7
Primary Care Users Results Access.....	8
Critically abnormal results .....	8
<b>Section 2 – Biochemistry and POCT .....</b>	<b>9</b>
Appropriate use of diagnostic tests.....	10
Allergy testing.....	10
Dynamic function testing.....	11
Drugs of Abuse.....	11
Interpretation of Results.....	11
Supplementary Requests .....	12
Genetic Tests .....	12
Faecal tests.....	12
Point Of Care Testing.....	13
Point of Care Testing requirements .....	14
<b>Section 3 – Haematology.....</b>	<b>16</b>
Routine Investigations ( <i>please refer to Appendix 1 for paediatric full blood count reference ranges</i> ) .....	16
Coagulation.....	17
ROTEM.....	18
Thrombophilia Screening.....	18
Miscellaneous tests .....	19
Factors Affecting Results.....	19
Anticoagulant Therapy .....	19
Supplementary Requests .....	19

<b>Section 4 – Blood Transfusion.....</b>	<b>20</b>
Requesting Procedure .....	20
Timing of Requests.....	20
Location of Blood Fridges.....	21
Electronic Issue.....	21
What to request.....	21
Miscellaneous Requests.....	23
Turnaround Times .....	24
<b>Section 5 – Biochemistry test list A–Z .....</b>	<b>25</b>
Blood/serum/plasma.....	25
Cerebrospinal Fluid (CSF).....	34
Please see separate document for collection of CSF for Biochemistry/Microbiology tests (on the intranet with the User Guide and BS/B SOP 227 on QPulse). .....	34
Other fluids.....	34
24 hour Urine Tests.....	35
back to Contents .....	35
Random Urine Tests .....	36
Appendix 1 – Paediatric Full Blood Count Reference Ranges .....	37

## Section 1: General Information

### Laboratory Locations

#### **Royal Blackburn Teaching Hospital**

The laboratory is situated on Level 0, Royal Blackburn Teaching Hospital, Haslingden Road, Blackburn BB2 3HH. During the hours of 9:00 to 17:00 Monday to Friday and Saturday 9:00 to 12:00, the Laboratory Reception is open. Outside these hours the outer doors will be open to Trust staff only for the collection of blood for transfusion from Blood Bank. Only authorised persons will be allowed access to the laboratory areas. Patients do not attend the department for any blood sampling. Venepunctures are performed in the Out-Patients department.

#### **Burnley General Teaching Hospital**

The laboratory is in the Burnley General Teaching Hospital, Casterton Avenue, BB10 2PQ, close to the Elective Centre Entrance B/Endoscopy and Bowel Screening. Core hours are 09:00 to 17:00, Monday – Friday. Patient samples should be delivered to GP Practices where they will be collected by hospital transport. Out of hours there is no access to the laboratory and samples should be delivered to the laboratory at RBTH.

#### **Point of Care Testing**

The Point of Care team are based in Room ES1534, Physiotherapy, level 1, at Royal Blackburn Teaching Hospital and can be contacted on 82870 (01254 732870) during the hours of 08:00 to 16:00 (Monday to Friday). Outside these hours support is available from Biochemistry on 84156 or 01254 734156. Spare blood Glucose/ketone meters and a stock of associated consumables are kept in both the Blackburn and Burnley Blood Science Laboratories.

### Blood Sciences Opening Hours

The department provides a full 24/7, routine diagnostic service including weekends and all statutory holidays. All samples will be analysed for the core tests **as soon as possible** on arrival to the Laboratory, irrespective of the time of day or night. Core hours for Blood Sciences are 9am to 5pm. The out-of-hours service is manned by a limited number of staff between 5pm and 9am. Please keep use of the service to a minimum between these times to enable us to provide the most efficient urgent and emergency service in these periods.

For results and general enquiries please contact the laboratory on:

Blackburn    01254 73 4144     (internal 84144)

Burnley     01282 80 4507     (internal 14507)

For clinical enquiries relating to Biochemistry please contact a Clinical Biochemist:

Jane Oakey     01254 735927     (Internal 85927)

[back to Contents](#)

## **Key Personnel & Contact Information**

Replace leading 8 with 73 for external telephone number. (Regional Code = 01254)

### **Laboratory Enquiries**

Blackburn	Results & Enquiries GP Supplies	84144 82974
Burnley	Reception	14507

### **Clinical Staff**

Clinical Director	Professor Anthony Rowbottom	<a href="mailto:anthony.rowbottom@lthtr.nhs.uk">anthony.rowbottom@lthtr.nhs.uk</a>
Consultant Clinical Biochemist	Jane Oakey	85927
Consultant Haematologists	Dr Jagdish Adiyodi Dr Diana Triantafyllopoulou	84187 84362

*(Out of hours the consultant Haematologists and Biochemists are contactable via switchboard)*

### **Directorate Staff**

Directorate Manager	Dayle Squires	84162
Pathology IT Manager	Howard Briggs	82473
Quality & Training Manager	Sushant Ghorpade	83103

### **Lead Biomedical Scientists**

Biochemistry & Reception	Diane Giles Chris Flynn	82490 82488
Haematology	Bilal Patel	82458
Blood Transfusion	Lee Carter	84190

<b>Transfusion Practitioners</b>	Steve Rigby Mary Sokolowski Gillian Smith	83568 82498 85760
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<b>Point of Care Testing Team</b>	Samantha Kelsall Jessie Higgins Heather Kane Shamira Valli	82870
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[back to Contents](#)

## **Request forms and identification policy**

To ensure rapid return of results to the originating source, request forms and sample containers must be fully identified. This should include:

Key request form identifiers:

- **Forename and Surname**
- **Hospital or NHS number**
- **Date of Birth**
- Address where possible
- Gender
- **Location**
- Requestor's name
- Type of specimen
- Date and time of sample collection
- Tests required
- All relevant clinical data

Key specimen container identifiers

- **Forename and surname**
- **Date of Birth**
- Time and date of collection

Points indicated in **RED** are mandatory requirements.

The laboratory will not process requests where there is insufficient information for unequivocal identification of the patient. Materials used for sample collection must be disposed of safely in accordance with the ELHT Healthcare Waste Policy.

### **Data protection**

All data and patient information will be handled in line with Trust Policies 'Guide to Data Protection' and C077 'Confidentiality of Personal Information'.

## **Specimen Transport**

### **Air tube system**

An air tube system is available for transporting samples to the laboratory's main specimen reception from departments within the hospitals.

### **Air tube Policy**

- All samples must be in a sealed specimen bag attached to a completed request form before being placed in the carriers.
- Carriers must contain bubble wrap and be closed securely at both ends. (Bubble wrap available)
- This system is available for Biochemistry and Haematology and Microbiology samples 24 hrs a day 7 days a week.
- During normal working hours, bulky/heavy samples (e.g. 24 hour collection bottles), patient collected samples (e.g. semen samples) and samples for histology should be delivered by hand to laboratory reception.
- Only one set of Blood Cultures (not glass) should be placed in a carrier at one time.

[back to Contents](#)

Do **not** send any of the following samples via the pneumatic air tube:

- Blood gas samples
- Glass containers
- Any leaking sample
- Items over 1.5kg
- Any sharps
- Any histology samples in formalin
- Cytology samples.
- CSF samples
- Any samples requiring immediate processing (within 30 minutes) e.g. insulin, C-peptide, renin

Due to the pressure and vibration in the air tube, it is important to ensure that tops on bottles are tightened correctly in order that samples do not leak.

It is important that samples are batched where possible to reduce the traffic of carriers in the Pathology Reception.

With the exception of transfusion, there is no need to telephone the laboratory for urgent work sent by the pneumatic air tube system.

## **Packaging and Transport of Specimens**

Biological specimens are a potential hazard to staff, (including GP practice staff, transport drivers, porters, laboratory staff) and the general public if not packaged and transported correctly to the laboratory .

All specimens, including emergency specimens must be transported in the approved manner to conform to Health and Safety requirements (i.e. in sealed plastic bags). Caps/lids on specimen containers must be secure.

When emergency samples are transported out of hours they must be sealed in the polythene sealable bag attached to the request form.

Samples should be transported to the laboratory at a temperature and within a timescale that does not cause degradation of the sample. Unless otherwise noted, samples should be transported at ambient temperature and arrive at the laboratory no more than 10 hours after the sample is collected. For GP surgeries the laboratory has transport runs designed to ensure these parameters are met.

### **Blood gas samples:**

- Must have an identification label or patient's chart with minimum of Hospital number and Surname.
- If sending a sample for blood Gas analysis to the laboratory, print an ICE request form and place the capped sample in specimen bag attached to ICE form, hand deliver, do NOT send via Pneumatic Air Tube.
- Any delays in transporting samples for blood gas ensure sample is capped and placed on ICE/water slurry.
- If analysing Blood Gas at a Point of Care ward analyser: always carry capped sample on a clean blue tray, mix sample well before presenting to analyser for sampling and ensure patient identification is present such as PAS label, patient chart or CAS card. Blue trays must be cleaned and returned to store after use.
- Samples are stable for 15 minutes room temperature and 60 minutes on ice/water slurry.

[back to Contents](#)

## **High Risk Specimens**

**For transport of specimens from patients with confirmed or suspected COVID-19 infection, please refer to the latest guidance on the ELHT sharepoint (triple bag and clearly mark as 'COVID-19').**

Other high risk are defined as specimens taken from cases of:

- Confirmed or suspected Hepatitis B infection of HBsAg carriers.
- Confirmed or suspected HIV infection.
- Infection or suspected infective disease of the liver.
- Confirmed or suspected enteric fever.
- Confirmed or suspected TB.
- Confirmed or suspected vCJD
- Any other confirmed or suspected high risk disease (if suspected Hazard Group 4 pathogen (e.g. viral haemorrhagic fever ((Lassa, Marburg, Ebola and Congo-Crimean), or Hendra or Nipah viruses, specimens should not be collected without prior consultation with the on-call Microbiologist.

All specimens from known or suspected cases must be sealed within the plastic sample bag or the smaller compartment of a plastic minigrip bag and the request form (if not the attached type) inserted within the larger compartment.

A "Danger of Infection" label must be placed on the request form, specimen and plastic bag. Pins, staples, etc must not be used to seal bags. Please indicate the nature of the risk on the request form. To retain confidentiality, yet ensure safe handling and analysis, the phrase "Blood Borne Virus Infection" can be used for proven or suspected cases of HIV or Hepatitis B or C infection.

## **Ward Based Results Access**

The majority of wards and departments within the Trust are able to access the Anglia ICE System to enquire on patient's results. Access is only available to staff who have an individual User ID and Password. To obtain a User ID please contact the IT help desk on extension 83135

### **Patient Search Instruction:**

To reduce the risk of errors when searching for patient details and results the following method of searching should be adopted by all staff using the Computer systems:

#### **ICE system:**

1. Log into the ICE system
2. Select the patient search option.
3. Enter your patient's RXR, surname, forename. Press ENTER
4. Select the required patient record by clicking on that row.
5. All the results for this patient will now be displayed. Click on the row to display the required results.
6. Note there is also an option to display results by ward/location.

[back to Contents](#)



### **Accessing Patient's INR Dosage:**

1. Use the ICE system as described above to access the patient record.
2. All INR results and patient dosing schedules are directly available in the patient record within the ICE system.

### **Primary Care Users Results Access**

Primary Care results are transmitted to ICE at set times throughout the day. Results are then transmitted from ICE into the practice IT systems.

If a Primary Care result is required **urgently**, please telephone the laboratory to check if the results are available rather than waiting for the results to go back to EMIS.

### **Critically abnormal results**

Critically abnormal results will be phoned back to the requestor in accordance with the Royal College of Pathologists guidance on the communication of critical and unexpected pathology results

[back to Contents](#)

## Section 2 – Biochemistry and POCT

### Blackburn

Biochemistry Lab 84156 (01254 734156)

Bleep 021

### Burnley Site

Biochemistry Lab 13018 (01282 803018)

The following routine biochemical profiles are available using brown top serum tubes:

Profile	Tests in profile
Renal	Sodium, Potassium, Urea, Creatinine
Liver	Total Bilirubin, ALT, Alkaline phosphatase (ALP), Albumin
Bone	Calcium, Adjusted calcium, Alkaline phosphatase (ALP), Albumin, Total protein
Lipid	Cholesterol, Triglycerides, HDL, LDL, total cholesterol/HDL ratio, non-HDL cholesterol

In cases where a previous potassium result is suspected to be falsely raised due to the patient having a high concentration of platelets or white cells, a lithium heparin tube (orange top) may be used. **Please note, however, that this sample type may be unsuitable for other tests and a brown topped serum tube should accompany the lithium heparin sample if other tests are required.**

### Common sample types

The vast majority of tests can be performed on serum gel tubes (brown top) with the exception of the following tests:

Glucose: Yellow top (fluoride EDTA)

Lactate: Yellow top (fluoride EDTA)

PTH: Pink top (EDTA)

HbA1c: Purple top (EDTA)

NT-proBNP: Orange top (lithium heparin)

Blood gas (sent to laboratory)

- Use balanced Lithium heparin preservative for capillary or syringe.
- Venous samples for carboxyhaemoglobin should be collected into a lithium heparin tube (orange top)
- For capillaries advise mixing with metal mixer and magnet to prevent clotting

[back to Contents](#)

## **24 hour urine collection procedure**

Patient information leaflets and collection containers are available from Specimen Reception. Sample type required will vary depending on test. Please see 'A to Z of urine tests' for information regarding correct specimen container to use. Please do not discard any liquid or powder which may be in the bottles provided. This acts as a preservative for the sample. Please ensure that the urine bottles are fully labelled with patient identifiers (name and date of birth).

## **Appropriate use of diagnostic tests**

Minimum retesting intervals are defined as the minimum time before a test should be repeated, based on the properties of the test and the clinical situation where it is used. Minimum retesting intervals are in use dependent on local criteria and based on the Royal College of Pathologists National Minimum Retesting (MRI) Intervals. Users are alerted to requests that breach MRIs by prompts when electronically requesting tests. If a MRI prompt is over-ridden, a comment explaining the reason must be provided.

Diagnostic test algorithms are available when electronically requesting certain tests (e.g. Vitamin D). These prompt the requestor to answer questions designed to determine if the request is appropriate.

For further information on minimum retesting intervals and diagnostic test algorithms, please contact the Clinical Biochemists.

## **Allergy testing**

Below is a list of allergens tested at the RBTH Laboratory. Careful history taking (including a food diary where appropriate) should be able to identify a likely cause and specific tests should only be requested if exclusion is not possible. Please do not "blanket" request specific IgE tests and include all relevant clinical details on the form as failure to do so may result in the relevant request not being processed.

- Mixed foods panel: Egg white, milk, cod, wheat, peanut and soya
- Mixed tree panel
- Mixed mould panel
- House dust mite
- Timothy grass
- Egg white
- Egg yolk
- Milk
- Codfish
- Soybean
- Wheat
- Aspergillus fumigatus
- Cat
- Dog
- Peanut
- Latex
- Nut panel (available in children only and referred to Immunology at the Royal Preston Hospital): peanut, hazelnut, almond, cashew nut, brazil nut and walnut.

[back to Contents](#)

## **Dynamic function testing**

A separate guide is available for dynamic function testing and this is available on the intranet in the Pathology section.

## **Drugs of Abuse**

Samples are referred to the Biochemistry Laboratory at Salford Royal Hospital for urine drugs of abuse analysis. Confirmatory testing is performed routinely on every sample. A random sample of urine is required (approximately 50 mL in a plain container). Information about likely exposure, where known, is useful.

The standard drugs of abuse screen includes opiates (Morphine, Norcodeine, Codeine, 6-monacetylmorphine, acetyl codeine), benzodiazepines, methodone/methadone metabolite, amphetamine, cocaine metabolite, buprenorphine/norbuprenorphine and cotinine.

Cannabis must be requested specifically

Results are reported as 'POSITIVE' or 'NEGATIVE' compared to clinical cut-offs for each drug.

Extended urine drugs screening or detection of other drugs not included in the standard screen may be possible. Please contact the Clinical Biochemist to discuss further.

**All paediatric samples for urine drugs of abuse analysis must be accompanied by a chain of custody form.**

For further information, please contact the Clinical Biochemists.

## **Interpretation of Results**

Reference ranges are displayed together with the result on every report. It is important to always refer to ranges provided by the reporting laboratory. In addition, please note that on statistical grounds, 5% of the 'normal' population will have results which lie outside the quoted reference range.

A variety of factors such as age, sex, ethnicity, exercise, diurnal rhythm and drugs can affect biochemical results. The method of collection and storage (e.g. venous stasis on calcium, delayed separation of serum on potassium), can also affect the interpretation. Analytical and biological variation must always be taken into account, especially when determining whether a change over time is significant.

The laboratory can provide advice on the uncertainty of measurement of the tests appearing in the list below, upon request.

Critical results will be telephoned to service users in accordance with local criteria based on the Royal College of Pathologists' guidelines.

[back to Contents](#)

## **Supplementary Requests**

Blood Sciences can only accept supplementary requests on samples previously referred to the laboratory up to 48 hours after receipt of the original request and providing the request is appropriate. This will depend on sample stability, tube type and for some tests including therapeutic drug measurement and Troponin I, there will be timing restrictions.

The following tests CANNOT be added on: lactate, ammonia, bicarbonate and LDH.

To order add on requests send a supplementary request form (a supplementary request form is available on ICE and must be sent to the laboratory).

Please note that supplementary requests will be treated as routine. If the request is urgent, it is recommended that another sample is taken. Verbal requests for add tests should have a confirmatory ICE supplementary request form sent immediately.

## **Genetic Tests**

Genetic testing for a range of conditions may be available through the Regional Genetics Service in Manchester. However, it is advisable to contact the centre directly prior to requesting such tests as access to specific counselling services may be required. It is necessary to complete a specific form for genetic requests (available from the link below) which includes a declaration of consent. Samples will not be forwarded to Manchester for analysis without this form.

Further information on genetic tests and the request forms are available on the Manchester Genetics website:

<https://www.mangen.co.uk/order-a-test/>

<https://mft.nhs.uk/nwqlh/documents/>

## **Faecal tests**

### **Reducing substances**

Please collect the stool sample in a blue top stool collection bottle. **Samples must arrive at the laboratory within 2 hours of collection with a clear indication of collection time.** Failure to include this information will result in the test being rejected.

### **Elastase**

Please collect the sample in a blue top stool collection bottle. Interpretation of results is provided by the referral laboratory.

### **Calprotectin**

Please collect the sample in a blue top universal faeces container. Interpretation of results is provided by the referral laboratory.

[\*\*back to Contents\*\*](#)

### Faecal Immunochemical Test (FIT)

This test is available to Primary Care requestors and is used to detect haemoglobin in faeces. The special FIT collection tube must be used. The FIT collection tubes and patient instructions on how to collect samples are available from Pathology. It is recommended that patients collect two separate samples from two different stools.

This test is performed within the department. FIT results are reported numerically and as Positive or Negative using a cut-off of 10µg Hb/g faeces. An information sheet on when to request FIT and the interpretation of results has been circulated to all practices.

### Samples referred to other laboratories

When the laboratory does not offer a particular test, samples will often be referred to an external laboratory. The laboratory has a list of referral laboratories for each test and this list is available upon request.

For more esoteric tests that do not appear within the ICE requesting system, please ring the Duty biochemist (via the general enquiry number) to discuss the request **BEFORE** arranging to take the sample, so that appropriate instructions can be given.

The majority of laboratories to which samples are referred are UKAS accredited. However, individual circumstances may arise whereby tests are referred to a non-accredited laboratory. This decision will be made at the discretion of the Head of Department or their deputy.

### Point Of Care Testing

Point of Care Testing is defined as “any Clinical Laboratory Medicine test performed for a patient by a healthcare professional outside the traditional centralised laboratory” by the Medicines Health Regulatory Authority (MHRA). ELHT Point of Care Testing policy is available on Trust Intranet Policy CP28.

#### **Golden Rules**

- Do not use any Point of Care Device until you have received training from the designated Trainer.
- Always use your own password and never share your password with anyone.
- Always identify your patient correctly on the Point of Care Device – remember to prefix RXR before 7 numerical digits for the hospital number.
- Always follow the latest Standard Operating Procedure (SOP) for the device available from the hospital intranet.
- Do not use any Point of Care testing device which has failed its Quality Control checks.
- Report any device breakdowns or problems to the ELHT Point of Care Team.
- All Patient results are confidential and must be kept securely.
- Any incidents related to Point of Care testing must be recorded on the ELHT incident management system.
- Any new Point of Care Device must be approved by ELHT Point of Care Testing Governance Committee and follow procedure in policy ELHT/C015 (Policy for Introducing New Clinical Techniques or Procedures and new Point of Care testing Devices).

[back to Contents](#)

**POCT Team Contact Details (Mon – Fri 8am-4pm)**

01254 732870 (Ext 82870)

[pointofcare@elht.nhs.uk](mailto:pointofcare@elht.nhs.uk)

Samantha Kelsall

POCT Coordinator

[samantha.kelsall@elht.nhs.uk](mailto:samantha.kelsall@elht.nhs.uk)

Jessie Higgins

POCT Practitioner

[jessie.higgins@elht.nhs.uk](mailto:jessie.higgins@elht.nhs.uk)

Heather Kane

POCT Associate Practitioner

[heather.kane@elht.nhs.uk](mailto:heather.kane@elht.nhs.uk)

Shamira Valli

POCT Associate Practitioner

[shamira.khalifa@elht.nhs.uk](mailto:shamira.khalifa@elht.nhs.uk)**Out of Hours** contact Biochemistry Ext: 84156 or 01254 734156[back to Contents](#)**Point of Care Testing requirements**

POCT Tests	POCT analyser/meter	Preservative	Minimum volume
Blood Gas and cooximetry	Werfen GEM 5000	Balanced Lithium heparin, syringe/capillary	3 mL, syringe 150 µL all tests 150 µL, full capillary 150 µL all tests 150 µL, half full capillary 65 µL all tests <i>except tHb, O2Hb, COHb, MetHb</i>
Blood glucose	Nova StatStrip	n/a	1 drop blood
Blood ketone	Nova StatStrip	n/a	1 drop blood from finger prick for POCT meter or send to Lab with ICE form in Li heparin tube minimum 0.5ml venous blood if no meter on department
Blood Haemoglobin	Hemocue analyser	n/a	2-3 drops whole blood from finger prick
Urine Dipstick	Visual read or Sterilab urine analyser	Plain container no preservative	Volume to allow all test pads to be dipped in urine sample
Blood INR	Roche CoaguChek	n/a	1 drop 8 µl
HbA1c	Abbott Afinion 2	Use Afinion sampling device	1.5 µl blood

**Point of Care Blood Gas Samples:**

- Expel all air and ensure no air bubbles present in sample.
- Ensure samples are mixed well before presenting to the analyser for sampling.
- Samples stable for 15mins room temperature and 60mins on ice/water.
- Note there is no haemolysis detection on point of care blood gas analysers, confirm potassium before clinical decision by venous sample sent to laboratory.
- For capillaries advise mixing with metal mixer and magnet to prevent clotting.

- All users of Point of Care blood gas analysers must have received training and their own user barcode which **must not be shared** with anyone else and must complete required updates at set time periods.
- All point of care blood gas users are responsible for identifying patient blood gas samples on the blood gas analysers and checking the details on the print out.
- Minimum identifiers are hospital number and surname, PAS label, wristband, CAS card labels can be scanned, DO NOT Scan the barcode on ICE Blood request forms (this is not the hospital number).

[back to Contents](#)



## Section 3 – Haematology

### Routine Investigations (please refer to Appendix 1 for paediatric full blood count reference ranges)

Investigation	Reference range	Approximate turnaround time	Tube type	Comments/ Special Precautions
<b>Full Blood Count</b>				
<i>Haemoglobin</i>	Male 130-180 g/L Female 115-165 g/L	Urgent: 1 hr In patient: 4 hrs GP/OPD: 12 hrs	EDTA (pink)	Please provide clinical details
<i>White cell count (WBC)</i>	4.0-11.0 10 <sup>9</sup> /L			
<i>Platelets</i>	150-450 10 <sup>9</sup> /L			
<i>Red cell count (RBC)</i>	Male 4.50 - 6.50 10 <sup>12</sup> /L Female 3.8 - 5.5 10 <sup>12</sup> /L			
<i>PCV</i>	Males 0.40 – 0.50 Females 0.36 – 0.46			
<i>MCV</i>	76-100 FL			
<i>MCH</i>	27.0-32.0 pg			
<i>MCHC</i>	310-360 g/L			
<b>Reticulocytes</b>	<b>20-120</b> 10 <sup>9</sup> /L	Urgent: 1 hr In patient: 4 hrs GP/OPD: 12 hrs	EDTA (pink)	Can be analysed on FBC sample
<b>IM Screen</b>		Urgent: 2 Hrs Other: 12 hrs	EDTA (pink)	Can be analysed on FBC sample
<b>Malarial Parasites</b>		Screening Test 2 Hours Confirmation Test 24 Hours	EDTA (pink)	Can be analysed on FBC sample. Please state any countries that the patient has recently visited. Be aware that the screening kit is not reliable for the detection of P.knowlsei.
<b>Haemoglobinopathy Screen</b>	<b>(Adult Ranges)</b> Hb A2 2.2 – 3.5 % Hb F 0 – 1.8 %	72 hours	EDTA (pink)	Can be analysed on FBC sample For antenatal requests please use the family Origin Questionnaire (FOQ). For other requests use the standard blood science request form and ensure that consent is taken.
<b>Hb S Test</b>		2 hours (urgent)	EDTA (pink)	Other than for urgent cases request a Haemoglobinopathy screen
<b>WBC Differential</b>	<b>(adults -10<sup>9</sup>/L )</b> Neuts 2.0-7.5 Lymphs 1.5 – 4.0 Monos 0.5 – 1.5 Eos 0.1 – 2.5 Basos 0.0 – 0.1	72 Hours	EDTA (pink)	This will be reflexed by the laboratory depending on the FBC results. Please provide clinical details

<b>ESR</b>	Male 1-10 mm/hr Female 3-15 mm/hr	Urgent 2 Hours Routine 12 Hours	Purple ESR Tube	These samples must not be under filled Labels must not obscure the read area.
<b>WBC (Fluid) Including Ascitic and pleural fluid</b>		In patient: 4 hrs	EDTA (pink)	Pleural fluids will not be tested on positive COVID samples

## Coagulation

Test	Reference Range (Adults Only)	Turnaround Time	Tube type	Comments/ Special Precautions
<b>Prothrombin Time/INR</b>		Urgent: 1 hrs In Patient: 4 hrs GP/OPD: 12 hrs	Citrate (Green)	These samples must not be under filled Samples to be received within 12 hours of collection
<b>APTT</b>		Urgent: 1 hrs In Patient: 4 hrs GP/OPD: 12 hrs	Citrate (Green)	These samples must not be under filled
<b>Coagulation Screen</b>	INR 0.9 - 1.2 seconds APTT 0.9 - 1.18 seconds	Urgent: 1 hrs In Patient: 4hrs GP/OPD: 12 hrs	Citrate (Green)	These samples must not be under filled. Samples to be received within 12 hours of collection  <ul style="list-style-type: none"> <li>• If the patient is on Warfarin please request INR</li> <li>• If the patient is on Heparin please request APTT</li> </ul> <p>If Coagulation Screen is requested for patients on Anticoagulants the turnaround times will be affected</p>
<b>D-Dimers</b>	<500 ng/mL Fibrinogen Equivalent Units	Urgent: 1hrs In Patient: 4 hrs GP/OPD: 12 hrs	Citrate (Green)	These samples must not be under filled
<b>FDPs</b>		This assay is no longer available. Use D-Dimer/fibrinogen instead		
<b>Fibrinogen</b>	1.5 – 4.5 g/L	Urgent: 1hrs In Patient: 4 hrs GP/OPD: 12 hrs	Citrate (Green)	These samples must not be under filled
<b>Thrombin time</b>	10 – 16 seconds	Urgent: 1hrs		These samples must not be under filled
<b>ROTEM</b>		Within 90 minutes during core hours. Outside of this, dependent on workload of BMS		ROTEM requires dedicated, adequately filled citrated sample and cannot be performed on a sample for Coagulation Studies/INR.

				Samples are only stable and suitable for ROTEM testing for 4 hours after taking
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EDTA Samples are stored for 3 days to allow add on requests. Coagulation samples are stored for 24 Hours.

## **ROTEM**

The ROTEM blood test is intended to be used to provide a quantitative and qualitative indication of the coagulation state of a blood sample. It records the kinetic changes in a sample of citrated whole blood as the sample clot retracts and/or lyses

Review of results is on a clinical basis and made by the requesting clinicians. It is an agreement between the requesting clinicians and the lab that the interpretation of the result is the responsibility of the requestor.

In practice, the requester calls ahead to inform the lab that a sample is being sent. The test requires a dedicated adequately-filled, un-spun Citrate sample, hence ROTEMs cannot be performed as an add-on to a Coagulation Screen. Please include time on the sample and request form. It is important to include a telephone number where the requestor can be contacted once initial results are available for viewing on the secure viewers in the relevant clinical areas.

## **Thrombophilia Screening**

Thrombophilia screens for Obs/Gynae and Maternity services are filtered through referrals via Maternity services. Appointments will be sent out and arrangements will be made for blood collection. All other requests are available via ICE.

- The patient must not be in the acute phase of any event
- The patient should not be currently pregnant
- The patient should not be on any anti-coagulants

A Thrombophilia screen will consist of:-

**Anti-Thrombin III , Protein C, Protein S , Fibrinogen, Lupus Screen, Factor V111, Factor V Leiden, Prothrombin Gene Variant, Cardiolipin Antibodies and Anti-Beta 2 Glycoprotein 1.**

Sample requirements for this will be 2 x 7mL Green Citrate (or 5 x 3 mL Green Citrate), 2 x Brown Clotted and 2 x Pink EDTA.

Test	Turnaround Time	Tube type
Lupus Screen only	14 Days	2 x 3ml citrate (Green)
Factor V Leiden only	14 Days	2 x EDTA (Pink)
Prothrombin Gene Variant Only	14 Days	2 x EDTA (Pink)

[back to Contents](#)

## **Miscellaneous tests**

Test	Turnaround Time	Tube type	Comments/ Special Precautions
G6PD	Urgent : 12 hrs Routine : 48 hrs	EDTA (pink)	Can be analysed on FBC sample
Cell marker studies/CD4	10 Days	2x EDTA (Pink)	Samples must be received in laboratory on Monday-Wednesday
Jak2	28 Days	EDTA (pink)	Performed following discussion with Consultant Haematologist
BCR-ABL	28 Days	EDTA (pink)	Performed following discussion with Consultant Haematologist
Plasma Viscosity	14 days Reference range = 1.45 – 1.8	EDTA (pink)	
Anti-Xa	Urgent 4 hours	2 x Citrate (Green)	Pre and post dose should be specified on the form. Test performed at CMFT

## **Factors Affecting Results**

Clotted and haemolysed samples are unsuitable for testing. Lipaemic samples may give erroneous results and therefore may be unsuitable for testing. Small samples may be insufficient for testing but paediatric blood tubes are available for babies and children allowing for a smaller sample of blood to be tested.

Samples stored at temperature outside of 2-25°C may exhibit haemolysis and therefore will be unsuitable for testing.

## **Anticoagulant Therapy**

Follow the Directorate of Medicine protocol –available on all wards

## **Supplementary Requests**

Haematology can only accept supplementary requests on samples previously referred to the laboratory up to 72 hours after receipt of the original request and providing the request is appropriate. This will depend on sample stability and tube type. To order add on requests send a supplementary request form (a supplementary request form is available on ICE and must be sent to the laboratory). Verbal requests for add tests should have a confirmatory ICE supplementary request form sent immediately.

[back to Contents](#)

## Section 4 – Blood Transfusion

### Blackburn Site

Telephone Transfusion lab 84529 (01254 734529)

Outside core hours Bleep 019

### Burnley Site

Telephone Transfusion Lab: 14318 (01282 804318)

Outside core hours: Bleep 020

### Requesting Procedure

Use red labelled BTS sample tubes.

Complete all the patient details on the special blood transfusion request form by **ballpoint pen**. **Blood transfusion fatalities are most often caused by clerical error** - double check that the information on the request form and the blood tube are complete and correct. If the data supplied is incomplete, Blood Transfusion staff cannot accept the blood specimen. **USE ONLY BLOOD TRANSFUSION TUBES.**

The patient's full name, DOB, Hospital number or NHS number should be on the sample tube and form.

Pre-printed labels must not be used on sample. If pre-printed label used on form, passport number **MUST** be written on form.

Alternatively, requests for group and antibody screens may be made using ICE Desktop

Advice for irradiated products is given on the reverse of the request form.

Clinical details must be provided on the request.

Both the request form and the sample must be signed by the person taking the blood. Any requests/bottles not meeting this requirement will be rejected and a new request form and sample will be required.

### Timing of Requests

Before blood can be issued a group and antibody screen needs to be undertaken. This takes approximately half an hour from the time of receipt into the laboratory.

If atypical antibodies are present the time required will be increased depending on the complexity of the case.

Requests for emergency issues of blood must be made by telephone. Blood is issued for definite use only.

[back to Contents](#)

Where a patient has had only one grouping episode a second sample should be sent for grouping before blood is issued. Where the subsequent time delay would have clinical implications blood will be issued off a single grouping sample and the compatibility report will have comments to reflect this

Emergency O Negative and O Positive un-crossmatched blood is available for emergency use.

## **Location of Blood Fridges**

### **Royal Blackburn Teaching Hospital**

Pathology Laboratory, Level 0, Royal Blackburn Hospital

### **Burnley General Teaching Hospital**

Outside the entrance door to the Blood Sciences Laboratory, Ground floor, Wilson Hey. (Keypad access)

## **Electronic Issue**

Blood is only issued for definite use. If the patient has a current valid blood group and antibody screen result on the laboratory system and has no antibodies, group specific blood can be issued in 10 minutes

Patients must have a current and valid blood group and antibody screen on the laboratory system (no longer than 3 days ago), before the proposed transfusion date.

If the patient has blood group antibodies at least 24hrs notice is required for compatible units to be issued.

Please note: Group and antibody screen and saved plasma, before surgery, can considerably reduce the time to supply blood, if no blood group antibodies are present. Ideally, a patient's sample will be taken on admission, or as near to the procedure as possible. An exception to the 3 day (72hr) time limit is possible, but only under urgent circumstances. Please consult with the laboratory for guidance.

## **What to request**

### **Group and Antibody Screen**

A hand written EDTA sample:

- 7.5ml sample for an adult
- 2.7ml or 1.2ml sample for a child/baby.

[back to Contents](#)

**Factors affecting results:** Clotted and haemolysed samples are unsuitable for testing. Lipaemic samples may give erroneous results and therefore may be unsuitable for testing. Small samples may be insufficient for testing but paediatric blood samples are available for babies and children allowing for a smaller sample of blood to be tested.

Samples stored at temperature outside of 2°C to 25 °C may exhibit haemolysis and therefore will be unsuitable for testing. Samples should be tested within 72 hours.

Senior BMS staff can be contacted for further advice on sample testing and factor affecting results. Clinical advice can be obtained from the Haematology Consultants.

### **Red Cells (Leucocyte depleted)**

Each pack contains approximately 350 mL. One donor pack will raise the haemoglobin in an average sized adult by about 10 g/l.

In cases where multiple packs are issued for urgent use i.e. trauma, these can be issued in a specially insulated transport container for local storage up to 1.5 hours before transfusion.

### **Fresh Frozen Plasma (FFP)**

The patient's blood group is required.

This product is stored at below minus 30°C and requires about 40 minutes to thaw out before use.

The volume is 180 mL per pack and should be transfused as soon as possible after thawing.

Coagulation results are usually required before decision on number of units required is taken.

The ward will be informed when the FFP is ready for collection from the appropriate location

Patients born after 1/1/1996 should receive Octaplas or Methylene Blue Treated FFP

### **Factor VIII and IX**

Freeze-dried product is available via the haemophilia centre on a case by case basis. Some other single or combined clotting factor freeze-dried concentrates may be available from Regional Blood Transfusion Centres.

### **NOVO SEVEN**

Activated Factor VII is not held in stock but is available in cases of massive blood replacement after discussion with the Consultant Haematologist on call.

### **Platelet Concentrates**

The blood bank, on the RBTH site, routinely holds one adult therapeutic dose of group A RhD Positive platelets. Specially selected platelets are available on request and are ordered in from NHSBT.

The patient's blood group is required.

Units must be collected directly from Blood Transfusion Laboratory. Platelets are never to be stored in the fridge.

### **Anti-D**

Anti-D is available as follows: Rhophylac (1500IU).

This is the standard dose for both sensitizing events and prophylactic anti-D clinic

[back to Contents](#)

**Albumin**

Human Albumin solution (NB: patient's blood group (Sample) is not required) units will be available from the site specific laboratory. Albumin is stored at 2-25°C.

Albumin is to be requested on a named patient basis only. It is also to be requested for definite use, not for "standby" purposes. It is not to be stored on the wards. Any albumin that is unused must be returned to the laboratory within 24 hours.

Albumin is available in the following concentrations and sizes:

4.5%	500ml or 250ml
20%	100ml

Note: when completing the transfusion form for an albumin request, please specify:

1. The concentration of albumin required.
2. The volume of albumin, i.e. how many mls
3. The time for when the albumin is required.

Any missing information will cause a delay in the product being issued.

**Beriplex**

Available in 500IU doses. Dosage is dependent on patient's weight and INR. See package insert for calculation.

**Suspected Transfusion Reactions**

If a transfusion reaction is suspected STOP the transfusion immediately.

All suspected reactions must be reported immediately to the Consultant Haematologist or senior Laboratory staff.

The laboratory will issue a form which must be completed and returned immediately to allow full investigation.

**Miscellaneous Requests****Tissue Typing/HLA Typing**

7.5 ml blood transfusion tube required for HLA B27, HLA Class I and II typing, HLA DQ2/DQ8. Also, 10 ml clotted blood required if for tissue or organ transplant together with a Haematology/Biochemistry combined request form.

**Cold Agglutinins**

5 ml EDTA (pink) sample. Use a Blood Sciences request form. Normal range time < 1 in 64 at 4C.

**Direct Coomb's Test (DCT)**

An EDTA sample is required together with a fully completed Transfusion request form.

**Kleihauer/Betke (KIB)**

Collect a 7.5ml blood transfusion sample from both cord and mother's blood after delivery and send within 12 hours of collection together with a fully completed Blood Transfusion combined request form. Immunoglobulin Anti-D must be administered within 72 hours of delivery. The standard dose of 1500 is suitable for clearance of <12mls of foetal red cells. A Kleihauer is not required for patients under 20 weeks gestation. Turnaround time for Kleihauer is 24 hours.

[back to Contents](#)



**White Cell Antibodies (Possible Cause of Some Blood Transfusion Reactions)**

10 ml clotted blood and a Transfusion Sample and a Transfusion request form.

**Platelet Antibodies (Possible Cause of Blood Transfusion Reaction)**

Contact Blood Transfusion for request form and sample requirements. Samples should arrive in the Laboratory before 12.00hrs Monday to Thursday only, excluding Bank Holidays, for referral on to the Blood Transfusion Centre.

**Foetal DNA**

Collect a 7.5mL Blood transfusion sample, together with a request form stating the expected date of delivery (EDD). Turnaround time for Foetal DNA is 2 weeks.

**Turnaround Times**

Specimen	Frequency of Testing	Time to Result
Group and Save	Daily on request	6 Hours
Cross match	Daily on request	Blood can be provided in an emergency within 15 minutes
Fresh frozen plasma	Daily on request	2 hours
Concentrated platelets	Daily on request	2 hours
Direct Coombs	Daily on request	6 hours
Cold Agglutinins	Daily on request	48 hours
Non-urgent antibody identification	Daily on request	12 hours
HLA-Typing	Daily on request	21 Days
WBC + Platelet antibody screens	Daily on request	21 Days

[back to Contents](#)

## Section 5 – Biochemistry test list A–Z

### **Blood/serum/plasma**

This table covers the majority of available tests that are performed at ELHT; other tests are available but are analysed at other laboratories. Please contact the Blood Sciences department for information regarding any test not listed. Unless specified, the reference ranges supplied in the handbook can be assumed to be for adults. In some cases, age related reference ranges may apply. It should be noted that results outside the reference range do not necessarily indicate disease. Similarly, results within the reference range do not preclude abnormality.

The laboratory will endeavour to meet the turnaround times stated. However, in exceptional circumstances this may be prolonged.

In most circumstances only one tube will be sufficient for all the tests required on that tube type. When requesting tests on ICE the system will indicate the number of tubes required.

**Please note that any deviations from the stated sample tube type must be discussed with the laboratory prior to sample collection. Different tube types may not be suitable for the requested tests.**

[back to Contents](#)

Analyte	Reference range	Approximate turnaround time*	Tube type (Sarstedt)	Comments
ALT (Alanine transaminase)	<35 IU/L (females) <50 IU/L (males)	4 Hours	Brown	
Albumin	<b>Age</b>	<b>Ref. range</b>	Brown	
	<1 yr	30-45 g/L		
	1-16 yrs	30-50 g/L		
	>16 yrs	35-50 g/L		
ALP (alkaline phosphatase)	30 - 130 IU/L	4 hours	Brown	Age related reference ranges apply
Alpha feto protein (AFP)	<8 KU/L	Next day, Mon-Fri	Brown	
Amikacin	No reference range quoted. Refer to Antimicrobial Formulary	4 hours	Brown	For interpretation please refer to Antimicrobial Formulary on the hospital intranet under Clinical Information Prescribing.
Ammonia	11 - 32 µmol/L	4 Hours	Orange	Send on ice within 15 minutes of collection
Amylase	30 - 110 IU/L	4 hours	Brown	
Angiotensin converting enzyme (ACE)	20-70 IU/L (Adult)	Next Day Mon-Fri	Brown	
AST (Aspartate transaminase)	14 – 59 IU/L	4 hours	Brown	
B12, vitamin	160 - 1000 ng/L	Next day Mon-Fri	Brown	>260 ng/l - Vitamin B12 deficiency highly unlikely.
Bicarbonate	22-29 mmol/L	4 hours	Brown	
Bile acids	0 - 9 µmol/L	Next day, Mon-Fri	Brown	
Bilirubin (total)	Adult <21 µmol/L	4 hours	Brown	
Bilirubin (conjugated)	0-10 µmol/L	4 hours	Brown	

B-type Natriuretic peptide (BNP)	<400 ng/L	2-3 days (Available in Primary Care only)	Orange	Pro-BNP <400 in an untreated patient makes heart failure unlikely
C-reactive protein (CRP)	<10 mg/L	4 hours	Brown	
CA125	<30 KU/L	Next day, Mon-Fri	Brown	
CA19.9	<35 KU/L	Next day, Mon-Fri	Brown	
Calcium	<b>Age</b>	<b>Ref. range</b>	4 hours	Brown
	<4 weeks	2.00-2.70 mmol/L		
	4 weeks – 16 yrs	2.20-2.70 mmol/L		
	>16 yrs	2.20-2.60 mmol/L		
Carbamazepine	4 -12 mg/L	4 hours	Brown	Pre-dose (trough) sample
Carboxyhaemoglobin	<3%	30 minutes	Orange	
CEA	<5 µg/L	Next day, Mon-Fri	Brown	
Chloride	95 - 108 mmol/L	4 hours	Brown	
Cholesterol	Desirable range 3.0 - 5.0 mmol/L	4 hours	Brown	
Cholesterol high density (HDL)	Desirable range M >1.0 mmol/L F >1.2 mmol/L	4 hours	Brown	
Cholesterol (non-HDL)	On high intensity statin treatment, aim for a greater than 40% reduction in non-HDL cholesterol	4 hours	Brown	
Cholesterol low density (LDL)	Desirable range <3.0 mmol/L	4hours	Brown	
Complement C3	0.75 - 1.65 g/L	Same day	Brown	
Complement C4	0.14 - 0.54 g/L	Same day	Brown	
Cortisol	9am sample 145-619 nmol/L	4 hours	Brown	

CK (creatine kinase)	Male 25-200 IU/L Female 40-320 IU/L		4 hours	Brown	
Creatinine	<b>Age</b>	<b>Male Ranges (µmol/L)</b>	<b>Female Ranges (µmol/L)</b>	4 hours	Brown
	<b>&lt;14 days</b>	27-81	27-81		
	<b>14 days - &lt; 1yr</b>	14-34	14-34		
	<b>1 yr- &lt;3yrs</b>	15-31	15-31		
	<b>3yrs - &lt;5yrs</b>	23-37	23-37		
	<b>5yrs - &lt;7 yrs</b>	25-42	25-42		
	<b>7yrs - &lt;9yrs</b>	30-48	30 – 48		
	<b>9yrs - &lt;11yrs</b>	28-57	28- 57		
	<b>11yrs</b>	36-64	36-64		
	<b>12 yrs</b>	36-67	36-67		
	<b>13 yrs</b>	38-76	38-74		
	<b>14 yrs</b>	40-83	43-75		
	<b>15 yrs</b>	47-98	44-79		
	<b>16 yrs</b>	54-99	48-81		
<b>&gt;16 yrs</b>	58 - 110	46 - 92			
Cryoglobulins	N/A		14 days	Special flask & tubes	Contact Biochemistry to arrange flask collection for this test
Digoxin	0.5-1.0 µg/L in heart failure Up to 2 µg/L in AF		4 hours	Brown	Pre-dose or at least 6 hours post dose
Ethanol	N/A		4 hours	Brown	Results reported in mg/L
Ferritin	Male 22 - 322 µg/L Female 10 - 291 µg/L		Next day, Mon-Fri	Brown	

FAI (free androgen index)	≤7.0% (females only)		Next day, Mon-Fri	Brown	
Folate	3.0-20.0 µg/l		Next day, Mon-Fri	Brown	
FSH (follicle stimulating hormone)	<u>Female</u> Follicular 1.0 - 11.0 IU/L Mid-cycle 6.0 - 21.0 IU/L Luteal 1.0 - 8.0 IU/L  Male 1.1 - 11.0 IU/L		Next day, Mon-Fri	Brown	
Gentamicin	No reference range quoted.  Refer to Antimicrobial Formulary		4 hours	Brown	For interpretation please refer to Antimicrobial Formulary on the hospital intranet under Clinical Information Prescribing.
GGT (Gamma glutamyl transferase)	0 - 65 IU/L		4 hours	Brown	
Glucose	Fasting 3.0 - 6.0 mmol/L		4 hours	Yellow	
Growth Hormone	>5.8 µg/L post stimulation (see DFT protocol handbook)		2-3 days, Mon-Fri	Brown	Random growth hormone measurements are rarely indicated
HbA1c	Non Diabetic Ref Range: 20 – 41 mmol/mol		Next day, Mon-Fri	Purple	
HCG	<6 IU/L		4 hours	Brown	
IgE	<3 months	<5 kU/L	2-3 days, Mon-Fri	Brown	
	3-12 months	<11 kU/L			
	1– 5 years	<29 kU/L			
	5 – 10 years	<52 kU/L			
	10– 15 years	<63 kU/L			
	15 – 20 years	<75 kU/L			
	>20 years	<81 kU/L			
Immunoglobulin A	0.8 - 4.0 g/L		Next day, Mon-Fri	Brown	

Immunoglobulin G	6.0 - 16.0 g/L		Next day, Mon-Fri	Brown	
Immunoglobulin M	0.4 - 2.3 g/L		Next day Mon-Fri	Brown	
Iron	Male 9 - 32 µmol/L Female 7 - 30 µmol/L		Next day, Mon-Fri	Brown	
Lactate	0.7 - 2.4 mmol/L		4 hours	Yellow	<i>Send samples to the lab immediately after sample collection</i>
LDH	Age range	Male (IU/L)	Female (IU/L)	4 hours	Brown
	<1 month	229-866	242-825		
	1-3 months	201-505	192-476		
	4-6 months	168-509	201-476		
	7-12 months	160-497	192-439		
	1-3 years	209-382			
	4-6 years	197-373			
	7-9 yrs	176-312			
	10-11 yrs	181-291	160-291		
	12-13 yrs	197-312	160-266		
	14-15 yrs	151-303	164-242		
	16-17yrs	143-279			
≥18 yrs	132-257				
Lithium	0.4 - 1.0 mmol/L		4 hours	Brown	12 hours post dose
LH	Female: Follicular phase reference range: 1.9 - 12.5 IU/L Mid cycle reference range: 8.7 – 76.3 IU/L Male: 1.5-9.3 IU/L		Next day, Mon-Fri	Brown	.
Magnesium	0.70 - 1.0 mmol/L		4 hours	Brown	

Oestradiol	Female: Follicular phase reference range 72-529 pmol/L Mid-cycle peak reference range 235 - 1309 pmol/L  Male <146 pmol/L		Next day, Mon-Fri	Brown	
Osmolality (serum)	275 - 295 mmol/kg		4 hours	Brown	
Paracetamol	Refer to nomogram for treating suspecting overdose		4 hours	Brown	
PTH (parathyroid hormone)	1.5 - 7.6 pmol/L		Next day, Mon-Fri	Pink	
pH	7.35-7.45		30 minutes	Heparinised blood gas syringe or capillary	
pCO <sub>2</sub>	Male: 4.6-6.4 kPa Female: 4.3-6.0 kPa		30 minutes		
pO <sub>2</sub>	11.0-14.4 kPa		30 minutes		
Phenobarbitone	10 - 40 mg/L		4 hours	Brown	Pre-dose (trough) sample  Out of hours analysis by arrangement only
Phenytoin	5.0-20 mg/L		4 hours	Brown	Pre-dose (trough) sample
Phosphate	<b>Age</b>	<b>Ref. range</b>	4 hours	Brown	
	<4 weeks	1.3-2.6 mmol/L			
	4 weeks – 1 yr	1.3-2.4 mmol/L			
	>1 yr-16 yrs	0.9-1.8 mmol/L			
>16 yrs	0.8 - 1.5mmol/L				
Potassium	<b>Age</b>	<b>Ref. range</b>	4 Hours	Brown	
	<4 weeks	3.4-6.0 mmol/L			



	4 weeks – 1 yr	3.5-5.7 mmol/L			
	>1 yr	3.5-5.3 mmol/L			
Progesterone	Post ovulatory >30 nmol/L		Next day, Mon-Fri	Brown	
Prolactin	Females 56-619 mU/L Males 45-375 mU/L		Next day, Mon-Fri	Brown	
Protein Electrophoresis	N/A		7 Days	Brown	
PSA	<60 years	<3.0 µg/L	Next day, Mon-Fri	Brown	
	60-69 years	<4.0 µg/L			
	≥70 years	<6.5 µg/L			
Protein (total)	60-80 g/L		4 hours	Brown	
Rheumatoid Factor	0-12 IU/mL		Same day	Brown	
Salicylate	<150 mg/L		4 hours	Brown	
SHBG	Male <50 years: 15 - 95 nmol/L		Next day, Mon-Fri	Brown	
	Male ≥ 50 years: 22-113 nmol/L				
	Female 23 - 159 nmol/L				
Sodium	133-146 mmol/L		4 hours	Brown	
T3 (free)	3.0- 7.1 pmol/L		Next day, Mon-Fri	Brown	
T4 (free)	10.4 - 24.5 pmol/L		Next day, Mon-Fri	Brown	
Testosterone	Female	≤1.7 nmol/L	Next day, Mon-Fri	Brown	Female samples with results above the reference range will be referred for LC-MS/MS testosterone analysis
	Male 18-39 years	9.3 – 32.2 nmol/L			
	Male 40 – 49 years	8.2 – 32.2 nmol/L			
	Male ≥ 50 years	7.6 – 32.2 nmol/L			
Theophylline	10 -20 mg/L		4 hours	Brown	

TIBC (Total iron binding capacity)	45 - 80 µmol/L	Next day, Mon-Fri	Brown	
TIBC saturation	20.0 - 55.0 %	Next day, Mon-Fri	Brown	
TSH	0.3 - 6.0 mU/L	Next day, Mon-Fri	Brown	
Thyroid peroxidase (TPO) antibodies	0-35 IU/mL	2-3 days, Mon-Fri	Brown	
Tobramycin	No reference range quoted Refer to Antimicrobial Formulary	4 hours	Brown	For interpretation please refer to Antimicrobial Formulary on the hospital intranet under Clinical Information Prescribing.
Troponin I (High sensitivity)	≤40 ng/L (females) ≤58 ng/L (males)	2 hours	Brown	
Urate (serum)	Male 200-430 µmol/L Female 140-360 µmol/L	4 hours	Brown	
Urea	<b>Age</b>	<b>Ref. range</b>	4 hours	Brown
	<4 weeks	0.8 –5.5 mmol/L		
	4 weeks – 1yr	1.0-5.5 mmol/L		
	1-16 yrs	2.5-6.5 mmol/L		
	>16 yrs	2.5-7.8 mmol/L		
Valproate	No reference range quoted	4 hours	Brown	
Vancomycin	No reference range quoted. Refer to Antimicrobial Formulary	4 hours	Brown	For interpretation please refer to Antimicrobial Formulary on the hospital intranet under Clinical Information Prescribing.

Vitamin D (25OH Vit D)	Vitamin D thresholds in respect of bone health: Serum 25-OH vitamin D <25 nmol/L is deficient 25-50 nmol/L maybe inadequate in some people >50 nmol/L is sufficient for almost the whole population	Next day, Mon-Fri	Brown
Zinc	10 - 24 µmol/L	2- 3 days, Mon-Fri	Brown

**Urgent turnaround times have been agreed for the following tests on the Emergency Department (ED) and Neonatal Intensive Care Unit (NICU):**

ED (90% of results to be reported within the stated turnaround times)

Within 60 minutes for Renal, Liver, CRP, Coagulation, INR, FBC

Within 90 minutes for Troponin

NICU:

Within 120 minutes for Renal, Bone, Magnesium, Glucose, Ammonia, Lactate, CRP, Coagulation and FBC.

### **Cerebrospinal Fluid (CSF)**

Please see separate document for collection of CSF for Biochemistry/Microbiology tests (on the intranet with the User Guide and BS/B SOP 227 on QPulse).

Test	Reference Range
CSF Protein	≤0.60 g/L
CSF Glucose	2.2-3.9 mmol/L (≥18 years) 2.5-4.5 mmol/L (<18 years) <i>CSF glucose result should be approximately 60% of the plasma glucose result.</i>
CSF bilirubin	≤0.007 absorbance units <i>Interpretative comments are added based on the oxyhaemoglobin absorbance and the bilirubin absorbance.</i>

### **Other fluids**

The following tests may be measured on other fluids (e.g. pleural, ascitic, pancreatic cyst).

Test	Sample Type
Total protein and albumin	Plain container
LDH	Plain container
Triglyceride	Plain container
Amylase	Plain container
Glucose	Yellow top tube (fluoride EDTA)

pH	Orange top blood gas syringe (lithium heparin)  Expel all air from the syringe and take to the lab immediately for analysis
CEA and CA 19-9	Plain container

Please note that no tests are accredited for fluid analysis and no reference ranges are available for these tests. The laboratory will endeavor to provide results on all fluid results but it may not be possible if the fluid is very viscous or thick. Please consider this when collecting fluid samples.

Other biochemical tests may be available on fluid samples; please discuss with the Consultant Biochemists.

### Interpretation of results

A clearly low total protein (<25 g/L) or a clearly high total protein (>35 g/L) usually distinguishes between a transudate and an exudate in **pleural fluids**. For borderline results, Light's criteria should be used; a fluid is considered an exudate if any of the following apply:

- Pleural fluid LDH is greater than 2/3 of the upper reference limit for serum LDH
  - This value is >171 IU/L
- Ratio of fluid protein to serum protein >0.5
- Ratio of fluid LDH to serum LDH >0.6

### 24 hour Urine Tests

Test	Reference range	Approximate turnaround time	Sample container (24 hour collection bottle)	Comments
Calcium	2.5 - 7.5 mmol/24hr (on a normal diet)	2 days	Plain	
Creatinine	8.8 - 17.6 mmol/24hr	2 days	Plain	
Magnesium	2.5-8.0 mmol/24hr	2 weeks	Acid bottle	<i>Samples referred for analysis at Wythenshawe Hospital</i>
Phosphate	15-50mmol/24hr	2 days	Plain	
Potassium	25.0 – 100.0 mmol/24hr	2 days	Plain	
Protein	<0.15 g/24hr	2 days	Plain	
Sodium	130-220 mmol/24hr	2 days	Plain	
Urate	1.5-4.5 mmol/24hr	2 days	Plain	
Metadrenaline	0 - 2 µmol/24hrs	2 weeks	Acid bottle	
Normetadrenaline	Male 0 - 5.3 µmol/24hrs Female 0 - 4.3 µmol/24 hrs	2 weeks	Acid bottle	
5-hydroxyindole acetic acid (5HIAA)	1 - 45 µmol/24 hrs	2 weeks	Acid bottle	

[back to Contents](#)

## Random Urine Tests

Analysis of the following tests is performed on random urine samples. An **early morning urine sample is preferable**. Due to the variability of the random urine sample (e.g. dietary/fluid intake), some tests may not have a reference range and should be interpreted in light of clinical findings.

Test	Reference range	Approximate turnaround time	Sample container	Comments
Albumin : creatinine ratio	<3 mg/mmol	2 days	Plain universal	
Amylase	50 – 750 IU/L	2 days	Plain universal	
Bence Jones Protein	N/A	7 days	Plain universal	
Calcium : creatinine ratio	Up to 0.75 mmol/mmol in adults Age related reference ranges available for children	2 days	Plain universal	
Drugs of abuse	Reported as Positive or Negative	2 days	Plain universal	<i>Samples are referred to Salford Royal Hospital for analysis. Please provide details of likely exposure and treatment.</i>
Osmolality	Interpret in light of clinical picture	Same day	Plain universal	Interpret with serum osmolality, serum sodium and urine sodium
Potassium	Interpret in light of clinical picture	2 days	Plain universal	
Pregnancy Test	Reported as POSITIVE or NEGATIVE	Same day	Plain universal (early morning)	
Protein : Creatinine ratio	<50 mg/mmol	2 days	Plain universal	
Sodium	Interpret in light of clinical picture	2 days	Plain universal	
U&E	Interpret in light of clinical picture	2 days	Plain universal	

## Faecal Tests

Test	Reference range
Faecal Immunochemical Test (FIT)	<10 µg Hb/g

[back to Contents](#)

## **Appendix 1 – Paediatric Full Blood Count Reference Ranges**

Age	Hemoglobin (g/dl)	RBC ( $\times 10^{12}/l$ )	Hematocrit	MCV (fl)	WBC ( $\times 10^9/l$ )	Neutrophils ( $\times 10^9/l$ )	Lymphocytes ( $\times 10^9/l$ )	Monocytes ( $\times 10^9/l$ )	Eosinophils ( $\times 10^9/l$ )	Basophils ( $\times 10^9/l$ )	Platelets ( $\times 10^9/l$ )
Birth (term infants)	14.9–23.7	3.7–6.5	0.47–0.75	100–125	10–26	2.7–14.4	2.0–7.3	0–1.9	0–0.85	0–0.1	150–450
2 weeks	13.4–19.8	3.9–5.9	0.41–0.65	88–110	6–21	1.5–5.4	2.8–9.1	0.1–1.7	0–0.85	0–0.1	170–500
2 months	9.4–13.0	3.1–4.3	0.28–0.42	84–98	5–15	0.7–4.8	3.3–10.3	0.4–1.2	0.05–0.9	0.02–0.13	210–650
6 months	10.0–13.0	3.8–4.9	0.3–0.38	73–84	6–17	1–6	3.3–11.5	0.2–1.3	0.1–1.1	0.02–0.2	210–560
1 year	10.1–13.0	3.9–5.1	0.3–0.38	70–82	6–16	1–8	3.4–10.5	0.2–0.9	0.05–0.9	0.02–0.13	200–550
2–6 years	11.0–13.8	3.9–5.0	0.32–0.4	72–87	6–17	1.5–8.5	1.8–8.4	0.15–1.3	0.05–1.1	0.02–0.12	210–490
6–12 years	11.1–14.7	3.9–5.2	0.32–0.43	76–90	4.5–14.5	1.5–8.0	1.5–5.0	0.15–1.3	0.05–1.0	0.02–0.12	170–450
12–18 years											
Female	12.1–15.1	4.1–5.1	0.35–0.44	77–94	4.5–13	1.5–6	1.5–4.5	0.15–1.3	0.05–0.8	0.02–0.12	180–430
Male	12.1–16.6	4.2–5.6	0.35–0.49	77–92							

[back to Contents](#)