Location of Document
Electronic copy in Q-Pulse, Trust Intranet and GP Intranet

Note: Prior to version 10.1 Q-Pulse tree location was LAB/ADMIN/022

CHANGES IN THIS VERSION

11.2 (Changes from 11.0) – Dr Giles Aldworth / Philip Logue / Telephone limits SWAH A&E / Lp(a / Phenobarbitone TAT / 24h Urine Urate Thymol / TPO green top / VIP not available / Thiamine EDTA / Methylmalonic acid / PTHrp not currently available / Pregnancy reference interval guide / Lipaemic index and FT3 reflex / Minimum resting intervals / Prolactin / Birmingham / Galactose-1-phosphate / Guildford / BJP and Afinion not UKAS accredited / Total protein no longer in EP / Ammonia no longer required on ice / Osmo / Order of draw

Changes in blue

This document represents the Clinical Biochemistry Laboratory User Manual of the Western Health & Social Care Trust Laboratory. All procedures contained herein are mandatory.

WHSCT CLINICAL BIOCHEMISTRY

Laboratory Users' Manual
Version 11.2

NOTE THIS VERSION REFLECTS THE SWITCH TO LiHEP GREEN TOP GEL AS THE SAMPLE BOTTLE OF CHOICE FOR MOST ROUTINE CLINICAL BIOCHEMISTRY TESTS. THIS SWITCH HAS BEEN MANDATED BY THE NI PATHOLOGY NETWORK SPECIALITY FORUM FOR CLINICAL BIOCHEMISTRY AND BRINGS THE WHSCT IN LINE WITH THE REST OF THE REGION

A UKAS accredited medical laboratory No. 9684

The Schedule of Accreditation (i.e. list of accredited tests) can be found on the UKAS website: https://www.ukas.com/search-accredited-organisations/

UKAS GEN6 STATEMENT

The Laboratory utilises WinPath Enterprise (provided by CliniSys) as our Laboratory Information Management System (LIMS). As this is a regional system, covering the whole of Northern Ireland, we are currently unable to fully meet the requirements of the UKAS publication GEN 6 – Reference to accreditation and multilateral recognition signatory status.

The UKAS publication GEN 6 sets out the requirements of reports/results released by the Laboratory containing the appropriate use of UKAS logos and identifying any tests that are accredited and those that are not. Although the LIMS currently being utilised by our Laboratory could allow us to present the UKAS logo within our reports, we could not remove it from reports where we have non-accredited tests. Also, whilst it is possible to enter a small amount of additional text without any difference in formatting at the end of each report, the referencing to the accreditation of tests could potentially interfere or cause the misinterpretation of pathology results (particularly tests that already have statements at the end of the reports explaining reference ranges, clinical advice, etc.). If the text were to be added in regards to accreditation status of each test, this would also have to be site specific or would have to state the accreditation status of all Laboratories within the region.

The Laboratory, along with our regional colleagues, have risk assessed this matter. Although we are not able to present this information on our reports the Laboratory's user manual presents full details of our accreditation, including a link to the UKAS page for our up-to-date schedule of accreditation, and details any tests that are currently out of scope.

Additionally, if a user presents a request to the Laboratory for analysis the user is entering into an agreement for testing and as such are agreeing to the fact that any reports associated with this testing cannot be regarded as having been issued under its accreditation, and therefore it is not covered by the multilateral agreements (i.e. EA MLA, ILAC MRA and IAF MLA) that UKAS is a signatory of.
[Note: Versions of this document prior to version 10.1 are under Q-Pulse LAB/ADMIN/022]

Contents

CLINICAL BIOCHEMISTRY LABORATORY

Introduction

Each request submitted and accepted by the Clinical Biochemistry laboratory for examination is considered a Service Level Agreement. The Laboratory will endeavor to provide a suitable medical laboratory service for each request to ensure appropriate examination and result interpretation in line with BS EN ISO 15189:2022 Medical laboratories – Requirements for quality and competence.

Location

The WHSCT Clinical Biochemistry Laboratory is located on two sites – The South West Acute Hospital (SWAH) in Enniskillen and the Altnagelvin Hospital in Londonderry. Both laboratory sites include a 24h emergency service. The Clinical Biochemistry Laboratory in Altnagelvin is located on Floor G0 of the Laboratory & Pharmacy Services Centre. The Clinical Biochemistry Laboratory in the SWAH address is:
is located in the Laboratory section on Floor -1 near the A&E department.

The Clinical Biochemistry Laboratory in Altnagelvin address is:
Department of Clinical Biochemistry
Western Health Social Care Trust
The Laboratory Building
Altnagelvin Area Hospital site
Glenshane Road
Londonderry
BT47 6SB

The Clinical Biochemistry Laboratory in SWAH address is:
Department of Clinical Biochemistry Laboratory
South West Acute Hospital
Irvinestown Road
Enniskillen
BT74 4RT

Laboratory Hours

Altnagelvin Laboratory Hours

(a)	Monday to Friday	9.00am - 5.15pm
(b)	Saturday	9.00am - 12.00noon
(c)	All other times (including Bank Holidays) a 24h emergency service is available.	

SWAH Laboratory Hours

(a)	Monday to Friday	08.55am - 5.00pm
(b)	Saturday	9.00am - 12.00noon
(c)	All other times (including Bank Holidays) a 24h emergency service is available.	

Clinical Services

For advice on test selection / interpretation contact the Consultant Staff.

Laboratory Contact Details

Telephone Numbers

Altnagelvin Hospital	02871 345171	
SWAH Hospital	02866 382000	
Laboratory Reception/Results/Enquiries	Altnagelvin	Ext 213796 / 7 / 8
	SWAH	Ext 252301 / 252284
Clinical Biochemistry Laboratory	Altnagelvin	Ext 213961
	SWAH	Ext 252275
Clinical Biochemistry Secretary	Altnagelvin	Ext 213804
Dr Mark Lynch **Consultant Clinical Scientist [Deputy Head of Dept]**	Altnagelvin	Ext 213806
Philip Logue [Lead BMS]	Altnagelvin	Ext 213808
	SWAH	Ext 252282
Laboratory Fax Number	Altnagelvin	02871 611186
	SWAH	02866382660

The Clinical Biochemistry Laboratory welcomes feedback from health care professionals and patients on ways to improve the service. Please contact any member of the laboratory team.

Arranging clinically urgent samples

Emergencies from within Hospital site:

During normal working hours:
The laboratory **must** be telephoned about **all** emergency requests during the day.
The request form should be labeled "**Urgent**" to allow the specimen to be identified by laboratory staff.
Outside normal working hours:
On Call staff must be telephoned or bleeped to arrange all emergency work before the specimen is sent.

Emergencies from GPs and other non-hospital site requestors:

During normal working hours:
GP/requestor **must** contact Clinical Biochemistry Laboratory, by telephone, to inform us that an urgent sample, requiring the results to be telephoned back, is being sent. Details of transport and approximate time of delivery to lab **must** be given.
The specimen and request form **must** be sent in an envelope to distinguish it from other routine requests. The envelope **must** be clearly marked URGENT BIOCHEMISTRY.
The accompanying request form **must** have the name and telephone number of the person to be contacted with the results.

If sample is to be received in late afternoon details of who to contact if Health Centre closed when results are available should also be given.

Request Forms/Specimen Information and Minimum Acceptance Criteria

All request forms (when applicable) and samples must be clearly identified with a set of mandatory matching identifiers. Where possible printed labels should be used on both form and sample.

Note: From 31st August 2023 the Clinical Biochemistry strictly enforces the NI Pathology Network Minimum Acceptance Criteria (MAC) Policy for the information provided on Request form and Sample bottles for all sample requests.

Table 1 NI Pathology Network Minimum Acceptance Criteria

Mandatory Laboratory Request Minimum Acceptance Criteria [MAC2]

A. MANDATORY LABORATORY REQUEST FORM INFORMATION						
Request Form	**Blood Transfusion**	**Blood Science: Haematology and Clinical Biochemistry**			**Microbiology**	**Cellular Pathology: Cytology and Histology**
H & C Number [1]	YES	YES	YES	YES	YES	YES
Patient Official First Name **AND** Surname	YES	YES	YES	YES	YES	YES
Sex	YES	YES	YES	YES	YES	YES
Date of Birth (DD/MM/YYYY)	YES	YES	YES	YES	YES	YES
Date and Time of Sample Collection	YES	YES	YES	YES	YES	YES
Full name of requesting Consultant **OR** Authorised Health Care Professional **AND** their HCP code[2]	YES	YES	YES	YES	YES	YES
WHSCT Consultant Code **OR** GP Cypher Code.	YES	YES	YES	YES	YES	YES
Hospital source **OR** location code **OR** GP practice code	YES	YES	YES	YES	YES	YES
Investigation (s) (test (s) Required	YES	YES	YES	YES	YES	YES
Name and Signature of staff member taking the sample	YES	NO	NO	NO	NO	YES
Anatomical Site and Specimen type	NO	NO	NO	NO	YES	YES

B. MANDATORY SAMPLE LABEL INFORMATION						
Sample Label	**Blood Transfusion[3]**	**Blood Science: Haematology and Clinical Biochemistry**			**Microbiology**	**Cellular Pathology: Cytology and Histology**
H & C Number [1]	YES	YES	YES	YES	YES	YES
Patient Official First Name **AND** Surname	YES	YES	YES	YES	YES	YES
Date of Birth (DD/MM/YYYY)	YES	YES	YES	YES	YES	YES
Date and Time of Sample Collection	YES	NO	NO	NO	NO	NO
Name and Signature of staff member taking the sample	YES	NO	NO	NO	NO	NO

[1]A Health & Care [H&C] number MUST be used unless the patient is not registered with a GP in NI OR is registered but does not yet have their H&C OR in an emergency situation in which case use the local hospital emergency numbering system AND clearly state "NO H&C available" on the Laboratory Request form.
[2] Health Care Provider [HCP] Code is now mandatory for ALL Lab Samples. To request a HCP please visit https://regional.sharepoint.hscni.net/sites/CCIS/SitePages/NIHCPCodeRequest.aspx
[3]Note: ALL details on the Blood Transfusion Specimen Bottle MUST be handwritten

The date and time of collection of samples spun at source will also be recorded as the laboratory receipt time – this will prevent samples being reported as too old - please contact laboratory for further information.

HCP Code exception explanation
WHSCT Clinical Biochemistry are **now** enforcing the need for HCP Codes as they are required for the new WinPath LIMS.

Specimen rejection criteria

The Clinical Biochemistry Laboratory continues to receive significant numbers of requests/samples that are unsuitable for processing/analysis and are thus rejected. These are designated *Problem Samples* and are reported accordingly. In addition to requests that fail the MAC2 criteria above, the following requests/samples will be rejected by the Laboratory and a *Problem Report* will be issued:

- Illegible Requests
- Request form and sample mismatches
- Samples collected into an incorrect sample bottle type
- Samples too old for analysis
- Samples not collected or transported under appropriate conditions
- Urine samples not received in urine Monovette tubes
- Samples with insufficient volume
- Requests with an insufficient number of sample bottles

Specimens from Infectious Patients

All specimens from known or potential carriers of Category III pathogens, e.g. HIV, Hepatitis B, **MUST** be clearly marked with hazard labels on both the request form and specimen tubes.

Only one "Hazard" specimen should be sent per plastic bag.
Such samples MUST NOT BE SENT VIA VTS CHUTE

Specimen Tubes /Containers

It is essential that the specimen is collected into the correct container to ensure accurate results. The following tubes are used:

Blood

Heparin Gel Tubes — Plastic tubes with **Green tops** containing a gel separator containing heparin for plasma samples.

Gel Tubes: — Plastic tubes with **Yellow tops** containing a gel separator for clotted specimens also known as SST (serum separator tubes).

Glucose Tubes: — Plastic tubes with **Grey tops** containing Sodium Fluoride and Potassium oxalate.

Clotted Tubes: — Plastic tubes with **Red tops** for clotted samples.

Heparinised Syringes: — Plastic Syringes coated with heparin
(*Needle must NOT be left on syringe*)

EDTA Tubes: — Plastic tubes with **Purple tops** containing potassium EDTA.

Paediatric samples: — **Small Heparinised** tubes (**Green top**) available via Supplies.
When filled tube should be inserted securely into a 4mL Heparin Vacuette plastic tube and the identification label attached to this
Small Glucose tubes (**grey top**) available from Lab Reception
Small Serum tubes (**red top**) available from Lab Reception.

Note: As per manufacturer's recommendations --Immediately following blood collection all green, yellow, red, purple and grey topped tubes MUST be gently inverted *(Turn the filled tube upside-down and return to upright position)* EIGHT times before sending to Lab. Such inversion assures a proper mix of additive and blood.
In addition:

a) Do not remove lids from Tubes – see below.
b) Do not shake the tubes. Vigorous mixing may cause foaming or haemolysis.
c) In tubes with anticoagulants (green, purple and grey tops), inadequate mixing may result in platelet clumping, clotting and/or incorrect test results.
d) Insufficient mixing or delayed mixing in serum tubes (red and yellow tops) may result in delayed clotting.

Always use the correct order of draw and mix samples carefully:

1. Blood Culture
2. Coagulation (blue top)
3. Serum (red / yellow top)
4. Heparin (green top)
5. EDTA (purple top)
6. Glucose (grey top)

Tube guide and order of draw

Western Health
Social Care - VACUE

SEE WHSCT Venous Blood Collection SOP on Trust Intranet.

VACUETTE® SELECTION CHART

Western Health and Social Care Trust

Version 2.1. Last updated 12.11.2025

Samples to be collected in the following ORDER OF DRAW as required:

	PPC code	GBO code	Draw Vol.	Cap Colour	Tube Type	Tests [BIOCHEMISTRY tests marked with * are run in WHSCT]	
1	KBC000151 +A2: A10 C000151 +A2: A10	454334	3 mL	Blue	Sodium Citrate	**HAEMATOLOGY TESTS:** Coagulation Screen, INR, D-Dimer/ XDP, Thrombophilia Screen, Lupus Anticoagulant, Factor assays.	Invert 4 - 5 times
2	KBC000139	454204	4 mL	Red	Serum	**HAEMATOLOGY TESTS:** Cold Agglutinin. **BIOCHEMISTRY TESTS:** Androstenedione, 17-Hydroxyprogesterone.	Invert 8 - 10 times
3	KBC000141	454228	3.5 mL	Yellow	Serum Gel	**HAEMATOLOGY TESTS:** Paul-Bunnell. **BIOCHEMISTRY TESTS:** **Proteins:** Serum Protein Electrophoresis* (SPE) [inc. Alb & TP], Immunoglobulins* (IgG, IgA, IgM), Serum free light chains* (FLC), Oligoclonal bands (with paired CSF), IgG subclasses (inc IgG4), ALP Isoenzymes, CK Isoenzymes, Alpha-1-Antitrypsin (AAT), Beta-2-Microglobulin (B2M), Ceruloplasmin, C3*, C4*, Haptoglobin*, Rheumatoid factor* (RF). **Vitamins:** Vit D (Total), Vit A, Vit E (protect from light). **General Biochemistry:** Lithium*, COVID Antibodies. **Bone Markers:** Crosslaps (CTX), Ostase, Total P1NP. **Specialist Endocrine:** Anti-Mullerian Hormone (AMH), Thyroglobulin & Thyroglobulin Antibody, P3NP. **MICROBIOLOGY TESTS:** ASOT, Bloods for Virus Reference Lab, Antibody Screen for Reference Lab.	Invert 8 - 10 times
4	KBC000219	454247	3 mL	Green	Li Hep Gel	**BIOCHEMISTRY TESTS: General Biochemistry Profiles:** **ELEC***: Na, K, Cl, Bicarbonate (CO2), Urea, Creatinine (eGFR), Total Protein. **LFT***: TBil, ALP, Alb, AST, ALT, GGT. **BONE***: Ca, Adjusted Ca, PO4, Alb, ALP. **LIPID***: Total Cholesterol, HDL, Triglycerides (LDL, TChol/HDL ratio, non-HDL Chol). **IRON***: Iron, Ferritin, Transferrin (Transferrin sat%). **THYROID***: TSH, FT4, (+ FT3 when required) **B12 & FOLATE***: Vit B12, Folate. **Other:** ACE, Amylase*, CK*, Beta-hCG*, DBIL*, CRP*, Ethanol*, LDH*, Lipase, Magnesium*, Paracetamol*, Pro-BNP*, Salicylate*, Troponin-T*, Urate*, Osmolality*. **TDM:** Carbamazepine*, Digoxin*, Phenobarbitone, Phenytoin*, Theophylline*, Valproate*. [NOTE: use yellow Top for Lithium] **Antibiotics:** Amikacin, Gentamicin*, Tobramycin, Vancomycin*, Teicoplanin. **Tumour Markers:** AFP, CA19-9, CA-125, CEA, PSA* **Endocrine:** Anti-TPO, Cortisol*, DHEAS, FSH, LH, Oestradiol, Progesterone, Prolactin, SHBG, Testosterone, Calcitonin [On ice & received in lab within 4h], Growth Hormone (GH), IGF-1, Insulin [inc. Hypopak], C-peptide [Received in lab within 4h]. **Misc:** CarboxyHb* and MetHb*, Vit C (On ice & protect from light), Bile Acids (Analysed at UH Lab, SEHSCT), Amino Acids, Hydroxybutyrate*.	Invert 8 - 10 times
5	KBC000149	454021	4 mL	Lavender	K3 EDTA	**HAEMATOLOGY TESTS:** Full Blood Count, Retics, ESR, Maternal sample for Kleihauers. **BIOCHEMISTRY TESTS:** Ammonia*, HbA1c*, Homocysteine (on ice), Porphyrins (Protect from light). **Specialist Endocrine:** ACTH [On ice & must be received in lab within 30min], Aldosterone, Renin [Must be received in lab within 3h], PTH* [Must be received in lab within 12h]. **Immunosuppressants:** Cyclosporine, Everolimus, Sirolimus, Tacrolimus. **Peptides:** Gut Hormones (CgA, Neurokinin A, Gastrin, Glucagon, Pancreatic Polypeptide, Vasoactive Intestinal Peptide, Somatostatin) [4x4 mL bottles needed for full profile. On ice and received in lab within 2h] **MICROBIOLOGY TESTS:** Meningococcal PCR Bloods and PCR bloods for reference labs. [For Paediatric PCR bloods smaller volume pink top EDTA tubes are acceptable]	Invert 8 - 10 times
6	KBC000152	458088	8 mL	Pink	Cross-match	**HAEMATOLOGY TESTS:** Group and Screen, Crossmatch, Direct Coombs, Cord sample for Kleihauers.	Invert 8 - 10 times
7	KBC000147	454221	2 mL	Grey	Na Fluoride EDTA	**BIOCHEMISTRY TESTS:** Glucose*, Lactate*, Hydroxybutyrate*. **Specialist Toxicology:** Methanol, Ethylene Glycol.	Invert 8 - 10 times
8	KBC000154	458080	8 mL	Dark Blue	Trace Elements	**BIOCHEMISTRY TESTS:** Tubes available from Biochemistry Lab. Note: A Separate sample is required for Plasma Metals and Blood Metals. **Plasma Metals:** Aluminium, Copper, Selenium, Zinc. **Blood Metals:** Lead, Manganese, Chromium, Cobalt, Mercury, Cadmium, Arsenic.	Invert 8 - 10 times

VAWH01 Greiner Bio-One Ltd. Tel: 01453 825255. info.uk@gbo.com

EDTA Contamination of Samples

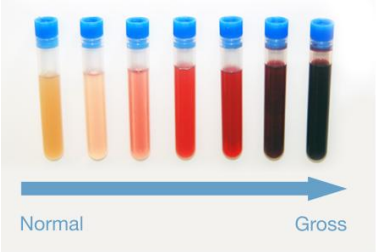
The Clinical Biochemistry Laboratory continues to receive a significant number of samples contaminated with EDTA (purple top tubes contain EDTA) [>300 per year].
Gross in vitro contamination with EDTA is relatively easy to spot as it causes extremely low Calcium, Magnesium and ALP results along with very high potassium levels. However more subtle contamination may be less obvious and could produce credible but misleading results.
EDTA contamination of serum samples may occur by two main mechanisms:

a) Gross contamination typically occurs following the direct transfer of blood collected into an EDTA tube (purple top) to a plasma green top or serum yellow top tube.
b) Less obvious contamination may occur following droplet transfer of small amounts EDTA or EDTA containing blood during blood collection.

Thus: a) Blood should never be transferred from one tube to another.
b) When taking multiple blood samples, any yellow tops or green tops must be collected before any purple top samples – see correct order of draw above).

Haemolysis

Haemolysis is the breakage of the red blood cell's membrane, causing the release of haemoglobin and other internal components into the surrounding serum/plasma.
Test results from all laboratory disciplines can be affected by haemolysis but especially biochemistry. Haemolysis may cause certain analytes to be increased due to leakage of red cell constituents (e.g. LDH and potassium), or may cause spectral interference in the test method (e.g. Direct Bilirubin) or may interfere directly with some of the chemical reactions involved during analysis. The amount of interference will depend on the degree of haemolysis. This is measured automatically on all Clinical Biochemistry samples and may also be seen visually as a red discolouration of plasma/serum upon centrifugation – as illustrated below.



Depending on the degree of haemolysis some (or in extreme cases all) test results will not be reported – i.e. test results will be dashed out

Increased rates of in vitro haemolysis may be caused by poor venepuncture technique:

1) Venepuncture from sites other than antecubital region of arm.
2) Prolonged tourniquet time (>1min)
3) Fist pumping during venepuncture
4) Cleansing the venepuncture site with alcohol and not allowing site to dry
5) Sluggish blood flow during venepuncture
6) Inappropriate use of small-bore or large bore needles
7) Use of wing sets (especially those designed for IV infusion)
8) Syringe draws **(Not recommended)**
9) Transferring into a tube by pushing down on the syringe plunger
10) Vigorous mixing or shaking of a specimen (Samples should mixed gently)
11) Under filled tubes
12) Delay in transfer of sample to the laboratory
13) Exposure to excessive heat or cold

Urine

Urine – Monovette® (Sarstedt) 3.2mL lemon top tube for urine sample for Albumin Creatinine Ratio. Available as stock item NSV code KBC000241 or Lab Reception. Also suitable for other urine and fluid specimens.

Universal Containers: CSF specimens – do not send urine or fluid samples in universal containers.
[Note: CSF samples for CSF Spectroscopy/Xanthochromia should be shielded from light]

24h Urine Containers: For some tests, urine containers with specific preservatives must be obtained from the laboratory.

Faeces

Faecal Occult Blood Seracult Plus FOB Cards have been replaced by QFIT testing as per CC/MEMO/2021/06/29 – all samples now sent to Causeway Laboratory

QFIT Introduction.doc

Some tests have specific collection and transport requirements which are described under the individual test name. If in doubt, please contact the laboratory before any sample is taken. Specimen tubes/containers for the Altnagelvin Site are available from Regional Supplies Service at Campsie, unless stated above. Specimen tubes/containers for the SWAH Site are available from the laboratory unless stated above.

Transport

Transport of samples to Clinical Biochemistry

Altnagelvin Hospital based samples:
VTS Chute system:
Samples should be sent to the Clinical Biochemistry Laboratory Chute Station – number 880.
Please note the following exceptions:

a) Blood Gas (pO_2 results are affected) [There are no blood gas analysers in Labs – use POCT]
b) CSF (Resultant haemolysis may interfere with CSF spectroscopy and also CSF samples are not readily repeatable – see below).
c) The VTS system is not 100% reliable. Occasionally pods sent via the VTS may be subject to delay, sent to an incorrect station or be diverted to an incorrect station so samples that are extremely urgent (e.g. Resus) not readily repeatable (e.g. CSF or samples taken following suppression or stimulation tests) or relatively unstable should not be sent via VTS

Hospital Porters:
Samples (including those unsuitable for VTS transport) may be sent to the Clinical Biochemistry Laboratory via Porters or other Hospital Staff. Sample should be left in Laboratory Specimen Reception Area.

GP Samples: Samples are transported to Laboratory via the normal Laboratory Transport Vans, Taxi or delivered in person as appropriate.

Urgent Samples: Laboratory staff should be informed either before samples are sent or samples should be handed directly to laboratory staff - See **Emergencies** above.

SWAH Hospital based samples:
VTS Chute system:
Pods with Red Bands are automatically sent to the Laboratory Reception docking station.
Pods with Black Bands need to be programmed to "Laboratory Reception"
Please note the following exceptions:

a) Blood Gas (pO_2 results are affected)) [There are no blood gas analysers in Labs – use POCT]
b) CSF (Resultant haemolysis may interfere with CSF spectroscopy and also CSF samples are not readily repeatable – see below).
c) The VTS system is not 100% reliable – see above.

Hospital Porters:
Samples (including those unsuitable for VTS transport) may be sent to the Clinical Biochemistry Laboratory via Porters or other Hospital Staff. Samples should be left in Laboratory Specimen Hatch – adjacent to the Blood Bank – please ring buzzer as appropriate.

GP / TCH Samples:
Samples are transported to Laboratory via the normal Laboratory Transport Vans, Taxi or delivered in person as appropriate.

Urgent Samples:
Laboratory staff should be informed before samples are sent or samples should be handed directly to laboratory staff - See **Emergencies** above.

Note: Samples should be transported at RT unless as otherwise indicated.

Transport of samples on ice to Clinical Biochemistry

Please keep the paper REQUEST FORM separate from the ice as these tend to get wet when the ice melts to water and leaks out!

The ice and sample should be separated from the paper REQUEST FORM and be fully sealed in a watertight container to prevent leakage.

Samples requiring transport on ice may be sent via the VTS but the ice and sample **MUST** be contained in special ward dedicated Green Plastic Screw-Topped Ice Transport containers.
Please do not place the Paper REQUEST FORM inside these containers

Table 2 Samples requiring transport on ice

Analyte	Sample	Tube Type	Maximum Stability on ice*
ACTH	Blood	**Purple Top**	15 min
Calcitonin	Blood	**Green Top**	240 min [120 min if not on ice]
Catecholamines**	Blood	**Green Top**	15 min
Glucagon	Blood	**Purple Top**	120 min
Homocysteine	Blood	**Purple Top**	30 min
Vitamin C***	Blood	**Green Top**	60 min
Peptides (Gastrin)	Blood	**Purple Top**	120 min
~~PTH Related Peptide (PTHrp)~~ Not currently available	Blood	**Special Bottle – contact Laboratory**	15 min

Note: Ammonia no longer required to be sent on ice – see below

*From time of venepuncture. Samples must arrive in Biochemistry within this time period or the sample will be rejected as unsuitable.

** Only as part of Clonidine suppression test

***Shield from light

Note: There are other analytes that also require transport on ice but these are only very rarely required – contact lab for advice.

Clinical Biochemistry available tests

Profile Tests

One or more of the following profile test groups may be requested using a single 3mL Green Top gel blood tube specimen [LiHep gel tube].

Table 3 Profiles

Profile	Test
Electrolyte Profile:	Na, K, Cl, Urea, Creatinine, Total CO_2, eGFR (CKD-EPI).
Liver Profile:	Total Bilirubin, ALP, GGT, AST, ALT, Albumin.
Muscle Enzymes:	Total CK, AST.
Bone Profile:	Ca, Adjusted Calcium*, Albumin, ALP, Phosphate.
Cardiac Profile:	Troponin T
Lipid Profile:	Total Cholesterol, Triglycerides, HDL, HDL/Total Chol ratio, calculated LDL.
Iron Profile:	Plasma Iron, Ferritin, Transferrin, calculated % Transferrin Saturation.
Thyroid Profile	Free T4, TSH, Free T3 (If TSH is < 0.1)
B12 and Folate	B12 and Folate

Routine blood glucose must be sent in a Sodium Fluoride blood tube (Grey Top) with a separate form.
* Adjusted Calcium = In-house equation – contact Laboratory for details.

Any combination of the following routine Clinical Biochemistry tests may be requested using one request form and ONE 3mL specimen (Green Top)
Tests that do not have a tick box should be clearly written in the Additional Tests area of the request form.

Table 4 Blood tests that maybe combined
Using one request form and using one specimen bottle

Test	Container	Comments
Alcohol (Ethanol)	**3mL Green Top**	Do not use alcohol wipes.
Amylase - plasma	**3mL Green Top**	
Bone Profile	**3mL Green Top**	ALP reference interval is age and sex related.
B12 and Folate	**3mL Green Top**	
CRP	**3mL Green Top**	
Calcium	**3mL Green Top**	
Carbamazepine/Tegretol	**3mL Green Top**	Separate form and sample required for SWAH
Cardiac Troponin	**3mL Green Top**	
Direct/Conjugated Bilirubin	**3mL Green Top**	
Digoxin	**3mL Green Top**	Specimen taken at least 6-8h after last oral dose.
Electrolyte Profile	**3mL Green Top**	
Hydroxybutyrate	**3mL Green Top**	Ketones
Iron Profile	**3mL Green Top**	Fasting sample preferred
LDH	**3mL Green Top**	
Lipid Profile	**3mL Green Top**	Specimen does not need collected fasting
Liver Profile	**3mL Green Top**	
Magnesium	**3mL Green Top**	
Muscle Enzymes	**3mL Green Top**	Total CK
Osmolality	**3mL Green Top**	
Paracetamol	**3mL Green Top**	
Phenytoin	**3mL Green Top**	
PSA	**3mL Green Top**	Minimum retesting interval 13 days
Salicylate	**3mL Green Top**	
Theophylline	**3mL Green Top**	
Thyroid Profile	**3mL Green Top**	
Urate	**3mL Green Top**	
Valproic Acid/Epilim	**3mL Green Top**	

Table 5 Yellow Top Tests run in WHSCT

Tests run in WHSCT that must be taken into Yellow Top – otherwise they will be rejected		
Lithium	**4mL Yellow Top**	Green tops contain Li and are unsuitable
Haptoglobin	**4mL Yellow Top**	
Rheumatoid Factor	**4mL Yellow Top**	
C3, C4	**4mL Yellow Top**	
Total protein	**4mL Yellow Top**	Total protein no longer part of electrolyte profile
Immunoglobulins G, A, M	**4mL Yellow Top**	
Free Light chains	**4mL Yellow Top**	
Serum Protein Electrophoresis SPE	**4mL Yellow Top**	
Tests run in BHSCT that must be taken into Yellow Top – otherwise they will be rejected		
Vitamin D	**4mL Yellow Top**	
Vitamin A and E	**4mL Yellow Top**	Shield from light
Bone markers	**4mL Yellow Top**	
Ceruloplasmin	**4mL Yellow Top**	
Regional Immunology Tests	**4mL Yellow Top**	Most immunology Antibody tests – see Regional Immunology Lab User Manual

Not all tests listed – see alphabetical list below for full details

Separate form(s) and specimen(s) MUST be sent for each of the following tests.
These must not be requested with the routine tests outlined above.

Table 6 Tests that require separate form and specimen bottle

Test	Sample	Container	Comments
Glucose - plasma	Blood	**2mL Grey Top**	Glucose is only stable in grey top sample.
Glucose Tolerance Test	Blood	**2 x 2mL Grey Top**	Both T=0 and T=120 min labeled samples should be sent together with ONE form.
HbA_{1c}	Blood	**4mL Purple Top**	Glycated Haemoglobin
Albumin Creatinine Ratio - ACR	Urine	**3.2mL Lemon Topped urine Monovette Tube**	Repeat early morning samples on 3 occasions.
Complement - C3, C4	Blood	**4mL Yellow Top**	
Cortisol - Blood	Blood	**3mL Green Top**	Random plasma cortisol samples are of very limited value.
Parathyroid Hormone PTH	Blood	**4mL Purple Top**	

The following tests (Protein Electrophoresis, Immunoglobulins and serum Free Light Chains) may be requested on one form and only ONE 4mL specimen (**Yellow Top**) is required.
These must not be requested with the routine tests outlined above – Note Green Top bottles are unsuitable and will be rejected.

Test requested should be clearly written in the Additional tests box.

Table 7 Protein tests that maybe combined
Using one request form and using one specimen bottle

Test	Sample	Container	Comments
Immunoglobulins	Blood	**4mL Yellow Top**	In childhood reference intervals vary with age - Contact Laboratory
Serum Protein Electrophoresis SPE	Blood	**4mL Yellow Top**	
Serum Free Light Chains	Blood	**4mL Yellow Top**	

Additional tests

May be requested on a sample that has already been processed. A completed request form for the additional tests must be forwarded to the laboratory stating the Sample IDentification number and the fact that the request is an add on. The SID number is on Lab Result Recall screen (Lab. Ref.) or report form (Lab Number at bottom LHS). [Verbal requests for urgent off site additional tests will be taken]. Specimens are held for 4 days after analysis [5 days total]. CSF samples (both analysed and spare) are stored frozen for a month – unless otherwise indicated. However, not all tests will be stable over this period. Contact laboratory to discuss.

Reflex testing

The Clinical Biochemistry automatically performs the following reflex testing:

- Potassium: Plasma results less than 2.5mmol/L are reflexed for Magnesium.
- TSH and FT4: TSH results less than 0.27 mIU/L with FT4 less than 12.0pmol/L are reflexed for FT3.
- Lipid Profile for samples with lipaemic index greater than 700
- Immunoglobulins: Depending on the levels found reflex testing for serum protein electrophoresis may be performed – contact laboratory for full details.
- Total protein and Globulins: Plasma Total protein levels ≥94g/L and/or Plasma Globulin [Total Protein – Albumin] levels ≥48g/L may prompt a reflex for protein electrophoresis.

Note: Total Protein is no longer part of Electrolyte Profile and must be requested separately - total protein with immunoglobulins and serum protein electrophoresis requires a yellow top sample.

Endocrine and Other Common Miscellaneous Tests

– Tube Type, Transport and Stability – all tests in table below refer to Blood.

Note: When **Red Top** tubes are specifically required **Yellow Top** tubes are unsuitable.

Note: In the WHSCT standard Clinical Biochemistry Tests are run on the Roche cobas 8000 analyser. Immunoassay tests [Specifically – FT4, TSH, FT3, Cortisol, PSA, hCG, Ferritin, PTH, Troponin T, NT-ProBNP, B12, Folate, Digoxin] are run on the Roche cobas e801 analyser. Please contact Laboratory if further information is required.

Table 8 Endocrine and Other Common Miscellaneous Tests

Analyte	Tube Type	Stability
Aldosterone / Renin	**4mL Purple Top**	Send to lab immediately - within 3h (Do not place on ice)
Androstenedione	**4mL Red Top**	Stable at room temperature
Cortisol	**3mLGreen Top**	Stable at room temperature
Follicle Stimulating (FSH) / Luteinising Hormone (LH)	**3mLGreen Top**	Stable at room temperature
Growth Hormone	**3mLGreen Top**	Stable at room temperature
HCG	**3mLGreen Top**	Stable at room temperature
Insulin	**3mL Green Top + 2mLGrey Top**	Stable at room temperature for 4h (Grey top for glucose)
Insulin like Growth Factor IGF 1	**3mLGreen Top**	Send to lab immediately - Plasma must be separated within 4h
C-peptide	**3mLGreen Top**	Send to lab immediately – Plasma must be separated within 4h
NT-ProBNP	**3mLGreen Top**	Stable at room temperature Minimum retesting interval 30 days
Dehydroepiandrosterone Sulphate (DHEAS / DHAS)	**3mLGreen Top**	Stable at room temperature
Oestradiol	**3mLGreen Top**	Stable at room temperature
Parathyroid Hormone Parathormone (PTH)	**4mL Purple Top**	Stable at room temperature
Bone Markers	**3mLGreen Top**	Send to lab immediately - Plasma must be separated within 2h
Procollagen III	**4mL Yellow Top**	Stable at room temperature
Progesterone	**3mLGreen Top**	Stable at room temperature
Prolactin	**3mLGreen Top**	Stable at room temperature No longer part of male or female hormone profile
Sex Hormone Binding Globulin	**3mLGreen Top**	Stable at room temperature
Testosterone / Androgen Profile	**3mLGreen Top**	Stable at room temperature
Thiopurine Methyl Transferase	**4mL Purple Top**	Stable at room temperature
Thyroglobulin	**4mL Yellow Top**	Stable at room temperature
Thyroid Hormones	**3mLGreen Top**	Stable at room temperature
Vitamin D	**4mL Yellow Top**	Send to lab immediately - Serum should be separated within 6h

Analyte	Tube Type	Stability
Bone Markers	**4mL Yellow Top**	Send to lab immediately - Serum should be separated within 2h

Common Paediatric Laboratory Tests

Sample Bottle / minimum volume requirements – all tests refer to Blood unless stated otherwise.

Table 9 Common Paediatric Tests

Test	Sample Bottle	Vol	Lab	Comment / Notes
ACR (Albumin / Creatinine Ratio)	**Sarstedt LEMON URINE**	5mL	B	Early morning urine sample preferred
ACTH	**2 x Small Pink Paed EDTA Bottle**	2 x 0.5mL	B	Transport to lab immediately on ice – stable for only 15min. Both samples must be filled to mark
Allergy Screen	**Adult Yellow Top Gel tube**	1mL	I	Clinician needs to outline tests required - if a sample from a hospital source comes in with RAST or allergy screen they get – Inhaled allergens only. Total IgE has to be requested and food allergens have to be specified.
Alpha Feto protein	**Adult Green Top Gel tube**	2mL	B	Belfast Lab
Amino acids Plasma	**Adult EDTA Purple Top**	1mL	B	RVH Children's lab, for screening send both urine and blood.
Amino acids Urine	**Sarstedt LEMON URINE**	3.2mL	B	
Ammonia	**Adult EDTA Purple Top**	1mL	B	Transport to lab immediately less than 30 minutes
Amylase*	**Small Green Paed Li Hep tube**	1mL	B	
Anti-transglutaminase Antibody	**Adult Yellow Top Gel tube**	0.5mL	I	Any combination of such antibodies may be requested on the same sample – 2mL blood should be sufficient for an extended Panel
Anti islet cell Antibody	**Adult Yellow Top Gel tube**	0.5mL	I	
Anti LKM Antibody	**Adult Yellow Top Gel tube**	0.5mL	I	
Anti TPO Antibody	**Adult Green Top Li Hep tube**	0.5mL	I	
Atypical Pneumonia	**Adult Yellow Top Gel tube**	2mL	M	
Anti-nuclear Antibody	**Adult Yellow Top Gel tube**	1mL	I	
B12 and Folate	**Adult Green Top Gel tube**	2mL	B	
Bilirubin Total*	**Small Green Paed Li Hep tube**	0.5mL	B	Light sensitive – place in envelope / Conjugated Bil may be requested on same sample
Blood Glucose	**Yellow Fluor/Oxalate tube**	1mL	B	Use if hypoglycaemia suspected
Bone Profile*	**Small Green Paed Li Hep tube**	1mL	B	Ca; PO4; Alb, ALP
Caeruloplasmin	**Adult Yellow Top Gel tube**	1mL	B	
Calprotectin	**WHITE top Universal**	5g	B	5g of faeces required
Carnitine	**Adult Green Top Li Hep tube**	1mL	B	Sheffield Children's Lab

Test	Sample Bottle	Vol	Lab	Comment / Notes
Urine Metanephrines (Replaces Catecholamines)	**ACIDIFIED Universal Tube**	20mL	B	Available from lab – urine must be acidified ASAP.
Chromosomes	**Adult Green Top Li Hep tube**	1mL	G	Tubes stored in fridge
CMV, EBV	**Adult Yellow Top Gel tube**	2mL	M	
Coeliac Screen	**Adult Yellow Top Gel tube**	1mL	I	
Complement	**Adult Yellow Top Gel tube**	1mL	B	C3, C4
Conjugated Bil*	**Small Green Paed Li Hep tube**	0.5mL	B	Light sensitive – place in envelope / Total Bil will be analysed also
Cortisol	**Adult Green Top Li Hep tube**	1mL	B	
Creatine Kinase*	**Small Green Paed Li Hep tube**	1mL	B	Muscle enzymes
CRP*	**Small Green Paed Li Hep tube**	1mL	B	
Cyclosporin / Tacrolimus / Sirolimus	**Small Pink Paed EDTA Bottle**	0.5mL	B	
DNA	**Adult EDTA Purple Top**	2mL	G	**Small Pink Paed EDTA Bottle** -contact BCH Genetics - ext 3173
Ferritin	**Adult Green Top Li Hep tube**	1mL	H	
Food Allergens	**Adult Yellow Top Gel tube**	0.5mL	I	Specify Allergens required
Gastrin Level	**Adult EDTA Purple Top**	4mL	B	Fasting sample send ASAP on ice
Gentamicin Level	**Small Green Paed Li Hep or Small EDTA Purple Top tube**	1mL	M	
Glycosaminoglycans (GAGS) (MUCU)	**Urine Lemon monovette**	3.2mL	B	3 early morning urine samples collected on 3 separate days
HbA_{1c}	**Small Pink Paed EDTA Bottle**	0.5mL	B	
Hormone profile	**Adult Green Top Li Hep tube**	2mL	B	Includes LH, FSH, PRL, Oest
Immunoglobulins	**Adult Yellow Top Gel tube**	2mL	B	Electrophoresis performed
Inhaled Allergens	**Adult Yellow Top Gel tube**	0.5mL	I	See Allergy screen
Insulin (fasting)	**Adult Green Top Li Hep tube**	2mL	B	Blood Glucose in Grey Top should be taken at same time.
Insulin antibodies	**Adult Yellow Top Gel tube**	2mL	B	Guilford
Iron Profile	**Adult Green Top Li Hep tube**	2mL	B	Includes iron, transferrin, ferritin.
Lactate	**Grey Top**	2mL	B	Glucose may be measured on same sample
Lipid Profile*	**Small Green Paed Li Hep tube**	1mL	B	Total Cholesterol; Trig; HDL
Liver profile*	**Small Green Paed Li Hep tube**	1mL	B	Bil; ALP; ALT; AST; GGT; Alb
Magnesium*	**Small Green Paed Li Hep tube**	1mL	B	
Mucopoly-saccharides				See Glycosaminoglycans
Organic acids (Urine)	**Sarstedt LEMON URINE**	3.2mL	B	
P and C ANCA	**Adult Yellow Top Gel tube**	0.5mL	I	

Test	Sample Bottle	Vol	Lab	Comment / Notes
Parathyroid Hormone (PTH)	**Adult EDTA Purple Top**	2mL	B	
Serum Protein Electrophoresis (SPEP)	**Adult Yellow Top Gel tube**	1mL	B	Immunoglobulins run with all SPE requests
TFTs	**Small Green Paed Li Hep tube**	1mL	B	Separate tube required
Therapeutic Drugs (except Lithium)	**Small Green Paed Li Hep tube**	1mL	B	In general - Sample just before next dose
Total IgE	**Adult Yellow Top Gel tube**	0.5mL	I	
TPMT	**Adult EDTA Purple Top**	2mL	B	Thiopurine Methyl Transferase
Trace Metals Selenium; Zinc; Copper; Lead	Royal Blue topped Greiner Trace Metal Tube	6mL	B	Selenium; Zinc; Copper; Lead Contact Biochemistry lab
U&E (EP)*	**Small Green Paed Li Hep tube**	1mL	B	Na; K; Cl; CO2; Urea; Cre; TP; Glucose
Urate*	**Small Green Paed Li Hep tube**	1mL	B	
Very Long Chain Fatty acids (Plasma)	**Adult Green Top Li Hep tube or Adult EDTA Purple Top**	2mL	B	Very Long Chain Fatty Acids
Vitamin A and E	**Adult Yellow Top Gel tube**	2mL	B	Light sensitive – place in envelope
Vitamin D	**Adult Yellow Top Gel tube**	2mL	B	Send to lab ASAP

Note: Any combination of Routine Biochemistry (see above tests in Bold*) may be requested on a single Small Green Paed Li Hep tube – for an extended panel please fill tube accordingly.

B = Biochemistry, H = Haematology, M = Microbiology, I = RVH Immunology, G = BCH Genetics

Table 10 Blood Bottle and Relevant Test

(Note: *tests run in WHSCT)

Cap Colour	Biochemistry Tests
Red Top [Serum]	**Specialist Drugs:** Methotrexate, Thiopentone, Lamotrigine, Levetiracetam **Specialist Endocrine:** Androstenedione, 17-Hydroxyprogesterone
Yellow Top [Serum]	**Proteins:** Serum Protein Electrophoresis* (SPE) [inc. Alb & TP], Immunoglobulins* (IgG, IgA, IgM), Serum free light chains* (FLC), Oligoclonal bands (with paired CSF), IgG subclasses (inc IgG4), ALP Isoenzymes, CK Isoenzymes, Alpha-1-Antitrypsin (AAT), Beta-2-Microglobulin (B2M), Ceruloplasmin, C3*, C4*, Haptoglobin*, Rheumatoid factor* (RF) **Vitamins:** Vit D (Total), Vit A, Vit E (protect from light) **General Biochemistry:** Lithium*, COVID Antibodies **Bone Markers:** Crosslaps (CTX), Ostase, Total P1NP **Specialist Endocrine:** Anti-Mullerian Hormone (AMH), Thyroglobulin & Thyroglobulin Antibody, P3NP
Green Top [With gel] [Plasma]	**General Biochemistry Profiles:** **ELEC*:** Na, K, Cl, Bicarbonate (CO2), Urea, Creatinine (eGFR) **LFT*:** TBil, ALP, Alb, AST, ALT, GGT **BONE*:** Ca, Adjusted Ca, PO_4, Alb, ALP **LIPID*:** Total Cholesterol, HDL, Triglycerides (LDL, TChol/HDL ratio, non-HDL Chol) **IRON*:** Iron, Ferritin, Transferrin (Transferrin sat%) **THYROID*:** TSH, FT4, (+ FT3 when required) **B12 & FOLATE*:** Folate, Vit B12 **Other:** ACE, Amylase*, CK*, Beta-hCG*, DBIL*, CRP*, Ethanol*, LDH*, Lipase, Magnesium*, Paracetamol*, Pro-BNP*, Salicylate*, Troponin-T*, Urate*, Osmolality* **TDM**: Carbamazepine*, Digoxin*, Phenobarbitone, Phenytoin*, Theophylline*, Valproate*. *[NOTE: Use Gold Top for Lithium]* **Antibiotics:** Amikacin, Gentamicin*, Tobramycin, Vancomycin*, Teicoplanin **Tumour Markers:** AFP, CA19-9, CA-125, CEA, PSA* **Endocrine:** Anti-TPO, Cortisol*, DHEAS, FSH, LH, Oestradiol, Progesterone, Prolactin, SHBG, Testosterone, Calcitonin [On ice & received in local lab within 4h], Growth Hormone (GH), IGF-1, Insulin [inc. Hypopak], C-peptide [Received in local lab within h] **Misc:** CarboxyHb* and MetHb*, Vit C (On ice & protect from light), Bile Acids (Analysed at UH Lab, SEHSCT), Amino Acids, Hydroxybutyrate

Cap Colour	Biochemistry Tests
Purple Top	Ammonia*, HbA_{1c}*, Homocysteine (on ice) **Specialist Endocrine:** ACTH [On ice & must be received in lab within 30 min], Aldosterone, Renin [Must be received in lab within 3h] PTH* [Must be received in lab within 12 h], Porphyrins (Protect from light) **Immunosuppressants:** Cyclosporine, Everolimus, Sirolimus, Tacrolimus **Peptides:** Gut Hormones (inc. CgA, Gastrin, Glucagon, Pancreatic Polypeptide, Vasoactive Intestinal Peptide, Somatostatin) [4 adult bottles needed for full profile. On ice & received in local lab within 2h]
Grey Top	Glucose*, Lactate*, 3-Hydroxybutyrate* **Specialist Toxicology:** Methanol, Ethylene Glycol
Dark Blue	**TRACE ELEMENTS AND METALS** NOTE: A Separate sample is required for Plasma Metals and Blood Metals. **Plasma Metals:** Aluminium, Copper, Selenium, Zinc. **Blood Metals:** Lead, Manganese, Chromium, Cobalt, Mercury, Cadmium, Arsenic.

Test Protocols

Test protocols are available for a wide range of dynamic tests and test strategies including:

- Short Synacthen Test
- Fluid Deprivation Test
- Growth Hormone Suppression Test
- Oral Glucose Tolerance Test
- Investigation of Cushing's Syndrome / Dexamethasone Suppression
- TRH Test
- Gonadotropin Releasing Hormone test
- Aldosterone / Renin
- Renal Stones investigation
- Hypopacks
- Biochemical Testing for Phaeochromocytoma: Urine, Plasma Metanephrines/Clonidine Suppression Test
- 72h Fast
- Tilt Test sample collection
- Preparation of samples for pyruvate analysis
- Handling and transport of CSF
- Levothyroxine Absorption test
- Lumbar Puncture Standard Operating procedure
- 5HIAA information sheet
- 24h Urine Collection – information sheet
- Sweat test – information sheet for parents/guardians and Adults
- Collection of urine samples for 28 day cortisol determination

See: WHSCT INTRANET or contact laboratory

Stability of Common Analytes

Taken from the following: WHO Use of Anticoagulants in Diagnostic Laboratory Investigations: (WHO/DIL/LAB/99.1 Rev.2 year 2002) MS Devgun. Delay in Centrifugation and measurement of Serum Constituents in Normal Subjects. Clin Physiol Biochem 1989;7:189-197 DJ Zhang et al. Effect of serum clot contact time on Clinical Chemistry Laboratory Results. Clin Chem 1998; 44:6 1325-33. (RT = Room Temperature, d = day, w = week, y=year)

Additional information

Time and temperature effect.p

Table 11 Stability of Common Analytes

	WHO				***Devgun***			***Zhang***
	Whole Blood	**Serum**			**Whole Blood**	**Serum**		**Whole Blood**
	RT	**RT**	**4ºC**	**-20ºC**	**After 7h RT**	**RT**	**4ºC**	**RT**
ELECTROLYTE								
Sodium	4d	2w	2w	1y	No change	5d	5d	At least 24h
Potassium	1h increase	6w	6w	1y	11% increase	2d	4d	3h increase
Chloride	1d decrease	7d	4w	1y	No change	3d	5d	6h decrease
Total CO_2	Unstable decrease	1d	7d	2w	No change	2d	2d	6h decrease
Urea	1d increase	7d	4w	1y	No change	5d	5d	At least 24h
Total Protein	1d	6d	4w	1y	No change	5d	5d	6h increase
Creatinine	2-3d increase	7d	7d	3m	No change	1d	5d	At least 24h
Glucose	10min (*Grey top)	2d*	7d*	1d*				3h decrease
BONE PROFILE								
Calcium	2d decrease	7d	3w	8m	No change	3d	5d	At least 24h
Phosphate	1h increase	1d	4d	1y	11% decrease	2d	5d	3h increase
Albumin	6d	2.5m	5m	2.5m	No change	5d	5d	6h increase
ALP	4d decrease	7d	7d	2m	No change	5d	5d	At least 24h
Mg	1d increase	7d	7d	1y				At least 24h
LIVER								
Bilirubin	Unstable decrease	1d	7d	6m	No change	3d	5d	At least 24h

ALT	4d decrease	3d	7d	7d				At least 24h
AST	7d decrease	4d	7d	3m	No change	2d	5d	At least 24h
GGT	1d decrease	7d	7d	1y	No change	5d	5d	At least 24h
MISC								
CK	7d decrease	7d	1m	1m				At least 24h
CRP	3w	11d	2m	3y				
Amylase	4d decrease	7d	1m	1y				At least 24h
Ammonia	15min	15min	2h	3w				
Lactate	6h	8h	3d					
Plasma OSM		3h	2d	3m				
LDH	1h increase	7d	4d	6w	No change	2d	5d	At least 24h
HbA_{1c}	3d			6m				
Urate	7d increase	3d	7d	6m				At least 24h
Cortisol	7d	7d	7d	3m				At least 24h
Troponin T	8h	24h	7d	3m				
ProBNP	2d	5d	5d	5d				
PSA	4-7d	7d	3w	1y				
HCG	1d	1d	7d	1y				
PTH	2-3d	6h	1d	4m				
RF		24h	8d	3m				
TDM								
Carbamazepine	2d	5d	7d	1m				
Phenytoin	2d	2d	1m	5m				
Digoxin		2w	3m	6m				
Valproate	2d	2d	7d	3m				
Theophilline		3m	3m	3m				
Lithium	1h decrease	1d	7d	6m				
THYROID								
FT4		2d	8d	3m				
TSH	7d	1d	3d	3m				At least 24h
LIPID								
Chol	7d increase	7d	7d	3m				At least 24h
Trigs	7d	2d	7d	1y				At least 24h
HDL	2d increase	2d	7d	3m				6h increase
PROTEINS								
C3*	1d	4d	8d	8d				
C4	1d	2d	8d	3m				
Haptoglobin	8d	3m	8m	3m				At least 24h
IgA	8d	8m	8m	8m				At least 24h
IgG	11d	4m	8m	8m				At least 24h
IgM	17d	2m	4m	6m				At least 24h
IOP								
Fe	2h increase	7d	3w	1y				6h increase
Transferrin	11d	4m	8m	6m				At least 24h
Ferritin		7d	7d	1y				At least 24h
B12		15min	1d	2m				
Folate		30min	1d	2m				

**C3 – In house studies suggest samples need to be separated on day of collection and stored at 4°C.*

Turnaround Times (TAT)

Table 12 Turnaround Times (TAT) - Altnagelvin

Test/Profile	TAT (Routine)*	TAT (In-Patient)	TAT (URGENT)
Electrolyte Profile	<36h	<4h	<1.5h
Blood Sugar	<36h	<4h	<1.5h
LFT	<36h	<4h	<1.5h
Direct / Conjugated Bilirubin	<36h	<4h	<3h
Bone Profile	<36h	<4h	<1.5h
NT Pro BNP	<36h	<4h	<3h
Muscle Enzymes (CK)	<36h	<4h	<1.5h
Lipid Profile	<36h	<4h	<1.5h
Iron Profile (Ferritin)	<36h	<4h	<1.5h
Paracetamol/Salicylate/Ethanol	<36h	<4	<1.5h
Amylase	<36h	<4h	<1.5h
Magnesium	<36h	<4h	<1.5h
Uric Acid	<36h	<4h	<1.5h
Ammonia			<3h
Lactate			<1.5h
Hydroxybutyrate			<3h
C-Reactive Protein	<36h	<4h	<1.5h
Thyroid Profile	<36h	<4h	<1.5h
Cortisol	48-72h		
Carbamazepine / Theophylline / Valproic Acid / Digoxin / Phenytoin / Vancomycin / Lithium	<36h	<5h (Dig <6h)	<4h
Gentamicin	<36h	<4h	<2h
Troponin T	<36h	<4h	<1.5h
PSA, Total	< 24h	< 24h	
LDH	<36h	<4h	<1.5h
PTH	<36h	<6h	<3h
B12 and Folate	<36h	<4h	
Beta HCG	<36h	<12h	<1.5h
Protein Electrophoresis / IgA, M, G Free Light Chains	<7d		
Anti-SARS-CoV-2 antibodies	<4d		
Bence Jones Protein	<28d		
Complement - C3 and C4	<7d		
Alpha-1-Acid Glycoprotein	<7d		
Haptoglobin	<3d		
Albumin Creatinine Ratio	<4d		
Urinary Protein	<4d		
Cryoglobulins	<4wk		
Hb A_{1c}	<4d		
Blood gas / CoOx	<1h Use POCT – No analysers in Laboratory		
CSF Xanthochromia			<4h

Test/Profile	TAT (Routine)*	TAT (In-Patient)	TAT (URGENT)
pH Faecal/Urine	<24h		
CSF protein, glucose and lactate			<1.5h
Osmolality Plasma and Urine		<4h	<2h
Urine Electrolytes		<8h	<2h
Pleural Fluid		<4h	
Creatinine Clearance	<4d	<4d	
Porphyrins / Porphobilinogen	5d		<6h
Sweat Test (Sweat Chloride)	Arranged with requesting physician / ward		
Rheumatoid Factor	<36h		

Table 13 Turnaround Times (TAT) – SWAH

Test/Profile	TAT (Routine)*	TAT (In-Patient)	TAT (URGENT)
Electrolyte Profile	<36h	<4h	<1.5h
Blood Sugar	<36h	<4h	<1.5h
LFT	<36h	<4h	<1.5h
Direct / Conjugated Bilirubin	<36h	<4h	<3h
Bone Profile	<36h	<4h	<1.5h
NT Pro BNP	<36h	<4h	<3h
Muscle Enzymes (CK)	<36h	<4h	<1.5h
Lipid Profile	<36h	<4h	<1.5h
Iron Profile (Ferritin)	<36h	<4h	<3h
Paracetamol/Salicylate/Ethanol	<36h	<4	<1.5h
Amylase	<36h	<4h	<1.5h
Magnesium	<36h	<4h	<1.5h
Uric Acid	<36h	<4h	<1.5h
Ammonia			<3h
Lactate			<1.5h
Hydroxybutyrate			<3h
C-Reactive Protein	<36h	<4h	<1.5h
Thyroid Profile	<36h	<4h	<1.5h
Carbamazepine / Theophylline / Phenytoin / Digoxin / Gentamicin / Lithium	<36h	<5h (Dig <6h)	<4h
Troponin T	<36h	<4h	<1.5h
PSA, Total	< 24h	<24h	
LDH	<36h	<4h	<1.5h
NT-ProBNP	<36h	<4h	<3h
PTH	<36h	<6h	<3h
B12 and Folate	<36h	<4h	
Beta HCG		<12h	<1.5h
Urinary Protein	<4d		
HbA_{1c}	<4d		
Blood gas / CoOx	<1h Use POCT – No analysers in Laboratory		
Osmolality Plasma and Urine		<4h	<2h

Test/Profile	TAT (Routine)*	TAT (In-Patient)	TAT (URGENT)
Urine Electrolytes		<8h	<2h
Pleural Fluid		<4h	
Creatinine Clearance	<4d	<4d	
CSF protein, glucose and lactate			<1.5h
Sweat Test (Sweat Chloride)	Arranged with requesting physician / ward		

***Note: does not include allowances for weekends and holidays**

Increase in TAT will occur if incorrect type or number of samples and request forms, insufficient or illegible data, incorrect positioning of 2D barcode or use of handwriting or eye readable labels on scan-able forms.

Telephone Limits

The following results will be telephoned to source ASAP **(Target within 2 hours)** if not already known.
Table 14 Telephone Limits

Analyte	Lower Limit	Upper Limit
Sodium mmol/L	**<125 ≤130 for <16y**	**≥160 ≥150 for <16y**
Potassium mmol/L	**≤2.5**	**≥6.5**
Urea mmol/L		**≥30.0 ≥10.0 for <16y**
Creatinine µmol/L		**≥350 ≥100 for <16y**
AKI Alert 1*	**Only if Potassium is >6.0 [GP – next day]**	
AKI Alert 2*	**All new occurrences**	
AKI Alert 3	**All new occurrences [Altnagelvin only - See additional email procedure]**	
CO2 mmol/L	**≤10**	
Calcium (Adj) mmol/L	**≤1.8**	**≥3.5**
Cortisol nmol/L	**Random ≤65 SST ≤250**	
Glucose mmol/L	**≤2.5**	**≥25.0 ≥15.0 if <16y**
Iron µmol/L	**≥55 <16y**	
TDMs all mg/L unless stated	**Carbamazepine ≥25.0 Theophylline ≥25.0 Phenytoin ≥25.0 Digoxin ≥2.5 µg/L Lithium >1.0 mmol/L [*Awaiting regional 1.5]**	
Blood gas / CoOx	**COHb ≥10% GP only**	

Analyte	Lower Limit	Upper Limit	
Sal and Para mg/L		**Sal ≥300** **Paracetamol ≥10** **Any detectable [>2] <16y**	
Ethanol mg/L		**≥4000** **≥100 for <16**	
Troponin T ng/L	**Note – to be put in place after WinPath**	**≥52 except cardiology** **GP samples >17 M** **GP samples >9 F**	
Ammonia µmol/L		**≥100**	
Lactate mmol/L		**≥4.0**	
Amylase U/L		**≥500**	
Triglyceride mmol/L		**≥20.0**	
Magnesium mmol/L	**≤0.4**		
Phosphate mmol/L	**≤0.3**		
Urate umol/L		**≥340** **Antenatal only**	
Total Bilirubin µmol/L		**≥300** **≥250 <16y**	
Con Bilirubin µmol/L		**≥25** **Neonates only**	
AST U/L		**≥500**	
ALT U/L		**≥500**	
CK U/L		**≥5000**	
CRP mg/L		**≥300 GP results only**	
Thyroid Function Tests	**Following Scenarios**	**FT4** pmol/L	**TSH** mU/L
	A	**≥50**	**≤1.0**
	B	**≤7.0**	**≥40**
CSF Spectroscopy		**All Positives**	

Altnagelvin and SWAH A&E

Analyte	Lower Limit	Upper Limit
Sodium mmol/L	**<125 ≤130 for <16y**	
Potassium mmol/L	**≤2.5**	**≥6.5**
Calcium (Adj) mmol/L		**≥3.5**
Ammonia µmol/L		**≥100 <18y**
Magnesium mmol/L	**≤0.4**	
Paracetamol mg/L		**Paracetamol ≥10 Any detectable [>2] <16y**

Uncertainty of Measurement

Uncertainty of Measurement, traceability and numerical significance are separate but closely related concepts that affect both the format and information conveyed in a quantitative test report. Uncertainty of Measurement provides a quantitative assessment of the quality of a test result. Current international standards (ISO 15189) require laboratories to provide estimates of uncertainty of measurement. An estimate of measurement uncertainty provides an interval of values within which the true value is believed to lie with a stated probability, and is therefore a quantitative indication of the reliability of a measurement.

Traceability and uncertainty are fundamental properties of all quantitative measurements. Because all measurements are made relative to a scale or defined standard, they are by definition *traceable* to this scale or standard. Traceability relates a measurement result to a stated metrological reference through an unbroken chain of calibrations or comparisons, each of which may contribute a stated level of uncertainty to the final test result. This unbroken chain of comparisons (leading back to a reference value) allows different laboratories to compare results and relate them to a common measuring scale.

A further tool to aid clinicians in the interpretation of results is the use of reference change values (RCV). These are of considerable use for the monitoring of patients, either in acute settings or in long term monitoring. Changes in serial results from an individual may be due to pathological improvement or deterioration in the individual, but may also be due to the following factors:

- Pre-analytical variation (CV_P)
- Analytical imprecision (CV_A)
- Within subject intra-individual variation (CV_I)

For a change to be significant, the difference in results must be greater than this inherent variation, or RCV, which can be calculated as:

$$RCV = 2^{½} Z(CV_P^{\,2} + CV_A^{\,2} + CV_I^{\,2})^{½}$$

Where Z is the number of standard deviations appropriate to the desired probability (i.e. 1.96 for P<0.05 and 2.58 for P<0.01)

If you require further information or explanation on any of aforementioned or require detailed estimates for any particular analyte or measurand please contact the Clinical Biochemistry Laboratory.

Consent

In general the Clinical Biochemistry Laboratory will assume that consent has been inferred, obtained or considered for every request that it receives.
It is noted that patient consent for the analysis of their samples is universally inferred when the patient willingly submits to the sample collecting procedure.
However it is accepted that there will be occasions when the patient will be unable to willingly submit to sample collection. Thus the Clinical Biochemistry Laboratory assumes that the clinical requestor will have considered this and has either obtained consent from the next of kin / parent / guardian or deemed that the request is in the best interests of the patient.

For in house tests: Specific written consent is not required for any test performed in the WHSCT Clinical Biochemistry Laboratories with the specific exception of sweat testing. Parental consent is mandatory for all sweat tests and should be obtained prior to booking an appointment on a minor (<16y).
Formal written consent is also taken by the referring clinician for CSF collection when possible.

For tests sent to or referred to other Laboratories: It is the responsibility of the requester to ensure that the patient has been informed of, and has consented to, any such tests as required.
Note: All genetic testing requires consent, for which there is a 'Consent Form' section at the bottom of the Medical Genetics request form. In this regard it is the responsibility of the referring clinician to inform the patient:

a) *of the genetic tests to be performed*
b) *of the requirement to store genetic material*
c) *that results will be forwarded to their Consultant and GP*
d) *that results will be used for the benefit of other family members*

If the Consent Form is not completed, then the Regional Genetics Laboratories will assume that the provision of a sample implies that the referring clinician has obtained consent for genetic testing, storage of genetic material and for further family testing.

Confidentiality of Service User Information

The Clinical Biochemistry Laboratory adheres to the Western Health & Social Care Trust's Policy on the Data Protection Act 1998 and Protection of Personal Information, which outlines the legal requirement for both the Trust and its' staff to treat personal information confidentially and ensure all information is held securely.

Comments/Complaints/Compliments procedure

The Clinical Biochemistry Laboratory adheres to the Western Health & Social Care Trust's Policy and procedure for the management of complaints and compliments. Copies of the policy are available upon request from the laboratory or via the Trust Intranet.
We aim to provide high quality services. If you have a comment, compliment or complaint about one of our services, please let us know by contacting a member of Laboratory staff.

Reference Intervals

Table 15 Reference Intervals – Taken from NI Regionally Agreed Age-Related Reference Intervals for General Biochemistry - WinPath

[Note: Unless indicated Plasma (green Top) and Serum (yellow top) intervals are the same]
Further details regarding the origin and nature of quoted intervals are available upon request – please contact Clinical Biochemistry Consultant Staff.

Profiles/ Test	Test	Age	Sex	Reference Interval		Units
				Lower	Upper	
EP	Sodium		M/F	135	146	mmol/L
	Potassium (serum – yellow top)			3.5	5.3	mmol/L
	Potassium (plasma – green top)	0 to <1w	M/F	3.5	6.2	
		1w to <26w	M/F	3.8	6.4	
		26wks to <2y	M/F	3.5	5.4	
		2y to <18y	M/F	3.3	4.9	
		18y and over	M/F	3.5	4.6	
	Chloride		M/F	95	108	mmol/L
	CO2	0 to <15d	M/F	10	20	mmol/L
		15d to <1y	M/F	10	24	
		1y to <5y	M/F	14	24	
		5y to <15y	M/F	17	26	
		15y to <19y	F	17	26	
		15y to <19y	M	18	28	
		19y and above	M/F	22	29	
	Urea	0 to <15 d	M/F	1.1	7.9	mmol/L
		15 d to <1y	M/F	1.3	5.8	
		1y to < 10y	M/F	3.2	7.6	
		10y to <19y	F	2.6	6.5	
		10y to <19y	M	2.6	7.2	
		19y and over	M/F	2.5	7.8	

Profiles/ Test	Test	Age	Sex	Reference Interval		Units
				Lower	Upper	
	Creatinine	0 to <15 d	M/F	35	86	umol/L
		15 d to <2y	M/F	15	38	
		2y to <5y	M/F	24	43	
		5y to <12y	M/F	33	59	
		12y to <15y	M/F	45	77	
		15y to <19y	M/F	48	79	
		19y and over	F	45	84	
		19y and over	M	59	104	
	eGFR (CKD-EPI)	>18y	M/F	>60		mL/min/1.73 m^2
LFT	Bilirubin, Total	0 to <15 d	M/F	0	250	umol/L
		15 d to <1y	M/F	0	10	
		1y to <9y	M/F	0	5	
		9y to <12y	M/F	0	8	
		12y to <15y	M/F	0	10	
		15y to <19y	M/F	0	12	
		19y and above	M/F	0	21	
	ALP	19y and above	M/F	30	130	U/L
	ALP - Age and sex related reference intervals – see table below					
	AST	0 to <15d	M/F	0	155	U/L
		15d to <1y	M/F	0	63	
		1y to <7y	M/F	0	41	
		7y to <12y	M/F	0	33	
		12y to <19y	F	0	23	
		12y to <19y	M	0	32	
		19y and over	F	0	32	
		19y and over	M	0	40	

Profiles/ Test	Test	Age	Sex	Reference Interval		Units
				Lower	Upper	
	ALT	0 to <1y	M/F	0	25	U/L
		1y to <13y	M/F	0	19	
		13y to <19y	F	0	17	
		13y to <19y	M	0	18	
		19y and over	F	0	33	
		19y and over	M	0	41	
	GGT	0 to <15d	M/F	17	175	U/L
		15 d to <1y	M/F	5	101	
		1y to <11y	M/F	4	12	
		11y to <19y	M/F	4	16	
		19y and over	F	6	42	
		19y and over	M	10	71	
	Albumin	0 to <15d	M/F	33	45	g/L
		15 d to <1y	M/F	31	50	
		1y to <8y	M/F	40	49	
		8y to <15y	M/F	42	51	
		15y to <19y	F	40	53	
		15y to <19y	M	43	53	
		19y and over	M/F	35	50	
	Bilirubin, Direct	0 to <15 d	M/F	4	9	umol/L
		15 d to <1y	M/F	0	4	
		1y to <9y	M/F	0	2	
		9y to <13y	M/F	0	4	
		13y to <19y	F	0	5	
		13y to <19y	M	1	5	
		19y and over	M/F	0	3	

Profiles/ Test	Test	Age	Sex	Reference Interval		Units
				Lower	Upper	
BP	Calcium [inc. Adjusted Ca]	0 to <1y	M/F	2.16	2.74	mmol/L
		1 to <19y	M/F	2.31	2.64	
		19y and over	M/F	2.20	2.60	
	Phosphate	0 to <15d	M/F	1.71	3.15	mmol/L
		15d to <1y	M/F	1.47	2.54	
		1y to <5y	M/F	1.33	2.06	
		5y to <13y	M/F	1.28	1.82	
		13y to <16y	F	1.00	1.70	
		13y to <16y	M	1.11	1.88	
		16y to <19y	M/F	0.94	1.55	
		19y and over	M/F	0.80	1.50	
Lipid	Total Cholesterol	0 to <15d	F	1.3	3.2	mmol/L
		0 to <15d	M	1.2	2.8	
		15d to <1y	M/F	1.7	6.1	
		1y to <19y	M/F	2.9	5.4	
		19y and over	M/F	2.8	5.0	
	HDL Cholesterol	0 to <15d	M/F	0.18	1.01	mmol/L
		15d to <1y	M/F	0.0	1.95	
		1y to <4y	M/F	0.72	1.68	
		4y to <13y	M/F	0.81	1.99	
		13y to <19y	F	0.70	1.96	
		13y to <19y	M	0.69	1.85	
		19y and over	M/F	1.00	2.50	

Profiles/ Test	Test	Age	Sex	Reference Interval		Units
				Lower	Upper	
	Triglycerides	0 to <15d	M/F	1.02	3.25	mmol/L
		15d to <1y	M/F	0.65	3.24	
		1y to <19y	M/F	0.54	2.47	
		19y and over	M/F	0.40	1.70	
	LDL Cholesterol (Calculated)		M/F		<3.0	mmol/L
	Chol / HDL Ratio(Calculated)		M/F	2.0	5.0	
	Non-HDL Chol (Calculated)		M/F			mmol/L
CSF	CSF - Protein		M/F	0.15	0.45	g/L
	CSF - Glucose [>75% of plasma glucose]	up to 18y	M/F	3.3	4.4	mmol/L
		18y and over	M/F	2.2	3.9	
	CSF - Lactate	Neonate	M/F	1.1	6.7	mmol/L
		3 to 10	M/F	1.1	4.4	
		>10	M/F	1.1	2.8	
		Adult	M/F	1.1	2.4	
Profiles/ Test	**Drug**	**Timing**	**Sex**	**Therapeutic Interval**		**Units**
				Lower	**Upper**	
TDM/Tox	Carbamazepine – Single drug regime	Trough	M/F	4	12	mg/L
	Carbamazepine – Multiple drug	Trough	M/F	4	8	
	Digoxin	6 - 8h after last dose	M/F	0.5	2.0	ug/L
	Digoxin in heart failure	6 - 8h after last dose	M/F	0.5	1.0	
	Lithium	Trough ≤65y	M/F	0.4	1.0	mmol/L
		Trough >65y	M/F	0.4	0.8	
	Phenobarbitone	Trough	M/F	10	40	mg/L
	Phenytoin	Trough	M/F	10	20	mg/L
	Theophylline	Trough	M/F	10	20	mg/L

Profiles/ Test	Drug	Timing	Sex	Therapeutic Interval		Units
				Lower	Upper	
	Valproate	Trough	M/F	50	100	mg/L
	Paracetamol	4h	M/F		<10	mg/L
		4h	M/F		Toxic >200	
		>12h	M/F		Toxic >50	
	Salicylate antipyretic/analgesic	Trough	M/F	30	100	mg/L
	Salicylate anti-inflammatory	Trough	M/F	150	300	
	Salicylate Toxic	Trough	M/F		300	
	Salicylate Lethal	Trough	M/F		700	
	Gentamicin	Trough	M/F		<1	mg/L
	Vancomycin	Trough	M/F	10	20	mg/L
	Gentamicin and Vancomycin See - WHSCT Secondary Care Antimicrobial Therapy Guidelines – Trust net					
Profiles/ Test	**Test**	**Age**	**Sex**	**Reference Interval**		**Units**
				Lower	**Upper**	
Iron	Iron	0 to <14y	M/F	5	25	umol/L
		14y to <19y	F	6	30	
		14y to <19y	M	8	31	
		19y and over	M/F	10	30	
	Ferritin	0 to <1m	M/F	150	973	ug/L
		1m to <6m	M/F	8.5	580	
		6m to <15y	M/F	14	101	
		15y to <19y	F	3.9	114	
		15y to <19y	M	21	173	
		19y to <60y	F	15	150	
		19y to <60y	M	30	400	
		60y and over	F	15	330	
		60y and over	M	30	400	

Profiles/ Test	Test	Age	Sex	Reference Interval		Units
				Lower	Upper	
	Transferrin	0 to <9w	M/F	1.11	2.43	g/L
		9w to <1y	M/F	1.15	3.52	
		1y to <19y	M/F	2.38	3.66	
		19y and over	M/F	2.00	3.60	
	Transferrin Saturation	0 to <1y	M/F	4.1	59.0	%
		1y to <14y	M/F	6.5	39.0	
		14y to <16 y	F	5.2	44.0	
		14y to <16y	M	9.6	58.0	
		16y and over	F	16.0	40.0	
		16y and over	M	16.0	50.0	
Thyroid	TSH	21y and over	M/F	0.27	4.20	mIU/L
	FT4	21y and over	M/F	12.0	22.0	pmol/L
	FT3	21y and over	M/F	3.1	6.8	pmol/L
	Thyroid - Age and sex related reference intervals – see table below					
B12 and Folate	Vitamin B12		M/F	350		ng/L
		<180 ‘Confirmed B12 deficiency’ 180 - 350 = ‘Indeterminate test result – possible B12 deficiency’ >350 = ‘Suggests vitamin B12 deficiency unlikely’				
	Folate		M/F	3.0	26.8	ug/L
Other	Magnesium	0 to <15d	M/F	0.82	1.62	mmol/L
		15d to <1y	M/F	0.81	1.27	
		1 to <19y	M/F	0.86	1.17	
		19y and over	M/F	0.70	1.00	
	Ammonia	Term Neonate	M/F		<100	umol/L
		29d and over	M/F		<50	
	Amylase	All	M/F	28	100	U/L
	Creatine Kinase [CK]	All	F	26	192	U/L
		All	M	39	308	

Profiles/ Test	Test	Age	Sex	Reference Interval		Units
				Lower	Upper	
	C-Reactive Protein [CRP]	All	M/F		<5	mg/L
	LDH	0 to <15d	M/F	0	1128	U/L
		15 d to <1y	M/F	0	424	
		1y to <10 y	M/F	0	305	
		10 y to <15y	F	0	260	
		10 y to <15y	M	0	270	
		15y to <19y	M/F	0	240	
		19y and over	F	135	214	
		19y and over	M	135	225	
	Cortisol	6am to 10am	M/F	166	507	nmol/L
		4pm to 8pm	M/F	74	291	
	hCG		M	0	5	U/L
	hCG non-pregnant pre-menopausal		F	0	5	
	hCG post-menopausal		F	0	15	
	Lactate	<16y	M/F	0.6	2.5	mmol/L
		>16y	M/F	0.5	2.2	
	Parathyroid Hormone (PTH)		M/F	17	74	ng/L
	Total Prostate Specific Antigen [PSA] NOTE: NICaN Referral limits are quoted not reference intervals	<49y	M		<2.5	ug/L
		49y to 59y	M		<3.5	
		60y to 69y	M		<4.5	
		70y to 79y	M		<6.5	
		80y or over	M		<10.0	
	Urate		F	143	339	umol/L
			M	202	417	
	Urate target in gout		M/F		360	
	Osmolality		M/F	275	295	mOsm/kg
	Rheumatoid Factor		M/F		<14	IU/mL
	Glucose - fasting		M/F	4.1	6.1	mmol/L
	For glucose tolerance tests see below					

Profiles/ Test	Test	Age	Sex	Reference Interval		Units
				Lower	Upper	
	Beta-Hydroxybutyrate		M/F	0.02	0.27	mmol/L
Cardiac	NT-proBNP	<1y	M/F		NA	ng/L
		1y to 3y	M/F		<320	
		4y to 6y	M/F		<190	
		7y to 9y	M/F		<145	
		10y	M/F		<112	
		11y	M/F		<317	
		12y	M/F		<186	
		13y	M/F		<370	
		14y	M/F		<363	
		15y	M/F		<217	
		16y	M/F		<206	
		17y	M/F		<135	
		18y	M/F		<115	
		19y to 34y	M/F		<115	
		35y to 44y	F		<237	
		35y to 44y	M		<115	
		45y to 54y	F		<284	
		45y to 54y	M		<173	
		55y to 64y	F		<352	
		55y to 64y	M		<386	
		65y to 74y	F		<623	
		65y to 74y	M		<879	
		75y and over	F		<1800	
		75y and over	M		<1800	
	Troponin T		F		<10	ng/L
			M		<18	

Profiles/ Test	Test	Age	Sex	Reference Interval		Units
				Lower	Upper	
Protein	Glycated Haemoglobin HbA_{1C} IFCC		M/F	20	41	mmol/mol
	Complement C3		M/F	0.75	1.65	g/L
	Complement C4		M/F	0.14	0.54	g/L
	Kappa FLC		M/F	3	19	mg/L
	Lambda FLC		M/F	6	26	mg/L
	Kappa/Lambda Ratio		M/F	0.3	1.7	
	Haptoglobin		M/F	0.3	2.0	g/L
	Total Protein	0 to <15d	M/F	51	80	g/L
		15d to <1y	M/F	43	69	
		1y to <6y	M F	59	73	
		6y to <9y	M/F	62	75	
		9y to <19y	M/F	63	78	
		19y and over	M/F	60	80	
Urine	Urine Amylase (Random)		M/F		491	U/L
	Urine Calcium (24h)		M/F	2.5	7.5	mmol/24h
	Urine Creatinine (Random)		M	3.5	24.6	mmol/L
			F	2.6	20.0	
	Urine Creatinine (24h)		M	9.0	19.0	mmol/L
			F	6.0	13.0	
	Creatinine Clearance		M/F	66	143	mL/min
	Urine Sodium (Random)		M/F	Results interpreted in line with clinical and fluid status		mmol/L
	Urine Potassium (Random)		M/F			mmol/L
	Urine Chloride (Random)		M/F			mmol/L
	Urine Osmolality (Random)		M/F			mOsm/kg
	Urine Sodium (24h)		M/F	40	220	mmol/24h
	Urine Potassium (24h)		M/F	25	125	mmol/24h
	Urine Chloride (24h)		M/F	110	250	mmol/24h
	Urine Magnesium (24h)		M/F	2.4	6.5	mmol/24h

Profiles/ Test	Test	Age	Sex	Reference Interval		Units
				Lower	Upper	
	Urine Phosphate (24h)		M/F	13	42	mmol/24h
	Urine Total Protein (24h)		M/F		<0.14	g/24h
	Urine Urea (24h)		M/F	428	714	mmol/24h
	Urine Uric Acid (24h)		M/F	1.5	4.5	mmol/24h
	Urine Albumin/Creatinine Ratio ACR		M/F		<3.0	mg/mmol
	Urine Calcium/Creatinine Ratio	<12m	M/F		<2.0	mmol/mmol
		1y to 3y	M/F		<1.5	
		3y to 5y	M/F		<1.1	
		5y to 7y	M/F		<0.8	
		>7y	M/F		<0.6	
	Urine Protein/Creatinine Ratio		M/F		<15.0	mg/mmol

Table 16 Thyroid - Age and sex related reference intervals

Assay	Age	Sex	Reference Interval	
			Lower	Upper
TSH mIU/L	0 to 6d	M/F	0.70	15.20
	6d to ≤3m	M/F	0.72	11.00
	>3m to ≤12m	M/F	0.73	8.35
	>1y to ≤6y	M/F	0.70	5.97
	>6y to ≤11y	M/F	0.60	4.84
	>11y to ≤20y	M/F	0.51	4.30
	21y and over	M/F	0.27	4.20
	Pregnant: 1st Trimester	F	0.33	4.59
	2nd Trimester	F	0.35	4.1
	3rd Trimester	F	0.21	3.15
FT4 pmol/L	0 to 6d	M/F	11.0	32.0
	>6 d to ≤3m	M/F	11.5	28.3
	>3m to ≤12m	M/F	11.9	25.6
	>1y to ≤6y	M/F	12.3	22.8
	>6y to ≤11y	M/F	12.5	21.5
	>11y to ≤20y	M/F	12.6	21.0
	21y and over	M/F	12.0	22.0
	Pregnant: 1st Trimester	F	12.1	19.6
	2nd Trimester	F	9.6	17.0
	3rd Trimester	F	8.4	15.6
FT3 pmol/L	0 to 6d	M/F	2.7	9.7
	>6d to ≤3m	M/F	3.0	9.3
	>3m to ≤12m	M/F	3.3	9.0
	>1y to ≤6y	M/F	3.7	8.5
	>6y to ≤11y	M/F	3.9	8.0
	>11y to ≤20y	M/F	3.9	7.7
	21y and over	M/F	3.1	6.8
	Pregnant: 1st Trimester	F	3.8	6.0
	2nd Trimester	F	3.2	5.5
	3rd Trimester	F	3.1	5.0

Note: Normal Reference intervals in pregnancy – please see the following as a guide – contact laboratory for further explanation – note to be used as a guide to ascertain differences between trimesters but not for absolute reference limits

Normal Reference Ranges and Laboratory Values In Pregnancy

Table 17 ALP - Age and sex related reference intervals

Age	Sex	Reference Interval		Units
		Lower	Upper	
0 to <15d	M/F	83	248	U/L
15d to <1y	M/F	122	469	
1y to <10y	M/F	142	335	
10y to <13y	M/F	129	417	
13y to <15y	F	57	254	
13y to <15y	M	116	468	
15y to <17y	F	50	117	
15y to <17y	M	82	331	
17y to <19y	F	45	87	
17y to <19y	M	55	149	
19y and over	M/F	30	130	

Table 18 Age related reference intervals – Immunoglobulins

Age	**IgA** (g/L)	**IgG** (g/L)	**IgM** (g/L)
Cord	<0.02	5.2 - 18.0	0.02 - 0.2
0 - 2 wks	0.01 - 0.08	5.0 - 17.0	0.05 - 0.2
2 - 6 wks	0.02 - 0.15	3.9 - 13.0	0.08 - 0.40
6 - 12 wks	0.05 - 0.40	2.1 - 7.7	0.15 - 0.70
3 - 6 mths	0.10 - 0.50	2.4 - 8.8	0.20 - 1.00
6 - 9 mths	0.15 - 0.70	3.0 - 9.0	0.40 - 1.60
9 - 12 mths	0.20 - 0.70	3.0 - 10.9	0.60 - 2.1
1 - 2 yrs	0.3 - 1.2	3.1- 13.8	0.5 - 2.2
2 - 3 yrs	0.3 - 1.3	3.7- 15.8	0.5 - 2.2
3 - 6 yrs	0.4 - 2.0	4.9 - 16.1	0.5 - 2.0
6 - 9 yrs	0.5 - 2.4	5.4 - 16.1	0.5 - 1.8
9 - 12 yrs	0.7 - 2.5	5.4 - 16.1	0.5 - 1.8
12 - 15 yrs	0.8 - 2.8	5.4 - 16.1	0.5 - 1.9
15 - 45 yrs	0.8 - 2.8	6.0 - 16.0	0.5 - 1.9
over 45 yrs	0.8 - 4.0	6.0 - 16.0	0.5 - 2.0

Table 19 Oral Glucose Tolerance Test - WHO classification

Interpretation	0min	120min
Normal	<6.1	<7.8
Diabetes Mellitus	≥7.0	**or** ≥11.1
Impaired Glucose Tolerance (IGT)	<7.0	**and** ≥7.8 **and** <11.1

Impaired Fasting Glucose (IFG)	≥6.1* **to** <7.0	**and** <7.8

*The WHSCT shared care guidelines have adopted a lower cut-off for the diagnosis of impaired fasting glucose (≥5.6 to <7mmol/L) following recommendations by the American Diabetes Association.

The WHSCT have adopted the following International Association of Diabetes and Pregnancy Study Group (IADPSG) values for the diagnosis of Gestational Diabetes for the 75g OGTT:

Fasting	≥5.1 mmol/L
1h	≥10.0 mmol/L
2h	≥8.5 mmol/L

Diagnosis of Gestational Diabetes made if glucose values exceeded at any time point.

Table 20 Interpretation of Sweat Chloride results

Age	Sweat Chloride (mmol/L)	Comment
<6 m	<30	"Cystic fibrosis is unlikely but requires genetic and clinical correlation"
<6 m	30 - 60	"Intermediate result which requires further cystic fibrosis assessment such as a repeat test and/or further investigations"
<6 m	>60 but <150	"Supports a diagnosis of cystic fibrosis"
>6 m	<40	"Cystic fibrosis is unlikely but requires genetic and clinical correlation"
>6 m	40 - 60	"Intermediate result which requires further cystic fibrosis assessment such as a repeat test and/or further investigations"
>6 m	>60 but <150	"Supports a diagnosis of cystic fibrosis"
All ages	>150	"Non-physiological sweat chloride result i.e. chloride >150mmol/L"

Table 21 Interpretation of Pleural Fluid results

Pleural Fluid	Comment
Pleural Fluid Gross Appearance:	The following descriptions are used: Clear, Cloudy, Purulent, Milky, Blood Stained, Straw Coloured, Amber Coloured.
Pleural Fluid Total Protein:	Results <25 g/L suggest transudate
	Results >35 g/L suggest exudates
	Total protein between 25 – 35 g/L – use Light's criteria – below.
Light's A fluid is classified as an exudate if any of the following criteria are met:	A Pleural Fluid: Plasma Protein Ratio greater than 0.5. (fluid protein ÷ plasma protein) A Pleural Fluid LDH activity above 150 U/L (2/3 ULN) A Pleural Fluid:Plasma LDH Ratio greater than 0.6. (Note: Patients with CHF on diuretics may show an increase in Pleural fluid protein values).
Pleural Fluid Cholesterol:	>1.6 mmol/L suggests exudate.
Pleural Fluid Albumin Gradient: (useful for patients on diuretics)	Plasma fluid albumin gradient = Plasma albumin minus fluid albumin
	<12 g/L indicates an exudate and >12 g/L a transudate.

Pleural Fluid	Comment
Pleural Fluid Glucose (`Is it rheumatoid?'):	>5.3 mmol/L suggests transudate.
	>1.6 mmol/L RA is unlikely cause
Pleural Fluid pH (`Does this parapneumonic effusion need draining?'):	<7.30 suggests the presence of an inflammatory or infiltrative process.
	<7.20 require drainage – not 100% sensitive.
Pleural Fluid Lipids (`Is it a chylothorax?'):	Triglyceride values > cholesterol suggests chylothorax.
	BTS guidelines – Triglyceride values >1.24 – chylothorax
	Triglyceride values <0.54 – psuedochylothorax
	Cholesterol values >5.18 – chylothorax
	Cholesterol values <5.18 – psuedochylothorax
Pleural Fluid Amylase (`Is pancreatitis the cause?'):	>125 U/L or the fluid / Plasma ratio is >1.0.
Pleural Fluid Creatinine / Urea:	Increased pleural fluid urea or creatinine may be specific for diagnosis of urinothorax, when fluid accumulates in the pleural space in urinary tract obstruction.
Pleural Fluid Bilirubin / Tumour markers:	Not useful.

Table 22 Interpretation of Ascitic / Peritoneal Fluid results

Ascitic / Peritoneal Fluid	Comment
Ascitic Fluid Gross Appearance:	The following descriptions are used: Clear straw coloured, Blood-stained, Turbid, Tea coloured, Black, Dark molasses, Green/brown
Ascitic Fluid LDH:	>225 U/L (ULN) associated with malignancy (Not generally useful)
Ascitic Fluid Glucose:	Fluid/Blood glucose ratio (GREY TOPs) of <0.7 - Tuberculous ascites (Not generally useful)
Ascitic Fluid Amylase:	>125 U/L – suggest pancreatitis (Not specific - values usually extremely elevated >500).
	Amylase activity in ascites of non-pancreatic origin ~half the plasma value.
Ascitic Fluid Creatinine:	Increased values may indicate the presence of urine.
Ascitic Fluid Triglyceride:	>2.25 mmol/L and > corresponding plasma concentration - Chylous ascites
	(Values up to 4.5mmol/L may be seen in with cirrhosis)
Ascitic Fluid Bilirubin:	>103 umol/L and > plasma value is consistent with intrahepatic or gallbladder fistula or upper gut perforation.
Ascitic Fluid Total protein:	Not recommended
	(>30 g/L - infection / malignancy
	<30 g/L - chronic liver disease/cirrhosis (<25 g/L greater probability))
Ascitic Fluid Tumour markers / Cholesterol / pH / Lactate / Enzymes	Not useful

Plasma Ascites Albumin Gradient (PAAG):

PAAG = Plasma Albumin – Fluid Albumin

PAAG <11 g/L [decreased portal pressure]	PAAG >11 g/L [increased portal pressure]
Malignancy – peritoneal (due to abnormal capillary permeability) Tuberculosis / Infection Pancreatitis Nephrotic syndrome	Malignancy – hepatic metastases (intrahepatic venous compression leading to portal hypertension) Cirrhosis / Liver disease Congestive cardiac failure

Interpretation of HbA_{1c} Results

Adapted from NI Pathology Network Clinical Biochemistry Speciality Forum -- HbA_{1c} Interpretation Guide Version 2.0 June 2023

Hb A_{1c} reference intervals, diagnostic cut offs and treatment targets all assume that the patients concerned have both a normal haemoglobin (Hb A0) and a normal associated red blood cell (RBC) lifespan.

In patients with haemoglobin variants and/or altered RBC survival (Table 22):

a) Hb A_{1c} should **not** be used for diagnosis.
b) Care should be taken when Hb A_{1c} is used for monitoring (Table 23)

Table 23 Clinical conditions affecting Hb A_{1c} measurement

Increase	Decrease	Variable
Iron deficiency anaemia	Iron treatment	Haemoglobin Variants**
Vitamin B12 deficiency	Vitamin B12 treatment	Blood Transfusion
CKD 4 and 5	Liver disease	
Splenectomy	EPO treatment	
Venesection	Haemolytic anaemia, Low Hb levels *	
	Splenomegaly	
	Medications: antiretrovirals, ribavirin, dapsone	

**RBC lifespan does not interfere analytically but the result obtained may not reflect the "true" glycation rate for the patient.*
*** Haemoglobin Variants occur in approximately 6% of the NI population. Haemoglobin variants may have different glycation rates and/or altered RBC survival and thus their Hb A_{1c} results need to be interpreted with caution as this may result in misleadingly higher or lower Hb A_{1c} results.*

The routine methodology in use in the laboratory (Sebia Capillary Electrophoresis) can detect haemoglobin variants and these will be flagged up as report comments – see table 24. Some of these variants will interfere analytically with the routine method result and some will not.

For those variants that **do not** cause any analytical interference in the routine methodology the result will be reported and flagged with a comment as per Table 24 below.

For those variants that do interfere analytically with the routine method the sample will be rerun using an alternative methodology (Boronic acid on the Abbott Afinion analyser – this is not UKAS accredited) and the result from this method reported and flagged with a comment as per Table 24. In some cases it will not be possible to report any Hb A_{1c} results from either method.

Hb A_{1c} results reported by the laboratory will be analytically correct, but it is important to bear in mind that although such results will be analytically correct the presence of the variant will affect how these result should be interpreted physiologically, especially if the reported result does not fit with the patient's clinical condition or other glucose measurements. See **Alternative methods used when Hb A_{1c} monitoring is invalid or physiologically misleading.**

Please note: Sebia Capillary Electrophoresis can also detect Hb A2. High Hb A2 levels (>3%) may be due to Vitamin B12 / Folate deficiency; Antiretroviral treatments; Hyperthyroidism and Beta-Thalassaemia. High levels will be flagged up using the associated comments – see Table 24. The advice is to evaluate the clinical context and consider possible clinical relevance.

Alternative methods used when Hb A_{1c} monitoring is invalid or physiologically misleading

- Quality-controlled blood glucose profiles using personal glucose meters
- Serum Fructosamine (yellow top tube). This is useful for monitoring patients with variants that interfere with Hb A0 and Hb A_{1c} results. Please contact laboratory to discuss.
- Unexplained discrepancies between Hb A_{1c} and other glucose measurements should always be investigated. Seek advice from Clinical Biochemistry.

  The patient's own analytically valid Hb A_{1c} results can be used to monitor trends on an individual basis but traditional reference intervals, diagnostic cut offs and treatment targets should not be used.

Guidance is available at: http://www.nice.org.uk/Guidance/NG28 : 2011 WHO report: Use of Glycated Haemoglobin (Hb A1c) in the Diagnosis of Diabetes Mellitus.

Table 24 Hb A1c Reporting comments

Results from samples with a haemoglobin variant or analytical issue are reported using the following comments

Code	Comment	Explanation
HBA1	Patient has a haemoglobin variant that does not interfere analytically with Hb A_{1c} result. See link or lab user manual for guidance.	A variant has been detected, but it does not interfere analytically with the routine method Hb A_{1c} result.
HBA2	Patient has a haemoglobin variant. Hb A_{1c} analysed by alternate method. See link or lab user manual for guidance.	A variant has been detected that interferes analytically with the routine Hb A_{1c} result. The Hb A_{1c} has been analysed by an alternate Boronic acid method.
HBA3	Hb A_{1c} result may not reflect true glycaemic status. See link or lab user manual for guidance.	No variant has been detected, but the Hb A_{1c} is physiologically unreliable for another reason (see Table 22)
HBA4	Unable to report Hb A_{1c} result. Contact Clinical Biochemistry lab if further guidance required.	In cases where Hb A_{1c} cannot be measured, the Clinical Biochemistry Laboratory should be contacted to discuss alternative measurements.
HBA5	Hb A_{1c} analysed by alternate method. See link or lab user manual for guidance.	Sample volume received was too low for analysis using routine method. Reported HbA1c has been analysed by alternative Boronic acid method and will be equivalent to those from the routine method.
HBA6	Elevated Hb A2 – causes include VitB12/Folate deficiency; Antiretrovirals; Hyperthyroidism and Beta-Thalassaemia. If no clinical suspicion of these, no further action needed.	Chromatogram shows Hb A2 greater than 3% - causes include Vitamin B12/Folate deficiency; Antiretrovirals; Hyper-thyroidism and Beta-Thalassaemia. If no clinical suspicion of these conditions, no further action required.

Reference intervals for Common Tests sent to other laboratories

Requests forwarded to BHSCT will be available in the actual results report obtained from the laboratory or you can access via link below

(Belfast Link Labs unless stated – as per BLL User Manual – Adult Intervals)- see hyperlink below – click on lab manual

Belfast Trust Laboratories User Manual | Belfast Health & Social Care Trust (hscni.net)

Common requests from SEHSCT

The following test are run in Ulster Hospital Laboratory and results are available on ECR

Test	Reference interval	Units
Bile Acids	0 - 10 (Fasting)	umol/L
	0 - 14 (Non-Fasting)	umol/L
Calprotectin (Faecal)	<60	ug/g
	Possible inflammatory disease >60	ug/g

How to interpret Calprotectin - see Document New Patients Pathway 

New Patient Pathway_Version 2_C

Details regarding the origin and nature of quoted reference intervals are available upon request – please contact Clinical Biochemistry Consultant Staff.

ALL OTHER TEST REFERENCE Intervals Contact Laboratory

Myeloma, Monoclonal Gammopathies, Monoclonal Gammopathy of Undetermined Significance (MGUS) and related conditions:

The WHSCT Clinical Biochemistry Laboratory recommends that GPs and other Clinicians adopt the Myeloma UK guidelines:

Myeloma UK GP Guidelines April 202

[Local guidelines specific for MGUS are also included in the Information Sheet for GPs below].

Please note the following WHSCT Clinical Biochemistry Laboratory Practice with respect to these guidelines:

The laboratory offers the following standard tests:
Bone profile; Electrolyte profile; Creatinine Clearance; Urine Protein and Albumin; Liver function tests; LDH, Uric acid, NT-proBNP; and Full Blood Count *[Haematology laboratory].*

And the following specific tests:
Serum Protein Electrophoresis (SPEP) *[This test may help identify and quantify the presence of Monoclonal Proteins, also known as Paraproteins, M-Proteins or M-Bands – Note the agreed term for use in NI is Monoclonal Protein]*
Serum Protein Immunofixation Electrophoresis (IFE) *[This test may also help identify and confirm the presence of Monoclonal Proteins and ascertain their type – heavy chains G, A, D, E or M and light chains Kappa (K) or Lambda (L)]*
Urine Protein electrophoresis and immunofixation – for detection of Bence Jones Protein (BJP) *[Laboratory will generally prompt requests for BJP depending on results from serum]*
Serum Free Light Chains (sFLC) *[Laboratory uses the Binding Site Optilite assay]*

Note: A single yellow top blood sample and associated request form is all that is required for any combination of Myeloma screen, SPEP, Immunoglobulins, complement and sFLC.
[Urine BJP testing is not required initially, except for amyloidosis patients, and will generally be requested by the laboratory - Single yellow monovette urine tube]

a) sFLC requests may not be run if SPEP, immunoglobulins and any further discretionary reflex testing results are normal. *[Except when requested by Haematology, Renal or Cardiology Consultants]* Minimum retesting interval set at 21 days in WinPath for SPE, BJP and SFLC
b) Requests for immunoglobulins (Including requests in connection with Coeliac screening – see below) may be reflexed tested for SPEP depending on the levels found.
c) Samples with plasma Total Protein levels ≥94g/L and/or Plasma Globulin [Total Protein – Albumin] levels ≥48g/L may prompt a reflex for protein electrophoresis.
d) Urine testing for Bence Jones Protein is not required for first line testing but may be prompted by the laboratory as a follow up depending on serum results.
e) The Clinical Biochemistry Laboratory will contact the requestor directly if results suggest that urgent referral to Haematology is warranted – *see referral criteria below*.
f) Interpretation of sFLC results:

Reference Intervals:	Kappa FLC	3 - 19 mg/L
	Lambda FLC	6 - 26 mg/L
	Kappa/Lambda FLC Ratio	0.3 - 1.7*

Note: These intervals are applicable to patients with **normal** renal function.
*The upper limit of the Kappa/Lambda FLC Ratio is 3.1 in patients with renal impairment.

A sFLC Ratio outside of the reference interval but greater than 0.1 and less than 7 would be deemed only minor abnormal. Absolute sFLC values for Kappa and Lambda less than 100 mg/L with a normal or minor abnormal ratio would be more in keeping with inflammatory disorders, liver disease, underlying infection, excess alcohol consumption and the metabolic syndrome rather than Myeloma, MGUS and other related conditions.

One of the diagnostic criteria for active myeloma is a sFLC ratio of ≥100 or ≤0.01 provided the involved light chain is >100 mg/L. ["Involved" refers to the type of immunoglobulin that makes up the Monoclonal Protein – e.g. an IgGK Monoclonal Protein *involves* an IgG heavy chain and a Kappa light chain]

Reporting of serum protein electrophoresis results:

a) All serum protein electrophoresis results are carefully examined and further immunofixation testing and sFLC performed if there are any suspected potential monoclonal bands.

b) Those bands that are found but are too small to be reliably typed, quantified and confirmed as Monoclonal Proteins (so-called "faint" bands for example) will not be reported directly but a comment suggesting a repeat after a year will be added. Associated sFLC will be reported. [As agreed with Haematology].
Many such "Faint" bands are polyclonal, transient and represent a humoral response to antigenic stimuli seen in infective or inflammatory conditions. Often a number of faint bands may be seen and these are categorised as oligoclonal bands. If other biochemistry and haematology results are normal these **DO NOT** require any further action and the request for repeat testing after a year is out of an abundance of caution.

c) Those bands that are found but are too small to be reliably quantified [usually bands ≤2g/L] but can be reliably typed as Monoclonal Proteins will be reported as "Minute" along with the isotype.

Explanation of Laboratory report comments:

In general the following standard report comments are used:

Example Report Comment	Explanation
No Monoclonal Protein detected [Previously the term *Paraprotein* was used]	Normal result – No indication of any detectable Monoclonal Proteins. No indication that follow up SPEP is required.
No Monoclonal Protein detected. Please repeat in 12 months.	Normal result – No indication of any detectable Monoclonal Proteins. Laboratory does suggest that a repeat SPEP request after a year should be considered because there was some indication from the electrophoretogram that this may be beneficial. For example, there may have been a faint band detected that was too small to be reliably quantified or typed [i.e. it is unclear whether this band is a Monoclonal Protein] or oligoclonal bands were found. [Oligoclonal bands are an incidental finding and indicate a central humoral response. They may be a significant finding when following patients post bone marrow transplant. They are not Monoclonal Proteins].
No Monoclonal Protein detected by IFE	Immunofixation electrophoresis IFE is about four times more sensitive at detecting Monoclonal Proteins than SPEP. This method is run if Monoclonal Proteins have been reported in the past but are no longer detectable by SPEP. This is usually for patients already under the care of haematology and may be an important finding in terms

	of treatment, monitoring and relapse.
Example Report Comment	**Explanation**
Monoclonal Protein detected M-Band 1 IgG Kappa 30g/L M-Band 2 IgG Lambda Minute band M-Band 3	Generally each Monoclonal Protein found will be reported – in this case the patient has two Monoclonal Proteins: M-Band 1 is an IgGK Monoclonal Protein of 30 g/L M-Band 2 is a Minute IgGL M-Band 3 is blank – there is no third band [Software does not allow these to be removed, just left blank]. *Note: In some patients, levels of the involved immunoglobulin are not reported – in this example of a 30g/L IgGK the respective IgG levels would not be reported.* *Contact laboratory for further explanation.*
Minute band detected in the slow gamma region.	Band is too small to be reliably quantified but is able to be typed – i.e. this band is a Monoclonal Protein but is ≤2g/L.
Free Light Chain results should always be interpreted in conjunction with other laboratory tests and clinical evidence; any anomalies should be discussed with testing laboratory	The sFLC assays have technical limitations that need to be taken into account. These include lot-to-lot variation; assay imprecision and instances in which it does not dilute in a linear fashion. In addition the quantification may sometimes not reflect the absolute level of protein found.
Polyclonal increase in gammaglobulins	In general, a polyclonal increase is an incidental finding and indicates a central humoral response such as those commonly seen in inflammatory disorders, liver disease, underlying infection, excess alcohol consumption and the metabolic syndrome.

Note: Serum protein electrophoresis SPEP separates proteins into 6 regions: Albumin, Alpha-1, Aplha-2, Beta-1, Beta-2 and Gamma – The Gamma is further split into 3 zones – Fast, Mid and Slow – see the example of a normal electrophoretogram pictured below.
The position of a Monoclonal Protein is no longer reported in terms of these regions as the absolute position of the Monoclonal Protein is of no clinical relevance. However if the position of a Monoclonal protein band changes this will be indicated by a report comment as this may be clinically significant.

When to refer (extracted from Myeloma UK guidelines above**):**

Table 5. Response to results & referral guidance

• Any paraprotein/abnormal sFLC ratio **with** significant symptoms indicative of an urgent problem (e.g. spinal cord compression, acute kidney injury)	Recommend referral for immediate assessment and/or admission as per local pathways
• Moderate concentration of paraprotein (IgG >15 g/L, IgA or IgM >10 g/L) • Identification of an IgD or IgE paraprotein (regardless of concentration) • Significant abnormal sFLC ratio (< 0.1 or > 7) ◦ Identification of BJP	Recommend urgent suspected cancer (USC) referral to Clinical Haematology
• Minor concentration of paraprotein (IgG < 15 g/L, IgA or IgM < 10 g/L) **without** relevant symptoms • Minor abnormal sFLC ratio (> 0.1 and < 7, but outside normal range) **without** relevant symptoms This pattern is common in elderly patients	Recommend **recheck** serum and urine in 2–3 months to confirm pattern and assess any progression. Patients whose paraprotein concentration increases (25% and > 5 g/L) or develop symptoms will need an **urgent referral.** Discuss with your Clinical Haematology Department if results not clear or concerns.
• No serum paraprotein • Normal sFLC ratio (0.26–1.65)* ◦ No BJP • Normal immunoglobulin levels *some laboratories may have a slightly different reference range	Myeloma very **unlikely** but symptoms may still need to be investigated with other clinical specialties

Immediate or emergency referral is needed for any patient showing signs of acute kidney injury, significant hypercalcaemia or spinal cord compression as these clinical situations are emergencies.

Urgent referral to haematology is needed for patients with one or more of the following:

- A new IgG Monoclonal Protein >15 g/L
- A new IgM or IgA Monoclonal Protein >10 g/L
- Identification of an IgD or IgE Monoclonal Protein (regardless of concentration)
- A significantly abnormal sFLC ratio (<0.1 or >7) or identification of BJP
- Any serum Monoclonal Protein <10 g/L but where there is clinical suspicion of myeloma
- Imaging confirming a lytic bone lesion or abnormality suspicious of myeloma
- Symptoms suggestive of underlying myeloma

Non-urgent/routine referral or discussion with clinical haematology may be appropriate for patients with a low level Monoclonal Protein or mildly abnormal sFLC ratio Minor abnormal sFLC ratio (> 0.1 and < 7, but outside normal reference interval) and no symptoms suggestive of myeloma. However, rechecking the serum or urine in 2–3 months is recommended to monitor the disease pattern and assess progression. Patients whose Monoclonal Protein concentration increases by >25% and >5 g/L or who develop symptoms will need an urgent referral to haematology as described above.

Please Note: The following Information sheet was sent out to GPs by our Haematology Consultants in March 2020:

Monoclonal Gammopathy of Undetermined Significance (MGUS): Information sheet for GPs March 2020

Definition:
MGUS is defined by the presence of a monoclonal immunoglobulin (also referred to as a Monoclonal Protein or paraprotein) in the serum or urine of an individual with no evidence of multiple myeloma, lymphoma, AL amyloidosis or other related disorders.
A Monoclonal Protein is a monoclonal immunoglobulin secreted by an abnormally expanded clone of plasma cells in an amount that can be detected by immunofixation of serum and/or urine. A Monoclonal Protein can be whole immunoglobulin (heavy and light chains) or just immunoglobulin free light chain (FLC).

When to test for a Monoclonal Protein:
A serum protein electrophoresis should be performed if there is clinical suspicion of a Monoclonal Protein related disorder or when the results of other tests raise the possibility of the presence of an Monoclonal Protein, such as:

- Elevated erythrocyte sedimentation rate (ESR)
- Unexplained anaemia, hypercalcaemia, renal impairment
- Raised total protein

It should be noted that a Monoclonal Protein is not present in polyclonal elevations of immunoglobulin levels such as those commonly seen in inflammatory disorders, liver disease, underlying infection, excess alcohol consumption and the metabolic syndrome. By definition, MGUS is not present if a Monoclonal Protein is not detectable except in the case of Light chain MGUS at concentrations of involved light chain below the limit of detection of the antisera.

Prevalance:
MGUS is uncommon below the age of 50 years. The prevalence increases with advancing age. It is present in approximately 1-2% of those aged 50-60 years, 2-4% in those aged 60-70 years, rising to 4-5% in those aged 70-80.
The commonest type of Monoclonal Protein is IgG, followed by IgM, then IgA. IgM Monoclonal Proteins are associated with lymphomas such as Waldenstrom's Macroglobulinaemia (WM), B cell non-Hodgkin's lymphoma (B-NHL) or chronic lymphocytic leukaemia/small lymphocytic lymphoma (CLL/SLL), rather than myeloma.

Risk of progression:
People with MGUS have an increased risk of developing malignant disorders such as myeloma or lymphoma. The overall risk of progression for each patient is approximately 1% per year. However, as most patients who have an MGUS are elderly, very few go on to develop myeloma or related disorders.
Features associated with a slightly higher risk of progression include a Monoclonal Protein level >15g/L, Monoclonal Protein subtype (IgA or IgM subtype have a higher risk) and an abnormal serum free light chain ratio.

Variables such as age, sex, immuno-suppression or the presence of Bence Jones proteinuria have not been found to be predictive of progression.

Baseline investigations following detection of Monoclonal Protein:
FBC, Electrolyte profile, LFT, Bone profile, Serum Free light Chain test and Urine in monovette tube for Bence Jones Protein & urine protein/creatinine ratio.

Baseline clinical assessment:
Assess patient for clinical features of

(a) Myeloma: Hypercalcaemia, renal failure, anaemia, bone pain/lesions, hyperviscosity
(b) Lymphoma: Lymphadenopathy, hepatosplenomegaly, pancytopenia, night sweats, fevers, weight loss
(c) Amyloidosis: Macroglossia, unexplained heart failure, peripheral neuropathy, carpal tunnel syndrome, nephrotic syndrome

Referral to Altnagelvin Haematology service:
Refer patient to haematology service as per local pathway for clarification of diagnosis and advice on future monitoring. The vast majority of patients with Monoclonal Proteins detected in routine practice are not at high risk of transformation and are suitable for monitoring in primary care.

Monitoring of patients with MGUS:
The purpose of monitoring is to try to identify transformation at an early stage. The risk of progression remains present for the rest of the patient's life and never disappears, even if the Monoclonal Protein remains stable.
Patients should be aware of and report relevant new symptoms and signs, particularly the development of new bone pain, weight loss, fatigue or other symptoms which might indicate progression to myeloma, lymphoma or amyloid.
There is no published evidence on which to base recommendations for the frequency of follow up. Guidance is therefore pragmatic. It would seem reasonable to monitor 6 monthly FBC, EP, BP and SPEP for the first year after detection of a Monoclonal Protein and then annually thereafter.
Symptoms may develop rapidly following progression. It is important that the patient is aware of those symptoms which may be associated with progression and that they are encouraged to promptly report these symptoms to their doctor.

Criteria for re-referral to Altnagelvin Haematology service include:

- If the concentration of the Monoclonal Protein increases by more than 25% (with a minimal absolute increase of 5g/L).
- If symptoms compatible with a diagnosis of myeloma, lymphoma or amyloid develop.
- If unexplained anaemia, other cytopenias, abnormal renal function or hypercalcaemia develop.

Patient Information Leaflet:
A patient information leaflet on MGUS is available at the following link:
https://www.macmillan.org.uk/cancer-information-and-support/worried-about-cancer/pre-cancerous-and-genetic-conditions/mgus

Serological testing for Coeliac disease

Further to the recent Notice issued by the regional Immunology laboratory on 9th January 2024 (see below): When requesting Immunoglobulins as part of serological Coeliac disease testing please indicate on the Request Form that "Coeliac" is the clinical reason for the request.
[This will be of benefit to the biochemistry laboratory as such requests do not automatically require serum protein electrophoresis].

Regarding the Notice from the regional Immunology laboratory:
If you suspect Coeliac disease please send 2 separate yellow top blood samples:

a) *One yellow top for Immunoglobulins on a WHSCT Request Form.*
b) *One yellow top for Tissue Transglutaminase (IgA-tTG) on an Immunology request form - this is forwarded to regional Immunology laboratory.*

Note: In the Notice below "recent testing" for immunoglobulins means within the last 3 to six months.

Notice - Regional Immunology Laboratory

SERVICE UPDATE: Serological testing for Coeliac disease

To: All Users of the **Regional Immunology Laboratory**

Coeliac Disease Testing

Issue: The current assay for coeliac disease is not detecting all cases of IgA deficiency.

First line testing for Coeliac disease:

Immunoglobulins; yellow top sample to Biochemistry; no need to repeat if recent testing has confirmed detectable IgA
IgA tissue Transglutaminase antibody (IgA tTG); yellow top sample to Immunology
Reflex testing:

This will be performed automatically by the Immunology Laboratory if:

IgA tTG result is **Positive** (>4.9 FLU): IgA Endomysial antibodies will be measured
If the IgA tTG result is **Undetectable**: IgG Endomysial antibodies will then be measured.
Interpretation of IgA tTG result:

Confirm IgA detectable before interpreting IgA tTG coeliac disease assay result.
If IgA is detectable then the IgA tTG result is valid.
If patient has absent IgA (<0.05g/L) and a **Negative** IgA tTG result please send a separate request for IgG Endomysial antibodies. (IgG Endomysial antibodies are only automatically tested if the IgA tTG is **Undetectable**).
If further information is required please contact:

immunologyaddons@belfasttrust.hscni.net

Thank you

BHSCT Regional Immunology Laboratory

Pathology harmony

To keep in line with other UK Clinical Biochemistry Laboratories the following Pathology Harmony reference intervals and units were adopted by the WHSCT from 20 Oct 2010.
[Pathology Harmony- see www.pathologyharmony.co.uk is a UK wide DoH initiative to harmonise several aspects of work including reference intervals within the clinical Laboratory]

Table 26 Pathology Harmony reference intervals

Analyte (Serum unless stated)	New UK wide Pathology Harmony Reference Intervals for non-pregnant Adults	
Sodium	133 – 146	mmol/L
Potassium	3.5 – 5.3	mmol/L
Chloride	95 – 108	mmol/L
Bicarbonate	22 – 29	mmol/L
Urea	2.5 – 7.8	mmol/L
Phosphate	0.8 – 1.5	mmol/L
Magnesium	0.7 – 1.0	mmol/L
Albumin	35 – 50	g/L
Total Protein	60 – 80	g/L
Osmolality	275 – 295	mmol/kg
ALP	30 – 130	U/L
CK	40 – 320 Male 25 – 200 Female	U/L
Adjusted Calcium	2.2 – 2.6	mmol/L
Total Bilirubin	Less than 21	µmol/L
Urate	200 – 400 Male 140 – 360 Female	µmol/L
Carbamazepine	4 – 12	mg/L
Phenobarbitone	10 – 40	mg/L
Phenytoin	5 – 20	mg/L
Theophylline	10 – 20	mg/L
Lithium	0.4 – 1.0	mmol/L
24h Urine Calcium	2.5 – 7.5	mmol/24h
24h Urine Phosphate	15 – 50	mmol/24h
24h Urine Urate	1.5 – 4.5	mmol/24h
24h Urine Magnesium	2.4 – 6.5	mmol/24h
BNP	Units changed from pg/mL	ng/L

Examinations performed within WHSCT and referred to other laboratories

Note: In the following table, outlining sample requirements, a number of tests are forwarded to various regional laboratories in Belfast [See under Sent to]. Such tests are not booked into or reported by the WHSCT Clinical Biochemistry Laboratory and any queries regarding these tests should be made directly to the relevant Belfast laboratory.

Table 27 Examinations performed in WHSCT and those referred or forwarded to other laboratories

Test	Sample	Volume	Container	Comments	Sent to
ACTH - Adrenocorticotrophic Hormone	Blood	4mL	EDTA/Purple Top	EDTA bottle must be filled completely to mark and transported to Lab on ice - within 30min	Endocrine Lab, RVH
Albumin (ALB)				See Bone Profile	
Albumin Creatinine Ratio (ACR)	Urine	3.2mL Early Morning Sample	Lemon Top Sarstedt Monovette Urine Tube	Repeat early morning samples on 3 occasions.	Altnagelvin
Alcohol (Ethanol)	Blood	4mL	Green top LiHep	Do not use alcohol wipes.	
Aldosterone (Renin)	Blood	4mL	EDTA/Purple Top Note: Red tops no longer accepted for aldosterone	Contact laboratory about patient preparation. EDTA sample bottle must be filled completely to mark and transported to lab within 3h. (Do **not** place on ice) Renin analysed on same specimen	Endocrine Lab, RVH
Alkaline Phosphatase Isoenzymes	Blood	4mL	SST/Yellow Top		Biochemistry Lab, RVH
Alpha Fetoprotein - Ante-Natal	Blood	4mL	SST/Yellow Top	Contact laboratory for interval in pregnancy	Dept of Genetics, BCH
Alpha Fetoprotein - Cancer Studies	Blood	4mL	Green top LiHep		Belfast Link Labs
Alpha Fetoprotein - Hydatidiform Mole	Blood	4mL	Clotted/Red Top	Mole follow-up studies	Oncology, Charing Cross Hospital
Alpha Fetoprotein – Liquor	Liquor	5mL	Universal Container	Contact laboratory for reference intervals	Belfast Link Labs
Alpha Galactosidase	Blood	4mL	EDTA/Purple Top	Fabry's disease	Willink Genetics Unit, Manchester
Alpha-1-Antitrypsin	Blood	4mL	SST/Yellow Top		Biochemistry Lab,

Test	Sample	Volume	Container	Comments	Sent to
					RVH
Alpha-1-Antitrypsin Phenotype	Blood	4mL	SST/Yellow Top		Biochemistry Lab, RVH
Alpha-1-Antitrypsin (GI protein loss)	Faeces	10g (min 2g)	Universal Container	Must reach laboratory within 1h.	PRU St Georges's London
Aluminium	Blood	6mL	Special tube - contact lab		Trace Metal Lab Belfast Link labs
Amino Acids - Blood	Blood	2.5mL	Green top LiHep	If Requested by Belfast. Give full clinical details including feeding and drugs. Ideally should examine urine at the same time.	Children's Biochemistry Lab RVH
Amino Acids - Routine Screen	Blood	1mL	Green top LiHep	For screening purposes send EDTA plasma with urine. Give full clinical details including feeding and drugs.	Children's Biochemistry Lab RVH
Amino Acids - Urine	Urine	3.2mL	Lemon Top Sarstedt Monovette Urine Tube	Give full clinical details including feeding and drugs. Ideally should examine plasma and urine at the same time.	Children's Biochemistry Lab RVH
Aminophylline				See Theophylline	
Ammonia	Blood	4mL	EDTA/Purple Top	Transport sample to lab without delay. Within 30min. Inform Lab prior to venepuncture. Do not use sterets/alcohol at site of venepuncture. Transport on ice no longer required	
Amphetamines	Urine - Random	3.2mL	Lemon Top Sarstedt Monovette Urine Tube		Toxicology Lab, Belfast Link Labs
Amylase - plasma	Blood	4mL	Green top LiHep		
Amylase – Random urine	Urine	3.2mL	Lemon Top Sarstedt Monovette Urine Tube	Needs a paired Green top LiHep for plasma amylase	
Amylase - 24h urine	Urine	24h	Plain 24h Urine Bottle		
Anaphylaxis	Blood	4mL	SST/Yellow Top	3 samples required: ASAP	Immunology

Test	Sample	Volume	Container	Comments	Sent to
				post reaction (within 1h), 2h post and 24h post. Samples analysed for Mast Cell Tryptase. Note: Procedure for the Notification and Initial Investigation of Suspected Anaphylaxis form must be completed – contact Laboratrory.	Belfast Link Labs
Androgen Profile	Blood	3mL	Green top LiHep	Includes: Testosterone, Sex Hormone Binding Globulin, Free Androgen Index, DHEA Sulphate.	Endocrine Lab, RVH
Androstenedione	Blood	4mL	Clotted/Red Top	Yellow Top not suitable	Endocrine Lab, RVH
ACE Angiotensin Converting Enzyme	Blood	3mL	Green top LiHep		Biochemistry Lab, RVH
Anti-SARS-CoV-2 antibodies N (COVID antibodies)	Blood	4mL	SST/Yellow Top	Results reported as DETECTED or NOT DETECTED	Belfast Link labs
APO A1	Blood	4mL	SST/Yellow Top		Uni Hospital Wales
APO B	Blood	4mL	SST/Yellow Top		Uni Hospital Wales
APO E Genotype	Blood	4mL	EDTA/Purple Top	Contact Laboratory	St. Thomas' Hospital, London
Ascitic Fluid				See Fluid Analysis	
Ascorbic Acid				See Vitamin C	
Auto Antibody Screen	Blood	4mL	SST/Yellow Top	Full clinical history must be given	Dept of Immunology, RVH
Bence Jones Protein	Urine - Random	3.2mL	Lemon Sarstedt Monovette Urine Tube	An early morning urine specimen is preferred. Not UKAS accredited	Altnagelvin
Beta HCG - Antenatal	Blood	3mL L	Green top LiHep		
Beta HCG - Cancer studies	Blood	4ml	SST/Yellow Top		Endocrine Lab, RVH / Charing Cross Hospital
Beta-2-Microglobulin	Blood	4mL	SST/Yellow Top	Reference interval is age related. Contact laboratory.	Biochemistry Lab, RVH
Bile Acids	Blood	3mL	Green top LiHep	Look up results in ECR	Ulster Hospital
Bilirubin Direct (Conjugated)	Blood	3mL	Green top LiHep	Same specimen may be used for Total and Direct	

Test	Sample	Volume	Container	Comments	Sent to
				Bilirubin	
Bilirubin Paediatric	Blood	0.5mL	Capiject Tube/Green	Same specimen may be used for Total and Direct Bilirubin	
Bilirubin Total	Blood	3mL	Green top LiHep	Same specimen may be used for Total and Direct Bilirubin	
Biotinidase	Blood	3mL	Green top LiHep		Sheffield Children's Biochemistry Lab
Blood Gas Analysis ***NOT UKAS – accredited***	Blood	2mL	1mL Heparinised Blood Gas Syringe, capillary tube, microsampler	If required – use POCT devices – there are no blood gas analysers in the Lab. Allow no air to mix with specimen or be trapped in syringe. Needle must NOT be left on syringe, use syringe cap. Do **not** send on ice.	POCT
NT- ProBNP (B-Type Natriuretic Peptide)	Blood	3mL	Green top LiHep	Samples must reach lab within 24h. Minimum retesting interval 30 days	
Bone Markers CTX serum crosslaps BAP Ostase Bone specific ALP P1NP	Serum`	4mL	SST/Yellow Top	Timing of sample: (08:00am to 11:00 am) & FASTING. Samples should be taken at the same time and conditions for all measurements. Sample should reach lab within 2h. Belfast analyses all 3 markers on one tube [BAP and Ostase are shorthand for bone specific ALP]	Belfast Link Labs
Bone Profile	Blood	3mL	Green top LiHep	ALP interval is age and sex related.	
Breast Cancer Marker BrCa1	Blood		EDTA/Purple Top	Phone Dr Morrison BCH 329241 ext 2764 first.	Dept of Genetics, BCH
C Reactive Protein (CRP)	Blood	3mL	Green top LiHep		
C1 Esterase Inhibitor	Blood	4mL	SST/Yellow Top		Immunology, RVH
C3 Nephritic Factor (C3NeF)	Blood	4mL	SST/Yellow Top		Immunology, RVH

Test	Sample	Volume	Container	Comments	Sent to
CA - 15-3	Blood	4mL	SST/Yellow Top	Contact laboratory for further information.	Oncology, Charing Cross Hospital
CA - 19-9	Blood	3mL	Green top LiHep	Contact laboratory for further information.	Belfast Link Labs
CA-125	Blood	3mL	Green top LiHep	Contact laboratory for further information.	Belfast Link Labs
Caffeine	Blood	4mL	Clotted/Red Top	Gel tube not suitable.	Birmingham
Calcitonin	Blood	3mL	Green top LiHep	Send to laboratory on ice within 4h. [Note: sample stable at RT for 2h]	Endocine Lab, RVH
Calcium - Plasma	Blood	3mL	Green top LiHep		
Calcium - Urine	Urine – 24h	24h	Issued from Laboratory	24h bottle contains dilute HCl acid	
Calculi Analysis (Renal Stones)	Calculi		Universal Container		Belfast Link Labs
Calprotectin	Faeces	5g	Universal Container	Look up results in ECR	Ulster Hospital Laboratory
Carbamazepine (Tegretol)	Blood	3mL	Green top LiHep	Take specimen immediately before next oral dose - Trough	
Carboxy Haemoglobin (COHb - CoOx) ***NOT UKAS – accredited in Altnagelvin***	Blood		1mL Heparinised Blood Gas Syringe, capillary tube, microsampler or 3mL Green top LiHep	If required – use POCT devices – there are no blood gas analysers in the Lab. Needle must NOT be left on syringe, use syringe cap.	POCT
Carnitine	Blood	1mL	Green top LiHep		Sheffield Children's
Carotene (Vit A + E)	Blood	4mL	SST/Yellow Top	No longer available - Vit A and E analysed. Send in envelope to shield from light –.	Biochemistry Lab, RVH
Catecholamines - Blood	Blood		Contact Laboratory	See CC/CP/024 – Plasma metanephrines now first choice.	St Helier Blood Sciences Laboratory
Catecholamines - Urine				See Metanephrines	
CEA (Carcino Embryonic Antigen)	Blood	3mL	Green top LiHep		Belfast Link Labs
Ceruloplasmin	Blood	4mL	SST/Yellow Top		Biochemistry Lab, RVH

Test	Sample	Volume	Container	Comments	Sent to
Chloride - Sweat	Sweat			See Sweat Test	Altnagelvin
Cholecalciferol				See Vitamin D	
Cholesterol - Total	Blood	3mL	Green top LiHep	Total cholesterol > 5.0 mmol/L may indicate an increased risk of vascular disease.	
Cholinesterase Activity	Blood	4mL	SST/Yellow Top	Samples should be collected the day after any induced apnoea. Or 6 weeks after if FFP or cholinesterase preparation used to treat.	Cholinesterase Investigation Unit, Bristol
Cholinesterase Phenotyping	Blood	4mL	SST/Yellow Top	See above	Cholinesterase Investigation Unit, Bristol
Chondroitin Sulphate				See Mucopolysaccharides Screen	Children's Biochemistry, RVH
Chromium (+ Cobalt)	Blood	6mL	Special tube - contact lab	Results available via NIECR	Trace Metal Lab Charing cross
Citrate – 24h Urine	Urine – 24h	24h	Issued from Laboratory	24h bottle contains Thymol	Belfast Link Labs
CKMB Isoenzyme	Blood	4mL	SST/Yellow Top	Only assayed if Total CK is > 170 U/L	Biochemistry Lab, RVH
Clozapine	Blood	4mL	EDTA/Purple Top	Whole blood	Department of Clinical Biochemistry, City Hospital, Dudley Rd, Birmingham, B18 7QH
Clobazam	Blood	4mL	Clotted/Red Top Or LiHep Non gel	Gel tube not suitable. See Benzodiazepine	Therapeutic Drug Monitoring Unit (TDM), Epilepsy Society, Chalfont St Peter, Chesham Lane, Buckinghamshire, SL9 ORJ
Clonazepam	Blood	3mL	Green top LiHep	Contact laboratory before proceeding. Poisons unit Tel 01719555095 must be contacted first.	Kings College Toxicology
Cobalt (+Chromium)	Blood	6mL	Special tube - contact lab		Trace Metal Lab Charing cross
Complement - C3, C4	Blood	4mL	SST/Yellow Top	Send immediately to Lab	Altnagelvin

Test	Sample	Volume	Container	Comments	Sent to
Copeptin				Contact Laboratory	
Copper - Blood	Blood	6mL	Special Container. Contact Laboratory	If other Trace metal samples are required then special tube required – contact lab	Trace Metal Lab, Belfast Link Labs
Copper - Urine	Urine – 24h	24h	Plain 24h Urine Bottle		Trace Metal Lab, Belfast Link Labs
Cortisol - Blood	Blood	3mL	Green top LiHep	Random plasma cortisol samples are of very limited value.	Altnagelvin
Cortisol - Urine	Urine – 24h	24h	Plain 24h Urine Bottle		Endocrine Lab, RVH
C-Peptide	Blood	3mL	Green top LiHep	Specimen must be sent to laboratory without delay. Plasma should be separated within 4h.	Endocrine Lab, RVH
Creatine Kinase (CK)	Blood	3mL	Green top LiHep		
Creatinine Clearance	Blood and Urine – 24h	3mL 24h	Green top LiHep Plain 24h Urine Bottle	Specimen of blood for plasma creatinine must be collected during the period of urine collection.	
Cryoglobulins	Blood			Contact Laboratory	Altnagelvin
CSF - Cerebral Spinal Fluid	CSF	1mL	Universal Container	Do not send via pneumatic tube	
CSF Protein Electrophoresis (Oligoclonal Bands)	CSF and Blood	0.5mL 4mL	Universal Container SST/Yellow Top	Do not send via pneumatic tube	Biochemistry Lab, RVH
CSF Tau Protein (Asialylated transferrin)	Nasal Fluid	0.5mL 4mL	Universal Container	For CSF Rhinorrhoea	Neuroimmunology & CSF Laboratory, (Box 76) 9th floor UCL Queen Square Institute of Neurology Queen Square London WC1N 3BG
CSF Xanthochromia	CSF	1mL	Universal Container	Samples should be shielded from light. Do not send via pneumatic tube	Altnagelvin
Cyclosporin	Blood	4mL	EDTA/Purple Top	Sent to various centres depending on source of request.	Freemans Kings College Harefield Newcastle Belfast

Test	Sample	Volume	Container	Comments	Sent to
Cystine	Urine – 24h	24h	Plain 24h Urine Bottle		Belfast Link labs
Cystine Screen	Urine - Random	3.2mL	Lemon Top Sarstedt Monovette Urine Tube	Early morning sample preferred.	Belfast Link Labs
Dehydroepiandro-sterone Sulphate DHEAS (DHAS)	Blood	3mL	Green top LiHep		Endocrine Lab, RVH
Digoxin	Blood	3mL	Green top LiHep	Take sample at least 6 - 8h after last oral dose.	
Drug Overdose / Poisoning	Urine	3.2mL	Lemon Sarstedt Urine tube	Indicate suspected drug ingested if known	Toxicology Lab, Belfast Link labs
Drugs of Abuse Screen - Amphetamine, Barbiturates, Benzodiazepines, Cannibinoids, Cocaine Metabolites, Opiates, LSD.	Urine - Random	3.2mL	Lemon Top Sarstedt Monovette Urine Tube	Indicate which drug group patient is suspected of abusing. Not available as an emergency test.	Toxicology Lab, Belfast Link Labs
Electrolyte Profile	Blood	3mL	Green top LiHep		
Electrolytes Urine	Urine – 24h Urine - Random	24h / 3.2mL	Plain 24h Urine Bottle Lemon Top Sarstedt Urine Tube		
Ethosuximide - Zarontin	Blood	4mL	Clotted/Red Top Or LiHep non gel		Therapeutic Drug Monitoring Unit (TDM), Epilepsy Society, Chalfont St Peter, Chesham Lane, Buckinghamshire, SL9 ORJ
Ethylene Glycol	Blood	2mL	Sodium Fluoride/Grey Top	Contact Laboratory	Toxicology Lab, Belfast Link Labs
Faecal Fat Excretion				No longer done.	
Fatty Acids, Very long chain	Blood	2mL	Green top LiHep	Contact 02872222148	Sheffield Children's Laboratory
Fluid Analysis ***NOT UKAS -***	Drain Fluid	3.2mL	Lemon Top Sarstedt	One or all of: pH, Total Protein, Amylase,	Altnagelvin

Test	Sample	Volume	Container	Comments	Sent to
accredited	Blood	2mL 4mL	Monovette Urine Tube / 1mL heparinised gas syringe - for pH Green top LiHep	Triglyceride, LDH. If pH required an extra 2mL is needed collected in a heparinised syringe. Plasma sample should also be sent.	
Folate	Blood	3mL	Green top LiHep	Analysed with Vitamin B12. Fasting sample required. Folate relatively unstable – samples should reach lab within 4h.	
Free Androgen Index- FAI		See Androgen Profile			
Free Light Chains	Blood	4mL	SST/Yellow Top	May be requested on same sample as Protein electrophoresis	Altnagelvin
Fructosamine	Blood	4mL	SST/Yellow Top		Birmingham
FSH - Follicle Stimulating Hormone	Blood	3mL	Green top LiHep		Endocrine Lab, RVH
Galactose-1-Phosphate	Blood	1mL	Green top LiHep Must be a non-gel LiHep tube – the “routine” green top with a yellow insert contains gel and is not acceptable.	EDTA/Purple Top not suitable Needs to reach Bristol lab within 24h of venipuncture [56h maximum] – blood should be taken just before posting – do not post on Friday.	Bristol
Galactose-1-Phosphate Uridyl Transferase GPUT (Beutler Test)	Blood	0.5mL	Green top LiHep Must be a non-gel LiHep tube – the “routine” green top with a yellow insert contains gel and is not acceptable.	EDTA/Purple Top not suitable Needs to reach Belfast lab within 24h of venepuncture (within 12h best).	Children’s Biochemistry Lab, RVH
Gastrin	Blood	4mL	EDTA/Purple Top	See Gut Hormone profile	Regulatory Peptide Lab, RVH
Gentamicin	Blood	3mL	Green top LiHep	EDTA/Purple Top also suitable.	
Glucagon				See Gut Hormone Profile	
Glucose - plasma	Blood	2mL	Sodium	Sodium fluoride/grey top	

Test	Sample	Volume	Container	Comments	Sent to
			Fluoride/Grey Top	sample is stable after 30min. Hypoglycaemia cannot be reliably diagnosed on a SST/yellow top sample.	
Glucose Tolerance Test	Blood	2 x 2mL	Sodium Fluoride/Grey Top	Time 0 and time 120min	
Hb A_{1C} Glycated Haemoglobin -	Blood	4mL	EDTA/Purple Top		
Glycosaminoglycans (GAGS)				See Mucopolysaccharides	
Gold	Blood	6mL	Special tube - contact laboratory		Trace Metal Lab, Belfast Link labs
Growth Hormone	Blood	3mL	Green top LiHep	Contact laboratory. Random levels of limited value.	Endocrine Lab, RVH
Gut Hormone Profile: Glucagon, Secretin, VIP, Pancreatic Polypeptides, Gastrin	Blood	16 mL (for full profile)	EDTA/Purple Top x 4	VIP only - 2 x EDTA VIP Not available at present PP only - 1 x EDTA Gastrin only - 1 x EDTA Samples should be sent on ice. Green top LiHep also suitable for Gastrin but not other gut hormones. Stable on ice for 2h.	Regulatory Peptide Lab, RVH
Haemochromatosis - Gene analysis	Blood	4mL	EDTA/Purple Top		Haematology Dept, Belfast Link Labs
Haptoglobin	Blood	4ml	SST/Yellow Top		Altnagelvin
HCG - Human Chorionic Gonadotrophin	Blood	3mL	Green top LiHep	Tumour marker requests referred to Belfast Link labs	Altnagelvin, SWAH, Belfast Link Labs
Homocysteine	Blood	4mL	EDTA/Purple Top	Transport sample to lab on ice within 30min. Inform Lab prior to venepuncture.	Belfast Link Labs
Hydroxybutyrate, Beta	Blood	3mL 2mL	Green top LiHep or Sodium Fluoride/Grey Top		
5-HydroxyIndole Acetic Acid (5-	Urine – 24h	24h	Plain 24h Urine Bottle	Avoid foods rich in 5-HT before and during	Biochemistry Lab, RVH

Test	Sample	Volume	Container	Comments	Sent to
HIAA)				collection. Contact Laboratory for full list.	
17-Hydroxy Progesterone	Blood	1mL	Clotted/Red Top	Yellow or green not suitable. Used for diagnosis of CAH. Sample should be taken between 8 and 9am. Infant should be 2 days old. Minimum of 1mL of serum required. Haemolysed samples unsuitable. Samples batched and *This is a specialised test provided by the Regional Endocrine Laboratory, Kelvin Building, Royal Victoria Hospital, Belfast. Due to the specialist nature of this assay samples are batched and analysed approximately every 10-14 days.* *If you require a sample to be analysed urgently for 17OHP please contact the laboratory to discuss, otherwise it will be analysed in the next routine batch (ie not treated as urgent). Please phone:* *Kirsty Spence (Principal Clinical Scientist) on 028961 51487* *Neil Gilmore (Clinical Scientist) 028961 51488* *Margaret McDonnell (Consultant Clinical Scientist) on 028961 51486* *NB babies must be at least 48h old before collection of sample for this test.*	Endocrine Lab, RVH
Hydroxyproline	Urine – 24h	24h	Plain 24h Urine Bottle	Avoid meat, fish and gelatine for 24h before and during collection	Biochemistry Lab, RVH
Hypertension Compliance screen	Urine - Random	10mL	Universal Tube	NCAT Request form should be filled out	Pathology/Special Chemistry

Test	Sample	Volume	Container	Comments	Sent to
				 NCAT Request form .docx	University Hospitals of Leicester Pathology Services
Hypo -Pack				Contact Laboratory	Children's Biochemistry Lab, RVH
IgE – Total or RAST	Blood	4mL	SST/Yellow Top		Immunology, RVH
IgG Subclasses	Blood	4mL	SST/Yellow Top		Biochemistry Lab, RVH
Imipramine	Blood	4mL	Clotted/Red Top	Gel tube unsuitable. Sample should be taken pre-dose. Contact BCH, Ext.3168.	Kings's College
Immunoglobulins	Blood	4mL	SST/Yellow Top	In childhood reference intervals vary with age.	Altnagelvin
Indicans	Urine – 24h	24h	Plain 24h Urine Bottle		Biochemistry Lab, RVH
Insulin - Pro		See Pro-insulin			
Insulin + C-Peptide	Blood	3mL 2mL	Green top LiHep Sodium Fluoride/Grey Top	Sodium Fluoride/grey Top for glucose MUST be taken at the same time. Send specimens to Laboratory immediately.	Endocrine Lab, RVH
Insulin Antibodies	Blood	4mL	SST/Yellow Top		SAS Peptide Hormone Section Guildford
Insulin Receptor Antibodies	Blood	4mL	SST/Yellow Top		Endocrinology Laboratory Addenbrooke's Hospital Hills Road Cambridge CB2 2QQ
Insulin-Like Growth Factor (IGF-1)	Blood	3mL	Green top LiHep	Send to lab immediately.	Endocrine Lab, RVH
Iron (Fe)	Blood	3mL	Green top LiHep	For suspected Iron deficiency, measure Ferritin only. For suspected overload request Iron Overload Profile.	
Iron Profile (Iron, Ferritin,	Blood	3mL	Green top LiHep	Sample should be taken after overnight fast.	

Test	Sample	Volume	Container	Comments	Sent to
TSat%)					
Lactate	Blood	2mL	Sodium Fluoride/Grey Top	Samples should be sent to Lab at RT within 1h. Samples received >6h will not be processed. [Lactate levels in whole blood may increase by up to 20% 6h].	
Lactate ***NOT UKAS – accredited***	CSF	1mL	Universal Container		
Lamotrigine (Lamictal)	Blood	4mL	Clotted/Red Top	Gel tube unsuitable. Sample before next dose	Toxicology Lab, Belfast Link Labs
Lanoxin				See Digoxin	
Largactil	Blood	4mL	Clotted/Red Top	Chlorpromazine	Toxicology Lab, Belfast Link Labs
Laxative Screen	Urine	3.2mL	Lemon Top Sarstedt Monovette Urine Tube	Prior approval by Consultant required	Chemical Pathology Reception Dept of Clinical Biochemistry Turnberg Building Salford Royal Hospital Stott Lane Salford, M6 8HD
LDH (Lactate Dehydrogenase)	Blood	3mL	Green top LiHep		
Lead - Blood	Blood	4mL	EDTA/Purple Top Or special Trace metal tube		Trace Metal Lab Belfast Link labs
Lead - Urine	Urine – 24h Urine – Random	24h 3.2mL	Plain 24h Urine Bottle Lemon Top Sarstedt Monovette Urine Tube		Trace Metal Lab Belfast Link labs
Leucocyte Lysosomal Enzymes	Blood	4mL	EDTA Purple Top		Willink Biochemical Genetics Unit, Manchester
Levetiracetam (Keppra)	Blood	4mL	Clotted/Red Top	Gel tube unsuitable. Sample before next dose. May be analysed on same sample as Lamotrigine if patient on both drugs	Toxicology Lab, Belfast Link Labs

Test	Sample	Volume	Container	Comments	Sent to
Lipase	Blood	3mL	Green top LiHep		Biochemistry Lab, RVH
Lipid Profile	Blood	3mL	Green top LiHep	Specimen should be collected after an overnight fast.	
Lipoprotein Electrophoresis	Blood	4mL	SST/Yellow Top	Specimen should be collected after an overnight fast.	St Thomas Hospital Chemistry Lab 4th floor , North Wing,St Thomas Hospital,Westminster Bridge Road,London,SE1 7EH
Lithium	Blood	4mL	SST/Yellow Top	Take sample 12h after last dose.	
Liver Profile	Blood	3mL	Green top LiHep	ALP reference interval is age related.	
Lipoprotein a Lp(a)	Blood	4mL	SST/Yellow Top		Biochemistry Ulster Hospital
Luteinising Hormone (LH)	Blood	3mL	Green top LiHep		Endocrine Lab, RVH
Magnesium - Blood	Blood	3mL	Green top LiHep		
Magnesium - Urine, 24h	Urine – 24h	24h	Issued from Laboratory	24h bottle contains dilute HCl acid.	
Magnesium - Urine, Random	Urine - Random	3.2mL	Lemon Top Sarstedt Monovette Urine Tube	Interpretation dependent on plasma magnesium and magnesium intake.	
MELAS Genetic testing	Urine-Early Morning	20mL	Universal Container	Samples posted to Newcastle so should be collected Mon-Fri	Newcastle Mitochondrial Service
Mercury	Urine	3.2mL	Lemon Top Sarstedt Monovette Urine Tube	METAL BEDPAN MUST NOT BE USED TO COLLECT URINE. Contact. BCH Ext. 2017 for details.	Trace Metal Lab, Belfast Link Labs
Metanephrines - Paediatric	Urine - Random	15mL	Contact Laboratory	Sample must be collected into acid. (500uL of 40% HCl to 15 mL of urine)	Biochemistry Lab, RVH
Metanephrines - Urine	Urine – 24h	24h	Issued from Laboratory	24h bottle contains dilute HCl acid. Repeat twice if clinical suspicion is high. Patients should avoid stimulants (e.g. coffee) and paracetamol on day of and day before test.	Biochemistry Lab, RVH

Test	Sample	Volume	Container	Comments	Sent to
Metanephrines - Plasma	Blood	4mL	EDTA Purple Top	See – CC/CP/024. Samples should be collected following an overnight fast and after patient has been supine for a minimum of 30min. [Record if supine or seated]. Collect one Purple Top EDTA whole blood (minimum volume 1mL) and Gently invert 8 times), place on ice and transport to the Clinical Biochemistry Laboratory to arrive within 2h of sampling -- record time of collection on request form.	Department of Blood Sciences Freeman Hospital Freeman Road Newcastle upon Tyne NE7 7DN
Methaemoglobin (MetHb) (MetHb - CoOx) ***NOT UKAS – accredited***	Blood	2mL 3mL	1mL Heparinised Blood Gas Syringe, capillary tube, microsampler or Green top LiHep	If required – use POCT devices – there are no blood gas analysers in the Lab. Needle must NOT be left on syringe, use syringe cap.	POCT
Methanol	Blood	2mL	Sodium Fluoride/Grey Top	BY SPECIAL ARRANGEMENT ONLY	Toxicology Lab, Belfast Link Labs
Methotrexate	Blood	4mL	Clotted/Red Top	Samples should be taken at 24h intervals after high dose therapy until serum level is <0.1 umol/L	Belfast Link Labs
Methylmalonic Acid	Blood	4mL	EDTA/Purple Top	Transport sample to lab on ice within 30min. Inform Lab prior to venepuncture. Usually requested with Homocysteine following low B12 and Folate	Cardiff and Vale University Health Board Metabolic Lab
Methylmalonic Acid	Urine - Random	3.2mL	Lemon Top Sarstedt Monovette Urine Tube		Children's Biochemistry Lab, RVH
Muco polysaccharides (Glycosamino glycans) (GAGS)	Urine - Random	3.2mL	Lemon Top Sarstedt Monovette Urine Tube		Children's Biochemistry Lab, RVH
Myoglobin				No longer available. Plasma CK offered in	

Test	Sample	Volume	Container	Comments	Sent to
				place. Rhab-domyolysis renal failure unlikely if CK <5000 U/L.	
Occult Blood	Faeces	Send in Seracult Card		Should avoid red meat, dark fish, uncooked vegetables, Iron supplements and alcohol for 3 days before and during collection. Note: False positive rate is reported by manufacturer as 1-2%	
Oestradiol	Blood	3mL	Green top LiHep	State menstrual phase on form.	Endocrine Lab, RVH
Oligoclonal Bands				See CSF Protein Electrophoresis	
Organic Acids	Urine - Random	3.2mL	Lemon Top Sarstedt Monovette Urine Tube	Full clinical details required.	Children's Biochemistry Lab, RVH
Osmolality, Plasma	Blood	3mL	Green top LiHep		
Osmolality, Urine	Urine - Random	1 mL at least	Lemon Top Sarstedt Monovette Urine Tube	Appropriate urine osmolality depends on clinical status. Contact laboratory.	
Ostase				See Bone markers	
Oxalate	Urine – 24h	24h collection	Issued from Laboratory	24h bottle contains Thymol – see renal stone investigations	Belfast Link Labs
Oxyhaemoglobin (OHb – CoOx) ***NOT UKAS – accredited***	Blood	2mL 3mL	1mL Heparinised Syringe, capillary, microsampler or Green top LiHep	If required – use POCT devices – there are no blood gas analysers in the Lab. Needle must NOT be left on syringe, use syringe cap.	POCT
Pancreatic Polypeptides				See Gut Hormone Profile	
P-ANCA C-ANCA Vasculitis screen	Blood	4mL	SST/Yellow Top		Immunology Lab, Belfast Link Labs
Paracetamol	Blood	3mL	Green top LiHep	Sample should be taken at least 4h after drug ingestion.	
Paraquat	Urine - Random	10mL	Universal Tube	Analysis of urine is the first line test.	Toxicology Lab, Belfast Link Labs

Test	Sample	Volume	Container	Comments	Sent to
Parathyroid Hormone (Parahormone, PTH)	Blood	4mL	EDTA/Purple Top	A Green top LiHep should also be taken for simultaneous Bone profile.	
pH – Faecal ***NOT UKAS – accredited***	Faeces	10g	Universal Container	Samples must be received in lab within 1h of collection.	Altnagelvin
pH- Blood				See Blood Gas Analysis	
pH – Urine ***NOT UKAS – accredited***	Urine	3.2mL	Lemon Sarstedt Monovette Urine		Altnagelvin
Phenobarbitone	Blood	3mL	Green top LiHep	Take specimen immediately before next oral dose – trough [No longer run in WHSCT]	BHSCT
Phenytoin	Blood	3mL	Green top LiHep	Take specimen immediately before next oral dose - trough	
Phosphate - Urine, 24h	Urine – 24h	24h	Issued from Laboratory	24h bottle contains dilute HCl acid.	
Phosphate - Urine, Random	Urine - Random	3.2mL	Lemon Top Sarstedt Monovette Urine Tube	Plasma and Random Urine Phosphate may be used to calculate renal tubular phosphate threshold. Contact Laboratory	Altnagelvin
Pleural Fluid				See Fluid Analysis	
Porphyria Screening [PBG and TUP]	Urine	3.2mL	Lemon Sarstedt Monovette Urine	All samples should be light protected. If the clinical suspicion of porphyria is high, please contact Consultant staff as first line tests may on occasion give negative results.	Altnagelvin
Porphyria Typing	Blood Urine Faeces	4mL 3.2mL 10g	EDTA/Purple Top Lemon Sarstedt Monovette Urine Universal	All samples should be light protected. If the clinical suspicion of porphyria is high, please contact Consultant staff as first line tests may on occasion give negative results.	Medical Biochemistry, Cardiff.
Procollagen 3	Blood	4mL	SST/Yellow Top		Biochemistry Lab, RVH
Progesterone	Blood	3mL	Green top LiHep		Endocrine Lab,

Test	Sample	Volume	Container	Comments	Sent to
					RVH
Prolactin	Blood	3mL	Green top LiHep	Levels up to 1000 mU/L can be induced by stress. Contact RVH ext 3180 No longer part of male or female hormone profile	Endocrine Lab, RVH
Protein – Random Urine	Urine	3.2mL	Lemon Top Sarstedt Monovette Urine Tube		
Protein – 24h Urine	Urine	24h	Plain 24h Urine Bottle		
Protein Electrophoresis	Blood	4mL	SST/Yellow Top		Altnagelvin
PSA - Prostate Specific Antigen	Blood	3mL	Green top LiHep	**Free PSA**: no longer available in NI Minimum retesting interval 13 days	
Pyruvate	Blood	1mL	Contact Lab, special bottle required.	Not generally required. Lactate alone usually sufficient.	Children's and newborn screening Lab. Newcastle
Reducing Substances - Faeces	Faeces	1g	Universal container	Send to lab within 60min of collection	Children's, RVH
Reducing Substances - Urine	Urine - Random	3.2mL	Lemon Top Sarstedt Monovette Urine Tube	Send to lab immediately.	Children's, RVH
Renal Stones				See Calculi Analysis	
Renal Stone Investigations	Urine - 24h Urine Random – early am	24h x 2 3.2mL	24h urine container with Thymol Issued from Laboratory Lemon Top Sarstedt Monovette Urine Tube	Two 24h urine collections required: Collected at least one week apart [Thymol] See – CC/CP/017 Random am urine for pH and cystine screen – bottle should be filled to top to avoid air.	Biochemistry Lab, RVH
Renin (Aldosterone)	Blood	4mL	EDTA/Purple Top	Contact laboratory about patient preparation. EDTA sample bottle must be filled completely to mark and transported to lab within 3h. (Do **not** place	Endocrine Lab, RVH

Test	Sample	Volume	Container	Comments	Sent to
				on ice) Aldosterone analysed on same specimen	
Rivotril				See Clonazepam	
Rheumatoid Factor	Blood	4mL	SST/Yellow Top	Test introduced 25/10/2021	
Salicylate	Blood	3mL	Green top LiHep		
Secretin				See Gut Hormone Profile	
Selectivity of Proteinuria	Blood Urine - Random	4mL 3.2mL	SST/Yellow Top Lemon Top Monovette Urine Tube	Send urine and blood samples together.	Biochemistry Lab, RVH
Sirolimus	Blood	4mL	EDTA/Purple Top	Take sample before next dose. State if on combination or mono therapy. Results are recorded in Lab computer.	Toxicology Lab, Belfast Link Labs
Sweat Test		Contact Lab		Sweat Chloride measured since July 2020	
Tacrolimus (FK 506)	Blood	4mL	EDTA/Purple Top		Toxicology Lab, Belfast Link Labs
Testosterone	Blood	3mL	Green top LiHep		Endocrine Lab, RVH
Theophylline Aminophylline, Nuelin	Blood	3mL	Green top LiHep	Measure 5 days after starting oral treatment and at least 3 days after any dose adjustment. A blood sample should usually be taken 4–6h after an oral dose of a modified-release preparation. Trough levels should be taken immediately before next oral dose. If aminophylline is given intravenously, a blood sample should be taken 4–6h after starting treatment.	
Thiamine - Vitamin B1		3mL	NON GEL Green top LiHep Or EDTA/Purple Top	Not available routinely Note: NON GEL LiHEP sample required – Do not send “routine” LiHep green top.	Department of Clinical Biochemistry Macewen Building Glasgow Royal

Test	Sample	Volume	Container	Comments	Sent to
					Infirmary Glasgow G4 0SF
Thio Purine Methyl Transferase (TPMT)	Blood	4mL	EDTA/Purple Top	Results are recorded in Lab computer. RECENT BLOOD TRANS-FUSIONS MAY MASK A DEFICIENT TPMT RESULT.	Birmingham
Thiopurine Metabolites	Blood	4mL	EDTA/Purple Top	Results are recorded in Lab computer.	Birmingham
Thyroglobulin	Blood	4mL	SST/Yellow Top	Haemolysis invalidates result	Endocrine Lab, RVH
Thyroid Antibody TPO - Thyroid Peroxidase Antibody	Blood	3mL	Green top LiHep		Endocrine Lab, RVH
Thyroid Antibody TSHR – TSH Receptor Antibody	Blood	4mL	SST/Yellow Top		Biochemistry Lab, RVH
Thyroid Profile FT4 + TSH (+ FT3)	Blood	3mL	Green top LiHep		
Thyroid Profile Alternative method FT4 + TSH (+ FT3)	Blood	3mL	Green top LiHep	Sent to Glasgow for analysis on Abbott Architect analyser From 18/10/21	Clinical Biochemistry Lab Glasgow
Trace metals				See individual metals	
Transferrin	Blood	3mL	Green top LiHep	Offered as part of Iron Profile	
Trimethylamine	Urine - Random	3.2mL	Lemon Top Monovette Urine Tube SST/Yellow Top		Children's Biochemistry, RVH
Troponin T	Blood	3mL	Green top LiHep		
TSH Binding Inhibitor Immunoglobulin (TBII)	Blood	4mL	Clotted/Red Top	If on neonate, samples required from mother also.	SAS Lab, RVI, Newcastle
Urate, Blood	Blood	3mL	Green top LiHep	In gout the target Uric Acid level is <360 umol/L. Samples from patients on Rasburicase should be collected in Green top LiHep and sent to lab on ice within 1h up to 4-5d	

Test	Sample	Volume	Container	Comments	Sent to
				after last dose (1/2 life 18h).	
Urate, Urine	Urine – 24h	24h	Issued from Laboratory	24h bottle contains Thymol	
Valproic Acid Sodium Valproate, Epilim	Blood	3mL	Green top LiHep	Only of value in assessing compliance -- there is no well defined therapeutic or toxic range.	Altnagelvin
Vancomycin	Blood	3mL	Green top LiHep	EDTA/Purple Top also suitable.	Altnagelvin
Vasoactive Intestinal Peptide (VIP)				See Gut Hormone Profile	
Vasopressin				Replaced by Copeptin	
Vitamin A	Blood	4mL	SST/Yellow Top	Analysed with Vit E. Send in envelope to shield from light.	Biochemistry Lab, RVH
Vitamin B1				See Thiamine	
Vitamin B12	Blood	3mL	Green top LiHep	Analysed with Folate. Fasting sample required.	
Vitamin C	Blood	3mL	Green top LiHep	Contact laboratory in advance. Specimen must be transported to lab on ice within 60min and shielded from light. EDTA/Purple Top **not** suitable	Biochemistry Lab, RVH
Vitamin D	Blood	4mL	SST/Yellow Top	Specimen must be transported to the laboratory within 3h. Current assay measures 25OH D2 and D3.	Endocrine Lab, RVH
Vitamin E	Blood	4mL	SST/Yellow Top	Analysed with vitamin A. Send in envelope to shield from light.	Biochemistry Lab, RVH
Zarontin				See Ethosuximide	
Zinc	Blood	6mL	Special Container. Contact Laboratory		Trace Metal Lab, Belfast Link Labs

For tests not listed above – contact Clinical Biochemistry Laboratory