Biochemistry Department Laboratory Handbook

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Introduction

In this handbook you will find basic information concerning the Biochemistry department within Pathology, including contact names and telephone numbers, details services, test repertoire, together with the sample requirements and turnaround time for tests. These laboratory turnaround times are an average, experience has indicated that unexpected delays can occur in the transmission of results and occasionally in analysis, particularly in the requests that are sent to other laboratories.

Further information that is applicable for all pathology disciplines can be found on the website below. Including, instructions for patient collected samples, consent, personal information protection and the laboratory's complaints procedure.
http://www.therotherhamft.nhs.uk/Pathology/Pathology/

The Biochemistry Department

The Biochemistry department analyses blood and other body fluids to determine the homeostasis of the numerous metabolic processes of the body. Biochemistry forms part of the Blood Sciences Department which is situated within the Pathology Directorate on A floor of Rotherham NHS Foundation Trust.

Due to the large number of samples analysed daily, much of the analysis is automated enabling the small team of Biomedical Scientists to perform many thousands of tests per hour for patients from both within the hospital and from the local community.

The Chemical Pathology department offers a large repertoire of analytes, the majority of which are measured in-house to help to ensure the best possible service and turnaround times for our users. For the less common tests, these are referred to various specialist laboratories around the United Kingdom following the completion of the available in-house tests first. The department is accredited by the United Kingdom Accreditation Service (UKAS) (Accredited to ISO 15189:2012), UKAS Medical accreditation number 9623. Our accreditation is limited to those activities described on our UKAS schedule of accreditation.

Location of the Laboratory

The Biochemistry Laboratory is situated within Pathology on 'A' level (top floor). Following the signs for Pathology, at the T junction near the central lifts go down the corridor opposite the lifts and the Pathology department is first on the left double wooden doors. Pathology Reception is straight ahead.

Laboratory opening times

Normal Service:	Monday – Friday 0900 hrs - 1730 hrs
Limited service:	Saturday mornings 0900hrs - 1300 hrs
Out of Hours:	Please contact the on-call Biochemistry BMS on EXT: 4241

Postal Address

Biochemistry Department (Blood Sciences)
Level A
The Rotherham NHS Foundation Trust
Moorgate Road
Rotherham
S60 2UD

Contact numbers

Business and Service Manager	01709 42 4023
Quality Manager	01226 43 2289 / 01709 42 4008
Deputy Quality Manager	01709 42 4008 / 01226 43 2289
Direct Line to Biochemistry Laboratory	01709 42 4241
Extensions via Hospital Switchboard	01709 82 0000

Out of Hours: The Biochemistry BMS on-call can be contacted on EXT: 4241

Consultant Chemical Pathologist Direct Line	01709 42 4412
Secretary	01709 42 4051
Consultant Clinical Scientist (Biochemist)	01709 42 4103
Blood Sciences Manager	01709 42 7621 / 01226 432061
Lead Biochemistry BMS	01709 42 7714
Senior Biochemistry BMS	01709 42 7714
Enquiries for previous results	01709 42 7553

Specimen Reception

All samples arrive at the laboratory via the centralized specimen reception area. The specimen reception area also deals with initial result enquiries.

Specimen Reception contact numbers are as follows:

- Urgent requests: 7510
- Result enquiries7553

Any queries regarding Specimen Reception should be directed to the Specimen Reception Manager on any of the above numbers.

Please ensure that specimens and correct request forms are clearly labelled (please include the NHS number where possible).

Requesting Tests

Specimens should always be in the appropriate container and accompanied by a request form. Details of specimen requirements are detailed in the Biochemistry Test Repertoire table available on the Biochemistry Website:

http://www.therotherhamft.nhs.uk/Pathology/Biochemistry/

Please use electronic test requesting where available. Requests should be made via the ICE or Meditech systems where possible, or in the event of electronic request failure or unavailability please use the manual request form or the reverse of the ICE paper.

Patient Collected Samples

Instructions for the collection of 24-hr and Overnight urine samples are provided with collection bottles and available from the Biochemistry Department. Some collection bottles may contain acid preservatives. Bottles are clearly marked and instructions included for safe use. Completed collections should be returned directly to the laboratory. Please contact the laboratory if there are any concerns.

Plastic specimen containers may be provided to collect stool/ faeces samples. For further information on how to collect this sample please refer to:

http://www.nhs.uk/chq/Pages/how-should-i-collect-and-store-a-stool-faeces-sample.aspx

Request form completion and labelling of sample

We cannot process samples unless we can be sure about the patient's identity, the test(s) required and where to send the result.

A *minimum of three* criteria should match on specimen and form for the sample to be accepted.

* Denotes mandatory requirement

SAMPLES MUST HAVE

- Patient's forename*
- Patient's surname*
- Date of birth and/or hospital or NHS number*
- Date and time of sample

REQUEST FORMS MUST HAVE

- Patient's forename*
- Patient's surname*
- Date of birth and/or hospital or NHS number*

- Destination for report
- Name of patient's consultant or GP
- Tests required
- Date and time of sample
- Relevant clinical information including current medication

Specimen Rejection

A sample **will not** be processed if the minimum criteria rule is not met. Where the information on request form and sample do not match, samples will not be tested. We will endeavour to contact the sender within an appropriate time scale to inform them of this and request a repeat sample. If a sample is regarded as "precious"/not repeatable e.g. a CSF sample or a sample from a dynamic function test, the user may be contacted to take full legal responsibility for the analysis of the sample.

Some unrepeatable samples (e.g CSF, sterile fluids and blood cultures) are treated as precious samples and the sample will be tested even if inadequately labelled, however a comment will be added to the result that the specimen was unlabelled, and the sender should take responsibility for the validity of the result. The requestor may be asked to attend the laboratory to confirm the identity of any mislabelled precious sample and sign a precious sample form.

High risk specimens

These include samples from patients known or suspected of being infected with a Hazard Group 3 pathogen must have a "Danger of Infection" label placed on both request form and all specimens.

Samples from patients falling into the categories below should be regarded as high risk for the laboratory:-

- HIV antibody positive
- Hepatitis B surface antigen or E antigen positive
- Hepatitis C positive
- Patient being investigatedfor Blood Borne virus
- IV drug user (past/present)
- All samples from GU Med/CASH
- Covid-19 positive

Packaging

All specimens irrespective of mode of delivery should be placed in the appropriate container which must be securely fastened. The container should be sealed into the plastic compartment attached to the request form. Specimens should be transported to the laboratory as rapidly as possible after collection to ensure that no significant deterioration occurs before processing.

Samples that arrive via other hospitals via post or transport should be packaged according to UN3373 requirements for safe transport.

Transportation of specimens

Specimens for tests that are unstable (please see Samples with Specific Transportation Requirements) e.g. blood gas/CSF specimens, and for requests that are very urgent, should be taken directly to the specimen reception.

Samples taken within the community at GP practices are transported to the laboratory by Courier Logistics.

Hospital samples are delivered either via the air tube system or by hand to the Laboratory Specimen Reception Department.

- Serum samples should be processed (centrifuged and serum separated from the cells) within 5 hours of collection. Any delay can influence potassium and enzyme results.
- Serum Glucose – stable for up to 4 hours in a fluoride oxalate tube, 1 hour in a serum tube
- Extreme temperatures (hot or cold) can cause abnormal levels of some analytes – especially potassium.

Samples with Specific Transportation Requirements

Various samples can NOT be transported by the hospital air tube or require special collection conditions, this list is not exhaustive but gives the most frequently encountered tests:

- **ACTH – on ice,** deliver immediately to laboratory, do NOT send via POD
- **Aldosterone and renin,** deliver immediately to the laboratory
- **Ammonia** - deliver immediately to laboratory, do NOT send via POD
- **Blood gases** - arterial blood, cap to prevent air contact, deliver immediately to laboratory, do NOT send via POD
- **Calcitonin - on ice**, deliver immediately to laboratory, do NOT send via POD
- **Carboxyhaemoglobin** - arterial blood, cap to prevent air contact, deliver immediately to laboratory, do NOT send via POD
- **Methaemoglobin** - arterial blood, cap to prevent air contact, deliver immediately to laboratory, do NOT send via POD
- **CSF –Xanthochromia** - protect from light, do NOT send via POD, ensure LFTs checked in last 24hrs if unsure – SEND PAIRED SERUM FOR LFTs. Hand deliver immediately.
- **Homocysteine** –deliver immediately to laboratory, do NOT send via POD
- **Porphyria full screen/Porphyrins** - protect from light, do NOT send via POD
- **Vitamin A (Carotene)** - protect from light, do NOT send via POD
- **Vitamin B1 (Thiamine)** - protect from light, do NOT send via POD
- **Vitamin B6** - protect from light, do NOT send via POD
- **Vitamin E** - protect from light, do NOT send via POD
- **Vitamin C (Ascorbic Acid)** - protect from light, do NOT send via POD

- **ALL High risk samples** – do NOT send via the POD

Biochemistry Paediatric Handbook

See related document CI-BIO-152 available from the Biochemistry website:
http://www.therotherhamft.nhs.uk/Pathology/Biochemistry/

Biochemistry Tests

These are listed in the Test Repertoire document. Adult blood sample tubes and urine bottles typically provide an excess volume of sample for measurement if full. If a high number of tests are required, please contact the laboratory prior to venepuncture for advice on sample types and number.

Please discuss with one of the Biochemistry Consultants should you require a test not listed there.

PTH and bicarbonate and tests listed on page 7 should be taken at the hospital to ensure rapid delivery to the laboratory.

The timing of sampling for therapeutic drug monitoring is vitally important and is shown in the Biochemistry Test repertoire table. Failure to comply with these timings and lack of information regarding this on the request form may result in a delay in sample analysis or sample rejection. Trough samples are preferred.

Advice on the interpretation of results is available from the Consultant Biochemist and Chemical Pathologist who may be contacted using the office telephone numbers above or via switchboard if out of hours.

Test Repertoire Available Out of Hours

The department offers a full range of acute services on a 24/7 basis.

Samples received requesting analytes that are processed at another site will be stored and sent the next routine working day.

Xanthochromia samples will always be processed within 24 hours of collection. Please contact the consultant biochemist or chemical pathologist on call if urgent analysis of xanthochromia is required.

Additional test requests

The department does not recommend or encourage the use of ‘add-on tests’ but under specific circumstances tests may be added as shown below.

For tests not routinely performed within the Blood Sciences department refer to the specific analytes within the test repertoire table.

Routine Chemistry, Endocrine & Therapeutic Drug Monitoring – Stable for up to 2 days, samples are recapped after analysis and stored at 24° C for up to 24 hours before being transferred to 4° C.

With the exception of:

- Plasma Amino Acids, up to 4 hours
- Bicarbonate – stable for up to 2 hours
- BNP - stable for up to 24 hours
- Ca125 – stable for up to 24 hour
- Creatine Kinase (CK) – stable for up to 24 hour
- Serum Glucose – stable for up to 4 hours in a fluoride oxalate tube, 1 hour in a serum tube
- Lactate- must be Fl/oxalate sample, accept if 4C or -20 Stored
- Phosphate- accepted up to 24 h but may be unreliable
- PTH- accepted to 2 hours
- Hs Troponin I – stable for up to 24 hours in fridge, 8hrs room temp
- Urea & Electrolytes - stable for up to 24 hours – but not potassium
- Vitamins B1, B2,B6, A,E- accepted up to 4 h dependent on storage/light exposure
- Vitamin K- accepted to 24h

Paediatric samples may be unsuitable for additional requests. The volume of the sample will be checked prior to addition of any test and the Consultant Biochemist may be approached for advice.

Rotherham and Barnsley Labs: Add on tests will **not** be accepted for

- ACTH
- Ammonia
- Plasma metanephrines
- Aldosterone/renin
- Cysteine (plasma)
- Homocysteine
- C-peptide (but insulin accepted up to 4h, insulin must not be haemolysed even only slightly)
- AMH
- Vitamin C

The time that any additional test is added on is noted on the report as some tests may be affected by a delay in analysis after the sample is taken from the patient.

Add on requests must be received on an additional request form. The new request form is available on 'Insite' or by contacting the Haematology or Biochemistry Laboratories. Alternatively, the current hand written forms may be used as long as the request clearly states 'Add on Request'. The forms can be hand written and must contain all the required patient demographics including: full name, date of birth, hospital unit number or NHS number (addressograph labels containing this data are acceptable). In addition, the form must contain the name of the requesting doctor (or appropriate

authorised healthcare provider), current location of the patient and contact details. Forms can be delivered to Pathology using the normal routes.

There is no need to contact the Laboratory to inform us that the request has been sent. If an add-on request is urgent and the results from this investigation will affect immediate patient management then please continue to telephone the Laboratory before sending down the hand written request.

Referred work

The Biochemistry Department provides a referral service for Vitamin analysis for other centres across the United Kingdom. For further details, please contact the laboratory using the contacts at the start of the handbook. Alternatively, information for users is available on the Biochemistry website:

http://www.therotherhamft.nhs.uk/Pathology/Biochemistry/

The Biochemistry Department maintains a list of names, addresses, tests sent and accreditation status of all laboratories to which work is routinely referred. These lists are available on request. The laboratory will seek to refer tests to UKAS accredited providers

Dynamic Function Tests

The Biochemistry laboratory processes samples from dynamic function tests which are required for the investigation of certain, usually endocrine, conditions.

Details of the Dynamic function tests and associated protocols are available from the Endocrinology department.

Test profiles

Many of the individual analytes are grouped into test profiles. The profiles have been developed to assist the clinician in reaching a diagnosis when used in conjunction with the clinical examination and any further diagnostic services available.

U+E Requires 100ul serum minimum	**LFT** Requires 100ul serum minimum	**LIPIDS** Requires 100ul serum minimum	**CALCIUM** Requires 100ul serum minimum	**TFT** Requires 400ul serum minimum	**GLUCOSE** Requires 70ul serum minimum
Sodium, Potassium, Creatinine, Urea Estimated GFR (calculated test)	Protein, Albumin, Bilirubin, ALT, Alkaline Phosphatase Globulins (calculated test)	Cholesterol, Triglyceride, HDL, LDL (calculated test)	Calcium, Adjusted calcium (calculated test) Albumin, Alkaline Phosphatase, Phosphate	TSH (First line test. fT4 and fT3 assayed as appropriate)	Glucose:- GP: fluoride oxalate sample Hospital: Serum tube

Reference Ranges

It is recommended that reference ranges provided with the laboratory results are used for interpretation. Reference ranges are available in the Biochemistry Test Repertoire document available on the Biochemistry website:

http://www.therotherhamft.nhs.uk/Pathology/Biochemistry/

Reference ranges are sourced from Pathology Harmony Jan 2011 where these are listed (https://www.acb.org.uk/resource/pathology-harmony---biochemistry.html)

All other routine biochemistry reference ranges are from the manufacturers IFU.

Reference ranges for the Vitamins A, B1, B6, C, and E; and the biogenic amines are from a mixture of locally derived and published sources. Please contact the laboratory for further information if required.

The reference ranges given are for *adult patients* and should be used as a guide only and should be interpreted in the light of the clinical scenario. See Biochemistry Paediatric Handbook for paediatric reference ranges, available on the Intranet Biochemistry page.

Factors known to affect biochemistry test results

If it is thought that a patient's results do not fit with the clinical picture, please phone the laboratory.

It is not practical to list all of the factors known to affect analyte concentration/assay performance but a few of the more common issues are listed below:

- Correct tube and blood draw order reduce the risk of interference – e.g. EDTA contamination with potassium, calcium and magnesium
- CSF samples for xanthochromia need to be protected from light
- Haemolysis, icteric and lipaemic samples can interfere with certain analytes. These are indicated as comments on the report and the sample should be repeated as the results will be unreliable. Common analytes affected include: sodium, potassium, bilirubin, magnesium, phosphate, AST, ALT, Troponin and hormones.
- Serum samples should be processed (centrifuged and serum separated from the cells within 12 hours of collection. Any delay can influence potassium and enzyme results.
- Extreme temperatures (hot or cold) can cause abnormal levels of some analytes – especially potassium.
- The use of the AIR TUBE can cause issues in certain analytes – see section on transportation of specimens.
- HbA1c is affected by any factor that affect red blood cell life span e.g. haemoglobinopathies
- Prolactin may be analytically elevated due to a benign condition such known as macroprolactin
- Time of taking a sample in relation to a person taking a drug will influence the concentrations and ability to interpret results for therapeutic drug monitoring.

- Sodium is affected by abnormal levels of protein and lipids. These can cause a falsely elevated reading in the laboratory and if there is any clinical suspicion a blood gas machine should be used to confirm – PLEASE SPEAK TO THE LABORATORY FIRST
- A high platelet and white blood cell count can cause a falsely elevated potassium (Pseudohyperkalaemia). It is recommended that a sample be taken in to a serum and a lithium heparin tube and sent immediately to the laboratory for confirmation.

Critical results

In the hospital, all results will be telephoned 24 hours a day if they meet the criteria stated below. All GP results meeting the telephone criteria will be telephoned during the normal working day. Out-of-hours, only those highlighted in red will be telephoned urgently to either the practice if it remains open or to the GP out-of-hours service, all results not coloured red will be telephoned the following working day.

ANALYTE	LOWER LIMIT (and below)	HIGHER LIMIT (and above)	Source
Sodium (mmol/L)	120 <130 if <16yrs	150	RCPath 2017 RCPath 2017 for children as particular concern of risk of death in children with hypoNa
Potassium (mmol/L)	2.5	6.5	RCPath 2017
Potassium (mmol/L) Heart Failure Nurses**	3.9	5.4	Barnsley and Rotherham local agreement
Potassium (mmol/L) GP Patients†		6.0 When AKI >1	RCPath 2017 On new occurrences
Glucose (mmol/L)	2.5	25 (>15 if <16 years)	RCPath 2017 State 30mmol/L for GP known DM patients Glucose results < 2.5 may be less crucial to phone immediately
Urea (mmol/L)		30 (>10 if <16 years)	RCPath 2017
Creatinine (umol/L)		350 (>200 if <16 years)	RCPath 2017 (actually states 354 umol/L) higher thresholds for known CKD or pt on dialysis. Need specific local points for babies.
AKI	Level of 2 or above		All new occurrences
AKI† GP Patients		1 When Potassium >6.0	RCPath 2017 All new occurrences
Serum Bicarbonate	10		RCPath 2017 GP only
Calcium - Adj (mmol/L)	1.8	3.0	Barnsley and Rotherham local agreement
PO4 (mmol/L)	0.3		RCPath 2017 Urgent inpatient, GP urgent, if OOH within 24 hours
Mg (mmol/L)	0.4		RCPath 2017
CK (U/L)		5000 unless ?MI	RCPath 2017

ALT (U/L)		735	RCPath 2017
AST (U/L)		510	RCPath 2017
Amylase (U/L)		590	RCPath 2017
Lipase (U/L)		265	RCPath 2017
Bilirubin (umol/L)		300	Barnsley and Rotherham local agreement
Conjugated Bilirubin (umol/L)		25	Neonates only RCPath 2017
Triglyceride (mmol/L)		20	RCPath 2010
Ammonia (umol/L)	All		Barnsley and Rotherham local agreement
Bile Acids (umol/L)		14	Barnsley and Rotherham local agreement
Iron (umol/L)		55	Barnsley and Rotherham local agreement
Uric Acid/Urate (umol/L)		340	Ante-natal only RCPath 2017
CRP (mg/L)		300	RCPath 2017
Troponin I High Sensitivity (ng/L)		120	RCPath 2017, Local agreement
Troponin I High Sensitivity (ng/L) **from GP**		3	Local agreement
Cortisol (nmol/L)	50 unless part of O/N Dexamethasone suppression test		RCPath 2017
Cortisol (nmol/L) (SST 30 minutes)	250		RCPath 2017 – To be phoned by Biochemistry Consultant authorising the DFT
fT4 (pmol/L)	5	30	Barnsley and Rotherham local agreement In patient within 2 hours GP/ Out pt next working day
fT3		10 if FT4 normal with suppressed TSH	Barnsley and Rotherham local agreement In patient within 2 hours GP/ Out pt next working day
TSH (mIU/L)		50 for 1st time	Barnsley and Rotherham local agreement In patient within 2 hours GP/ Out pt next working day
Paracetamol (mg/L)		If detected	Barnsley and Rotherham local agreement
Salicylate (mg/L)		If detected	Barnsley and Rotherham local agreement
Phenytoin (mg/L)		25	RCPath 2017
Carbamazepine (mg/L)		25	RCPath 2010
Theophylline (mg/L)		25	RCPath 2017
Digoxin (ug/L)		2.5	RCPath 2017
Lithium (mmol/L)		1.5	RCPath 2017
Phenobarbitone (mg/L)		70	RCPath 2010
Valproate (mg/L)		150 for 1st time	Barnsley and Rotherham local agreement
PBG		Positive	Barnsley and Rotherham local agreement
Ethanol (mg/L)		Detected	Barnsley and Rotherham local agreement
Osmolality (mosm/kg)	270	300	Barnsley and Rotherham local agreement
Blood Gas††	All results where paper reports given		Barnsley and Rotherham local agreement
HbA1c		120mmol/mol	SY&B local Agreement for first-time HbA1c

			results without a glucose requested / not known diabetic

Generally the local agreement results in more results being phoned that is advised by the RCPath
**Heart failure patients that have been identified with a sticker on the request card are phoned at different potassium limits.

Therapeutic drug monitoring results will be telephoned (as specified above) if they are significantly outside the therapeutic range. It must be stressed, however, that the patient and not the biochemistry result should be treated as therapeutic ranges are only guides and there is wide inter-individual variation.

Service Disruption

There are occasions where there may be an interruption to service or where turnaround times may be longer than anticipated. In such instances, users will be notified in advance where possible. Within the hospital this is via the Trust's Communication Team. Where unplanned disruption occurs, escalation will be made via the 221 Bleep Holder.

Measurement Uncertainty

The laboratory makes regular estimates of measurement uncertainty for all analytes. Please contact the laboratory if further information is required.

Data Protection

Laboratory Medicine is committed to ensuring the confidentiality of all patient sensitive information. All data and information acquired while providing the services of the laboratory is handled in strict accordance with the Trust Confidentiality Policy. This ensures data is managed in compliance with all relevant legal obligations, standards and guidelines and professional codes of conduct. The requirements for preserving data integrity and patient and staff confidentiality are laid down in the Data Protection (2018) Act and General Data Protection Regulation (GDPR). This is supported by TRFT policies. The department follows guidelines detailed in the Trust Confidentiality & Data Protection Policy.

The Pathology Confidentiality Policy (MPL-PP-007) builds on the Trust's Confidentiality Policy in giving clear guidelines on the transmission of patients' Pathology results and reports.

Feedback and Complaints Procedure

Suggestions about our service may be raised by email, letter, phone call or by calling personally at the laboratory.

All complaints are dealt with in accordance with the Trust Concerns and Complaints Policy and the departmental complaints and feedback policy. If you have any concerns about the services provided by the laboratory, please let us know using any of the contact options provided above.

Formal complaints can be made through the Trust Patient Experience Team http://www.therotherhamft.nhs.uk/yourexperience/

See also the Laboratory Medicine website. http://www.therotherhamft.nhs.uk/Pathology/Pathology/