PATHOLOGY SERVICES HANDBOOK 2023

INTRODUCTION

This handbook is intended as a source of reference to all healthcare staff and patients using the Countess of Chester Hospital NHS Foundation Trust Pathology Services.

If the information you require cannot be found here please contact the appropriate department. Calls from outside the hospital should be prefixed with 36.

The Pathology department (CN9061) is accredited by the United Kingdom Accreditation Service (UKAS) for ISO15189:2012- Medical Laboratories.

9061

For details of the UKAS accredited tests please visit **www.ukas.com**

"Accreditation provides you, the patient, with confidence that the hospital service you are visiting is providing you with the best possible care and is delivering a quality led service with patient safety and delivery at its core."

The Pathology Quality Manual and Quality Policy can be found via these links.

For any problems with access to links or queries regarding content, please contact the Pathology Quality Manager Abigail Armstrong on 01244 365519 or abigail.armstrong@nhs.net

Where to Find Us

Postal Address:

Pathology Laboratory
Countess of Chester NHS Foundation Trust
Liverpool Road
Chester
CH2 1UL

Click here for the Countess of Chester Hospital NHS Foundation Trust web-site.

Location of Laboratory Services

The Cellular Pathology, Blood Sciences (Chemical Pathology, Haematology and Blood Transfusion) and Immunology Departments are located at the rear of the main hospital on the **first floor** in the **ORANGE ZONE F12.** Follow the signs for **F12** Pathology/Orange Zone

and go to Pathology Reception which is just inside the main entrance door to the Pathology area opposite CCU.

The Microbiology department is not located within the Countess Health Park.

Microbiology services are provided by:

Cheshire and Wirral Microbiology Service,
11 Bassendale Road,
Bromborough,
CH62 3QL
Main Telephone Number: 01244 362500

There are regular transport runs between the Countess and the Cheshire and Wirral Microbiology Service laboratory.
The Microbiology User Handbook can be accessed via this link or via the Trust Intranet.

Opening hours

BLOOD SCIENCES – Chemical Pathology/Haematology/Blood Transfusion

The Blood Sciences laboratories maintain a 24 hour 7 day a week continuous process pattern for hospital work. **The core working hours are 09:00 – 17:30 Monday to Friday.**

Outside these core working hours the laboratory will be served by 2 duty Biomedical Scientists (BMS), one covering Biochemistry and the other covering Haematology and Blood Transfusion. During this period it will not be necessary to contact the BMS regarding routine work sent to the laboratory. Requests should be delivered to the laboratory and left at the Specimen Reception; those departments/wards with an air tube system can continue to send samples through this mechanism.

These samples will be dealt with routinely and authorised results can be accessed via EPR+. **Only results that are grossly abnormal will be phoned.**

If required the duty BMS must be contacted via bleep 2552 (for Biochemistry), bleep 2553 (for Haematology/Transfusion) or switchboard for:

- ALL urgent requests, in order that work can be prioritised.
- ALL requests for blood gases and cross-matching of blood after 17:30 hours.

Histopathology & Diagnostic Cytology:

Monday - Friday:	8.30am – 5.00 pm

NB No out of hour's service is available for Histology / Diagnostic Cytology. Histology specimens must be received by the lab before 11am for processing that day. **Diagnostic cytology samples must be received by the lab before 4.00 pm in order to be processed that day.**

Immunology:

Monday – Friday	9.00am – 5.30pm

Outside the above core working hours contact the out-of-hours Biomedical Scientist via hospital switchboard, who will forward information or contact the Consultant Immunologist as required.

Phlebotomy Service Contacts:

Julie Pierce/Lucy Kirkham	Blood Sciences Operational Managers	01244 366919
Rose Edwards	Phlebotomy Manager	01244 366537 Bleep 3388
Sian Cochran	Senior Phlebotomist	01244 363711 Bleep 2572

INFORMATION FOR HEALTHCARE PROFESSIONALS

Pathology results

In-patient and out-patient results are available electronically on EPR+ Powerchart as soon as they are authorised. Hardcopies are also sent out in some cases. All Histology/Cytology results are currently sent out electronically and on paper.

GP results are transmitted electronically via Clinisys ICE to surgeries throughout the day. Paper copies of Blood Science results are also posted out daily to some practices. All Histology/Cytology results are currently sent out as hardcopies.

The communication of critical and unexpected pathology results

We apply the guidelines published by the Royal College of Pathologists which can be found here

Biochemistry:

Analyte	Units	Lower limit (=to or <)	Upper limit (= to or >)	Comments
Na	mmol/L	120	150	If <16 years phone at 130mmol/l
K	mmol/L	2.5	6.0	Exclude haemolysis, old sample, EDTA contamination
Urea	mmol/L		30 (>10 if <16yr)	
Creatinine	umol/L		354 (>200 if <16yr)	
AKI stage		2	3	GPs only
Glucose	mmol/L	2.5	25 (≥15 if <16y)	If type 2 DM then >30
Calcium	mmol/L	1.8	3.0	
Mg	mmol/L	0.4		
Phosphate	mmol/L	0.3		
ALT	U/L		675	
CK	U/L		>5000	
Amylase	U/L		610	GPs only
CRP	mg/L		300 (In patients) 100 (GPs)	
Salicylate	mg/L		300	

Paracetamol	mg/L		Any detectable	
Digoxin	ug/L		2.5	Should be 6 hours post dose
Theophylline	mg/L		25	
Phenytoin	mg/L		25	
Lithium	mg/L		1.2	
Vancomycin	mg/L		30	
Cortisol	nmol/L	100		Unless part of dexamethasone suppression test or day profile
TFT (new)	pmol/L	FT4< 3.2	TSH > 46	Phone to ward, OP and GP only Do not phone to OOH
	mU/L	FT4 >30	TSH < 0.02	
Albumin	g/L	< 20		GPs only
Bilirubin	umol/L		300	Paediatrics only
Cord bilirubin	umol/L		100	Paediatrics only
TnI	umol/L		Above reference range	To GPs and A&E only
Ammonia	umol/L		100	
Bicarbonate	mmol/L	10		
Ethanol	mg/dL		400	
Urate	mmol/L		0.34	Ante natal only

Haematology

Parameter	Unit	Level	Comment
Haemoglobin	g/L	< 80	If no previous Note: if the Hb has significantly dropped within a short time frame which could indicate a substantial bleed then telephone, even if result >80
White cell count			
Neutrophils	x109/L	< 1.5	Check film before phoning – may need Consultant comments
	x109/L	>50	
Lymphocytes	x109/L	>50	
Platelets	x109/L	<80	Check sample for clots then check blood film to exclude clumping before phoning
Platelets	x109/L	<30	Perform checks as above and refer urgently to Consultant Haematologist.
Platelets	x109/L	>1000	Requires urgent but not immediate referral
Blood film - Some results e.g. low platelets must have a blood film review before phoning. It is sometimes appropriate to ask a Consultant Haematologist to review the blood film and the results before phoning. On these occasions the Consultant will phone the requesting clinician.			
Malaria parasites	Positive		Refer to Consultant Haematologist and Tropical School of Medicine
Coagulation			• Abnormal coagulation screens unexpectedly / significantly prolonged for given clinical details • All coagulation results on patients who are actively bleeding • Coagulation screens on all paediatric patients • Coagulation screens on all ? meningitis /septicaemia patients • All urgent pre-op results • Even slightly abnormal results for obstetric patients • Obstetric abruptions/APH/PPH • Other cases of high risk DIC i.e. ? malaria/obstetric accidents/bleeding
INR		>5	GP patient – telephone surgery Dawn managed GP – notify Dawn Office (if the Dawn BMS has left – approx 5:30pm – the GP or emergency service should be given the result along with further patient details which can be found in the patients yellow booklet in the Dawn office). Patient is on a ward

For day-to-day problems e.g. non-receipt of electronic results at GP Practices, in the first instance please contact the PCSS helpdesk.

For un-resolved, ongoing problems or to discuss strategic issues, contact Martin Langan, Pathology Services Manager on Tel 01244 365659 or e-mail at m.langan@nhs.net

Reference ranges for many Blood Sciences tests are given as part of the report (on EPR+ or on paper copy). Information about laboratory tests can be found at the following website: http://labtestsonline.org.uk/

How to take blood samples

Training in this subject can be arranged via the Education and Training Centre and all staff taking blood should be adequately trained and competency assessed.
Any queries regarding venepuncture can be directed to the Phlebotomy Manager (x6537) or the Transfusion Practitioner (x5126) as appropriate.

Blood Sample Containers:

These are colour coded as follows:-

	Samples to be collected in the following order			
1	Blue Cap	Sodium Citrate	(Plasma). Tube must filled between the arrow	6ml
2	Gold Cap	Contains Serum Gel separator	(Serum)	5 ml
3	Red Cap	No Anticoagulant	(Serum)	6ml
4	Green Cap	Lithium Heparin	(Plasma)	6 ml
5	Lavender Cap	EDTA	(Plasma)	4 ml
6	Pink Cap	EDTA (6ml)	(for Blood Transfusion)	6 ml
7	Grey Cap	Fluoride Oxalate	(Plasma)	2ml/5ml

Paediatric samples

Tube		Sample volume
Orange top (Lithium heparin) (Adult green top equivalent)	Plasma	1.3ml
Red top (EDTA) (Adult purple top equivalent)	Plasma	1.3ml
Green top (Citrate) (Adult blue top equivalent)	Plasma	1.3ml
Brown Top (gel separator) (Adult gold top equivalent)	Serum	1.1ml
Yellow top (fluoride) (Adult grey top equivalent)	Plasma	1.3ml

The order of draw is important – advise can be sought from the Head Phlebotomist (on bleep 3388).

To order blood collection tubes please email: coch.pathologystores@nhs.net

Cerebrospinal fluid (CSF) collection

Preferably, collect 3 specimens into plain, sterile bottles and 1 specimen in a fluoride oxalate tube. The **2nd** specimen and the fluoride oxalate tube should be sent to the Blood Sciences department for glucose and protein estimation, and for a xanthochromia screen, if necessary (please do not use the POD transport for CSF samples). Please ensure that sample for Xanthochromia (2nd sample) is protected from light.

Bacteriology and virus tissue culture are routinely performed on the first and third specimens. Examination for TB must be requested if appropriate. With cases of presumed bacterial meningitis, nose and throat swabs should also be collected. With possible viral (aseptic) meningitis a throat swab and faeces sample for viral culture is essential in addition to the CSF specimen.

The Biomedical Scientist from Clinical Biochemistry and the Biomedical Scientist from Microbiology must be informed at all times.

In cases of suspected malignancy a separate sample should be submitted to Cytology within two hours of collection. Please contact the Cellular Pathology Laboratory ext. 5645 prior to delivery

Collection and delivery of semen samples

Semen analysis tests are carried out by appointment only by the embryologist in the Fertility Unit. Contact the Fertility Clinic for further information, request forms and to make appointments on Tel 01244 366401.

Labelling of samples

Laboratory staff are not allowed to amend details on the sample or request form.

Samples should be labelled by the person who took the sample and specimen containers should never be pre-labelled. We encourage that the date of collection is always checked and corrected on the specimen label and form. Where possible a correctly dated form and label should be re-printed.
Please sign the specimen label when a full check of all information on it has been made.

1. All specimens **must** be labelled with the following information:

    - NHS or hospital number
    - Patients full name or unique coded identifier
    - Date of birth

    (*Use of the NHS or CHI Number on paper and electronic patient records is now a mandatory requirement included within the NHS Operating Framework 2008/9. Patient data should be used to identify the sample up to the point where a NHS or CHI Number is allocated whereupon this becomes the primary identifier.)

It is desirable to also include:

- Date and time
- Nature of sample, including qualifying details, e.g. left, distal etc. **especially if more than one sample per request is submitted**

2. A single **unique** identifier may be used in exceptional circumstances for confidentiality (for example, in sexual health clinics).

3. Tissue samples should also be labelled with the Hospital or NHS number as well as the forename, surname, date of birth and site of specimen. Microscope slides (e.g. FNAS) must have the patient's forename, surname and date of birth written in pencil.

4. Note that samples for the Blood Transfusion department require more stringent labelling – see Blood Transfusion Section.

5. When labelling the tube or sample container, it is essential to cross check the identity of the patient. This is particularly important for babies and children and confused adults where the wristband or notes should be checked. Normally adults can be asked to give their full name and date of birth.

6. Multiple samples taken at different times on a single patient **mus**t be labelled on the tube with the time (24 hour clock) when the specimen is taken. (For example, oral glucose tolerance tests). The request form should indicate that there are multiple samples with their times.

Completion of request forms

ELECTRONIC REQUESTS – HOSPITAL ORDER ENTRY:

For hospital patients, electronic test requesting should be made via the EPR+ computer system. All fields on the request form must be completed.

GP ELECTRONIC TESTS REQUESTS – Clinisys ICE:

The Clinisys ICE system, if installed, can be used at GP Practices to order laboratory tests for Haematology, Clinical Biochemistry, Histology, Non-Cervical (Non Gynae) Cytology and Microbiology. The system can also be used to order cervical cytology (LBC) tests which are processed and screened at Wirral University Hospitals NHS Trust. All fields on the request form must be completed.

The system can also be used to view all results on patients, including those ordered during in-patient stays. ICE Request forms can be ordered from Pathology Stores. These forms incorporate peel-off labels which should be used to label the specimens at collection.

HARDCOPY REQUEST FORMS – if electronic requesting not available:
The request form must include the following details:

- Full name or coded identifier
- DOB
- NHS number or hospital number
- Consultant or requesting GP
- Location for report or practice stamp
- Investigations required
- Patients address (for GP requests)
- Date and time of collection
- Type of specimen (s)
- Relevant clinical information
- Signature of requesting clinician

Requests without essential information or a signature will be referred back to the requesting doctor and will cause a delay in specimen processing and reporting.

Use of the NHS or CHI Number on paper and electronic patient records is now a mandatory requirement included within the NHS Operating Framework 2008/9. Patient data should be used to identify the sample up to the point where a NHS or CHI Number is allocated whereupon this becomes the primary identifier.

Haematology/Chemical Pathology/Immunology: (Magenta)

Specimen bag and combined request form.
It is essential that demographics on every request are legible, and each request **must** include the NHS number or hospital number (as appropriate), together with the name of the GP/Consultant and the location.

Full clinical details including any treatment (e.g. chemotherapy) aids the efficient and appropriate processing of requests through the laboratory.

Blood Transfusion: (PINK)
Combined specimen bag and Request form one part. **ALL** patient demographics are essential; inadequately labelled specimens will not be accepted. Addressograph labels are NOT ACCEPTED on transfusion blood samples, the labels must be hand written. Note that all requests for the Blood Transfusion department can only be made using paper requests forms.

The Transfusion department has ZERO-TOLERANCE to samples that are inadequately labelled as they do not comply with the minimum criteria for sample identification according to the BCSH Guidelines (2012).

HOSPITAL REQUESTS FOR HISTOLOGY/NON-GYNAE CYTOLOGY: (BLACK AND WHITE)
Combined specimen bag and single request form. Separate specimen bags are available from the general stores for larger specimens. Order entry is available in Endoscopy.

GP REQUESTS FOR HISTOLOGY/NON-GYNAE CYTOLOGY: (MAGENTA)
These tests can be ordered via Clinisys ICE (Cellular Pathology) – place specimen in a double pouched clear plastic bag. Otherwise use a magenta specimen bag and combined request form. It is essential that demographics on every request are legible, and each request **must** include at least 3 patient identifying details (full patient name, date of birth, NHS number, hospital number), specimen details, relevant clinical details, name and signature of the GP/Consultant together with the requestor's location.
Cervical LBC Samples: (White)
Clinisys ICE form or Wirral form (Word template) for Wirral laboratory.

Microbiology: (Blue)
Please refer to separate Microbiology handbook.

ADD ON TESTS
Contact the laboratory concerned directly if you need to add on a test not stipulated on the request form. Once blood has been collected it may not be possible to add on a test if the correct tube for the additional test has not been collected. Some tests cannot be added on and tested due to time related performance criteria.

To order additional tests:

- For requests ordered but not sent, hand-write extra tests on request.
- For samples already received by the laboratory, please use an 'add on request form' or if these are not available, phone the appropriate department and ask to add tests.

Criteria for accepting and rejecting samples

ACTION TAKEN IN THE EVENT OF NON COMPLIANCE

a. If minimum specimen and request form criteria are not met, the specimen will not be processed.

b. If adequate identification cannot be established the specimen may not be processed and a rejected report issued.

c. The specimen will be retained in its transport bag with the request form for 24 hours. It is the responsibility of the requestor to contact the laboratory. However, analysis will only be carried out if the specimen identity can be established

d. For Histopathology specimens, those GP specimens that do not meet the minimum acceptance criteria will be returned with a written request for the minimum data required.

e. It may be practical to establish identity on certain types of specimens, such as CSF, multiple samples and tissues. Where possible the laboratory staff will initiate appropriate action.

f. For **urgent specimens** that do not meet the minimum data requirements, a member of the laboratory staff will contact the requesting clinician or source to request an urgent repeat sample.

g. For **unrepeatable specimens**, laboratory staff will contact the requesting clinician or source to request that the person taking the blood (or submitting the pathology sample) come to the laboratory to label the sample.

Transport of diagnostic specimens

Please refer to *Pathology Portering Services Logistics* on Share Point

Specimens should be delivered to Pathology main reception (First floor, F12 wayfinder). Cellular Pathology specimens from theatres and clinics may also be delivered directly to the Cellular Pathology reception by porters/staff with security access.

Specimens from collections at GP surgeries and other external sources will be transported to the Pathology department via Trust transport vehicles at regular intervals.

Microbiology specimens delivered to Pathology Main Reception will be transported to the Cheshire and Wirral Microbiology Service at Bromborough by Trust transport vehicles at regular intervals.

IMPORTANT REMINDER TO ALL HEALTH CARE WORKERS INVOLVED IN THE COLLECTION, PACKING, STORAGE OR TRANSPORT OF CLINICAL SPECIMENS

All specimens should be regarded as being potentially infective. You have a personal and statutory duty of care to protect the Health and Safety both of yourself and of others who deal directly or indirectly with patient specimens and/or the associated clinical waste. Failure to comply with the Trust infection prevention policies is notifiable under the Trust's Incident Reporting Scheme, whether or not an accident, injury or infection has resulted.

The following Infection Prevention Policy applies to any clinical material taken from a patient and sent to a diagnostic or a research laboratory:
The specimen must be placed in a suitable container and the lid or cap secured to prevent leakage.
The container must be enclosed in the sealable section of the combined request form which will contain any spillage accidentally occurring in transit.

Laboratory staff have a discretionary right to discard any sample that is received in a state which renders it hazardous for them to handle. Where there is a perceived to be a lack of duty of care, formal notification may be made to the Trust's Governance Manager.

Clinical samples must not be sent to outside agencies other than via the Trust's own transport systems or contracted services; if to be posted, the sender is directly responsible for complying with current postal regulations regarding biological samples.

GUIDE TO LABORATORY TESTS

All testing is performed within the Trust unless otherwise stated.

Some specialised tests are sent to reference laboratories. We endeavour to select only those laboratories with proven quality standards, for example, those like ourselves which are accredited by the United Kingdom Accreditation Service (UKAS).

Please note:
Some of the reference ranges may change from time to time due to changes in the methodology or equipment used. Between revisions of this handbook the laboratory will inform users of any significant changes in reference ranges.

When printed, this information is only valid on the day of printing.

An A-Z list of tests is given within the relevant handbook sections for Haematology, Clinical Biochemistry and Immunology/Allergy.

BLOOD SCIENCES KEY CONTACTS

Consultant Chemical Pathologist, **Director of Blood Sciences**	Dr Shirley Bowles	01244 365652
Secretary		01244 365365
Consultant Chemical Pathologist	Dr Andreas Tridimas	01244 365642
Consultant Clinical Biochemist	Dr Emma Lewis	01244 365653
Haematologist of the Week	**Contact Haematology secretaries**	
Consultant Haematologist, **Deputy Director of Blood Sciences** **Head of Service and Clinical Lead**	Dr Salaheddin Tueger	01244 365387
Secretary		01244 365378
Consultant Haematologist **Clinical Lead for ANNB SCT Screening Programme** **Blood Transfusion Lead**	Dr Arvind Pillai	01244 365382
Secretary		01244 365390
Consultant Haematologist	Dr Sean McGoldrick	01244 364714
Secretary		01244 365377
Consultant Haematologist	Dr Matthew Alley	01244 365093
Secretary		01244 365377
Haematology SpR and SHOs		01244 365694
Haematology Specialist Registrar	*Bleep*	2845
Haematology SHO	*Bleeps*	2640 2965
Pathology Services Manager	Mr Martin Langan	01244 365659
Blood Sciences Operational Managers	Lucy Kirkham Julie Pierce	01244 366065 01244 366919
Blood Sciences Main Laboratory		01244 365649, 01244 365658
Specimen Reception		01244 365380
Blood Bank Managers	Clare Barnard Emma Kirkham	01244 365126
Transfusion Laboratory		01244 365385
Transfusion Practitioner	Ms Hayley Speirs	01244 365383
Transfusion Practitioner bleep		3215

Anticoagulant Office (DAWN)		01244 365373
Biochemistry Out of core hours' bleep		2552
Haematology/Transfusion Out of core hours' bleep		2553

HAEMATOLOGY TESTS

The repertoire of tests is listed below, results are available daily unless stated.

The schedule of scope for the UKAS accredited tests can be viewed here.

Unless otherwise stated, reference intervals in the table below are for adults, and are a guide only. It is recommended that for any individual patient, the reference intervals and comments on the report are always viewed.
Note that age and sex specific reference ranges are available electronically on the patient report.

Paediatric samples.

Paediatric specimen bottles are available on request from the main hospital stores.

Source of reference range key:

M = manufacturer suggested range for that test.
L = Locally derived
B = BCSH guidelines
N = Nationally accepted range
D = Dacie and Lewis, 12th edition
BB = Barbara Bain, Blood cells, A Practical Guide, 2nd edition
RL = Reference lab range

Routine blood tests

TEST	Reference Interval (Adults)	Container	Volume	Notes	Turnaround time after receipt – 90% within	Source of reference range
Blood Film	See report	EDTA lavender	1.5 - 4.0 ml	Lab will look at films on any abnormal FBC results and if requested.	24 hrs	NA
Bone Marrow (sent to HODS)	See report	N/A	N/A	Contact Consultant Haematologist	1 week	NA
Cell Surface Markers – Immunophenotyping (sent to HODS)	See report	EDTA lavender Bone marrow		Contact Consultant Haematologist	1 week	NA
Cytogenetics (sent to HODS)	See report	Cytogenetics Media		Contact Consultant Haematologist	2 weeks	NA
ESR	See chart below	EDTA lavender	1.5 - 4.0 ml	Can use FBC sample.	2 hrs	D

FBC	See chart below	EDTA lavender	1.5 - 4.0 ml		1 hr	See details below
Haemoglobinopathy investigations	See report for interpretation	EDTA lavender	4.0 ml	Clinical data and family history are essential. Investigations for thalassaemia, HbS etc.	Full report 1 week. Urgent HbS 4 hrs	
Haemosiderin	Semi-quantitative	Urine	2.0 -10.0 ml	Contact Lab	72 hrs	RL
Haemoglobin A1C	< 48 mmol/mol (non-diabetic level)	EDTA lavender		HbA1cM (monitoring) HbA1cD (diagnostic) available to GPs on ICE National range	24 hrs	N
Malarial Parasites	See report	EDTA lavender	1.5 - 4.0 ml	Supply Clinical detail as "Malaria Screen" with visit history/clinical findings	8 hrs	NA
Reticulocytes	See chart below	EDTA lavender	1.5 - 4.0 ml	Can use FBC sample.	8 hrs	M

FBC RANGES (ADULT) – source – Dacie & Lewis 12th edition / Barbara Bain, Blood Cells, A Practical Guide 2nd edition / locally validated

TEST	MALE	FEMALE	UNITS	Source of reference range
WBC	4.0 – 11.0	4.0 – 11.0	X10*9/L	D
PLTS	120 – 400	120 – 400	X 10*9\L	D/L
HB	135 – 170	115 – 160	g/L	D
RBC	4.5 – 6.0	3.5 – 5.5	X 10*12/L	D/L
PCV/HCT	0.39 – 0.50	0.34 – 0.46		D/L
MCV	82.0 – 100.0	82.0 – 100.0	FL	D/L
MCH	26.0 – 32.6	26.0 – 32.6	g/dL	D/L
MCHC	32.0 – 36.0	32.0 – 36.0	g/dL	D/L
NEUTS #	2.0 – 7.5	2.0 – 6.0	X 10*9/L	D/L
LYMPHS #	1.0 – 3.5	1.0 – 3.5	X 10*9/L	D/L
MONO #	0.18 – 0.86	0.18 – 0.86	X 10*9/L	D/L
EOS #	0.0 – 0.46	0.0 – 0.4	X10*9/L	D/L
BASO #	0.0 – 0.1	0.0 – 0.1	X 10*9/L	D/L
ESR	*Male <50yrs:* 1 – 15 *Male >50yrs:* 1 – 20	*Female <50yrs:* 1 – 20 *Female >50yrs*: 1 - 30	mm/hr	D/L
Retics #	30 – 100	30 – 100	X 10*9/L	M
Retics %	0.2 – 2.0	0.2 – 2.0	%	M

Coagulation Tests Available:

TEST	Reference Range (Adults)	Container	Volume	Notes	Turnaround time – 90% within:	**Source of reference range**
Coagulation Screen:	PT 12.5 – 15 seconds APTT 26-35 seconds	Sodium Citrate - Blue	2.7 ml	PT, APTT Clauss fibrinogen performed if required.	1 hr	L/M
APTT ratio	2.0 – 3.0 but may vary	Sodium Citrate - Blue	2.7 ml	APTT ratio used for monitoring unfractionated IV heparin only	1 hr	L
D-Dimer	0 – 500 ng/Ml FEU	Sodium Citrate - Blue	2.7 ml	Used as negative predictor for DVT – contact DVT nurse. Used in the diagnosis of DIC	1hr (all specimens)	M
INR	Set on individual basis	Sodium Citrate - Blue	2.7 ml	Use to monitor warfarin only	1 hr	N
Factor Assays: (e.g. FVIII)	Refer to report as range will vary	Sodium Citrate - Blue	2.7 ml	The lab will perform relevant factor assays when required.	2 hrs for 1 assay. 2 weeks if non-urgent	M
Thrombophilia	Refer to conclusion on report	Sodium Citrate - Blue	4 x 2.7 ml	Request will be vetted by the Consultant Haematologist.	2 - 4 weeks	M
Lupus Anticoagulant, Antiphospholipid Antibodies,	Refer to conclusion on report	Sodium Citrate - Blue	3 x 2.7 ml	Request will be vetted by the Consultant Haematologist.	2 - 4 weeks	M
Thrombin Time	11.5 – 21.0	Sodium Citrate - Blue	2.7 ml	Can usually be done on the Coagulation Screen sample	4 hrs	M
Heparin Anti-Xa levels	Refer to report	Sodium Citrate - Blue	2.7 ml pre and post injection samples required	Contact DVT nurse for advice. Used only for monitoring LMW Heparin in specific clinical conditions.	4 hrs	M
HIT test	Positive/ Negative	Serum (Red)		Contact laboratory for advice *Samples to arrive at lab within 1hr*	4 hrs	M
Rivaroxaban	Refer to report	Sodium Citrate - Blue	2.7 ml	Contact the Consultant Haematologist.	4hrs	M

BLOOD TRANSFUSION

The Transfusion Laboratory offers a 24-Hour service providing Blood and Blood Products when required.

An Antenatal screening service is also available. The Trust operates a protocol for Routine Antenatal Anti-D Prophylaxis (RAADP).

Blood Transfusion - Sample Requirements:

The collection of blood samples is only permitted by staff who have been trained and competency assessed. Contact Transfusion practitioner (ext. 5383) for advice or to arrange training.

Refer to appropriate instructions on transfusion protocols when collecting blood samples.

Specimen Identification – Special Requirements for Transfusion

Mistakes or omissions in the labelling of samples and request forms can lead to serious and life-threatening consequences, hence, the need to follow strict safety checks.

Incorrectly or incomplete labelling of samples/request forms will not be accepted by the Transfusion Laboratory.

Samples for blood group / antibody screens and cross matching **MUST** be legibly hand-written, and labelled with the following details:

- Surname
- Forename (Initials and abbreviations are not acceptable)
- Hospital Number (or NHS number)
- Date of Birth
- Ward / Location
- Date sample taken
- Signature of person responsible for taking the sample

DO NOT label specimens with ADDRESSOGRAPH or ORDER ENTRY labels.

Group and Antibody Screen

All samples have a group and antibody screen and are available for 72 hours only.

Routine Cross match request

A second sample will be requested by the Transfusion Laboratory for confirmation of the ABO group of a patient with no transfusion history on record.

A routine cross match can take between 45 minutes to 2 hours, depending on the urgency of the request and availability of the blood units.

The validity of a sample for further cross match requests will be dependent on the patient's transfusion history.

Blood is held for at least **24hrs** from the time required. Please notify the laboratory if the reservation period is to be extended.

Contact ext. 5385 or bleep 2553 out of hours for further advice.

Urgent/Emergency Crossmatch requests

Urgent requests should be telephoned to Ext 5385 between the hours of 9-5:30 or out of hour's bleep 2553.

In extreme cases of emergency there is a small supply of group O Rh Negative and O Rh Positive blood available in the Main Hospital Issue Fridge. Maternity fridge stocks paediatric emergency units and Obstetric emergency O Rh negative units. Always inform the laboratory that this blood has been used, in order that it can be quickly replaced and documented on EPR+ as transfused to the patient.

Fully cross-matched blood takes 30- 45 minutes to prepare.

Under certain circumstances, the laboratory may be able to issue fully compatible blood in less time.

PLEASE CONTACT THE LABORATORY (Extn.5385) FOR CONFIRMATION.

Group-compatible (un-crossmatched) blood is available after about **15 minutes**. (This is cross-matched and antibody screened retrospectively).

Unknown patients

A system for the identification of unconscious or unknown patients is established in the Accident and Emergency Department, and a Hospital Number is assigned prior to being presented for urgent testing or cross matching. The Blood Transfusion Department cannot process specimens unless the patient is registered on EPR+.

Medical staff and laboratory staff must use discretion in such circumstances to positively identify the patient's sample. Responsibility rests with the medical officer taking the transfusion sample.

MSBOS

The Hospital operates a Maximum Surgical Blood Ordering Schedule **(MSBOS)** for all procedures. The MSBOS can be found in the pre-operative assessment guidelines on the trust document library.

Management of Blood Products outside the laboratory

- **The collection and administration of blood products is only permitted by staff who have been trained and competency assessed. Contact Transfusion practitioner (ext. 5383) for advice or to arrange training.**
- REFER TO APPROPRIATE INSTRUCTIONS ON BLOOD FRIDGES, AND HOSPITAL TRANSFUSION PROTOCOLS WHEN COLLECTING BLOOD.
- Blood must **not** spend longer than 30 minutes out of the fridge before being transfused, and if it is not used then it should be returned to the Blood Bank.

- If there is wastage of a blood product on the ward return it to the laboratory for it to be disposed of.
- **NEVER** store blood products in a ward fridge.
- If a patient in your care receives a blood product, **you must ensure** that the traceability documents are fully completed and returned to the laboratory. Laboratory staff will then update EPR+ to show that the unit has been transfused. This is a mandatory requirement.
- Blood products must never be transferred out of the hospital with a patient without prior arrangement with Blood Transfusion Dept.
- If blood warming is necessary, specific blood warming device must be used.

Location of Blood Fridges

Each fridge is controlled by an electronic tracking system. The system uses bar code technology to control the release of blood components. To access the fridge individuals must have been competency assessed and received a bar code and pin number.

- Main Hospital Issue Fridge – ground floor pathology, outside Transfusion laboratory
- Theatre Recovery Fridge - only used to store blood for patients in theatre.
- Maternity Fridge – Milk Bank room.
- Ellesmere Port Hospital Fridge – Bluebell ward.
- Hospice of the Good Shepherd.

Investigation of Suspected Transfusion Reaction

Follow the Trust policy on the intranet entitled, “Management and reporting of a suspected transfusion reaction.” Click here to view the policy or access the document via the Transfusion page on the Trust intranet.

Investigations require:

- Completed Suspected Blood Transfusion Reaction Form
- The donor pack causing the suspected reaction complete with giving set (**only in serious acute reactions**)
- One pink topped EDTA tube for transfusion investigations
- One red topped tube
- Set of blood cultures for microbiology

After a suspected transfusion reaction ward test urine for blood and if positive send the sample to the Blood Sciences laboratory for haemosiderin Identification.

Further blood samples required are Clotting Screen (blue), FBC (purple), UE & LFT (gold).

A new sample will be required for any further cross match requests, which will be processed once investigations are complete.

BLOOD PRODUCTS

The following Blood Products are available

PRODUCT	PREPARATION	NOTES
Red Blood Cells (RBC)	Dependant on clinical need	Use within 30 mins of removal from fridge
Fresh Frozen Plasma (FFP)	Thawing in Lab (30 minutes)	Use within 4 hours.
Solvent Detergent/Virally inactivated Plasma	Thawing in Lab (30 minutes)	Use within 4 hours.
Platelet concentrate	Please contact the laboratory. Order before 6am for 10:30am delivery, or before 12:00pm for 15:30pm delivery.	Ordered on a named patient basis, we do not carry routine stock.
Cryoprecipitate	Thawing in Lab (30 minutes)	Use within 4 hours.
Human Albumin Solution (HAS), 5% or 20%	Ready for use	Exposure to light minimised for 20%
Prophylactic Anti-D 500iu, 1500iu	Ready for use	All antenatal sensitizing events are now treated with 500iu Anti-D. 500iu for postnatal women. 1500iu for routine antenatal anti-D prophylaxis. For Rh Neg females only
Prothrombin Complex Concentrate (PCC)	Ready for use	MUST discuss with Consultant Haematologist.
Fibrinogen Concentrate	Ready for use	Issued to Obstetrics and Theatre for use in PPH only. MUST discuss with Consultant Haematologist for use outside of the PPH pathway.

Other coagulation factors may be available after special consideration, and discussion with a Consultant Haematologist.

All products will be issued ONLY to NAMED PATIENTS.

Remember: Right Blood – Right Patient – Right Time – Right Reason

REQUEST	CONTAINER	VOLUME	INFORMATION	TURNAROUND TIME
Group & Antibody Screen Antenatal Screen	EDTA (**Pink**)	6ml	Samples must be handwritten. See Specimen labelling requirements below.	Routinely, these are performed within 24 hours, but can be available sooner, if clinically indicated Contact the lab
Cross-match	EDTA (**Pink**)	6 ml	Samples must be handwritten. See Specimen labelling requirements below.	Routine within 2 hrs. For urgent crossmatches contact the lab. Patients with clinically significant antibodies may require up to 48 hours' notice.
Cord blood	EDTA **(lavender** or **Pink**)	4 ml or 6ml		2 hours
DAT/DCT	EDTA (**lavender** or **Pink**)	4 ml or 6ml		2 hours
Kleihauer	EDTA (**Pink** or **lavender**)	4 ml	For identification of foetal cells in Rh NEGATIVE mothers with Rh POSITIVE babies.	24 hours
Cold Agglutinins	EDTA (**Pink**)	6ml	Samples must be handwritten. See Specimen labelling requirements below. Screening will take place on site and sent away if positive.	This test is referred to the NHSBT for testing. Approximately 7 days TAT.
REQUEST	**CONTAINER**	**VOLUME**	**INFORMATION**	**TURNAROUND TIME**
Platelet immunology	Number and type of samples required stated on the back of form "D"		Contact laboratory for H&I form D **Do not refrigerate samples	10-14 days
HLA type and / or antibody	EDTA (**Pink**) and Clotted (**Red**).	6ml	Contact laboratory for H&I form A **Do not refrigerate samples**.	10-14 days
ffDNA	EDTA (**Pink**)	6ml	IBGRL form 4674 **Do not refrigerate samples**.	10- 14 days

KLEIHAUER TESTING

- Kleihauer tests are to be sent to the Transfusion Laboratory.
- Use a Blood Transfusion Request form.

Kleihauer blood samples are required on:

- All RhD-negative women post-delivery and RhD-negative women following a potentially sensitizing event after 20 weeks gestation.
- Testing at less than 20 weeks will only be carried out in specifically requested cases of CVS and amniocentesis.

TEST	Reference Range (Adults)	Container	Volume	Notes	Turnaround time after receipt:
Kleihauer	Bleed in mls and anti-D requirement reported	EDTA purple or pink	1.5 -4.0 mls		24 hrs

For full guideline refer to BCSH Guidelines "The estimation of fetomaternal haemorrhage, (2009)" and trust policy on intranet entitled "Anti-D" found here

CLINICAL BIOCHEMISTRY AND POINT OF CARE TESTING

Routine Investigations

Any combination of the following groups of tests can be performed on a single clotted blood specimen (gold topped bottle). Tests can also be requested individually.

PLEASE SPECIFY WHICH TESTS OR GROUP OF TESTS YOU REQUIRE

Renal profile (U&E's): Sodium, Potassium, Urea, Creatinine
Specimens should reach the laboratory within four hours of collection. Storage prior to separation will result in leakage of potassium out of cells and thus inappropriately high results. This effect is increased if specimens are refrigerated. Potassium results will not be reported on specimens known to have been collected the day before analysis.
The GP Renal Profile includes e-GFR.

Liver profile (LFT) consists of:
Total bilirubin, Albumin, ALT, Alkaline phosphatase and Total Protein. GGT will be reflexed automatically if LFT results are abnormal.

Bone profile consists of:
Calcium, Albumin, Corrected Calcium (calculated), Phosphate, Alkaline phosphatase

Proteins:
Total Protein, Albumin

Cardiac marker:
Troponin I

Fasting lipid profile consists of:
Total cholesterol, Triglyceride, HDL cholesterol, LDL cholesterol (calculated) HDL / Cholesterol Ratio
When the triglycerides exceed 4.5 mmol/L: LDL-cholesterol is not reported, as the Friedewald equation, used to calculate this parameter, is not valid in these circumstances.

Lipid screen (non-fasting):
Total Cholesterol, Triglyceride, HDL-cholesterol, Total Cholesterol: HDL- C ratio, Non-HDL cholesterol (ie Total – HDL-C)

Glucose (requires grey top bottle)
Please indicate whether fasting or random

Iron Studies
Serum Iron, Transferrin, UIBC, TIBC

For a patient with suspected myeloma, the appropriate biochemical investigations are:
Serum protein electrophoresis (gold-top serum sample)
Urine Bence Jones protein (early morning urine sample in plain bottle)

For a patient with suspected coeliac disease, the appropriate biochemical investigations are:

Serum tissue transglutaminase antibody (performed in-house by the Immunology department)

Sending Samples during normal laboratory hours:

Specimens requiring immediate attention should be labelled 'URGENT'
Send specimens via the air tube system or hospital courier to the Blood Sciences Laboratory
Results will only be telephoned if they fall outside certain critical limits.

Sending samples 'Out-of-hours'

Send to the Blood Science laboratory using the pneumatic air tube system.
After analysis, the results will be available on EPR+.
Results will only be telephoned if they fall outside certain critical limits.

Drug Screens

Only limited urine screening is performed in this laboratory. For all other toxicological analyses the specimens are sent to other laboratories. Contact the Blood Sciences Laboratory for advice on drug screening if required.

Endocrine Investigations

Although basal investigations are often useful in the diagnosis or exclusion of many endocrine disorders, it is frequently necessary to perform dynamic function tests where deficient or excess hormone secretion is suspected. In order for such investigations to be performed safely, reliably and reproducibly, it is vital that they are carried out according to strict protocols and preferably by experienced personnel. It is therefore recommended that, wherever possible, such tests should be carried out on the Medical Day Unit by the staff working regularly on that Unit. Appointments for patients to attend the MDU can be made by contacting the staff directly. If this is not feasible, copies of the protocols used in the Countess of Chester Hospital can be obtained from the Biochemistry Department. The protocols for commonly used dynamic function tests are also available on Sharepoint (Trust intranet).

Prior to initiating complex endocrine tests, it is strongly recommended that cases of suspected endocrine dysfunction are discussed with either a Consultant Endocrinologist or the Chemical Pathologist with a view to ensuring the most effective programme of investigations.

TURNAROUND TIME FOR URGENT TESTS

The turnaround time for **Emergency Medicine** and **Urgent requests** for TNI and U&E is **90 mins. These are key Turnaround times, which are monitored through Key Performance Indicators.**
Most other routine biochemistry tests can be performed within 1 hour if required.

Reference Ranges

Adult Reference ranges for most tests are included in the table. The appropriate reference intervals for each result will be available electronically on the laboratory report - these will, where indicated, relate to the age and sex of the individual patient. Reference ranges for some tests performed as send aways by external reference laboratories are only given on the report and not in this handbook.
It is important to appreciate the limitation of such reference ranges when interpreting results.

If advice is required on test requesting, please contact the Blood Sciences laboratory.

Biochemical Investigations

All the biochemical investigations available are listed in the tables below, including those sent away to other laboratories. The schedule of scope for the (UKAS) accredited tests can be viewed at ukas.com (reference number 9061).
The tests are grouped according to type of specimen (blood or urine etc.) and then alphabetically within each group.
Any special instructions regarding the collection of specimens are also included.

Clinical chemistry tests performed in house

ANALYTE	REFERENCE RANGES	UNITS	NOTES	Turn around Time (days)
CSF Tests:				
CSF analysis (CSF protein, CSF glucose, xanthochromia)	Protein 0.13 - 0.45 Glucose 2.2 - 3.9	g/L mmol/L	Bottle 2 (protected from light) + fluoride oxalate tube for Blood Sciences Bottle 1 + 3 for microbiology Send to lab immediately, not in air tube POD system.	1
Blood Tests:	**Target turnaround is 90% within time stated:**			
Alpha-1 antitrypsin	0.9-2.0	g/l	Gold-top serum tube	1
Angiotensin converting enzyme	18 - 55	iu/mL	Gold-top serum tube	7
Albumin	32 - 46	g/L	Gold-top serum tube	1
Alkaline phosphatase	46 – 148 (adult)	IU/L	Gold-top serum tube	1
Alpha fetoprotein (AFP)	<10 (adult)	IU/ml	Gold-top serum tube	1
Alanine aminotransferase (ALT)	8 – 45 (Adult)	IU/L	Gold-top serum tube	1

Ammonia	11 – 32(Adult)	mmol/L	Lithium heparin tube, send to lab immediately, on ice.	1
Amylase	13 - 122	IU/L	Gold-top serum tube	1
Anti-Mullerian Hormone	7.25 -104.46 (18-25yrs) 4.93 - 95.60 (26-30yrs) 2.57 – 71.90 (31-35 yrs) 1.29 – 40.56 (36-40yrs) 0.07 – 21.35 (41-45yrs)	pmol/L	Gold-top serum tube	7
Aspartate aminotransferase (AST)	F 10 – 32 M 10 - 38	IU/L	Gold-top serum tube	1
B12	150 – 750 normal 120 – 150 intermediate <120 deficient	ng/L	Gold-top serum tube	1
Bicarbonate (Serum)	20 – 32	mmol/L	Gold-top serum tube	1
Bile acids	<14	mmol/L	Gold-top serum tube	1
Bilirubin (neonatal)	Refer to chart	mmol/L	Lithium heparin capillary	1
Bilirubin	3 - 25 (male) 3 - 20 (female)	mmol/L	Gold-top serum tube	1
NT-proBNP (B-Type Natriuretic Peptide (BNP) Test)	See report		Gold-top serum tube	1
CA19-9	0 - 31	IU/mL	Gold-top serum tube	1
CA125	< 35	IU/mL	Gold-top serum tube	1
Calcium (adjusted)	2.10 -2.70	mmol/L	Gold-top serum tube	1
Calcium (ionised)	1.15-1.33	mmol/L	Lithium heparin tube	1
Carboxyhaemoglobin	<2	%	Li heparin tube.	1
Carcinoembryonic antigen (CEA)	0.5 - 14	µg/L	Gold-top serum tube	1
Chloride	101 - 111	mmol/L	Gold-top serum tube	1
Cholesterol	See relevant guidelines	mmol/L	Gold-top serum tube	1
Complement C3 C4	0.9 – 1.8 0.1 - 0.5	g/L g/L	Gold-top serum tube	1
Conjugated bilirubin	1 - 6	mmol/L	Gold-top serum tube	1
Cortisol	155 – 607 (9am Collection)	nmol/L	Gold-top serum tube	1
Creatine kinase	Male: 38 - 174 Female: 26 - 140	IU/L	Gold-top serum tube	1

Creatinine	See report – age specific	mol/L	Gold-top serum tube	1
C-reactive protein	< 10	mg/L	Gold-top serum tube	1
Ethanol	Not detected	g/L	Fluoride oxalate tube	1
Ferritin	22 - 322	µg/L	Gold-top serum tube or EDTA plasma	1
Folate	4 - 50	µg/L	Gold-top serum tube	
Follicle stimulating hormone (FSH)	Female: Follicular 2.5 – 10.2 Ovulatory 3.4 - 33.4 Luteal 1.5 – 9.1 Post-menopausal 23.0 – 116.3 Male: 1.4 - 18.1	IU/L	Gold-top serum tube Date of LMP aids interpretation	2
Free thyroxine (FT4)	7.86 – 14.41	pmol/L	Gold-top serum tube	1
Free tri-iodothyronine (FT3)	3.7 - 6.0	pmol/L	Gold-top serum tube	2
Gamma-GT	4 – 53	IU/l	Gold-top serum tube	1
Growth hormone (GH)	F < 3.61 M < 0.97	µg/L	Gold-top serum tube	1
Glucose	Fasting: 3.6 - 5.6	mmol/L	Fluoride oxalate	1
High density lipoprotein cholesterol (HDL-chol)	F > 1.2 M >1.0	mmol/L	Patient must fast for 12 hours. Gold-top serum tube.	1
HCG	0 – 4.0 (post-menopausal range up to 10)	IU/L	Gold-top serum tube	1
Immunoglobulins (IgA, IgG, IgM)	IgA: 0.69 – 3.82 IgG: 7.2 - 16.9 IgM 0.63 -2.77 (Adult Ranges) See Report for Paediatric range	g/L	Gold-top serum tube.	1

Iron	F 8.8 – 27.0 M 9.5 – 29.9	mol/L	Gold-top serum tube.	1
Ketones (serum)	Not detected	-	Li-heparin tube	1
Lactate	0.63 - 2.44	mmol/L	Grey-top fluoride oxalate. Send sample to lab immediately.	1
Lactate dehydrogenase (LDH)	266 - 500	IU/L	Gold-top serum tube.	1
Luteinising hormone (LH)	Female: Follicular 1.9 – 12.5 Ovulatory 8.7– 76.3 Luteal 0.5 – 16.9 Post-Menopausal: 30 – 72.5 Male: 1.5 – 9.3	IU/L	Gold-top serum tube. Date of LMP aids interpretation	2
Magnesium	0.7 - 1.0	mmol/L	Gold-top serum tube.	1
Methaemalbumin	POS/NEG	-	Gold-top serum tube.	1
Methaemoglobin	0.4 - 1.5	%	Li heparin tube.	1
Oestradiol	Females over 19years: Follicular 83-422 Ovulatory 118-1897 Luteal 134-902 Post-menopausal <92 Females 12-18years: 134-719 Males over 19 years <115	pmol/L	Gold-top serum tube. Date of LMP aids interpretation.	2

Osmolality	288 - 298	mmol/L /Kg	Gold-top serum tube.	1
Parathyroid hormone (PTH)	1.1 - 6.9	pmol/L	Gold-top serum tube. Send sample to lab immediately.	1
Phosphate	0.8 - 1.4	mmol/L	Gold-top serum tube.	1
Placental growth factor (PLGF)	See report	pg/ml	Purple topped tube	1
Potassium	3.5 – 5.0	mmol/L	Gold-top serum tube	1
Procalcitonin	See report	ng/mL	Gold-top serum tube	1
Progesterone	Female: Pre-ovulatory 0.6 - 6.7 Ovulatory cut-off 30 Post-menopausal 0.5 - 1.5 M < 6.5	nmol/L	Gold-top serum tube. Date of LMP aids interpretation.	2
Prolactin	Male: 82 - 442 Female: 82 - 524	mU/L	Gold-top serum tube.	2
Prostate specific antigen (PSA)	Age-related ranges on report	g/L	Collect sample prior to any rectal examination. Gold-top serum tube.	1
Protein Electrophoresis /immunofixation	See Report	-	Gold-top serum tube	7
RA Latex	0-10 IU/L	Gold-top serum tube	5 ml	24 hrs
Sex hormone binding globulin (SHBG)	Male: 13.2 – 89.5 Female :13.2–135.7	nmol/L	Gold-top serum tube.	2
Sodium	133 - 144	mmol/L	Gold-top serum tube.	1
Testosterone	Male: 6.7-27	nmol/L	Gold-top serum tube	2

	Female: 0.5 – 3.5			
Thyroid Function Tests	FT4 7.86 – 14.41 TSH 0.35 – 5.50	pmol/L mIU/L	Gold-top serum tube.	2
Thyroid Stimulating Hormone (TSH)	0.35 – 5.50	mIU/L	Gold-top serum tube.	2
Total Iron Binding Capacity (TIBC)	45 – 70	mol/L	Gold-top serum tube.	2
Total Protein	60 - 80	g/L	Gold-top serum tube.	1
TPO (thyroperoxidase)	0 - 9	IU/mL	Gold-top serum tube.	1
Transferrin	2.2 - 4.0	g/L	Gold-top serum tube.	7
Triglycerides	Fasting 0.6 – 1.7	mmol/L	Gold-top serum tube.	1
Troponin I	Females <11.6 Males <19.8	ng/L	Gold-top serum tube. *Baseline on admission.* *Repeat after 3hs*	1
Urea Also U&E	See report – age and sex specific	mmol/L	Gold-top serum tube.	1
Uric Acid	0.23 - 0.42 (male) 0.12-0.42 (female)	mmol/L	Gold-top serum tube.	1
Vitamin D	>50	nmol/l	Gold-top serum tube.	1
Carbamazepine	3 - 10	mg/L	Gold-top serum tube. Pre-dose sample.	1
Digoxin	0.8 - 2.0	µg/L	Gold-top serum tube. At least 6 h post dose sampling.	1
Gentamicin	See report		Gold-top serum tube.	1
Lithium	0.4 – 1.0 those > 65 yrs old should aim for lower levels	mmol/L	Gold-top serum tube. Collect at least 12 hours post dose.	1
Paracetamol	See treatment normogram	mg/L	Gold-top serum tube. Collect sample at least 4 hours post ingestion	1
Phenytoin	10 - 20	mg/L	Gold-top serum tube. Pre-dose.	1
Salicylate	N/A	mg/L	Gold-top serum tube.	1
Teicoplanin	Dosed by Pharmacist, dependent on	mg/L	Gold-top serum tube	x2/week

	therapeutic use			
Theophylline	10 - 20	mg/L	Gold-top serum tube Pre-dose.	1
Tobramycin	See report	mg/L	Gold-top serum tube.	1
Valproate	50 - 100	mg/L	Gold-top serum tube.	1
Vancomycin	See report	mg/L	Gold-top serum tube.	1

Urine tests:

Amylase	See report	IU/24h	24h urine collection without preservative.	1
Bence Jones Protein	POS/NEG	-	Early morning urine	7
Calcium	See report	mmol/ 24h	24h urine collection	1
Cannabinoids	POS/NEG	-	Random urine	2
Chloride	110 - 250	mmol/ 24h	24h urine collection without preservative	1
Creatinine Clearance	See report	mL/min	24h urine collection without preservative. Gold-top serum tube also required within 24 hr of urine collection	1
Drugs of abuse screen:			Random urine.	
Amphetamines	POS/NEG	-		2
Benzodiazepines	POS/NEG	-		2
Cocaine	POS/NEG	-		2
Methadone	POS/NEG	-		2
Opiates	POS/NEG	-		2
Ethanol	< 0.1	g/L	Random urine.	1
Glucose	See report	-	Random urine or timed	1

			specimen (as part of GTT).	
Myoglobin	POS/NEG	-	Random urine.	1
Microalbumin	See report			
Osmolality	50 - 1400	mmol/kg	Random urine. (White top container only) Fluid intake dependent.	1
Phosphate	13-42	mmol/ 24h	24h urine collection without preservative.	1

Potassium	See report	mmol/24h	24h collection without preservative.	1
Pregnancy Test	POS/NEG	-	Early morning urine sample.	1
Protein	0.01 - 0.12	g/L/24hr	24h collection without preservative	1
Urea	Varies with dietary intake	mmol/24hr	24h collection without preservative	1
Urea and electrolytes	See individual tests	mmol/24hr	24h collection without preservative.	1
Uric acid	See report	mmol/ 24h	24h collection without preservative.	1

Faeces Tests:

Faecal Immunochemical Test (FIT)	0-10	µg/g	OC-Auto sampling bottles (provided by lab)	7
pH	7 – 7.5	-	Fresh Specimen, liquid only.	7
Reducing Substances	Semi-quant	-	Fresh Specimen	2
Miscellaneous:				
Body fluid protein, glucose, Albumin, amylase, urea, creatinine, LDH, electrolytes, pH	See report		Sterile, universal container	1
Sweat Test	Conductivity < 60	mmol/L	Phone lab for appointment.	2

Arterial Blood gas ranges

Samples should be collected in a green lithium heparin gas syringe

ANALYTE	REFERENCE RANGES	UNITS	NOTES	Turn around Time
pH	7.35-7.45			1
pCO_2	4.5-6.1	KPa		1
pO_2	12-14	KPa		1
sO_2	75-99	%		1
Hct	35-50	%		1
tHB	115-174	g/L		1
Na	133-144	mmol/l		1
K	3.5-5.0	mmol/l		1
Cl	95-108	mmol/l		1
Ionised calcium	1.2-1.3	mmol/l		1
O_2Hb	95-99	%		1
COHb	0.5-2.5	%		1
MetHB	0.4-1.5	%		1
HHb	0.4-1.5	%		1

Base excess (BE)	-3 to +3	mmol/l		1
HCO3	20-32	mmol/l		1

BLOOD SCIENCES TESTS REFERRED TO REFERENCE LABORATORIES:

For Reference ranges and units see report.

Test	Sample	Minimum Volume	Reference Lab Turnaround Time	Procedure Notes	Site Code
A1AT Phenotype	Gold top serum tube	2mL	10 days	Only sent if A1AT is low – test added by lab	PRU
A1AT Genotype	Lavender top EDTA tube	2mL	28 days		PRU
A1AT (Faecal)	Faeces	>200ug/g stool	7 days		STGEORGES
Acetylcholine Receptor Abs	Gold top serum tube	20µL	7 days		BUXT
ACTH	Lavender top EDTA tube	4mL	7 days	Send to lab on ice	RLHCP
Acylcarnitine profile	Green top Lithium Heparin (can use Gold top serum tube /Grey top fluoride oxalate tube)	0.5mL	5-14 days		SHFCH
Adalimumab	Gold top serum tube	5mL	10 days		EXETER
ADAMS13	Blue top Sodium Citrate	3.5mL	3 weeks	Requires haematology consultant authorisation	RLHCOAG
Adrenal antibodies	Gold top serum tube	2mL	5 days		PRU
Aldosterone	Lavender top EDTA tube	4mL	14 days		RLHCP

ALP, isoenzymes	Gold top serum tube	5mL	3 weeks		AP
Alpha Amino Adipic Semialderhyde	Random Urine	1mL	4 weeks		UCLICH
Aluminium	Trace element free tubes plasma or Gold top serum tube	500µL	7 days	Avoid contamination from gloves	LEEDS
Amikacin	Gold top serum tube	5mL (For neonatal 0.5mL Lith Hep)	3 days	Requires pre dose level	RLHCP
Amino acids	Urine/ Green top Lithium Heparin	1mL	10 days	fasting sample preferred	AHEY
Amiodarone	Lavender top EDTA tube	0.5mL	7 days		CARDIFF
Amylase isoenzymes	Gold top serum tube / Green top Lithium Heparin	0.5mL	5 weeks		GOS
Amyloid A	Gold top serum tube	2mL	7 days		PRU
Androstenedione	Gold top serum tube	5mL	7 days		RLHCP
Anti-Caspr2	Gold top serum tube	15µL	10 days		BUXT
Anti-Lgi1	Gold top serum tube	15µL	10 days		BUXT
Anti Ganglioside Abs	Gold top serum tube	10µL	10 days		BUXT
Anti-ovarian antibodies	Gold top serum tube	2mL	5 days		PRU
Antithrombin antigen	Blue top Sodium Citrate	9mL	3 weeks		RLHCOAG

Apixaban Levels	Blue top Sodium Citrate	1 mL	1 day		RLHCOAG
Apo E genotype	Lavender top EDTA tube	4mL	1 month		STGEORGE
Apolipoprotein (a)	Lavender top EDTA tube / Green top Lithium Heparin	1mL	7 days		BIRMHEART
Arsenic	Lavender top EDTA tube	2mL	5 days		SURTEL
B2-transferrin	Nasal Fluid and Gold top serum tube	5µL	2 days		BUXT
B-hydoxy butyrate	red top serum tube	0.5mL	2 weeks		AHEY
B-2 microglobulin	Gold top serum tube or Urine	2mL Serum or 20mL Urine	2 days		PRU
Biotin/biotinidase	Green top Lithium Heparin	2mL - adult, 250µL-paediatrics	4 weeks		RVI
CA15-3	Gold top serum tube / Green top Lithium Heparin / Lavender top EDTA tube	2mL	2 days		PRU
Cadmium	Lavender top EDTA tube or urine	blood 2mL	5-10 days	2 mL or 10 mL	SURTEL
Caffeine	Gold top serum tube / Green top Lithium Heparin	2mL	2 days		BIRMCITY
Calcitonin	Gold top serum tube	2mL	7 days	Send to lab on ice	CHRIST

Cardiac muscle antibodies	Gold top serum tube	2mL	5 days		PRU
Carnitine	Green top Lithium Heparin (can use Gold top serum tube / Grey top fluoride oxalate)	0.5mL	5-14 days		SHFCH
Cholinesterase/pseudo cholinesterase	Gold top serum tube / Green top Lithium Heparin	1mL	4 weeks		MRIBIO
Chromium	Whole blood EDTA trace element tube/ Lavender top EDTA tube	2mL	5 days	Use plastic cannula or collect blood for Chromium after blood has been drawn for other test, otherwise discard first 5mL	SURTEL
Chromogranin A+B	Lavender top EDTA tube	3mL	21 days	Fasting sample (6-8 hrs). Send to lab on ice immediately	ICSMEU
Chromosome studies	Green top Lithium Heparin	3mL	6 weeks		LWH
Clobazam	Lavender top EDTA tube	300µL	7 days		CARDIFF
Clonazepam	Gold top serum tube	200µL	3 days		NEURO
Clozapine	Lavender top EDTA tube	2mL	2 days		KINGSBIO
B-CTX (beta C-TELO Peptide)	Lavender top EDTA tube	0.5mL	3 days		RLHCP
Cobalt	Whole blood EDTA trace element tube/ Lavender top EDTA tube	2mL	5 days		SURTEL
Colistin	Gold top serum	2mL	3 days	only pre-dose required	BRISTOL

	tube			now (May 2015)	
Complement C1Q	Gold top serum tube	2mL	20 days		PRU
Copeptin (CTproAVP)	Gold top serum tube / Lavender top EDTA tube / Green top Lithium Heparin	1mL	4 weeks		RVI
Copper/caeruloplasmin	Gold top serum tube and 24 hour urine	2mL	7 days		UHWBIO
CSF Igs/Oligo bands	CSF and Gold top serum tube	5µL	5 days		BUXT
Cyclosporin	Lavender top EDTA tube	4mL	3 days	Pre dose	RLHCP
Cyclosporin (paediatric)	Lavender top EDTA tube	1mL	10 days	Any patient under 16 years	AHEY
Cystine	Urine	1mL	10 days	Request urine amino acid profile	AHEY
C1 esterase inhibitor	Gold top serum tube	3mL	16 days	Only if C4 low	RLHIM
7-dehydro-cholesterol	Green top Lithium Heparin	1mL	3-6 weeks		SHFCH
11-deoxycortisol	Gold top serum tube	250µL	1 week		KINGSBIO
Dabigatran Levels	Blue top Sodium Citrate	1mL	7 days		RLHCOAG
DHEA	Gold top serum tube	5mL	7 days		RLHCP
Dihydrotestosterone	Gold top serum tube	5mL	35 days		LEEDS
DPD/Creatinine ratio	Urine	20mL	6 weeks	Protect from light	NORFOLK
Downs screening	Gold top serum tube	5mL	2 days		BOLTON

Elastase, faecal	Faeces	>200ug/g stool	3 weeks		WYTH
ELF Score	Gold top serum tube	5mL	2 days		LGI
Edoxaban Levels	Blue top Sodium Citrate	1mL	1 day		RLHCOAG
Ethosuximide	Gold top serum tube / Green top Lithium Heparin	200µL	3 days	Pre dose	TDM unit
Ethylene Glycol	Grey top fluoride oxalate or Lavender top EDTA tube	2mL	1 day		BIRMCITY
Erythropoietin	Gold top serum tube	1mL	7 days		LGI
Fabrys disease	Lavender top EDTA tube	2mL	4 weeks		WIL
Factor V Leiden mutation	Blue top Sodium Citrate	1.3mL - Neonate, 2.9mL - adult	14 days		MRI
Factor VIII (8) away	Blue top Sodium Citrate	1mL	3 weeks for routine, on the day if urgent on a treatment plan.		RLHCOAG
Factor VIII (8) inhibitor	Blue top Sodium Citrate	1mL	3 weeks for routine, on the day if urgent on a treatment plan.		RLHCOAG
Factor IX (9) inhibitor	Blue top Sodium Citrate	1mL	3 weeks for routine, on the day if urgent on a treatment plan.		RLHCOAG

Factor XIII (13) assay or subunits	Blue top Sodium Citrate	1mL	3 weeks for routine, on the day if urgent on a treatment plan.		RLHCOAG
Factor IX, X,XI,XII,II,V or VII – adult	Blue top Sodium Citrate	1mL	3 weeks for routine, on the day if urgent on a treatment plan.		RLHCOAG
Factor IX, X,XI,XII,II,V or VII – child	Blue top Sodium Citrate	1.3mL	2 weeks		AHEY
FDH(Familial dysalbuminaemic hyperthyroxaemia)	Gold top serum tube	1mL	1 month		REFTFT
Familial Hypercholesterolaemia	Lavender top EDTA tube				LWH
FGF-23	Lavender top EDTA tube	1mL	2-3 weeks		NORFOLK
Flecainide	Green top Lithium Heparin	0.5mL	5 days		AHEY
Free fatty acids	Gold top serum tube	0.5mL	2 weeks		AHEY
Fructosamine	Gold top serum tube	2mL	1 day		BIRMCITY
C1 esterase inhibitor Functional assay	Gold top serum tube	3mL	16 days		RLHIM
G6PD	Lavender top EDTA tube	4mL	4 days		RLHHAEM
Gabapentin	Urine	20mL	5 days		BIRMCITY
GAD Abs	Gold top serum tube	2mL	PRU - 5 days BUXT – 10 days		PRU - Diabetic cause / BUXT - neurological
Gal-1-P Uridyl Transferase	Green top Lithium Heparin	0.5mL	5 days	Patient must not have been transfused in last 3	AHEY

				months	
Ganciclovir	Gold top serum tube	1mL	3 days		BRISTOL
Gastrin	Lavender top EDTA tube	3mL	21 days	Fasting sample (6-8 hrs). Send on ice to laboratory immediately	ICSMEU
Gilberts gene analysis	Lavender top EDTA tube	>4mL (1-2mL -Paed)	42 days		LWH
Gliadin antibodies	Gold top serum tube	2mL	5 days		PRU
Glucagon	EDTA plasma	3mL	21 days	Fasting sample (6-8 hrs). Send on ice to laboratory immediately	ICSMEU
Gluten immunogenic peptide	Urine	10mL	5 days		PRU
Glycine receptor antibodies	Gold top serum tube	1mL	14 days		OXRAD
Glycolipid Abs	Gold top serum tube	10µL	10 days	Also MAGAB's, requested with Paraneoplastic Abs	BUXT
Gut hormone profile	2x Lavender top EDTA tube	3mL	21 days	Fasting sample (6-8 hrs). Send on ice to laboratory immediately	ICSMEU
HFE gene C282Y	Lavender top EDTA tube	>4mL (1-2mL -Paed)	42 days		LWH
Haemochromatosis gene H63D	Lavender top EDTA tube	>4mL (1-2mL -Paed)	42 days		LWH
Haptoglobin	Gold top serum tube	5mL	3 days		RLHCP
Haemoglobinopathy Studies (HBOP) Away	Lavender top EDTA tube	4mL	10 days		TRAFFORD
Hereditary Spherocytosis (EMA Binding)	Lavender top EDTA tube	5mL	4 days		MRIIMM
HLA	Lavender top	4mL	10 days		RLHIM

	EDTA tube				
HLA + HLA B27	Lavender top EDTA tube	4mL	10 days		RLHIM
HLA DQ2 AND DQ8	Lavender top EDTA tube	4mL	10 days		RLHIM
Homocysteine	Gold top serum tube / Lavender top EDTA tube / Green top Lithium Heparin	2mL	10 days	Send to lab on ice	AHEY
Homocystine	Green top Lithium Heparin	2mL	10 days		AHEY
17-hydroxyprogesterone	Gold top serum tube	4mL	14 days	Neonates should be >48hrs old	RLHCP
17-hydroxyprogesterone	Blood spot card	bloodspot samples should be collected at 3 different times throughout one day (6 bloodspots in total)	1 month	Collect free flowing blood from a finger prick	MRIBIO
IA2 antibodies	Gold top serum tube	2mL	10 days		PRU
IgA Check	Gold top serum tube	1mL	5 days	For low IgA's Name, DOB, NHS or CC number, Date sample taken, on specimen	NBSSHEF
Infliximab	Gold top serum tube	5mL	10 days	orders drug and antibody levels	EXETER
Inner Ear Antibodies	Gold top serum tube	250µL - 500µL	10 days		CAM

Isavuconazole	Red top serum tube	Adult - 1mL paediatric – 0.5mL	2 days		WYTH
Islet cell Abs	Gold top serum tube	2mL	5 days		PRU
Isoniazid	Grey top fluoride oxalate	1-2mL	3 days	Post dose sample, taken 2 hours after the end of administration (and/or 6 hours if monitoring absorption)	BRISTOL
Itraconazole	Red top serum tube	Adult - 1mL/Neonate - 0.5mL	2 days		WYTH
IGF-1	Gold top serum tube	250µL	5 days		UHBIRM
IGF-2 (IGF-1/IGF-2 ratio)	Gold top serum tube	0.3mL	14 days		ROYSUR
IgG subclasses	Gold top serum tube	7mL	3 days		MRIIMM
Inhibin B	Gold top serum tube / Green top Lithium Heparin	2mL	2 weeks		PRU
Insulin (Insulin with C-peptide)	Gold top serum tube	5mL	7 days	Only if glucose <2.5 Send to lab on ice immediately	RLHCP
Insulin C-peptide (Paed)	Green top Lithium Heparin	0.5mL	4 days	Send to lab on ice immediately	AHEY
Insulin antibodies	Gold top serum tube	2mL	5 days		PRU
Anti-interferon beta Abs	Gold top serum tube	500µL	21 days	Only for patients on anti-interferons	NEUROIMM
Keppra/levetiracetam	Lavender top EDTA tube	200µL	7 days		CARDIFF
Lamotrigine	Gold top serum	20µL	2 days		BUXT

	tube				
Laxative + diuretic screen	Urine	25 mL	3 days	Ideally 3 consecutive days; 25 mL each	BIRMCITY
Lead	Lavender top EDTA tube	2mL	3 days		RPS
Free light chains	Gold top serum tube	2mL	2 weeks		LAB/AP
Lipoprotein (a)	Gold top serum tube / Lavender top EDTA tube / Green top Lithium Heparin	1mL	7 days		BIRMHEART
Lymphocyte subsets or T&B, CD4, CD20 etc.	Lavender top EDTA tube	3mL	3 days		RLHIM
Lipase	Gold top serum tube	250uL	1 week		HUDD
Malaria Screen Away	Lavender top EDTA tube, thin film and thick film	4mL	2 days	Contact Lab before sending	LSTM
Manganese	Red top serum tube	2mL	5 days	Use plastic cannula, or collect blood for Mn after blood has been drawn for other tests, otherwise discard first 5mL.	SURTEL
Myelin associated glycoprotein Abs	Gold top serum tube	2µL	21 days		BUXT
Mercury	Lavender top EDTA tube	2mL	5 days		SURTEL
Methanol	Grey top fluoride oxalate	2mL	1 day		BIRMCITY
Methotrexate	Red top serum tube or Green top Lithium Heparin	0.5mL	24 hours		AHEY

Methyl histamine	Urine	5mL	2 weeks		PRU
Methylmalonic acid	Gold top serum tube / Lavender top EDTA tube	0.5mL	7 days		NEUROIMM
Mucopolysaccharides	Urine	10mL	1 month	Also GAG's	AHEY
MuSK antibodies	Gold top serum tube	20µL	21 days		BUXT
Mycophenalate	Gold top serum tube	2mL	8 days		WYTH
Neuronal Abs (antineuronal antibodies)	Gold top serum tube or CSF	15µL	15 days		BUXT
NMO antibodies (or aquaporin-4 antibodies)	Gold top serum tube	1mL	14 days	Special Patient Info form must be filled in.	OXRAD
NSE (Neurone Specific Enolase)	Gold top serum tube	2mL	8 days (on the day if urgent)		PRU
Olanzapine	Lavender top EDTA tube	250µL	7 days	protected from light	CARDIFF
Oligoclonal bands	CSF and Gold top serum tube	5µL	5 days	Blood and CSF required for this test	BUXT
Organic acids	Urine	10mL	7 days		AHEY
Orosomucoid (α1-acid glycoprotein)	Gold top serum tube	2mL	7 days		PRU
Oxalate (plasma)	Lavender top EDTA tube	4mL	7 days		TDL
Oxcarbazepine	Gold top serum tube	200µL	3 days		NEURO
Parathyroid antibodies	Gold top serum tube	2mL	5 days		PRU
Pituitary antibodies	Gold top serum tube	2mL	5 days		PRU
Pre-albumin	Gold top serum tube	2mL	7 days		PRU

Procollagen type 1 N propeptide (P1NP)	Lavender top EDTA tube	1mL	2 weeks		NORFOLK
Phenobarbitone	Gold top serum tube	1mL	2 days		BUXT
Phytanic acid	Green top Lithium Heparin, Grey top fluoride oxalate or Lavender top EDTA tube	1mL	15 days		BIRMCHIL
Plasma 5HIAA	Green top Lithium Heparin	1mL	20 days	Overnight Fast	LEEDS
Plasma catecholamines	Lavender top EDTA tube	2mL	10 days		HOPEBIO
PNH screen	5ml EDTA PB	4mL	24 hours		HODS Lab RLHHAEM
POMPE Disease/ White Cell Acid Maltose	Lavender top EDTA tube	2mL	4 weeks		WIL
Porphyrin screening	Lavender top EDTA tube -/Random Urine/Faeces	5-10mL blood/3mL urine	10 days	Protect from light	UHWBIO
Posaconazole	Red top serum tube	Adult - 5mL/Neonate - 0.5mL	2 days		WYTH
PBG/creatinine ratio	Urine	3mL	10 days	Protect from light, send to lab without delay	UHWBIO
Prednisolone	Gold top serum tube	2mL	8 days		WYTH
Procollagen aminopeptide Type III	Gold top serum tube / Green top Lithium Heparin / Lavender top EDTA tube	2mL	5 days		PRU
Protein S activity away	Blue top Sodium	1mL	1 month - call		RLHCOAG

(Free Protein S)	Citrate		for tat		
Protein S antigen	Blue top Sodium Citrate	1mL	1 month - call for tat		RLHCOAG
Protein C antigen	Blue top Sodium Citrate	1mL	1 month - call for tat		RLHCOAG
Protein Selectivity	Gold top serum tube + 24 hr urine	2mL serum + 20mL urine	5 days		PRU
Prothrombin Gene Variant	Blue top Sodium Citrate	1.3mL - Neonate, 2.9mL - adult	14 days		MRI
Pyruvate	Green top Lithium Heparin	100µl	1-2 weeks	Contact lab first, special collection tube required	GOS
Pyruvate Kinase	Lavender top EDTA tube	1mL	10 days	Contact lab before taking – needs time matched control	KINGSBIO
Quantiferon TB	Quantiferon tubes – purple, grey, green and yellow	1mL	7 days	Mon-Thurs blood collection only	MRIIMM
Quetiapine	Gold top serum tube	2mL	5 days		BIRMCITY
Renin (supine/upright)	Lavender top EDTA tube	4mL	14 days		RLHCP
Risperidone	Lavender top EDTA tube	2mL	7 days		CARDIFF
Rifampicin	Gold top serum tube	100µl	3 days		BRISTOL
Ristocetin cofactor	Blue top Sodium Citrate	3.5mL	1 month - call for tat		RLHCOAG
Rohypnol	Gold top serum tube	4mL	5 days		BIRMCITY
RNA polymerase	Gold top serum tube	2mL	5 days		PRU

Selenium	Red top serum tube	2mL	5 days		SURTEL
Sialotransferrin (Transferrin Isoforms)	Gold top serum tube	1mL	9 days		NEUROIMM
Sirolimus	Lavender top EDTA tube	1mL	2 days		RLHCP
stone analysis	Stone	NA	5 days		BIRMCITY
Striated muscle test (Skeletal muscle antibody)	Gold top serum tube	2mL	5 days		PRU
Sugar chromatography	Urine, faeces	Urine - 0.5mL	3 days	Positive reducing substances only – test added by lab	AHEY
Sulphonylureas	Gold top serum tube or urine	0.6mL - Serum/10mL Urine	1 week		ROYSUR
Tacrolimus (FK506)	Lavender top EDTA tube	4mL	3 days	Any patient under 16 years, sent to AHEY	RLHCP
TPMT (thiopurine methyl transferase)	Lavender top EDTA tube	4mL	1 day		BIRMCITY
TGN (thioguanine nucelotide)	Lavender top EDTA tube	4mL	2 days	Patients on Azathiorpine only	BIRMCITY
Thiamine (Vitamin B1, red cell transketolase)	Lavender top EDTA tube	4mL	14 days		RLHCP
Thyroglobulin	Gold top serum tube	1mL	1 month		UHBIRM
Thyroglobulin Abs	Gold top serum tube	5mL	10 days		UHWBIO
Toxicology screen	Urine	20mL	2 days	Can be done on blood but urine is preferred sample	BIRMCITY
Trimethylamine	Urine	10mL	6-8 weeks		SHFCH
Tryptase + mast cell tryptase	Gold top serum tube	5mL	7 days		RLHIM
Urine arsenic	Urine	20mL	5 days		SURTEL

Urine barium	Urine	20mL	5 days		BIRMCITY
Urine catecholamines	24 hr urine	24 hour urine	14 days		STHELIER
Urine c-peptide	Spot urine (boric acid)	20mL	7 days		EXETER
Urine cadmium	Urine	20mL	5 days		SURTEL
Urine citrate	24 hour urine	24 hr urine Acidified	10 days		WYTH
Urine cortisol	24 hour urine	full collection	14 days		RLHCP
Urine homocystine	Random urine	1mL	10 days	Part of urine amino acid screen	AHEY
Urine iron	24 hour urine or random urine	20mL	5 days		SURTEL
Urine nickel	24 hour urine or random urine	20mL	5 days		SURTEL
Urine mercury	24 hour urine or random urine	20mL	5 days		SURTEL
Urine methylmalonic acid	Urine	3-5mL	20 days		UHWBIO
Urine mucopolysaccharides	Urine	10mL	1 month		AHEY
Urine oligosaccharides	Urine	20mL	1 month		AHEY
Urine oxalate	24 hour urine/random	24 hr urine Acidified	10 days		WYTH
Urine pipecolic acid	Urine	1mL	3-6 weeks		SHFCH
Urine steroids	24 hour urine	20mL	3 weeks	Pt off steroids for at least 2 weeks.	KINGSBIO
VLCFA	Green top Lithium Heparin, Grey top fluoride oxalate or Lavender top EDTA tube	2mL	15 days		BIRCHIL
Vitamin B6	Lavender top	200µL	2 weeks	Protect from light	ROTHERHAM

	EDTA tube				
Vitamin C	Green top Lithium Heparin	2mL	4 weeks	Request preservative tube containing metaphosphoric acid (MPS) prior to taking the sample.	ROTHERHAM
1,25 diOH vitamin D	Gold top serum tube	10mL	28 days		NORFOLK
Urine 5HIAA	24 hr urine with acid	full collection	10 days	Special container with acid	RLHCP
Vitamin K	Gold top serum tube	5mL	10 days	Protect from light.	STTHOMHAEM
Vitamin A + E	Green top Lithium Heparin or Gold top serum tube	0.5mL	3 weeks	Protect from light.	AHEY
VMA (HMMA)	Urine	20mL	14 days	Send random urine to lab without delay	STHELIER
Voltage gated calcium channels	Gold top serum tube	20µL	21 days		BUXT
Voltage gated K channel Abs	Request Anti-Caspr2 and Anti-Lgi1				
vonWillebrand Screen – Adult	Blue top Sodium Citrate	3.5mL	1 month - call for tat		RLHCOAG
vonWillebrand Screen – Child	Green top paediatric Sodium Citrate	1.3mL	2 weeks		AHEY
Von willebrand factor antigen	Blue top Sodium Citrate	3.5mL	1 month - call for tat		RLHCOAG
Voriconazole	Red top serum tube	Adult - 5mL/Neonate - 0.5mL	2 days		WYTH
White cell enzymes	Lavender top EDTA tube	5mL	3 weeks		WIL

Zinc	Gold top serum tube	5mL	5 days		RLHCP
Zinc protoporphyrins	Lavender top EDTA tube	1mL	3 days		RPS
ZnT8	Gold top serum tube	2mL	5 days		PRU

POINT OF CARE TESTING (POCT)

Diagnostic testing has traditionally been performed in the central laboratory in batches, however new smaller robust technology now available has allowed for some testing to be performed at or near the patient.

Point of care testing may be defined as:

All diagnostic testing performed outside the central laboratory by non-laboratory personnel

To achieve the best possible results from POCT devices it is essential that all POCT is implemented in partnership with the Pathology Department and follows the same quality procedures to ensure the results produced are reliable and comparable to those produced by the central laboratory.

A POCT Team has been appointed within pathology to oversee this service.
A POCT policy is available on the Intranet which acts as a blueprint for all staff considering implementing POCT.

The POCT Team will advise on:

- testing methods available
- limitations of testing
- training
- support
- quality assurance
- risk

Point of Care Testing within the Trust currently supported by the POCT Team includes:

- Blood Glucose
- Blood Gas
- Cardiac Markers
- Pregnancy Testing
- Urinalysis
- Creatinine Testing
- INR's
- Haemoglobin
- Foetal fibronectin
- ROTEM

These POCT tests are excluded in the scope for the UKAS accreditation.

For further information, or if considering implementing POCT, please contact the POCT Co-ordinator.

Contact details:

Biochemistry Laboratory	Blood Sciences	01244 365025

IMMUNOLOGY AND ALLERGY SERVICE

The Immunology service is located within the Countess of Chester Hospital Pathology department,. It is a medical speciality providing a clinical diagnostic service in Allergy & Auto-immune Serology (Immunology).

Principal Staff and contact details

Sessional consultant cover is provided by **Consultant Immunologist**
Royal Liverpool and Broadgreen University Hospitals Trust.

Dr Hana Alachkar	Tel: 0151 706 4349 (secretary)	hana.alachkar@nhs.net
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Mr Kevin Clooney	01244 365030	kevin.clooney@nhs.net

Enquiries
Immunology report enquiries:
Mr Kevin Clooney
Tel: 01244 365030

General Specimen Requirements for Auto Immune Serology/Allergy testing

The schedule of scope for the Immunology UKAS accredited tests can be viewed at ukas.com (reference number 9061)**.**
The following investigations are available:

Blood Samples should be collected in a red topped tube, faecal samples in a blue topped faeces container

Request	REFERENCE RANGES	Information	Turn around Time
Coeliac screen – tissue transglutaminase	Negative = <7u/ml Positive >10U/ml	Screening for IgA is incorporated in this test and Total IgA levels are reported when clinically indicated. IgG tTG screening is available and normally only performed on Selective IgA deficient patients, or by special request, please contact the laboratory if this test is required. (Anti-endomysial antibodies measured and reported when indicated).	5 days
Autoantibody screen	Negative	Anti Nuclear Antibodies (ANA), Anti Smooth Muscle Antibodies (SMA), Anti Mitochondrial Antibodies (AMA), Anti Gastric Parietal Cell (GPC) antibodies. Please note that Liver / Kidney Microsomal (LKM) antibodies are also included in this screen.	Routine – 5 days Urgent by request same day if possible
Ant dsDNA screen	Negative	antibodies to native, or double stranded DNA	5 days
Anti dsDNA quantification	Negative <10IU/Ml Positive >15IU/ml		5 days
ENA screen	Negative	This includes Ro, La, Sm, RNP, Scl-70, Jo-1 & centromere.	5 days
Anti-neutrophil cytoplasmic antibodies (ANCA)	MPO – negative <3.5IU/ml	Primary screen is by immunoassay if positive this will be confirmed on immunofluorescence	Routine – 5 days Urgent

screen	positive >5IU/ml PR3 negative <2IU/ml, positive >3IU/ml		by request same day if possible
Glomerular basement membrane (GBM) antibodies	Negative = <7u/ml, positive = >10U/ml		Routine – 5 days Urgent by request same day if possible
Anti-CCP antibodies	Negative = <7u/ml, positive = >10U/ml		5 days
Intrinsic factor ((IF) antibodies	Negative		5 days
Skin antibodies	Negative	A complete investigation of bullous skin disease should include both direct immunofluorescence (on biopsy material) and indirect immunofluorescence (on an exogenous substrate) for skin basement membrane and epidermal intercellular desmosome antibodies.	10 days
Auto immune liver profile (immunoblot)	Negative	A complete investigation of liver disease should include Anti AMA – M2 (pyruvate dehydrogenase complex), LKM, LC-1 and SLA/LP. Please note that these antibodies are also detected in the Auto Antibody screen. This investigation is usually performed when indicated by the Auto Antibody screen.	10 days
Myositis antigen profile (immunoblot)	Negative	A complete investigation of Myositis disease should include Anti Mi-2, Ku, PM-Scl 100, PM-Scl 75, Jo-1, SRP, PL-7, PL-12, EJ, OJ and Ro-52. Please note that these antibodies are also detected in the Auto Antibody	10 days

		screen.	
Autoimmune Hep 2 cytoplasmic profile (immunoblot)	Negative	A complete investigation of cytoplasmic fluorescence of Hep 2 cells should include Anti AMA – M2, Ribosomal-P, Jo-1, SRP, PL-7, PL-12, EJ, OJ and Ro-52. Please note that these antibodies are also detected in the Auto Antibody screen. This investigation is usually performed if indicate by the Auto Antibody screen	10 days
Thyroid stimulating hormone receptor (TRAB) antibodies	Negative <2.9IU/l, positive >3.3IU/l		10 days
IgE	Adult <100KUA/l		5 days
Specific IgE	<0.35KUA/L	Indicate specific test other than: House dust mite, Timothy grass pollen, cat, dog epithelium and silver birch pollen.	5 days note less common allergens will take longer
Aspergillus IgG antibodies (‘precipitin’)	<40mgA/L	Specific IgG antibodies to *Aspergillus fumigatus* alone may not give a complete picture. Therefore, the total IgE and specific IgE antibodies to *A. fumigatus* are also measured.	10 days
Avian IgG antibodies (‘precipitins)	Pigeon serum, feathers & droppings <40 mgA/l Parrot serum, feathers & droppings <10 mgA/l Budgerigar serum, feathers & droppings <10 mgA/l		10 days
Micropolyspora	<40mgA/l	Specific IgG antibodies to	10 days

IgG antibodies ('precipitins') (Farmer's Lung)		*Micropolyspora faeni* are available.	
Cardiolipin antibodies	IgG Anti Cardiolipin Antibodies Negative <10 u/ml Positive >40 u/ml IgM Anti Cardiolipin Antibodies Negative <10 u/ml Positive >40 u/ml	Blue topped citrate tube acceptable if part of a thrombophilia screen	7 days
Beta 2 glycoprotein antibodies	IgG Anti Beta 2 Glycoprotein Antibodies Negative <7 u/ml Positive >10 u/ml IgM Anti Beta 2 Glycoprotein Antibodies Negative <7 u/ml Positive >10 u/ml	Blue topped citrate tube acceptable if part of a thrombophilia screen	7 days
Anti-PLA2 receptor screen	Negative	If positive sample will be sent for quantitation	10 days
Faecal Calprotectin	<200ug/g	This test is used to differentiate between Inflammatory Bowel Disease (IBD) and Irritable Bowel Syndrome (IBS), in line with NICE guidance: DG11.	7 days

Cryoglobulins
EDTA (Pink) and Clotted (Red). 6ml
Contact Specimen Reception for container to keep the samples at 37^{o}C.
Samples must be handwritten. See Specimen labelling requirements below.

Samples to be sent to specimen reception immediately after collection.

7 days: A primary investigation is performed in house by the immunology department. Positive samples are confirmed by the Immunology department, Liverpool Clinical Laboratories.

Immunology Send Away Tests

See table in blood sciences section

Clinical advice on the use and interpretation of immunology laboratory tests:

Clinical advice can be given by Dr H Alachkar, Consultant Immunologist, RLBUHT, 0151 706 4349 and technical advice by K.M. Clooney on 01244 365030

The following is advice on the use of immunology in certain clinical settings.

AUTOIMMUNITY

Abbreviations: ANA – antinuclear antibodies
dsDNA – double-stranded DNA
ENA – extractable nuclear antigen(s)
MCTD – mixed connective tissue disease
SLE – systemic lupus erythematosus

General comments
Broadly, autoantibodies are of relevance to the diagnosis of multisystem connective tissue disease and also organ-specific autoimmune disease.

1. Connective tissue disease
Although autoantibody testing is a useful adjunct to the diagnosis of autoimmune connective tissue disease, the tests have limited specificity. Also, these diseases affect only a small proportion of the community. As a result, the tests will have a low positive predictive value if they are used indiscriminately — that is to say, if the tests are performed on patients who have little or no real clinical evidence of relevant disease, most of the positive results will be found in patients without disease.

Therefore, the sensible advice is: *if you don't think there are real clinical grounds for suspecting the patient to have an autoimmune connective tissue disease — don't ask for autoantibodies; the result is unlikely to tell you anything useful.*
Similarly, if you receive a positive autoantibody result on a patient, think: *are the clinical findings in keeping with this result?* Not - the *result is positive, so the patient must have disease.*

Consider the following common examples of situations in which autoantibody tests can mislead:

- Patients whose only clinical feature is non-specific joint discomfort unaccompanied by any signs of an inflammatory process. This is a very common clinical scenario and does not usually indicate an autoimmune process. Therefore, autoantibody testing is unlikely to contribute usefully to the management of such patients – even if the result is positive, it is unlikely to alter the management. (On the other hand, patients who *do*

have clinical signs of inflammatory joint disease should be considered for a rheumatology opinion *regardless* of antibody test results.)

- Frequently, a positive speckled pattern ANA is reported, with negative ds DNA antibodies and negative ENA antibodies. This combination of results occurs with increasing frequency in the ageing female population and is most often of no diagnostic significance.

Interpretation

Problems of interpretation are most frequently encountered with antinuclear antibodies (ANA) and antibodies to extractable nuclear antigens (ENA), so these are discussed further below.

There are two main features of the ANA report — the *pattern* and the *titre*.

Five patterns are routinely reported:

i. **Homogeneous** — due to autoantibodies binding to DNA, or proteins which are closely associated with it.

When we detect a homogeneous ANA, we automatically perform further testing for dsDNA antibodies, which are classically associated with SLE. However, even when these aren't found, SLE is still the main disease association of a homogeneous ANA.

ii. **Speckled** — due to autoantibodies binding to antigens which are less widely distributed through the nucleus.

When we detect a speckled ANA, we automatically perform further testing for antibodies to extractable nuclear antigens (ENAs). The ENA antibodies routinely tested for are:

Ro (SS-A) — found in SLE (increased risk of vasculitis, nephritis, lymphadenopathy, leucopoenia), and primary Sjögren's syndrome. Ro is also associated with subacute cutaneous lupus (when it is usually the only autoantibody present) and neonatal lupus (sometimes complicated by heart block).

La (SS-B) — usually found in association with Ro.

Sm (an abbreviation of "Smith", *not* smooth muscle) — found in SLE (increased risk of renal involvement).

RNP (or u1-RNP) — found in SLE, mixed connective tissue disease (when it is usually the only autoantibody present), sometimes in rheumatoid arthritis.

RNP-70 — Antibodies to the 70 kD RNP polypeptide show a higher specificity for MCTD than antibodies to the complex as a whole.

Scl-70 — found in the disseminated form of scleroderma (increased risk of visceral involvement).

Jo-1 — found in polymyositis/dermatomyositis.

When ENA antibodies aren't found, the significance of a speckled ANA is unclear and often of no obvious clinical significance (see 'general comments' above).

iii. **Nucleolar** — due to autoantibodies binding to antigens only present in the nucleolus. Nucleolar antibodies are associated with scleroderma and scleroderma-polymyositis overlap syndromes.

iv. **Centromere** — found in limited cutaneous scleroderma (also known as CREST syndrome); likely to be relevant if the patient has Raynaud's phenomenon.

v. **Nuclear dots (Sp100)** — not often seen, but associated with primary biliary cirrhosis.

The titre of the ANA is simply the highest dilution of the serum which still gives a positive result on immunofluorescence – thus, a titre of 1:1280 represents a 'stronger' antibody than a titre of 1:160.

Is there a titre at which an antibody automatically becomes clinically significant? – No, but common sense applies: an antibody present at 1:1280 is *more* likely to be significant than an antibody present at 1:160. However, once again, it cannot be overemphasised that meaningful interpretation is only possible in the context of the clinical findings.

Other autoantibodies

Three other antibodies need specific mention because of their importance and / or ability to confuse:

i. **Mitochondrial antibodies (specifically M2 type)** — this autoantibody is associated with primary biliary cirrhosis.

If detected in a patient with raised liver enzymes, a gastroenterology / hepatology opinion should be sought.
M2-positive patients with normal liver enzymes should have long-term monitoring of their liver function.

ii. **Liver / kidney microsomal antibodies (LKM)** — the major association of LKM antibodies is autoimmune hepatitis, but they have been found in viral and drug-induced hepatitis and cryptogenic cirrhosis.

iii. **Anti-neutrophil cytoplasmic antibodies (ANCA**) — there are two diagnostically significant ANCAs:

- Antibodies to neutrophil myeloperoxidase (anti-MPO), which typically give a perinuclear pattern on immunofluorescence (pANCA). They are predominantly associated with microscopic polyangiitis and necrotising crescentic glomerulonephritis (or rapidly progressing glomerulonephritis – RPGN), but are also present in about 60 % of cases of Churg-Strauss vasculitis.
- Antibodies to proteinase 3 (anti-PR3), which typically give a cytoplasmic pattern on immunofluorescence (cANCA). They are predominantly associated with Wegener's granulomatosis, but also found in some patients with microscopic polyangiitis and Churg-Strauss vasculitis.

Sometimes a cANCA pattern will be reported with negative antibodies (to PR3 and MPO) — this is of uncertain significance. However, a pANCA with negative antibodies can occur in inflammatory bowel disease (especially ulcerative colitis) or primary sclerosing cholangitis, though it is not a robust test for these conditions.
Propylthiouracil, used in the treatment of hyperthyroidism, has been reported to cause a drug-induced ANCA, with associated vasculitis.

It should be remembered that **a negative ANCA does not exclude a diagnosis of vasculitis** — some well-characterised vasculitides are typically ANCA-negative, e.g. polyarteritis nodosa and rheumatoid vasculitis.

2. Organ-specific autoimmunity

These tend to cause fewer interpretive problems for the user and are less likely to be requested when there is no evidence of relevant disease. However, it is important to bear in mind that even organ-specific antibody results (e.g. thyroid autoantibodies) should be interpreted in the context of a clinical or biochemical assessment of organ function.

i. **Thyroid Stimulating Hormone receptor (TSH-r) antibodies (TRAB)** – Thyroid receptor is an integral membrane glycoprotein which forms a binding site for TSH on the surface of thyroid follicular cells. Thyroid receptor antibodies (TRAb) are measured in patients with the various forms of thyroid disease to identify those with Graves disease. The treatment differs from other forms of hyperthyroidism, as a considerable proportion of these patients undergo long term remission after anti-thyroid drug treatment, and can therefore be spared ablative forms of therapy. As TRAb levels decrease in the course of anti-thyroid drug treatment a rise may indicate an early relapse of hyperthyroidism.

Pregnant women with Graves disease, or that have previously been treated for Graves disease are at risk of having a child with neonatal hypothyroidism. TRAb determination provides a method of assessing the risk of the onset of hyperthyroidism in the foetus. Raised levels at differing stages of pregnancy have been linked to an increased risk of having a child with neonatal hypothyroidism, depending on the clinical status of the patient. Guidelines from the European Thyroid

Association have made recommendations for when to test for TRAb in different clinical presentations.

Allergy

Total serum IgE and a variety of antigen-specific IgE tests are available. These tests were previously done by the method of radio-allergosorbent testing (RAST). Although this is no longer used, the term RAST has persisted and is understood as a reference to IgE tests.
Think critically when requesting IgE tests —

- There is little point in random, "blind" screening for specific IgE against allergens which the clinical history has *not* implicated as potential causes of symptoms. Using allergy tests in this way is expensive and rarely helpful.
- If there *is* a suspected antigen, request a specific IgE test *to that antigen,* not to other irrelevant ones.
- Open-ended requests for "RAST" tests, without specifying the allergen, are not acceptable. Requests should be made for specific allergens as indicated by the history.
- If requesting allergen-specific IgE tests, always requests a total IgE, as it will aid interpretation. As the total IgE increases, the positive predictive value of a high specific IgE reading will decrease and the negative predictive value of a low reading will increase.

A case in point is markedly atopic patients (usually with eczema) with very high total IgE levels and moderately elevated specific IgE tests to multiple allergens that they are not clinically sensitive to.

- An isolated total IgE is not very informative. It is associated with atopy but is not a good predictor of specific allergy. It is not correct to conclude that a patient with a high total IgE 'must be allergic to something'.

IgE tests are only useful in cases of suspected type I (immediate) hypersensitivity and are essentially useless for the investigation of delayed hypersensitivity (such as contact eczema) and, of course, of no value in the investigation of non-specific symptoms with a low probability of being due to any allergic process.
Examples of clinical phenomena which can be due to IgE-mediated allergy are:

- allergic rhinitis
- asthma
- urticaria / angioedema
- anaphylaxis

Finally, interpret IgE test results with caution**. The history is by far the most important component of an allergy assessment.** Just as a positive specific IgE does not always mean that the patient is clinically allergic to the antigen (see example of atopic eczema above), a negative specific IgE, in the context of a convincing clinical history, does not guarantee that the patient is not allergic

Suspected immunodeficiency

It is important to discuss with the immunologist any patient who is suspected to have an immunodeficiency disorder:

- Patients with unexplained low immunoglobulin levels – after excluding haematological malignancy (e.g. paraproteinaemia or CLL), or significant protein loss (e.g. nephrotic syndrome).

As a guide, a total IgG of less than 3 g/l is likely to be significant, levels between 3 and 4 g/l of possible significance, and levels between 4 and 5 g/l of variable significance and levels above 5 g/l unlikely to be significant.
Any combination of low IgA and IgM, with normal IgG, is of doubtful significance but any patient with dysgammaglobulinaemia should have a paraproteinaemia excluded.

- Patients with a history of unusually severe or recurrent infection (e.g. pneumonia, severe sinusitis, meningitis, septicaemia, deep-seated / visceral abscesses, invasive fungal infection).
- Any patient who is suspected to have angioedema due to C1-inhibitor deficiency.

Patients with chronic lung disease (COPD or bronchiectasis), which is frequently associated with recurrent infection in the absence of any specific immunodeficiency; do not need to be referred routinely because of infections. If necessary, their humoral immunity can be assessed by their respiratory team (advice on this is available separately), only referring those with convincing evidence of an antibody defect.

Special considerations affecting performance of the test and the interpretation of the results:

No special considerations

Time limits for requesting additional tests:

Further tests can be requested up to one month from the date of the initial collection of the specimen by contacting the department and completing the relevant request form. It should be noted that the immunology laboratory automatically carries out further investigations if an autoantibody test indicates the need for a further specialised test.

MICROBIOLOGY AND INFECTION CONTROL

The Microbiology department (CN9595) is accredited by the United Kingdom Accreditation Service (UKAS) for ISO15189:2012- Medical Laboratories

9595

For details of the UKAS accredited tests please refer to the Cheshire and Wirral Microbiology User Guide available separately on Trust intranet. The Cheshire and Wirral Microbiology User Guide can also be accessed by clicking on this link to the http://intranet/clinical-services/diagnostics/pathology.aspx

Consultant Medical Microbiologist and **Clinical Lead**	Dr Ildiko Kustos	01244 366788
Secretary		*01244 366773*
Consultant Medical Microbiologist	Dr Jeremy Gardner	01244 366785
Secretary		*01244 366773*
Departmental Manager	Mr Alex Warrington	01244 362499
Acting Chief Biomedical Scientist	Mr Dave Bond	01244 363352
Quality Manager	Ms Joanne Evans	joanneevans1@nhs.net

Out of hours contact On-call Biomedical Scientist/Consultant Microbiologist/ICN via switchboard

HISTOLOGY, CYTOPATHOLOGY AND MORTUARY SERVICES

Key Contacts:

Consultant Histopathologist – & **Clinical Lead for Histopathology**	Dr Natalie Meara	*01244 364519*
Secretary	*Mrs L Lewis*	*01244 365374*
Consultant Histopathologist	Dr Amy Gilbert	*01244 365381*
Secretary	*Mrs L Lewis*	*01244 365374*
Consultant Histopathologist	Dr Michael Wall	*01244 365375*
Secretary	*Mrs E Wrench*	*01244 365389*
Specialist Registrars		*01244 363552*
Departmental Manager & **HTA Designated Individual**	Mr Alan Shaw	*01244 365646*
Quality Manager	Mrs Abigail Armstrong	*01244 365519*
Main Laboratory		*01244 365645*

Mortuary:

Mr R Mealing	Mortuary Manager	*01244* 365360	Bleep 2738
Ms JL Rushin	Senior APT	*01244* 365360	Bleep 2738
Mr J Cunningham	Trainee APT	*01244* 365360	Bleep 2738

Cellular Pathology Hours:

Monday – Friday:	**8.30 am – 5 pm**
Bank Holidays	**Closed**

NB: No out of hours service is available in this department. Histology specimens must be received by the lab before 11am for processing that day. Cytology samples must be received by the lab before 4.00 pm in order to be processed that day.

HISTOLOGY LABORATORY

Hospital requests must be submitted on the black text on plain white request form with attached bag or via electronic ordering on the EPR system. GP requests must be submitted on the combined magenta text request form or Clinisys ICE.

Every effort must be made to confirm the correct patient identity before sample collection and steps must be taken to minimise risk of sample interchange.

Request forms/specimen pots for any histology or cytology specimens must be filled in with all necessary details before acceptance into the laboratory.

If electronic ordering is not available handwritten request forms must contain:

- At least 3 patient identifying details (this can include full patient name, NHS number, hospital number or patient date of birth). Ideally all details should be submitted.
- Relevant specimen details.
- Relevant clinical information.
- The name and signature of the requesting clinician.

Requests submitted without essential information (as listed above) will not be accepted into the laboratory until a requesting clinician has attended the laboratory to complete the necessary details.

Inadequate GP requests will be returned to origin for attention.

Please note that processing of a sample will be delayed where patient and/or specimen details have not been correctly given.

Adequate patient details must also be completed on the specimen pot.

The schedule of scope for the Cellular Pathology and Non-Gynae Cytology UKAS accredited tests can be viewed at ukas.com (reference number 9061).

Histopathology Laboratory - Routine Histology

Specimens for routine Histology should be submitted to the laboratory in an appropriate container containing histological fixative (10% buffered formalin). These specimen containers (along with request forms) are available from the Supplies department in several sizes. To allow for adequate fixation, specimens should be placed in a container with at least three times their volume of fixative, so an appropriately sized container should be chosen.

Please label the container and NOT the lids, making sure that the lid is securely fitted, and place the container in a sealed clear plastic bag accompanied by Histology request form, with the requested data correctly and legibly filled in. Specimen containers that are small enough should be placed into the specimen bag that is attached to the request form, following the instructions given on the form. Specimen containers that are larger should be placed into a larger clear plastic bag, and then sealed with a bag tie. These larger bags and bag ties are available from the general hospital stores. The request form should then be firmly attached to the **OUTSIDE** of the specimen bag, **NOT** placed inside.

Please note that incorrectly or inadequately filled in forms and labels will cause a delay in the processing of a specimen as a requesting clinician will be requested to attend the lab to rectify any issues (in the case of GP requests, specimens will be returned to origin for attention).

Specimens received before 11 am will be added to the tissue processor on the day of receipt, space permitting. All adequately fixed specimens are dissected within 24 hours of receipt (except at weekends).

Relevant clinical information on the request form is essential. If possible please also indicate the date by which the results should be available (i.e. the date of the patient's next appointment). This will enable the laboratory staff to manage the workload and prioritise specimens according to urgency.

Consent

Please indicate in the clinical details section if the patient would like to 'opt out' of consenting to his/her anonymised sample being used for purposes other than diagnosis e.g. audit, teaching, training, public health monitoring or simple research. This will enable laboratory staff to know if the patient has any objection to using his/her anonymised sample for the purposes described above.

High Risk Samples

To protect laboratory staff, any high risk histology/cytology samples must be clearly labelled with "Risk of Infection" (using hazard stickers where possible) and sealed in a plastic specimen bag, if the patient is a known or suspected carrier of HIV, Hepatitis B/C or TB. Any paper request form should also clearly state the reason for the risk of infection.

Urgent Specimens

Urgent specimens should be clearly marked "URGENT" and delivered to the laboratory as soon as possible for inclusion on that day's tissue processor run. Please state on the form when the report is required and also give a contact name and telephone number.

Frozen sections

Requests for frozen sections should be booked and discussed with a Consultant Pathologist no later than one day prior to surgery. This is to ensure that a Pathologist is available for reporting and the cryostat is not being serviced. Please contact the Pathology Secretaries on ext. no. 5389/5376/5374 and they will direct the call to the appropriate Consultant.
Specimens should be submitted **fresh in a clean DRY container WITHOUT fixative and a contact name and telephone number written on a fully completed request form.**
Unbooked frozen sections will only be performed under exceptional circumstances (e.g. unexpected intraoperative finding) and only after discussion with a pathologist by a member of the medical staff.
Frozen sections will not be performed on specimens carrying high risk of infection e.g. TB or HIV.

Specimens that require bacteriological, in addition to histological examination.

Should a specimen require bacteriological as well as histological examination then it should be submitted in a sterile bacteriology container to the Microbiology department, with both the bacteriology and histology request forms. The Microbiology department should be requested to pass the specimen on to the Histology laboratory, as soon as they have selected their material. **However, in most cases it is preferable to send a separate specimen to the Microbiology dept.**

Formaldehyde Safety

The 10% buffered formalin solution used by the Cellular Pathology department should be stored in an appropriate area and at a temperature above 20^{o}C (to prevent crystallisation).

Formalin containers should be kept closed and protected from direct sunlight and moisture and (where possible) containers should not be stacked - to avoid spillage incidents.

Formalin is toxic by inhalation, ingestion and with skin contact, so appropriate PPE i.e. gloves should be worn when dealing with it.

If splashed in eyes irrigate thoroughly with water for 10 minutes and obtain medical attention. If inhaled, remove from exposure, rest and keep warm. In severe cases, or if exposure has been great obtain medical attention. If in contact with the skin, drench thoroughly with water, remove contaminated clothing and wash before re-use. Unless exposure has been slight, obtain medical attention. If ingested, wash out mouth thoroughly with water and give plenty of water to drink. Obtain medical attention.

In the event of a spillage:

For small spillages:
If staff feel able to deal with a small spillage of formalin solution, appropriate protective clothing (gloves etc.) should be worn, the area should be well ventilated (if possible) and the immediate area around the spill should be closed off to other staff.
If local regulations permit, mop up with plenty of water and run to waste, diluting greatly with running water. Otherwise, absorb the spilt formalin using an inert absorbent material and double bag all the waste created in orange clinical waste bags for disposal. The affected area should be ventilated to dispel residual vapour.

For large spillages:
For larger spillages of formalin the affected area should be sealed off and the Cellular Pathology laboratory should be contacted on ext. 5645/5646.

NB: Formalin spillages should be recorded as potential Health & Safety incidents on Datix.

CYTOLOGY LABORATORY

Request forms

A separate request form should be filled out for histology and cytology specimens sent from the same patient.

Hospital requests must be submitted on the black text on plain white request form with attached bag or via electronic ordering on the EPR system. GP requests must be submitted on the combined magenta text request form or Clinisys ICE.

Every effort must be made to confirm the correct patient identity before sample collection and steps must be taken to minimise risk of sample interchange.

If electronic ordering is not available handwritten request forms must contain:

- At least 3 patient identifying details (this can include full patient name, NHS number, hospital number or patient date of birth). Ideally all details should be submitted.
- Relevant specimen details.
- Relevant clinical information.
- The name and signature of the requesting clinician.

Requests submitted without essential information (as listed above) will not be accepted into the laboratory until a requesting clinician has attended the laboratory to complete the necessary details.

Please note that processing of a sample may be delayed where patient and/or specimen details have not been correctly given.

Adequate patient details must also be completed on the specimen pot. Any slides sent for cytological staining must possess the patient name, date of birth and hospital number written on the frosted section at the top of each slide.

Consent

Please complete the consent section on the request form to indicate if the patient would like to 'opt out' of consenting to his/her anonymised sample being used for purposes other than diagnosis e.g. audit, teaching, training, and public health monitoring or simple research. If a hospital consent form has been signed by the patient, prior to removing the sample, please complete the consent section on the histology request form. This will enable laboratory staff to know if the patient has or has no objection to using his/her anonymised sample for the purposes described above.

Turnaround time for non-gynae samples:

Most non-gynae results are available within 72 hours of receipt in the laboratory (except weekends and bank holidays). Some non-gynae results may be delayed if further immunohistochemical staining is undertaken in the Histology laboratory.

NON-GYNAECOLOGICAL CYTOLOGY

HIV Positive/High Risk Patients

High risk cytology samples must be clearly labelled with "Risk of Infection" hazard stickers if the patient is a known or suspected carrier of HIV, Hepatitis B/C,TB or SARS-CoV-2. The request form must also state the reason for the risk of infection.

Endometrial cytology

Material from endometrial sampling should be placed in formalin.

Sputum for malignant cells

Sputum samples should be collected into clean, dry, sterile containers and submitted to the laboratory as soon as possible after collection. If microbiological examination is also required a separate sample should be sent to the Microbiology department. Sputum sample should only be submitted if the patient has suspected lung cancer and is unfit for bronchoscopy. Sputum cytology should not be requested routinely in patients presenting with respiratory infections. Sputum screening is not an effective investigation for occult malignancy. If the patient has produced saliva, or there are visible food particles, it is better to begin again straight away. Better samples may be forthcoming early in the morning (but before breakfast!), or with the assistance of a physiotherapist. As sputum quality deteriorates rapidly and day old specimens rarely produce any useful results any induced sputum specimens should reach the laboratory in a timely fashion. The accompanying request form should give precise details of the patient clinical background.

Urine for malignant cells

Samples should be taken for the investigation of haematuria. Early morning or mid-stream urine samples are not appropriate for cytological examination. The whole of a voided sample should be collected and a maximum 25 ml sample of the fluid submitted to the laboratory in

a clean, dry 30 ml sterile universal container. The sensitivity of urine for low grade transitional cell carcinoma is low, thus urine cytology should never be used to exclude urothelial neoplasia. The appearance of urine cytology is significantly altered by instrumentation or catheterisation which should thus be recorded in the clinical information accompanying the specimen. The presence of calculi should also be recorded. If microbiological examination is also required a separate sample should be sent to the Microbiology department.

Pleural / Ascitic / Pericardial fluids

Samples should be collected into clean, dry, sterile universal containers and sent to the laboratory as soon as possible after collection. 25-50 ml of sample is desirable. If microbiological examination is also required a separate sample should be sent to the Microbiology department. If transport is delayed then refrigerate sample. Delays of over 48 hours are undesirable

Fine Needle Aspiration (FNA) Cytology

Green cytology transport medium (Cytospin fluid) should be used for these specimens –See SharePoint for FNA technique
The transport medium (collecting fluid) should then be aspirated into the syringe through the needle and squirted with the aspirated material back into the specimen container. The specimen should then be sent to the laboratory without delay.

If an adequacy assessment of an FNA sample is required, these should be pre-booked via the Histopathology secretaries (ext. 5389/5376/5374) to ensure Consultant staff are available to perform the assessment.

Dr Meara and Dr Wall provide a clinic based ad hoc fine needle aspiration service to hospital users on request. Please contact them via their secretaries to arrange this.

Samples collected in this way into cytology transport medium are not suitable for microbiological culture. If microbiological examination is also required a separate sample should be sent to the Microbiology department.

Bronchial washings/BAL

These specimens are collected during bronchoscopy to investigate focal or diffuse lung abnormalities. The nature of the abnormality being investigated should be clear from the clinical information included with the specimen so that the laboratory can perform the appropriate preparations. Please send a maximum of 25 ml of washings in a clean, dry, sterile 30 ml universal container. If transport is delayed then refrigerate sample. Delays of over 48 hours are undesirable.

Bronchial brush biopsies

Bronchial brushings are taken at bronchoscopy for the investigation of suspected tumours. The highest diagnostic yield is found when a visible abnormality is sampled. Bleeding induced by biopsy of the lesion may obscure the cellular material and thus the brushing should be performed before a biopsy is taken. The brush should be broken off, unsheathed and immersed in blue / green cytology transport medium (Cytospin fluid). Please note that this method of collection is preferable to the preparation of smears taken from the brush. If smears are to be made they must be fixed immediately in 95 % alcohol and the necessary patient identifying details must be clearly labelled in pencil on the frosted end of the slide.

EBUS-TBNA samples

EBUS-TBNA may be performed under local anaesthesia with sedation, or under general anaesthesia. A flexible bronchoscope containing an ultrasound probe is inserted via the trachea and guided through the bronchial tree towards the appropriate area of the mediastinum. The targeted lymph nodes or masses are identified using bronchoscopic visualisation and real-time ultrasound imaging. A needle extended from the bronchoscope through the bronchial wall is used to puncture the mass and to aspirate tissue. A mass can be punctured several times to gain an adequate sample, and several masses can be punctured during the same session. These samples should be submitted in a container filled with buffered formalin fixative.

Synovial fluids

Please note that any synovial fluids requiring analysis for crystals (polarised light microscopy) should be sent directly to Microbiology on a Microbiology request form – this service is no longer provided by the cytology department.

Any samples requiring other cytological examination should be collected into a clean, dry, sterile 30 ml universal container and sent to the Cytology laboratory as soon as possible.

Cerebrospinal fluid (CSF) for malignant cells

The sample should be collected into a clean, dry, sterile 30 ml universal container. **CSF will deteriorate within 2 hours of collection and must reach the laboratory within this period**.
If possible inform the laboratory that an **urgent CSF sample** is being taken. Please submit **separate samples to clinical chemistry or the Microbiology department** if protein analysis, cell counts or culture are required. Specimens collected at the weekend are unsuitable for malignant cell analysis.

Please note: The Cytology department is not staffed after 5pm or at weekends.

Instructions for the storage, handling and transport of Cytospin © collection fluid

Cytospin © collection fluid is a mildly alcoholic liquid which may:

- Cause irritation to the eyes, skin and respiratory tract
- Nausea, vomiting and stomach pain if ingested, unconsciousness in severe cases
- Cause dermatitis on repeated skin exposure

Cytospin collection fluid should be stored in a cool dry well-ventilated area and is stable at normal temperatures. Keep container lids tightly closed. Avoid high temperatures, sources of ignition and direct sunlight.

Wear gloves when handling Cytospin © collection fluid. If ingested do not induce vomiting and give plenty of water to drink. Beware of aspiration if vomiting occurs. Obtain medical attention.

In the event of a spillage:
Ventilate area to dispel residual vapour and eliminate all sources of ignition
Absorb on an inert absorbent, transfer to a plastic container, spill is classed as special waste
Samples should be submitted to the laboratory in individual plastic bags along with their matching request forms.

Cytology - Out of Hours
Guidance for submitting a Serous fluid to Cytology (Out of Hours)

Serous fluid samples including peritoneal washings (ascitic, pleural, peritoneal pericardial and peritoneal washings)

- Ideally 25-50mls fluid should be sent in a clean, dry, labelled container with screw cap (Note: no formalin or alcohol should be added to the sample as both of these can cause interference with adherence to slide and quality of staining)
- The fluid should be submitted as soon as possible to minimise cell deterioration, so that cell preservation is not compromised
- If there is a delay in delivering the sample to the laboratory between 8:30 and 4:30pm, the sample should be brought directly to the Pathology reception and the reception staff notified that the sample needs to be kept refrigerated at 4^0C.

Seminal Fluid Analysis

This analysis is no longer carried out by the Cytology laboratory. Contact the Fertility Clinic for an appointment on Tel 01244 366401

GYNAECOLOGICAL CYTOLOGY

Cervical cytology

Cervical cytology screening for Cheshire, Wirral and Merseyside has been reconfigured in order to comply with new national guidelines over laboratory workload and the 14 day turn round time targets.

LBC samples will continue to be picked up from Western Cheshire GP practices and CASH clinics and are sent to the Manchester Royal Infirmary Cytology Centre (MRICC)
All kits are supplied by MRICC

MRICC offers HPV primary Screening - all samples are tested for High-risk HPV infection. Only those preparations that are Hr-HPV positive then go on to have cytology performed. Management rules associated with test of cure continue to exist, but everything is now governed by the woman's HPV status.

GMC / NMC codes are an absolute requirement for the NHSCSP acceptance policy and for sample taker database.

From 1st January 2011 all English laboratories will follow the NHSCSP guidelines relating to the achievement of the 14 day TRT target.

Contact numbers for cervical cytology services.

All enquiries: MRICC 0161 276 5111

Colposcopy enquiries: Countess of Chester Hospital Colposcopy department: 01244 366268

For Instructions for taking cervical / vaginal samples please refer to the MRICC website;

https://mft.nhs.uk/the-trust/other-departments/laboratory-medicine/cytology/gynaecological-cytology/

Instructions for the storage, handling and transport of LBC vials

LBC vials and Cervex brushes should be stored at room temperature on open shelves. We do not recommend sample takers hold vast quantities of stock and it should be rotated to ensure it does not exceed the use by date.
Wear gloves when handling LBC vials. If ingested do not induce vomiting and give plenty of water to drink. Beware of aspiration if vomiting occurs. Obtain medical attention.

In the event of a spillage:
Ventilate area to dispel residual vapour and eliminate all sources of ignition. Absorb liquid using an inert absorbent material and transfer to a plastic container. A spillage such as this is classed as special waste.
Specimen vials should be submitted to the laboratory in individual orange plastic bags (supplied by Manchester) or brown transport envelopes along with their matching request forms.

MORTUARY SERVICES:

Mortuary Contact Numbers:

Mr R Mealing	Mortuary Manager	*01244* 365360	Bleep 2738
Ms JL Rushin	Senior APT	*01244* 365360	Bleep 2738
Mr J Cunningham	APT	*01244* 365360	Bleep 2738
Locum Consultant Histopathologist	Dr Mark Lord	*01244 365360*	
Locum Consultant Histopathologist	Dr Seth Horsu	*01244 365360*	

Deaths to be Reported to HM Coroner

The Coroner's Officers should be informed of deaths in the following circumstances: (They may be contacted via Ext.5110 on the Patient Services Office)

- The cause of death is unknown or uncertain;
- The death has occurred within 24 hours of admission. Following discussion, the Coroner's Officer will advise whether or not a death certificate may be issued;
- The death was violent or unnatural, or there are suspicious circumstances;
- The death may be due to an accident (whenever it occurred);
- The death may be due to self-neglect or neglect by others;
- The death may be due to an industrial disease or may be related to the deceased's employment;
- The death occurred during or soon after an operation/procedure or before recovery from the effects of anaesthesia or if recent surgery may have contributed to death. This will not necessarily mean that there will be a post-mortem.
- The death may be a suicide;
- The death occurred during or shortly after detention in police or prison custody; the deceased was sectioned or DOL.
- The death may be due to an abortion or pregnancy.
- If the family are unhappy about any aspect of management.
- The death was drug-related;

- The death occurred within 30 days of chemotherapy or radiotherapy or when treatment may have contributed to death

Once a death has been reported to the Coroner's Officer, the doctor should not complete a death certificate unless subsequently instructed to do so by the Coroner's Officer.
If you are in any doubt as to whether a death should be reported, contact one of the Consultant Histopathologists.
If the Coroner's Officer indicates that a Coroner's post-mortem examination is to be performed, a post-mortem request form should be completed giving relevant clinical details.

Hospital Autopsies

In cases where a Coroner's post-mortem is not performed, consideration should be given to requesting a hospital post-mortem. Written consent for such an autopsy is required from a close relative of the deceased, and the appropriate form is available in the Patient Services Office. Three copies of the consent form should be signed, one given to the relatives, one kept in the notes and one sent with the notes and the post-mortem request form to the histopathology secretaries. Information leaflets for families regarding the post-mortem examination and what it entails are available at the Patient Services office. A post-mortem request form should be completed, giving a brief clinical summary and points of special interest. This will then be sent with the case-notes to the Pathology Department prior to commencement of the autopsy.

A hospital autopsy should be requested to:

- Verify the cause of death based on a clinical diagnosis and/or to determine the extent of known or assumed lesions in **problematic cases**;
- Investigate cases that are important for training, education and research;
- Monitor the effects of therapy, especially newly introduced drugs, and the reliability of new diagnostic procedures;

Medical staff should note that a doctor who has been in attendance during the last illness of a patient has a statutory duty to issue a death certificate. If the cause of death is unknown or uncertain, the case should be reported to the Coroner. Relatives **must not** be pressurised with the possibility of a Coroner's investigation in order to secure permission for a hospital autopsy.
A death certificate **must** be issued before a hospital autopsy is requested.

Such cases may be discussed with a Consultant Histopathologist.

"High Risk" cases

High-risk cases are those infected, or potentially infected, with a hazard Group 3 pathogen. These include Hepatitis B, Hepatitis C, tuberculosis, patients who are HIV positive and intravenous drug addicts. Post-mortem examinations will only be performed on such high-risk cases when a special need has been agreed with one of the Consultant Histopathologists.
All high-risk bodies must be placed in a body bag and labelled "DANGER OF INFECTION" in accordance with the appropriate hospital policy.

FEEDBACK ON OUR PATHOLOGY SERVICES AND THE COMPLAINTS PROCEDURE

For any problems with access to handbook links or queries regarding content, please contact the Pathology Quality Manager, Abigail Armstrong, on 01244 365519 or email abigail.armstrong@nhs.net

The Countess of Chester Hospital NHS Foundation Trust welcomes feedback, both positive and negative, from its patients, staff and visitors. Visit Trust website to see how to contact us or to take part in our user surveys.

The Pathology department also surveys its clinical users in primary and secondary care on a regular basis. Our most recent survey was distributed in January 2022 and the results are available from the Pathology Quality Manager (abigail.armstrong@nhs.net) or via the following links GP user survey 2022 Hospital user survey 2022

We welcome feedback from our users over the services we provide. Any queries, comments or complaints can be sent to the Quality Manager abigail.armstrong@nhs.net or directly to the clinical or technical head of the service concerned. Contact details for all key personnel are given in the relevant sub-sections of this handbook.