

Department of Clinical Biochemistry & Immunology
North Glasgow

User Handbook

Document: CLIN003

Revision: 28

Approved by: Linda Mackinnon

IN THE EVENT OF PROBLEMS OR UNFORESEEN EVENTS – CONTACT
THE HEAD OF DEPARTMENT

North Glasgow Clinical Biochemistry Service User Handbook

Glasgow Royal Infirmary
Gartnavel General Hospital
Stobhill Hospital

<http://www.nhsggc.org.uk>

User Handbook

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Contacts

Glasgow Royal Infirmary Switchboard.....0141 211 4000

Gartnavel General Hospital Switchboard0141 211 3000

Duty Biochemist.....0141 211 (2)4003 (option 3)

General enquiries0141 211 (2)4003 (option 2)

Metabolic Biochemist (based at QEUH)0141 354 (8)9060 (option 4)

GRI Specimen Reception0141 211 (2)4047

GGH Specimen Reception0141 211 (5)3347

For direct dialling to a hospital extension from outwith the hospitals, replace the last four digits of the hospital number with the last four digits of the extension you require (i.e. to contact General Enquiries at GRI, one would dial 0141 211 4003).

		Site	Extension	Title / Specialty
Dr Janet	Horner	GRI	(2)4631	Consultant Biochemist & Lead Clinician
Dr Maurizio	Panarelli	GRI	232 (2)0830	Consultant Biochemist & Head of Service for NHSGGC
Mr John	Hepburn	GRI	(2)5534	Technical Services Manager
Mrs Linda	Mackinnon	GRI	(2)4339	Quality Manager
Dr Caroline	Millar	GRI	(2)4317	Consultant Biochemist
Ms Karen	Smith	GRI	(2)4424	Consultant Clinical Scientist, Endocrinology
Dr Dinesh	Talwar	GRI	(2)4490	Consultant Clinical Scientist, Core & STEM DRL
Dr Anthony	Catchpole	GRI	(2)5178	Clinical Scientist, STEM DRL
Ms Donna	Chantler	GRI	(2)4597	Clinical Scientist, Endocrinology
Dr Alison	Fairservice	GRI	(2)4365	Clinical Scientist
Dr Lyn	Ferguson	GRI	(2)4119	Specialty Trainee, Chemical Pathology & Metabolic Medicine
Ms Amy	Frank	GRI	(2)4235	Clinical Scientist
Mrs Susan	Johnston	GRI	(2)4365	Clinical Scientist, Endocrinology
Dr Christina	Kanonidou	GRI	(2)4365	Specialty Trainee, Chemical Pathology & Metabolic Medicine
Dr Craig	Livie	GRI	(2)4119	Clinical Scientist
Mr Ian	Pattie	GRI	(2)4494	Clinical Scientist, Core
Dr Neil	Syme	GRI	(2)4235	Clinical Scientist, Core & Endocrinology
Dr John	Wadsworth	GRI	(2)5178	Clinical Scientist, STEM DRL
Mrs Trish	Love	GRI	(2)5123	Laboratory Sector Manager
Mr Scott	Gibb	GRI	(2)4559	Specialist Section Manager
Mrs Christine	Robertson	GRI	(2)4634	Reception Manager
Mrs Angela	Winters	GRI	(2)5712	Office Manager
Ms Sheena	Brownlie	GRI	(2)4628/4629	Finance administrator
Mrs Laura	Courtney	GRI	232 0725	Administration assistant
Mrs Julie	Ferguson	Cross-site	07747 802146	Blood Science IT Manager
Mr Billy	McCue	GRI	(2)4586	Blood Science IT Technician

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General Information

The Clinical Biochemistry service is provided by the laboratories at Glasgow Royal Infirmary and Gartnavel General Hospital. There is a small satellite laboratory at Stobhill ACH, which handles emergency samples only. We provide an analytical and interpretative service. Please telephone us to discuss any problems or issues you may have. Our efficiency depends to a large extent on your cooperation. Your compliance with a few simple rules concerning safety, specimen identification and transport of specimens to the laboratory, all outlined in this handbook, will greatly help us deliver an efficient service.

Clinical advice

A duty biochemist is always available for advice on test selection, procedures and interpretation. During routine working hours contact 0141 211 (2)4003 (option 3), for urgent enquiries between 5pm-9am Monday-Friday and 1pm-9am Saturday-Sunday; the Duty Biochemist may be contacted through the hospital switchboard.

Results

Authorised reports are available electronically via Clinical Portal, TrakCare (inpatient results) or ICE/Lab Importer (primary care). The majority of in-patient and out-patient locations, and GP practices within NHSGGC no longer receive hard copy reports. The laboratory will telephone grossly abnormal results.

Telephone requests for results

Please note that we need to establish the caller's identity before giving results over the telephone. We cannot give results to patients or their relatives. We can only provide results to medical practitioners or their authorised deputies.

Add-On Requests to Existing Specimens

Requests for add-ons may be made up to 96 hours after receipt by emailing. Please note some analytes are only stable for up to 24 hours.

northglasgow.biochem@ggc.scot.nhs.uk

When emailing, please provide the patient's full name and CHI number and use a secure email account (nhs.net or GGC). Add-ons will be processed as soon as is possible, between 9am-5pm, Monday-Friday and 9am-1pm Saturday-Sunday. For an urgent add-on test, please contact the emergency lab on 0141 211 4487 (24487) or send a fresh sample.

Point-of-care testing

The Clinical Biochemistry department provides full support for blood gas analysers and glucose meters in North Glasgow hospitals, including:

- A full training and assessment programme.
- A programme of quality control and maintenance to the wards.
- Replacement meters.
- Help and advice when problems arise.

For further information contact the POCT team: NorthGlasgow.BiochemistryPOCT@ggc.scot.nhs.uk

Research

Please contact the Head of Department to discuss Clinical Biochemistry participation in research projects

Pneumatic tube

A pneumatic tube transport system is available at both GRI and GGH. The pneumatic tube system may be used for blood samples but **should not be used for:**

- High risk samples e.g. TB, Anthrax, VHF
- Sharps
- Samples for Blood Gas Analysis
- Pathology samples
- Heavy material (>kg)
- Large liquids >30mL such as urine or pleural washes
- Leaking samples
- CSF samples

Contamination results in tube shut down for all users until disinfection process is complete.

NHSGGC Biochemistry Laboratory Services

General information is available on the Clinical Biochemistry website:

<http://www.nhsggc.org.uk/about-us/professional-support-sites/biochemistry/north-glasgow-biochemistry/>

Glasgow Royal Infirmary (GRI)

Department of Clinical Biochemistry,
Macewen Building,
Glasgow Royal Infirmary,
GLASGOW G4 0SF
Fax 0141 552 3324
Specimen Reception 0141 211 (2)4047

Emergency requests and out-of-hours service 0141 211 (2)4487

Location of the laboratory and hours of work

The laboratory is in the Macewen Building, at Alexandra Parade (adjacent to Accident & Emergency Department). It provides routine service Monday – Friday between 9am and 5pm and on Saturday between 9am and 12pm. An emergency service operates at all times.

Reporting Office/interpretative advice

Call the Duty Biochemist on ext 24003/4 (option 3) from any of the hospitals (211 4003/4, option 3, if telephoning from outside) during working hours, and via the switchboard out-of-hours.

Requests from the following locations and patient groups are handled as priorities:

Locations:

A&E, minor injuries, same day admissions
Acute Assessment Unit
Intensive Care Unit, critical care
Labour ward
Mat Care Assessment, Mat Assessment Unit
Assisted Conception Suite
All theatre and recovery samples
Ward 63 enhanced recovery

Patients / Tests:

All baby samples
HCG samples from Sandyford clinic & EPAS
Drugs of Abuse screens (emergency only)
All gases/ met Hb / carboxy Hb
CSF samples

Any other requests for emergency analysis must be arranged with the laboratory to alert staff to the arrival of an urgent sample. Also, the electronic request form must specify urgent request.

Gartnavel

Gartnavel General Hospital (GGH)

Department of Clinical Biochemistry
Gartnavel General Hospital
1053 Great Western Road
GLASGOW G12 0YN
Fax 0141 211 3452
Specimen Reception 0141 211 (5)3347

Location of laboratories and hours of work

The main laboratory is at GGH (in the Laboratory Block of the GGH Complex). This laboratory provides routine and emergency services Mon - Fri between 8.45 am and 7.30 pm for the Beatson Oncology Centre and wards at GGH.

The 24/7 emergency laboratory is at GRI, Macewen Building ground floor.

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North Glasgow Specialist Services:

Specialist Biochemistry and Endocrine Laboratory: Based in Macewen Building, GRI
<http://www.nhsggc.org.uk/about-us/professional-support-sites/biochemistry/nhsggc-specialist-endocrine-laboratory/>

Scottish Trace Element and Micronutrient Diagnostic and Research Laboratory: Based in Macewen Building, GRI
Email: STEMDRL@ggc.scot.nhs.uk
<http://www.trace-elements.co.uk/index.asp>

South Glasgow Specialist Services:

General laboratory information is available on the Clinical Biochemistry website:
<http://www.nhsggc.org.uk/about-us/professional-support-sites/biochemistry/south-glasgow-biochemistry/>

Specialist Toxicology: Based in QEUH
The Specialist Toxicology Handbook can be accessed via the above website

Specialist Metabolic analyses: Based in QEUH
The Specialist Metabolic Handbook can be accessed via the above website

Specimen Collection and Handling

Sample containers of any type should be obtained through normal supply routes for consumables. The Biochemistry Department does not supply containers or packing materials except by special arrangement. Specimens will not be sent to external laboratories on behalf of ward staff unless specifically arranged. Please follow these simple rules to help us provide a service of quality to our patients.

1. Test Requesting

- If request is made electronically, select patient details with care and please give clinical details.
- Ensure printing is clear on form and check date on form is correct. Positively confirm the identity of the patient prior to sampling.
- A label is provided for every sample required – please stick the right label on the right tube.
- Sometimes more than one form is printed. Please use these as some samples go directly to other hospital/labs in Glasgow.
- Do not write tests on form – written requests cannot be accepted.
- When given instructions on sampling, please follow these.
- If paper request forms are used, ensure the request form is completed correctly (Surname, Forename, DOB, CHI No. (or other unique identifier e.g. TJ no.), date & time of specimen collection & brief clinical details).
- The name and full address to which the report should be sent (Consultant, GP Surgery, Hospital Ward, Clinic etc) must be included on the request form.
- The laboratory will not process samples that do not have clear patient identification. Any handwritten forms must be legible.
- Clinical information included on the form permits laboratory staff to assess the validity of results and may prevent unnecessary repeat analyses. Supporting information may be required for correct interpretation. For example, therapeutic drug monitoring requests require information about dosage, time since last dose, and a complete list of prescribed drugs.
- Please give contact/page number in case of abnormal results

2. Specimen Labelling and sample identification

Normally, the minimum criteria for adequate identification includes the patient's forename and surname, plus date-of-birth and CHI number (or other unique identifier e.g. TJ number). Ideally address should also be available.

- When emergency tests are required for **unidentified patients** the requesting clinician should indicate 'unknown male/female' in place of name and surname, and **must** indicate the exact time of sample withdrawal. The Casualty number should be used, where available.
- It is preferred that details are printed. Identification of the Ward/Clinic/Surgery is essential for telephoning results. The laboratory cannot process specimens that are not clearly identified and will not process unlabelled specimens.

3. Patient Preparation

- The patient should be resting for at least 5 minutes before withdrawal of blood.
- Venous blood samples should be taken with minimal stasis.
- Hyperventilation by the patient during arterial blood gas sampling may affect results.
- Many analyses require that the specimen be collected under specified conditions, e.g. fasting. In some cases, the requirements are quite stringent, e.g. for the measurement of plasma renin/aldosterone. In all cases, you should make sure that the appropriate requirements are met. If in doubt, please contact the Duty Biochemist.

4. Specimen Collection

- Ensure that the correct sample container is used for the requested tests.
- For venous blood use vacuum blood collection tubes.
- Collect fluid samples (ascitic, drain etc) into vacutainers – the laboratory can provide details of aspiration devices
- You must use an appropriate container for each test.
- If more than one tube is collected from a patient, the potassium EDTA tube should be filled last to avoid errors in potassium and calcium measurement.
- Anticoagulant tubes should be inverted several times to ensure adequate mixing.

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- When taking arterial blood gas samples expel liquid heparin from arterial blood gas syringes. The heparin should fill only the dead-space of the syringe. Air bubbles should be expelled before the syringe is sealed.
- Some analyses require that the samples be collected into special containers and/or separated and deep-frozen within minutes of collection. Details of the appropriate collection containers for all samples – blood, urine, CSF, and faeces – can be found on page 10.
- Where there is any doubt about sample preparation, storage, or transport please contact the Duty Biochemist.

5. Specimen Packaging

In order to minimise the risk of interchange of samples and cross contamination a specimen bag must contain specimens from one patient only. Always ensure the sample container is securely capped.

6. Storage Prior To Transport To Laboratory

- Do not expose the specimens to extremes of temperature prior to transport.
- Samples should be transferred to the laboratory with minimal delay to maintain sample integrity. Delays in centrifugation can affect the values obtained for certain analyses (e.g. potassium).

7. Safety and Dangerous Specimens

This guidance applies to blood and other body fluid samples for Biochemistry, Immunology, Haematology, Microbiology, Virology and Genetics. It does not apply to Pathology where existing procedures should continue.

Clinical staff need no longer use “DANGER OF INFECTION” stickers to highlight samples containing (or suspected of containing) blood borne viruses (BBV) such as HIV and hepatitis B or C. It is not necessary to alert laboratories (other than Pathology) about potential infectivity of such samples since all laboratories observe standard precautions.

Users **MUST** alert relevant laboratories by phone (contact details below) for the following samples:

- i) body fluids containing group 4 hazard grade pathogens, namely from patients with confirmed or high possibility viral haemorrhagic fevers (VHF). (Refer to VHF guidance).
- ii) CSF from patients with tuberculous meningitis (or high suspicion of). (CSF spectrophotometry would **not** be performed on such samples).
- iii) Sputum from patients with Middle East respiratory syndrome (MERS), or high suspicion of – **MUST** be discussed with Consultant virologist before sample sent

The above samples MUST NOT be transported via pneumatic tube.

Biochemistry contact: reporting biochemist 24003/4 (option 3) Mon – Fri, 9am-5pm on call consultant outwith hours above via switchboard

8. Disposal Of Phlebotomy Equipment

Please refer to your local health and safety procedures for the safe disposal of all materials used during specimen collection

9. Dealing With Spillages And Breakages

Please refer to your local health and safety procedures for dealing with spillages and breakages.

10. Collection Of Specimens From Neonates

- Specimens from the neonatal unit are mainly capillary specimens taken from heel stabs. Care should be taken to ensure that the specimen is taken from the outer aspect of the heel, that there is no contamination, that undue force is not exerted and that the blood is free-flowing and is collected quickly. Even with the best blood collection technique, samples may still show haemolysis and results cannot then be given for certain analytes, e.g. potassium, conjugated bilirubin.
- The volume of blood required for routine analyses (e.g., U&E, LFT, Bone, CRP, bilirubin, triglycerides) depends on the number of tests/test profiles being requested. In general we require 0.25 mL blood for 1 test/test profile, 0.5mL for 2 and 0.75mL for 3 or more. However, this is dependent on the haematocrit and more blood will be required if the haematocrit is high.
- Blood can be taken from an arterial line if the umbilical artery has been catheterised. It is important not to use a line that is used for infusion, since this can lead to contamination of specimens and to increased risk of infection.
- Blood gases are analysed by medical staff in the laboratory at the ward.

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Data Protection

The Data Protection Act 2018 is based upon eight enforceable principles of good practice:

1. Personal data shall be obtained and processed fairly and lawfully.
2. Personal data shall be held only for specified and lawful purposes and shall not be further processed in any manner incompatible with those purposes.
3. Personal data shall be adequate, relevant, and not excessive in the relation to the required purposes.
4. Personal data shall be accurate and, where necessary, kept up-to-date.
5. Personal data shall not be retained longer than is necessary.
6. An individual shall be entitled to have access to his or her data and where appropriate, have it corrected or erased.
7. Appropriate technical and organisational measures shall be taken against unauthorised or unlawful processing of personal data and against accidental loss or destruction of the data.
8. Personal data shall not be transferred outside EU countries unless an adequate level of data protection exists.

Organisations are obliged to comply with these principles. Failure to comply can result in an enforcement notice being issued by the Registrar.

Request Intervention

Request intervention (RI) procedures have been set up for a number of tests to facilitate more appropriate testing and help reduce unnecessary repeat testing. Appropriate time intervals for repeat testing have been discussed with clinical colleagues before being introduced. Requests for repeat analyses for a limited set of tests are held for viewing by the Duty Biochemist and may be over-ridden if deemed appropriate.

Comprehensive clinical details assist the Biochemist in this task. Note requests from relevant clinics/consultants will be exempted from RI and full details of clinic, location and consultant code should be provided on all requests. Note samples are only stored for 3-4 days.

Analyte	Request Intervention interval (days)
Calprotectin (faecal)	120
Copper	14
Lipids	28
Protein electrophoresis	90
Selenium	14
Thyroid Function Tests (TFT) + T3	30
Vitamin A	14
Vitamins B1, B2 & B6	14
Vitamin D	340
Vitamin E	14
Vitamin K	14
Zinc	14
β Carotene	14

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Specimen Information

Tube Types

The following tube are available within Greater Glasgow and Clyde. Note the colour for paediatric bottles may be different, please check the preservative. Other tube colours may be in use in other hospitals.

Description / Preservative	Adult bottle colour
Blood spot	BS card
Blood: Fluoride/oxalate	Grey
Blood: Potassium EDTA	Purple
Blood: Lithium Heparin	Green (non-gel) **
Blood: Plain	White
Blood: Serum Separator Tube (gel)	Yellow
Blood: Trace element tube	Dark-blue
Fluid: Plain	White
Urine: 24 hr acid	2.5 L urine bottle containing acid (available from local lab)
Urine: 24 hr plain	2.5 L urine bottle
Urine: Early morning plain (EMU)	White 20 mL universal container
Urine: Random plain (Random UC)	White 20 mL universal container
Faeces: Calprotectin	Calex tubes
Faeces: qFIT (faecal haemoglobin)	Alpha qFIT 'Picker'
Faeces: Other tests	White 20 mL universal container

*** Green and yellow top tubes are lithium heparin with gel and are unsuitable for all STEM DRL trace element and vitamin tests.*

Turn Around Time definition

Turnaround time is calculated from time of receipt of sample to authorisation of result. Results are available electronically in NHSGGC TrakCare and Clinical Portal following authorisation. Emergency requests are normally available electronically one hour after specimen receipt.

Sample Volume

The majority of tests can be carried out on a single full serum sample (yellow top). If a large number of tests are required (eg >10), please provide an additional yellow top bottle. The sample volume in the following table is a guide only.

UKAS Accreditation

The specimen catalogue (below) indicates which GRI Biochemistry tests are accredited to the ISO 15189:2012 standard *Medical laboratories – Requirements for quality and competence*. Non-accredited tests still follow rigorous quality control procedures.

** NB. We are currently verifying a different analyser platform for some tests (indicated with *) so some results produced may not be UKAS accredited during this verification period. Please contact the laboratory for further information if required.*

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Specimen Catalogue

The following table lists all of the assays available in North Glasgow Biochemistry. The reference ranges refer to adults only unless otherwise stated. Paediatric ranges are available for some analytes. The volume stated is the preferred amount, however smaller sample volumes may be acceptable (further information available on specific websites). For urgent analysis, please contact the lab.

Please note that biotin (Vitamin B7) can interfere with some immunoassay test results. If patients are on high doses of biotin, please contact the laboratory to discuss any unexpected result.

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Analyte (SET)	Sample	Adult Tube	Vol (mL)	Accredited	Result time (days)	Reference Range and General Comments
α1-Antitrypsin	Blood	Yellow	2	Yes	1	1.1 – 2.1 g/L Phenotyping available by arrangement.
α-Fetoprotein (AFP)	Blood	Yellow	2	Yes	1	See tumour marker bookmark Refer to specialist endocrine website
1,25 Dihydroxyvitamin D	Blood	Yellow	2	Yes	35	Refer to specialist endocrine website
17-Hydroxyprogesterone	Blood	Yellow	1	Yes	7	Part of androgen screen. Refer to specialist endocrine website For any urgent newborn samples please contact the lab to notify the Duty Biochemist.
17-Hydroxyprogesterone (blood spot)	Blood spot	BS card	-	Yes	56	Refer to specialist endocrine website
25-Hydroxyvitamin D3 & D2	Blood	Yellow	2	Yes	14	Refer to specialist endocrine website
5-Hydroxyindoleacetic acid (HIAA)	Urine	24 hr acid	-		14	Refer to specialist endocrine website
Adrenocorticotrophin (ACTH)	Blood	Purple	1	Yes	7	Refer to specialist endocrine website
Alanine aminotransferase (ALT) (LFT)	Blood	Yellow	2	Yes*	1	< 50 U/L
Albumin (LFT)	Blood	Yellow	2	Yes*	1	35 – 50 g/L
Albumin (urine)	Urine	EMU	2		1	< 20 mg/L
Albumin/creatinine ratio (ACR)	Urine	EMU	2		1	Male: < 2.5 mg/mmol Female: < 3.5 mg/mmol
Aldosterone	Blood	Purple	2		14	Refer to specialist endocrine website
Alkaline phosphatase (LFT)	Blood	Yellow	2	Yes*	1	30 – 130 U/L ALP may be elevated in children, during pregnancy and in the elderly. Age and sex related ranges available.
Alkaline phosphatase isoenzymes	Blood	Yellow	2	Yes	21	Qualitative test, only measured if ALP > 250 U/L.
Aluminium	Blood	Green (non-gel)	1	Yes	6	Refer to STEM DRL website.
Aluminium (RO water)	RO Water	Universal	1		10	Refer to STEM DRL website.
Amylase	Blood	Yellow	2	Yes*	1	< 100 U/L
Amylase/creatinine clearance ratio	Urine & Blood	Universal & Yellow	5 & 2		1	1 to 5% < 1% suggests macroamylasaemia. > 5% suggests acute pancreatitis.
Androstenedione	Blood	Yellow	1	Yes	7	Part of androgen screen. Refer to specialist endocrine website
Angiotensin converting enzyme (ACE)	Blood	Yellow	2	Yes	1	< 88 U/L
Anti-Mullerian Hormone (AMH)	Blood	Yellow	2	Yes	14	Refer to specialist endocrine website

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Analyte (SET)	Sample	Adult Tube	Vol (mL)	Accredited	Result time (days)	Reference Range and General Comments
Anti-thyroid peroxidase antibody (anti-TPOAb)	Blood	Yellow	2	Yes	1	Refer to specialist endocrine website
Apolipoprotein A-1	Blood	Yellow	2	Yes	7	1.0 – 2.2 g/L
Apolipoprotein B	Blood	Purple	2	Yes	7	0.6 – 1.3 g/L
Arsenic	Urine	Universal	2	Yes	10	<i>Refer to STEM DRL website.</i>
Arsenic (hair)	Hair	Sealable bag	-	Yes	10	<i>Refer to STEM DRL website.</i>
Aspartate aminotransferase (AST) (LFT)	Blood	Yellow	2	Yes*	1	< 40 U/L
Bence Jones protein (BJP)	Urine	Universal	2	Yes	14	Qualitative test. Early morning sample preferred. Also request serum protein electrophoresis. See tumour marker bookmark
Bicarbonate	Blood	Yellow	2	Yes*	1	22 – 29 mmol/L Sample must be received in the lab within 2 hr.
Bilirubin (Total) (LFT)	Blood	Yellow	2	Yes*	1	< 20 µmol/L
Bilirubin (Direct/Conjugated)	Blood	Yellow	2	Yes*	1	< 15% total, only measured if total bilirubin > 45 µmol/L
Blood gases (arterial)	Blood	Syringe			POC	H ⁺ : 36 – 44 nmol/L PCO ₂ : 4.6 – 6.0 kPa PO ₂ : 10.5 – 14.0 kPa
CA125	Blood	Yellow	2	Yes	1	See tumour marker bookmark Refer to specialist endocrine website
Cadmium	Blood	Purple	1		6	<i>Refer to STEM DRL website.</i>
Cadmium (urine)	Urine	Universal	2	Yes	10	<i>Refer to STEM DRL website.</i>
Caeruloplasmin	Blood	Yellow	2	Yes	1	0.16 – 0.47 g/L Paediatric ranges available on request.
Calcitonin	Blood	Green	1	Yes	14	Separate and freeze plasma. Transport frozen. Refer to specialist endocrine website
Calcium	Urine	24 hr plain	2		1	2.5 – 7.5 mmol/24 hr Ca/Creat ratio: 0.04 – 0.7
Calcium (Bone)	Blood	Yellow	2	Yes*	1	2.20 – 2.60 mmol/L Adjusted for albumin.
Calprotectin	Faeces	Calex tubes	1-5 g	Yes	7	Please see NHSGGC guidelines for advice and secondary care referral.
Carbamazepine	Blood	Yellow	2	Yes	1	4.0- 12.0 mg/L Pre dose sample preferred. Conversion Factor (molar into mass units) µmol/L x 0.24 = mg/L.
Carboxyhaemoglobin	Blood	Syringe			POC	0.5 – 1.5 % of total haemoglobin Neonates: < 5 % of total haemoglobin Smokers: 10 – 15 %
Carcinoembryonic antigen (CEA)	Blood	Yellow	2	Yes	1	See tumour marker bookmark Refer to specialist endocrine website
Chloride	Blood	Yellow	2	Yes*	1	95 to 108 mmol/L
Chloride (urine)	Urine	24 hr plain	5		1	150 – 250 mmol/24hr
Cholesterol (β-Quant ultracentrifugation)	Blood	Purple or Yellow	7		10	A full bottle (7 mL) is required. Includes: total Cholesterol, VLDL, LDL, HDL)
Cholesterol (Lipids or Chol & Trig)	Blood	Yellow	2	Yes*	1	Total < 5.0 mmol/L desirable in 'at-risk' individuals. LDL < 3.0 mmol/L desirable in 'at risk' individuals. HDL > 1.0 mmol/L desirable in 'at risk' individuals. Calculated LDL = Chol – HDL-C - 0.46 x trig
Chromium	Blood	Purple	1	Yes	10	<i>Refer to STEM DRL website.</i>

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Chromium (urine)	Urine	Universal	5	Yes	10	Refer to STEM DRL website.
Chromogranin A	Serum	Yellow	1		28	Refer to specialist endocrine website
Cobalt	Blood	Purple	1	Yes	10	Refer to STEM DRL website.
Cobalt (urine)	Urine	Universal	5	Yes	10	Refer to STEM DRL website.
Copper	Blood	Green (non-gel)	1	Yes	6	Refer to STEM DRL website.
Copper	Urine	24 hr plain	5	Yes	6	Refer to STEM DRL website.
Copper (liver)	Liver	Universal		Yes	10	Refer to STEM DRL website.
Cortisol	Blood	Yellow	2	Yes	1	7 – 9 am: 240 – 600 nmol/L 9 pm – 12 midnight: 50 – 290 nmol/L 30 min post 250 µg synacthen > 450 nmol/L
Cortisol (saliva)	Saliva	Plain tube	2.5		35	Collection tubes available from lab Refer to specialist endocrine website
Cortisol (urine)	Urine	24 hr or Random	10	Yes	14	Refer to specialist endocrine website
C-Reactive protein (CRP)	Blood	Yellow	2	Yes*	1	< 10 mg/L
Creatine kinase (CK)	Blood	Yellow	2	Yes*	1	Female: 25 – 200 U/L Male: 40 – 320 U/L
Creatinine (U&E)	Blood	Yellow	2	Yes*	1	40 – 130 µmol/L Age and sex related ranges available.
Creatinine (urine)	Urine	24 hr plain	2	Yes	1	9.0 – 18.0 mmol/24 hr
Creatinine clearance 24hr	24hr Urine & Blood	Universal & Yellow	2 & 2		1	80 – 140 mL/min Varies with age and sex. Requires serum creatinine on a sample taken during the urine collection period.
Cryofibrinogen	Blood	Purple	2	Yes	14	Normally absent. Pre-arrange with laboratory for warm flask.
Cryoglobulin	Blood	White	2	Yes	14	Normally absent. Pre-arrange with laboratory for warm flask.
Dehydroepiandrosterone sulphate (DHAS)	Blood	Yellow	2	Yes	7	Refer to specialist endocrine website
Digoxin	Blood	Yellow	2	Yes	1	0.5 – 2.0 µg/L Collect at least 6 hr post-dose. Conversion Factor (molar into mass units) nmol/L x 0.78 = µg/L.
Drugs of abuse screen	Urine	Universal	20		1	Qualitative screening test for amphetamines, metamphetamines, barbiturates, benzodiazepines, cannabinoids, cocaine, methadone, opiates, phencyclidine and tricyclic antidepressants.
Ethanol	Blood	Grey	2	Yes*	1	Reported in mg/dL. Conversion Factors: molar into mass units mmol/L x 4.6 = mg/dL mass to molar units mg/dL x 0.22 = mmol/L
Follicle stimulating hormone (FSH)	Blood	Yellow	2	Yes	1	Ranges available upon request. Vary throughout cycle and with age.
Gamma glutamyl transferase (GGT)	Blood	Yellow	2	Yes*	1	Male < 70 U/L Female < 40 U/L
Gastrin (Fasting)	Blood	Green	1	Yes	35	FASTING sample. LABILE. Refer to specialist endocrine website
Gentamicin	Blood	Yellow	2	Yes*	1	Trough: pre-dose Peak: 1 hour post-dose. Refer to pharmacy for prescribing protocols.
Glucose	Blood	Grey	2	Yes*	1	Fasting: 3.5 – 6 mmol/L
Glucose (CSF)	CSF	Grey	0.5	Yes*	1 hr	> 70% of plasma glucose Compare with simultaneous plasma glucose
Growth Hormone (GH)	Blood	Yellow	2	Yes	7	Refer to specialist endocrine website
Haemoglobin A _{1c} (HbA _{1c})	Blood	Purple	2	Yes	1	Non-diabetic: <42 mmol/molHb

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						Impaired glucose regulation: 42-47 mmol/molHb Diabetes: ≥ 48 mmol/molHb
Haptoglobin	Blood	Yellow	2	Yes	1	0.3 – 2.0 g/L
HDL-cholesterol (<i>Lipids</i>)	Blood	Yellow	2	Yes*	1	Total < 5.0 mmol/L desirable in 'at-risk' individuals. LDL < 3.0 mmol/L desirable in 'at risk' individuals. HDL > 1.0 mmol/L desirable in 'at risk' individuals. Calculated LDL = Chol – HDL-C - 0.46 x trig
Human chorionic gonadotrophin (HCG)	Blood	Yellow	2	Yes*	1	See tumour marker bookmark Refer to specialist endocrine website
Immunoglobulins	Blood	Yellow	2	Yes	1	IgG: 6 – 16 g/L IgA: 0.8 – 4.0 g/L IgM: 0.4 – 2.4 g/L Age-related reference range available.
Insulin	Blood	Green	2	Yes	7	FASTING sample. LABILE. Avoid haemolysis. Refer to specialist endocrine website
Insulin C-peptide	Blood	Green	1	Yes	7	FASTING sample Refer to specialist endocrine website
Insulin-like growth factor (IGF1)	Blood	Yellow	2	Yes	7	Refer to specialist endocrine website
Iron	Blood	Yellow	2	Yes	1	10 – 30 µmol/L
Iron (liver)	Liver	Universal	0.5 mg	Yes	10	Refer to STEM DRL website.
Iron (urine)	Urine	Universal	1	Yes	10	Refer to STEM DRL website.
Lactate	Blood	Grey	2	Yes*	1	0.5 – 2.2 mmol/L
Lactate dehydrogenase (fluid)	Fluid	White	2		1	> 120 U/L Pleural fluid/serum LDH > 0.6: consistent with exudates
Lactate dehydrogenase (LDH)	Blood	Yellow	2	Yes	1	80 – 240 U/L
Lead	Blood	Purple	0.5	Yes	6	Refer to STEM DRL website.
Lipase	Blood	Yellow	2	Yes	1	8 – 78 U/L
Lipid profile	Blood	Yellow	2	Yes*	1	See individual components Total cholesterol, triglycerides, HDL-cholesterol. Fasting sample
Lipoprotein (a)	Blood	Purple	2	Yes	7	< 30 mg/dL Increased coronary risk over 30mg/dL.
Lithium	Blood	Yellow	2	Yes	1	0.4 – 1.0 mmol/L Other ranges acceptable depending on clinical circumstances. Samples must be collected 12 hr ± 30 min post dose.
Luteinising hormone (LH)	Blood	Yellow	2	Yes	1	Ranges available upon request. Vary throughout cycle and with age.
Macroprolactin	Blood	Yellow	2	Yes	7	Refer to specialist endocrine website Only available if prolactin > 700 mU/L
Magnesium	Blood	Yellow	2	Yes*	1	0.7 – 1.0 mmol/L
Magnesium (urine)	Urine	24 hr plain	5	Yes	6	2.0 – 11.0 mmol/24 hr
Manganese	Blood	Green (non-gel)	1	Yes	6	Refer to STEM DRL website.
Mercury	Blood	Purple	1	Yes	6	Refer to STEM DRL website.
Mercury (hair)	Hair	Universal		Yes	10	Refer to STEM DRL website. Contact 0141 211 5178 to arrange.
Mercury (urine)	Urine	Universal	5	Yes	10	Refer to STEM DRL website.
Metadrenalines (plasma)	Blood	Purple	2		28	Refer to specialist endocrine website
Metadrenalines (urine)	Urine	24 hr acid	2		28	Refer to specialist endocrine website

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Methaemoglobin	Blood	Green/syringe	1		1	< 1.5% Send ASAP; protect from light.
Methotrexate	Blood	Yellow	2	Yes	1	See local protocols. Toxic levels: > 10 µmol/L at 24 hr > 0.5 µmol/L at 48 hr > 0.1 µmol/L at 72 hr Assay detection limit: 0.1 µmol/L. Interpretation related to time since start of dose. If the patient has had prep of mass monoclonal A/B or had carboxypeptidase G2 as a rescue therapy the specimen should not be tested by this assay.
Micronutrient screen	Blood	1 x Green & 1 x Purple	5 5		10	Includes: copper, zinc, selenium, manganese and vitamins A, B1, B2, B6, C and E. Screens for Scottish customers also include vitamins D and K. <i>Refer to STEMDRIL website.</i>
Nickel	Urine	Universal	1	Yes	10	<i>Refer to STEMDRIL website.</i>
NTproBNP	Blood	Purple	2		1	See NHSGGC Heart Failure Diagnostic Pathway for guidance
Oestradiol	Blood	Yellow	2	Yes	1	Ranges available upon request. Oestradiol varies throughout cycle and with age.
Osmolality	Blood	Yellow	2	Yes	1	275 – 295 mmol/Kg
Osmolality (urine)	Urine	Universal	5	Yes	1	Fresh specimen required.
Oxalate (urine)	Urine	24 hr acid	2	Yes	14	Adult male: 0.08-0.49 mmol/24 hr Adult female: 0.04-0.34 mmol/24 hr Children: reference ranges for oxalate:creatinine ratio are available
Paracetamol	Blood	Yellow	2	Yes*	1	Refer to BNF diagram. Collect at least 4 hours post-dose. Relate to time after dose to assess hepatotoxicity. Conversion Factor (molar to mass units) mmol/L x 151 = mg/L
Parathyroid hormone (PTH)	Blood	Purple	2	Yes	1	Refer to specialist endocrine website
Phenobarbitone	Blood	Yellow	2	Yes	1	Neonates: 15.0-30.0 mg/L Adults: 15.0-40.0 mg/L Collect pre-dose (not critical). Conversion Factor (molar to mass units) µmol/L x 0.23 = mg/L
Phenytoin	Blood	Yellow	2	Yes	1	Neonates: 6.0-15.0 mg/L Adults: 10.0-20.0 mg/L Collect pre-dose. Conversion Factors (molar to mass units) µmol/L x 0.25 = mg/L
Phosphate (urine)	Urine	24 hr plain	2		1	13 - 39 mmol/24 hr Varies with diet.
Phosphate (Bone)	Blood	Yellow	2		1	0.8 – 1.5 mmol/L
Potassium (U&E)	Blood	Yellow	2	Yes*	1	3.5 – 5.3 mmol/L Invalid in old/ haemolysed samples.
Potassium (urine)	Urine	24 hr or Random	2		1	25 – 125 mmol/L Interpret with serum concentration. Varies with diet
Pregnancy test (HCG)	Urine	Random UC	5		1	Sensitivity: 25 U/L. Qualitative result. HCG is detectable approximately 7-10 days after conception.
Progesterone	Blood	Yellow	2	Yes	1	> 20 nmol/L Confirms ovulation if taken in mid-luteal phase.
Prolactin	Blood	Yellow	2	Yes	1	Male <400 mU/L Female <630 mU/L Avoid stress.
Prostate-specific antigen (PSA)	Blood	Yellow	2	Yes	1	See tumour marker bookmark Refer to specialist endocrine website
Protein (CSF)	CSF	Plain UC	2	Yes*	1 hour	< 0.45 g/L. Contamination with blood renders this test invalid.
Protein (fluid)	Fluid	White	2		1	< 30 g/L Pleural fluid/serum protein > 0.5: consistent with exudates.

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Protein (LFTs)	Blood	Yellow	2	Yes*	1	60 to 80 g/L. Avoid venous stasis and haemolysis.
Protein (urine)	Urine	24 hr plain	2		1	< 150 mg/24 hour
Protein electrophoresis	Blood	Yellow	2	Yes	14	Paraprotein quantitation and typing. Also request urine BJP. See tumour marker bookmark
qFIT (faecal haemoglobin)	Faeces	Picker	2ug		2	Please see NHSGGC qFIT website
Renin Concentration	Blood	Purple	5		14	Refer to specialist endocrine website Do not collect on ice. Avoid haemolysis. Separate and freeze plasma. Transport frozen.
Salicylate	Blood	Yellow	2	Yes*	1	Intoxication: > 350 mg/L Severe Toxicity: > 700 mg/L >280 mg/L, if under 5 years Conversion Factor (molar to mass units) mmol/L x 138 = mg/L
Selenium (Plasma)	Blood	Green (non-gel)	1	Yes	6	Refer to STEM DRL website.
Selenium (Red cell)	Blood	Green (non-gel)	1	Yes	6	Refer to STEM DRL website.
Sex hormone-binding globulin (SHBG)	Blood	Yellow	2	Yes	1	Refer to specialist endocrine website
Sodium (U&E)	Blood	Yellow	2	Yes*	1	133 to 146 mmol/L. Avoid haemolysis.
Sodium (urine)	Urine	24 hr plain	2		1	Varies with diet.
Steroid profile (urine)	Urine	24 hr plain	10	Yes	28	Refer to specialist endocrine website
Testosterone (female)	Blood	Yellow	1	Yes	7	Part of androgen screen Refer to specialist endocrine website
Testosterone (male)	Blood	Yellow	2	Yes	1	Adult males: 10 – 36 nmol/L Analysed by immunoassay
Theophylline	Blood	Yellow	2	Yes	1	Neonates: 5.0 to 10.0 mg/L 1 Month - 1 year: 5.0 -15.0 mg/L Adults: 10.0 to 20.0 mg/L (5.0 to 10.0 mg/L adequate in some circumstances). Collect pre-dose or > 8 hours post-dose for slow-release preparations. Conversion Factor (molar to mass units) $\mu\text{mol/L} \times 0.18 = \text{mg/L}$
Thyroglobulin and Thyroglobulin antibody	Blood	Yellow	2	Yes	7	Refer to specialist endocrine website
Thyroid stimulating hormone (TSH) (TFT)	Blood	Yellow	2	Yes	1	0.35 – 5.0 mU/L
Thyrotrophin receptor antibodies (TRAb)	Blood	Yellow	2	Yes	14	Refer to specialist endocrine website
Thyroxine, free (fT4) (TFT)	Blood	Yellow	2	Yes	1	9.0 – 21 pmol/L
Tri-iodothyronine total (T3)	Blood	Yellow	2	Yes	1	0.9 – 2.5 nmol/L
Tobramycin	Blood	Yellow	2	Yes	1	Trough: pre-dose; peak: 1 hr post dose Refer to pharmacy for prescribing protocols.
Transferrin	Blood	Yellow	2	Yes	1	2.0 to 4.0 g/L
Triglycerides (Lipids, Chol & Trig)	Blood	Yellow	2	Yes*	1	0.2 – 2.3 mmol/L Fasting range only (12 hr fast)
Troponin I high sensitivity	Blood	Green	2	Yes*	1	Male: \leq 34 ng/L in men Female: \leq 16 ng/L in women Refer to NHSGGC chest pain pathway for guidance.
Urate	Blood	Yellow	2	Yes*	1	Males: 200 – 430 $\mu\text{mol/L}$ Female: 140 – 360 $\mu\text{mol/L}$ <9 years (M and F): 110 – 300 $\mu\text{mol/L}$

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Urate (urine)	Urine	24 hr plain	2		1	1.5 to 4.5 mmol/24 hr
Urea (U&E)	Blood	Yellow	2	Yes*	1	2.5 to 7.8 mmol/L
Urea (urine)	Urine	24 hr plain	2		1	160 to 500 mmol/24 hr
Valproate	Blood	Yellow	2	Yes	1	50 to 100 mg/L Poor correlation between serum concentration and effect. Collect pre-dose (not critical). Only useful to detect toxicity or non-compliance. Conversion Factor (molar to mass units) $\mu\text{mol/L} \times 0.14 = \text{mg/L}$.
Vancomycin	Blood	Yellow	2	Yes*	1	Trough: pre-dose <i>Refer to pharmacy for prescribing protocols.</i>
Vitamin A (retinol) & carotenoids (α & β)	Blood	Green (non-gel)	1	Yes	10	<i>Refer to STEM DRL website.</i>
Vitamin B1 (thiamine diphosphate)	Blood	Purple	1	Yes	10	<i>Refer to STEM DRL website.</i>
Vitamin B2 (flavin adenine nucleotide)	Blood	Purple	1	Yes	10	<i>Refer to STEM DRL website.</i>
Vitamin B6 (pyridoxal phosphate)	Blood	Purple	1	Yes	10	<i>Refer to STEM DRL website.</i>
Vitamin C (ascorbic acid)	Blood	Green (non-gel)	1		10	<i>Refer to STEM DRL website.</i>
Vitamin E (tocopherol)	Blood	Green (non-gel)	1	Yes	10	<i>Refer to STEM DRL website.</i>
Vitamin K (phylloquinone)	Blood	Purple	2	Yes	10	<i>Refer to STEM DRL website.</i>
Zinc	Blood	Green (non-gel)	1	Yes	6	Blood should be spun within 4 hr or within 24 hr if refrigerated. <i>Refer to STEM DRL website.</i>
Zinc (urine)	Urine	24 hr plain	2	Yes	6	<i>Refer to STEM DRL website.</i>
Zinc protoporphyrin	Blood	Purple	1		6	<i>Refer to STEM DRL website.</i>

A number of other specialist tests are available in referral labs. Details are available via the Duty Biochemist 0141 211 4003, option 3.

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Trace Elements and Vitamins – STEMDR

The Scottish Trace Element and Micronutrient Diagnostic and Research Laboratory (STEMDR) is in part centrally funded by the National Services Division of NHS Scotland to provide a specialist analytical and advisory service for trace elements and vitamins. The principal aspects of this service are:

- a reliable analytical and interpretative service of trace elements and vitamins for the NHS in Scotland
- analysis of water quality for Scottish renal dialysis units
- monitoring of occupational exposure to toxic elements
- research and audit aimed at improving the services offered

Full details of tests available and sample requirements can be found at <http://www.trace-elements.co.uk>

Diagnosis of Wilson's Disease:

The first line tests recommended for suspected Wilson's Disease are plasma copper and 24 hour urine copper. In borderline cases a simple dynamic test (Copper-65 Absorption Test) is available. Contact 0141 211 5178 or refer to website.

Micronutrient Screen

The following analyses are part of the Micronutrient Screen (each of these tests may also be requested separately):

Trace elements: copper, zinc, selenium, manganese.

Vitamins: A, E, B1, B2, B6, C. (Screens for Scottish customers also include vitamins D and K)

Specimens required: 1 Heparin non-gel tube (5mL) and 1 EDTA tube (5mL). Please note if using TrakCare, 'Micronutrient set 2' should be requested. This requires 1 EDTA and 3 Heparin non-gel tubes, but 2 of the heparin tubes only need to be partially filled.

The assessment of nutritional status should also include measurements of urea & electrolytes, calcium, glucose, magnesium, protein/albumin and CRP.

Notes:

- Blood specimens should be sent to the laboratory promptly, accompanied by one request card (if from outwith NHS Greater Glasgow and Clyde) appropriately filled and marked 'Micronutrient screen' (to arrive at GRI Monday to Thursday only).
- Micronutrient screening for patients on TPN: blood samples for micronutrient screening should be taken at least eight hours after TPN infusion has been completed to allow micronutrients to distribute from the central compartment to tissues. In patients who depend on long-term TPN micronutrient concentrations should be measured no more frequently than every 2-3 months.
- The inflammatory status of the patient should be assessed (by measuring CRP) before requesting a micronutrient screen, if:
CRP levels > 10 mg/L, *laboratory assessment of plasma selenium, copper and vitamin C are unlikely to be reliable*
CRP levels > 20 mg/L *laboratory assessment of plasma zinc, vitamin A and vitamin D are unlikely to be reliable*

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Complaints and Feedback

The Department shares the corporate objectives of NHS Greater Glasgow and Clyde (NHSGGC) and commits to provide a comprehensive and efficient analytical, interpretative, clinical advisory and educational service of the highest quality to the Hospitals and General Practitioners within NHSGGC.

The Department constantly strives to improve its service. If we fail to provide the service that you expect, please get in contact with our Quality Manager or Head of Technical Services. Should you wish to make a complaint about a clinical issue or our reporting please contact our Lead Consultant.

We investigate all complaints and will inform complainants of any outcomes. Complaints are investigated, reviewed monthly at management meetings and general feedback is given to all our staff at monthly staff meetings.

Keeping the service efficient

Electronic requesting:

1. There is a label for every sample required that tells you tube type. Please ensure that you stick the right label on the right tube
2. Sometimes more than one form is printed. Please use these, as some samples go directly to other hospital/labs in Glasgow
3. Please do not write tests on form – written requests cannot be accepted
4. Ensure printing clear on form and check that date on form correct
5. When given instructions on sampling, please follow these.
6. Please give clinical details and contact/page number in case of abnormal results

Paper request forms:

1. Tell us who the patient is. Please use labels if available. If there are no labels, please write legibly the patient's name, CHI No, date-of-birth and the ward. Please put the date and time of the collection on the form and the specimen bottle. Do not put more than one patient's specimens into one primary specimen bag.
2. Tell us where you are. Write your name and the name or number of your ward so that we know where to send the report. Many results are not delivered because we do not know where to send them.
3. If you are using the phlebotomy service, fill the request form the night before blood collection but make sure that the date of collection is correct. Make sure that there is patient ID on each specimen bottle, that the bottles are not leaking and that they are placed in the polythene bag for transport. We cannot analyse blood that comes in an unmarked bottle.

Further general points:

1. Please send specimens to the laboratory as soon as possible.
2. If you are sending emergency samples notify the laboratory. This ensures priority handling.
3. On Saturdays, Sundays and Public Holidays you need to send samples early. They must reach us before 11am.
4. Use Clinical Portal or TrakCare to obtain results.
5. Call the Duty Biochemist if you need advice.

This handbook is also available on the NHSGGC website:

<http://www.nhsggc.org.uk/about-us/professional-support-sites/biochemistry/north-glasgow-biochemistry/laboratory-handbooks/>