NHS
University Hospitals Bristol and Weston
NHS Foundation Trust

Department of Pathology

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Blood Sciences
User Guide

Essential guidelines for staff that use
University Hospitals Bristol and Weston Trust
Blood Science Services at Weston

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Blood Sciences User Guide

1.1 Scope of document

This document is a User Manual which describes the services provided by the Pathology Blood Sciences laboratories at Weston General Hospital for all users and the information contained herein is correct at time of printing.

Previous versions of this manual must be destroyed on receipt of the latest version.

2.0 General information

2.1 Laboratory Availability

Routine Hours in Blood Sciences are:
09.00 - 17.30 Monday - Friday (exc. Public Holidays)

Outside of these hours a multi-disciplinary Out of Hours (OOH) service is provided, which is staffed by a single biomedical scientist. This service is for essential urgent requests only (see section 8 below). The OOH BMS can be paged on bleep 017.

2.2 Blood Sciences Contacts List

Blood Sciences				
Head of Service: Adrian Brown	2575	01173422575	adrian.brown@uhbw.nhs.uk	Mon - Fri
Deputy Head of Service: Patrick Simms	3309 2575	01934 647009 01173422575	Patrick.Simms@UHBW.nhs.uk	Mon - Fri
Quality Manager	5306	01934 647053	natalia.casey@uhbw.nhs.uk	Mon - Fri
Specimen reception	5308	Switchboard		Mon - Fri
Chemical Pathology Lab	3308	01934 647055		Mon - Fri

Chemical Pathologist:	3310	01934 647019		
Dr Wycliffe Mbagaya	3310	01934 647019	wycliffe.mbagaya@uhbw.nhs.uk	Mon / Wed / Thurs
Dr Andrew Day	3310	01934 647019	andrew.day@uhbw.nhs.uk	Tue
Haematology Laboratory	3307	01934 647054		Mon - Fri
Blood Transfusion Lab	3302	01934 647052		Mon - Fri
Dr Lisa Wolger	3324	Contact via: NHS e-referral – Advice and Guidance Service		Mon - Fri
Dr Nikesh Chavda	3323			
Dr Chith Batugedara	3323			
Transfusion Practitioner: Ms Egle Gallo	3301 Bleep 004	01934 647050	egle.gallo@uhbw.nhs.uk	Mon - Fri
Haematology Secretaries	3300	01934 881006		Mon - Fri

3.0 Sample collection

3.1 Before the sample is taken (Chemical Pathology and Haematology)

- It is imperative that any sample taken from a patient can be identified using 3 patient identifiers. Without this minimum information, a sample cannot be guaranteed to be processed. To do so, the minimum requirement for identification is:
  - Surname
  - Forename
  - Date of birth or hospital registration number or NHS number

3.1.1 Type of sample / Sample requirements

Blood samples should always be obtained using correct technique. This will normally be using the Vacutainer system.

Note: If samples are taken by syringe and needle they **must not** be ejected into blood tubes through a hypodermic needle as this may result in haemolysis.
Adequate filling of blood tubes is essential for safe and efficient operation of laboratory services. (i.e. complete vacuum draw or up to line on tube).

Partially filled tubes may result in an inappropriate mix of blood and preservative/anticoagulant or 'short sampling' at the analysis stage, which may cause incorrect results. Under filled tubes will be rejected for certain tests such as Clotting Screens, D-Dimer, INR and ESR which require filling to the line.

Special handling of small samples also results in unnecessary exposure of staff to risk of blood-borne infection.

3.1.2 Specific test - additional information

Patient leaflets are available from Pathology on request for the following procedures:

- 24 hour Urine Collections
- Additional information for 24 Hour Urine collections for Catecholamines or 5HIAA
- Blood Transfusion related leaflets are available (produced by NHSBT)

3.1.3 ICE requesting

Most tests that we process are now available on the ICE requesting system. Each request will generate the appropriate number of labels for the containers that we will require to perform these tests. Also, this allows us to add requesting information to a test when it is chosen, to ensure that it is relevant for the patient. These include, alert messages, questions to ensure the clinical details are taken into account and suggesting other tests which may be more relevant. This information is decided by the Laboratory Consulting staff.

Inpatient requests can be added to the morning phlebotomy round and should be added before 7am. OPAU, Harptree, Berrow and Steepholm can add patients to the afternoon rounds and this must be done before midday.

GP requests can be made and postponed so the labels are produced at the time of the patients appointment.

3.1.4 Request Forms

Ideally, most requests will now be made electronically through the ICE system. However, Blood Transfusion requests MUST be made manually (see section 3.1.5).

Where this is not the case or during downtime, we will accept paper request forms, however it is important that they are filled in correctly. For guidance on the completion of request forms, including the minimum criteria for positive patient identification, please refer to the Pathology User Guide.

3.1.5 Blood Transfusion

ALL requests for Blood Transfusion investigations (e.g. group and screen, crossmatch, batch product requests including Human Albumin Solution, Direct Coombs testing) MUST be made on purple Blood Transfusion paper request forms and include the following details:

- Forename and Surname
- Date of Birth
- Hospital or NHS number
- Signature of person who collected the sample
- Signature of Medical Officer (if blood product / component requested)
- Relevant clinical details
- Date and time of sample collection

Requests for free fetal DNA testing are the ONLY exception to the above. Such requests may be made on ICE with request form printed, or NHSBT ffDNA forms.

Requests for additional units / crossmatch (include HAS) may be telephoned to the transfusion laboratory on 3302 (during routine hours only).

Blood Sample Requirements Table

Chemical Pathology		
Most common tests	Yellow top tube	At least half full (min 2.5mL)
Glucose, Alcohol	Grey Top Tube	Requires 2ml
Antibiotic levels	Yellow top tube	At least half full (min 2.5mL)
Trace elements e.g. se, Zn	Dark Blue Top Tube	Requires 6ml
Specialist Tests	See ‘Sample Tubes’ documents or refer to Laboratory	

Haematology/ Blood Transfusion		
Full Blood Count	Purple Top Tube 	Requires at least 1mL
Abnormal Haemoglobin	Purple Top Tube 	Requires at least 1mL
HbA1c	Purple Top Tube 	Requires only 1mL
Malaria	Purple Top Tube 	Requires at least 1mL
Glandular Fever	Purple Top Tube 	Requires at least 1mL
ESR	Purple Top Tube 	At least half full (min 2.5mL)
Clotting Studies	Light Blue Top Tube 	Must be filled to the line. Test will not be processed if tube not full
Other tests	Yellow top tube 	At least half full (min 2.5mL)
Blood Transfusion	Pink Top Tube 	At least half full (min 2.5mL)
We may not be able to carry out all the tests requested if sample volume is insufficient.		

Notes:

1. Samples should be taken directly into the Vacutainer whenever possible following the Recommended Order of Draw for Weston General Hospital (available from Pathology)
2. If using a syringe, the needle must be removed and the blood dispensed into the bottle by removing the rubber top. The top should be replaced firmly, with a final twist and taped up to indicate that the lid has been removed.

If sample volume is unavoidably small, please use only 1mL for FBC and send one single yellow top tube for chemistry tests.

3.2 Special requirements including timing of sample collection

Some tests require the sample to be taken when fasting or at a specific point in the drug regime. For information on specific tests please contact the laboratory or consult the "Sample Tubes" documents available on in appendix 3.

3.3 Collecting the Sample

3.3.1 Sample Labelling

It is imperative that any sample taken from a patient can be positively identified. Therefore, minimum labelling requirements must be adhered to. These are documented for all Pathology specimens in the Pathology User Guide.

In addition to the requirements detailed in the Pathology User Guide, for antibiotic and therapeutic drug assays the time of sample collection should be supplied.

Please ensure that ICE labels are affixed to the specimen tube parallel to the manufacturer's label to ensure there are no delays to the test results.

Labelling of Blood Transfusion Specimens

All Samples tubes for blood transfusion must be labelled at the patient bedside in one continuous uninterrupted event. All samples must be handwritten and must contain the following information:

- Patient full name (first name and surname)
- Patient Date of Birth
- Patient hospital number or NHS number
- Signature of the person taking the sample
- Time and date of sample

This information must match exactly what is on the form and computer systems.
DO NOT USE ADDRESSOGRAPH or ICE LABLES ON BLOOD TUBES (i.e. case note labels). This practice is unsafe as it can lead to patient misidentification. Addressographs do not give enough information for blood transfusion and cause a significant number of errors. The samples should be written up when next to the patient.

Blood Transfusion laboratory operates a zero-tolerance policy on labelling of samples. ANY errors will result in rejection of the request.

3.4 TRANSPORT TO THE LABORATORY AND SAMPLE STABILITY

For information on methods of sample transportation to the Laboratory, please refer to the Weston Pathology User Guide. It is imperative that specimens arrive in the Laboratory in a timely manner. Due to varying stabilities of the analytes measured in Blood Sciences, please be aware that some tests may not be processed if specimens are not receipted on the day of collection.

4.0 CHEMICAL PATHOLOGY

The Chemical Pathology department provides a comprehensive, clinically led service, with a complete repertoire of tests to support clinical care and due emphasis upon timeliness, efficiency and effectiveness.

Most tests are carried out on site and other tests are referred to specialist centres.

Urgent and critically abnormal test results are telephoned. All users will be able to access results using the Sunquest ICE system once the tests have been completed.

Users are welcome to telephone the laboratory to enquire about result availability if not yet available on ICE.

With due emphasis on 'added value', results interpretation and advice about further testing and investigation is always available, either from a Consultant Chemical Pathologist or a senior Biomedical Scientist. A Consultant Chemical Pathologist is always available (in the Department, by mobile phone or via the UHBW Duty Biochemist rota outside normal working hours) to discuss investigation, interpretation and relevant aspects of patient management.

Consultant Chemical Pathologists are also happy to review patients on the wards by request. A Consultant Chemical Pathologist also runs a Lipid Clinic and undertakes a weekly Clinical Nutrition Team ward round.

The Department supports clinical research and audit projects and is active in training medical and scientist trainees at all levels.

4.1 Chemical Pathology Investigations and Turnaround Times

Test Name	Sample type	Container	Test information	TAT
Adrenocorticotropic hormone (ACTH)	Blood	EDTA tube	Poor *in vitro* stability - **sample must be sent on ice to lab immediately**. **Sent to the BRI**	72 hours
Alanine transaminase (ALT) *	Blood	Serum (SST) or LiHep (PST)	Part of Liver Function Test ALT is primarily a marker of hepatocellular damage, although it can be raised due to release from other tissues such as in rhabdomyolysis.	6 hours
Albumin	Blood	Serum (SST) or LiHep (PST)	Albumin is produced by the liver and is important in maintaining vascular fluid balance.	6 hours
	Fluid	Universal pot	Not validated in this sample type	6 hours
	Urine	Universal pot	Albumin:Creatinine ratio (ACR) is calculated. Also known as 'microalbumin' or 'microalbuminuria'	6 hours
Alkaline phosphatase (ALP) *	Blood	Serum (SST) or LiHep (PST)	Part of Liver Function Test ALP can be elevated due to bone pathology and hepatobiliary disease. ALP is also produced by the placenta and results will be higher in pregnancy.	6 hours
Alkaline phosphatase isoenzymes	Blood	Serum (SST) or LiHep (PST)	Only indicated if total ALP activity is elevated. Can confirm the diagnosis of benign transient hyperphosphatasaemia (BTH).	2 weeks
Alpha-1-Antitrypsin (A1AT)	Blood	Serum (SST) or LiHep (PST)	A1AT phenotype is automatically added if: Age <16 years, *or* Total A1AT <1.0 g/L	24 hours
Alpha-1-antitrypsin phenotype	Blood	Serum (SST) or LiHep (PST)	For diagnosis of A1AT deficiency	2 weeks
Alpha-fetoprotein (AFP) **	Blood	Serum (SST) or LiHep (PST)	AFP tumour marker ONLY. For antenatal Downs syndrome screening use special paper request form.	24 hours (Mon-Fri)
	CSF	Universal pot	Not validated in this sample type	24 hours (Mon-Fri)
Ammonia	Blood	EDTA tube	Ammoniagenesis occurs *in vitro*, leading to falsely high results. **sample must be sent on ice to lab immediately**. **Sent to the BRI**	24 hours
Amphetamines (urine)	Urine	Universal pot	Usually remains detectable in urine for 24-72 hours. Care should be taken to avoid tampering with the sample and that the sample is fresh and from the correct individual. **Sent to the BRI**	48 hours (Mon-Fri)
Amylase	Blood	Serum (SST) or LiHep (PST)	Please request Lipase as the first line screen for acute pancreatitis	24 hours
	Fluid	Universal pot	Not validated in this sample type	24 hours

	Urine	Universal pot	Amylase is a small protein and is predominantly renally cleared. For calculation of amylase:creatinine clearance ratio (ACCR)	24 hours
Angiotensin Converting Enzyme (ACE)	Blood	Serum (SST) or LiHep (PST)	Patients on ACE inhibitors will give falsely low results. **Sent to the BRI**	24 hours
	CSF	Universal pot	Not validated in this sample type	
Aspartate transaminase (AST)	Blood	Serum (SST) or LiHep (PST)	AST is used as a marker of hepatocellular damage, but due to poor specificity for liver tissue has largely been superseded using ALT.	24 hours
Benzodiazepine (urine)	Urine	Universal pot	Request if only benzodiazepines required, otherwise request urine drug screen (Opiates, methadone and benzodiazepines). Care should be taken to avoid tampering with the sample and that the sample is fresh and from the correct individual	24 hours (Mon-Fri)
Bicarbonate	Blood	Serum (SST) or LiHep (PST)	Cannot be added on to an existing request; bicarbonate rapidly equilibrates with CO_2 in the atmosphere.	6 hours
Bile Acids (Total Bile Acids)	Blood	Serum (SST) or LiHep (PST)	Bile acids are used as a marker of obstetric cholestasis and are not a routine markers of liver function.	24 hours
Bilirubin (total)	Blood	Serum (SST) or LiHep (PST)	Bilirubin is the breakdown product of haem and is cleared by the liver in a two-step process; conjugation followed by excretion. Increased bilirubin can be due to liver damage, cholestasis, or increased haem breakdown e.g. haemolysis. Can be requested as part of an LFT or by itself	6 hours
Bilirubin (conjugated / direct)	Blood	Serum (SST) or LiHep (PST)	Increased conjugated fraction is often a sign of cholestasis. Most useful for investigation of Gilbert's Syndrome.	24 hours
Bilirubin (Fluid)	Fluid	Universal pot	Not validated in this sample type	6 hours
CA 125 **	Blood	Serum (SST) or LiHep (PST)	Primarily a marker of ovarian cancer. See NICE guideline CG 122 for further information. Use with caution for diagnosis as also increased significantly in many benign conditions.	24 hours (Mon-Fri)
CA 15-3	Blood	Serum (SST) or LiHep (PST)	CA15-3 is used to monitor treatment for breast cancer. Not indicated for diagnosis.	24 hours (Mon-Fri)
CA 19-9	Blood	Serum (SST) or LiHep (PST)	CA19-9 is frequently raised in pancreatic cancer. However, it can also be raised due to other abdominal pathologies, such as cholestasis and jaundice, and consequently is not advised for diagnosis without supporting imaging.	24 hours (Mon-Fri)
Calcium	Blood	Serum (SST) or LiHep (PST)	The albumin adjusted calcium will also be automatically calculated from calcium and albumin. Can be falsely reduced due to contamination from EDTA - observe correct order of draw.	6 hours
	Urine	Universal pot	Reported as calcium: creatinine ratio on a spot sample. Random urine samples are acceptable from children, but in adults a 24h collection is preferred.	6 hours

		24h bottle (acid)		6 hours
Carbamazepine	Blood	Serum (SST) or LiHep (PST)	Pre dose sample.	24 hours
Carcinoembryonic antigen (CEA) **	Blood	Serum (SST) or LiHep (PST)	Used to monitor treatment and recurrence of colorectal cancer. Not suitable for use in diagnosis as it may not be raised in cancer and can be raised due to a variety of other pathologies.	24 hours
	Fluid	Universal pot	Not validated in this sample type	
Chloride	Blood	Serum (SST) or LiHep (PST)	Not part of routine electrolytes	6 hours
	Urine	Universal pot	Not part of routine urine electrolytes.	6 hours
Cholesterol	Blood	Serum (SST) or LiHep (PST)		6 hours
Cocaine (urine)	Urine	Universal pot	Not part of routine drugs of abuse screen. Usually remains detectable in urine for 24-72 hours. Care should be taken to avoid tampering with the sample and that the sample is fresh and from the correct individual	24 hours (Mon-Fri)
Complement (C3 & C4)	Blood	Serum (SST) or LiHep (PST)		24 hours
Cortisol ***	Blood	Serum (SST) or LiHep (PST)	Cortisol shows a strong diurnal rhythm, and a randomly timed cortisol is limited diagnostic utility. Dynamic function tests are the best way to formally exclude or diagnose adrenal disease, although early morning (9am) or midnight cortisol can be useful. Please ring x27834 to discuss investigation.	6 hours
	Urine	24h bottle (plain)	Also known as urine free cortisol (UFC). Useful in diagnosis of hypercortisolism	2 weeks
	Saliva	Salivette	Salivettes available from the laboratory. Recommended to send paired early morning and late evening samples. Both cortisol and cortisone are measured. Useful in diagnosis of hypercortisolism.	4 weeks
C-Peptide	Blood	EDTA tube	Serum (SST) or lithium heparin (PST) also acceptable, but have reduced *in vitro* stability	24 hours (Mon-Fri)
	Urine	Boric acid pot	Universal pot also acceptable, but reduced *in vitro* stability	24 hours (Mon-Fri)
C-reactive protein (CRP)	Blood	Serum (SST) or LiHep (PST)	Used as a non-specific marker of inflammation.	6 hours
Creatine kinase (CK)	Blood	Serum (SST) or LiHep (PST)	Creatine kinase is released in large amounts from muscle when tissue damage occurs, although a raised CK can be a sign of tissue damage anywhere in the body.	6 hours

Creatinine	Blood	Serum (SST) or LiHep (PST)	Creatinine is produced at a relatively constant rate by the body and cleared by the kidneys. It is therefore a useful marker for glomerular filtration rate and used to calculate eGFR. At the UHBW, an enzymatic assay is used to give greater accuracy of creatinine results.	6 hours
Digoxin	Blood	Serum (SST) or LiHep (PST)	Samples should be taken 6-8 hours post dose	24 hours
Drugs of Abuse Screen	Urine	Universal pot	Consists of Opiates, Methadone and Benzodiazepines. Care should be taken to avoid tampering with the sample and that the sample is fresh and from the correct individual **Sent to the BRI**	48 hours
Electrolytes (E)	Blood	Serum (SST) or LiHep (PST)	Consists of Potassium, Sodium, Creatinine and eGFR. In vitro haemolysis raises serum potassium, and difficult venesection can cause a high potassium. EDTA contamination will also cause falsely raised results; please observe correct order of draw.	6 hours
Electrolytes (no Potassium) (GPE)	Blood	Serum (SST) or LiHep (PST)	Consists of Sodium, Creatinine, Urea and eGFR	6 hours
eGFR	Blood	Serum (SST) or LiHep (PST)	Calculated according to the CKD-EPI 4 variable equation	6 hours
Estradiol (E2)	Blood	Serum (SST) or LiHep (PST)	Some, but not all, exogenous oestrogens can cross react in the assay. Results may be unreliable if patient is on HRT or an oral contraceptive, depending on the formulation.	6 hours
Faecal Calprotectin	Faeces	Stool pot	**Sent to the BRI**	2 weeks
Ferritin (Serum)	Blood	Serum (SST) or LiHep (PST)		24 hours
Folate (Serum)	Blood	Serum (SST) or LiHep (PST)		24 hours
FIB-4	Blood	Serum (SST) and EDTA	Calculated score generated from age, AST, ALT and platelet count.	24 hours
Follicle stimulating hormone (FSH)	Blood	Serum (SST) or LiHep (PST)		24 hours
Gamma-glutamyl transferase (GGT)	Blood	Serum (SST) or LiHep (PST)	Gamma glutamyl transpeptidase is increased in cholestasis. It can also be induced secondary to many medications and ethanol use.	6 hours
Gentamycin	Blood	Serum (SST) or LiHep (PST)	Please refer to Trust guidelines on DMS	6 hours
Globulin	Blood	Serum (SST) or LiHep (PST)	Globulin = Total protein - Albumin. Raised results may indicate monoclonal or polyclonal raised immunoglobulins. Low results may indicate low immunoglobulins.	6 hours

Glucose Tolerance Test	Blood	Fluoride oxalate tube	GTT = Baseline + second sample taken 120 mins later	6 hours
Glucose (Serum)	Blood	Fluoride oxalate tube	Serum (SST) or lithium heparin (PST) also acceptable if sample received promptly in the lab. Glucose is rapidly metabolised *in vitro* unless fluoride oxalate tube used	6 hours
	CSF	Fluoride oxalate tube	A plain pot is also acceptable if sample received promptly in the lab.	6 hours
Growth Hormone	Blood	Serum (SST) or LiHep (PST)	A random GH measurement is of low clinical utility. Best used as part of stimulation or suppression testing. See also IGF1	24 hours (Mon-Fri)
Haptoglobin	Blood	Serum (SST) or LiHep (PST)		24 hours
HDL Cholesterol	Blood	Serum (SST) or LiHep (PST)		6 hours
Homocysteine	Blood	EDTA		14 days
Human Chorionic Gonadotrophin (hCG)	Blood	Serum (SST) or LiHep (PST)	HCG can be used as a tumour marker when germ cell tumours are suspected. HCG is secreted by the placenta in pregnancy, and therefore also provides the basis for urine pregnancy testing. For patients under the care of the Early Pregnancy Unit, HCG can be used to monitor progression of a pregnancy, but blood should not routinely be used for pregnancy testing.	6 hours
	CSF	Universal pot	Not validated in this sample type	6 hours
Immunoglobulins: IgA, IgG, IgM, IgE	Blood	Serum (SST) or LiHep (PST)		1 week
IGF-1	Blood	Serum (SST) or LiHep (PST)	This is the screening test for disorders of growth hormone deficiency or excess	48 hours (Mon-Fri)
Insulin	Blood	Serum (SST) or LiHep (PST)	For investigation of hypoglycaemia	48 hours
Iron	Blood	Serum (SST) or LiHep (PST)	For investigation of suspected overdose	24 hours
Transferrin Saturation	Blood	Serum (SST) or LiHep (PST)	This test should generally be requested only for the investigation of iron overload. Request ferritin frontline to investigate iron deficiency	24 hours (Mon-Fri only)
Lactate	Blood	Fluoride oxalate tube	Lactate is rapidly produced by cells *in vitro*, and samples should always be in a fluoride tube (grey top). **Should be measured on Blood Gas Machine in the first instance**. **If not, sent to the BRI for analysis**	48 hours

	CSF	Fluoride oxalate tube		24 hours
Lactate Dehydrogenase (LDH) *	Blood	Serum (SST) or LiHep (PST)	The test is highly sensitive to haemolysis	24 hours
	CSF	Universal pot		24 hours
Lipase	Blood	Serum (SST) or LiHep (PST)	The first line screen for acute pancreatitis	6 hours
Lipoprotein (a)	Blood	Serum (SST) or LiHep (PST)		1 week
Lipoprotein Electrophoresis	Blood	Serum (SST) only	Samples should be collected ideally after a 12 hour fast	2 weeks
	Pleural fluid	Universal pot	For diagnosis of chylothorax. Triglycerides will be measured first: A value <0.5 mmol/L excludes chylothorax, and a value >1.2 mmol/L confirms chylothorax.	2 weeks
Lithium	Blood	Serum (SST) only	Serum sample required. Lithium heparin plasma is NOT suitable. Samples for therapeutic monitoring should be taken 12 hours post dose.	24 hours
Liver Function Test (LFT)	Blood	Serum (SST) only	Consists of: ALT, ALP, Albumin, Total Bilirubin, Total Protein	6 hours
Luteinising hormone (LH) **	Blood	Serum (SST) or LiHep (PST)		24 hours (Mon-Fri)
Magnesium	Blood	Serum (SST) or LiHep (PST)	Can be falsely reduced due to even slight contamination from EDTA tubes - observe correct order of draw.	6 hours
	Urine	Universal pot		6 hours
Methadone metabolite (urine)	Urine	Universal pot	Care should be taken to avoid tampering with the sample and that the sample is fresh and from the correct individual	24 hours (Mon-Fri)
Methotrexate	Blood	Serum (SST) or LiHep (PST)	ONLY for monitoring of high dose treatment. Methotrexate levels do not need to be measured routinely in patients on long term therapy.	24 hours
Neurone Specific Enolase (NSE)	Blood	Serum (SST) only	A marker of neuronal damage. Also can be raised in non-small cell lung cancer and neuroendocrine tumours.	24 hours
NT-proBNP	Blood	Serum (SST) or LiHep (PST)		48 hours
Opiates (urine)	Urine	Universal pot	Care should be taken to avoid tampering with the sample and that the sample is fresh and from the correct individual. Not specific for morphine – codeine will produce a positive result. If confirmation is required, please contact the lab.	24 hours (Mon-Fri)

Osmolality	Blood	Serum (SST) or LiHep (PST)		24 hours
	Urine	Universal pot	Paired serum osmolality required for interpretation. If investigating hyponatraemia, it is recommended to additionally request urine sodium.	24 hours
Paracetamol *	Blood	Serum (SST) or LiHep (PST)	The test is highly sensitive to haemolysis	6 hours
Parathyroid hormone (PTH) **	Blood	EDTA tube	A concurrent calcium result is required for interpretation.	24 hours
Phosphate	Blood	Serum (SST) or LiHep (PST)		6 hours
Potassium *	Blood	Serum (SST) or LiHep (PST)	Potassium leaks from cells over time, and so samples should be received in the laboratory or separated within twelve hours. Cold temperatures accelerate this effect. In vitro haemolysis raises serum potassium, and difficult venesection can cause a high potassium. EDTA contamination will also cause falsely raised results; please observe correct order of draw.	6 hours
Progesterone	Blood	Serum (SST) or LiHep (PST)	For confirmation of ovulation in mid luteal phase (approx. day 21 of a 28 day cycle)	24 hours (Mon-Fri)
ProCalcitonin				6 hours
Prolactin **	Blood	Serum (SST) or LiHep (PST)		24 hours (Mon-Fri)
Prostate-specific antigen (PSA)	Blood	Serum (SST) or LiHep (PST)		24 hours (Mon-Fri)
Protein Electrophoresis	Blood	Serum (SST) only	Screening for myeloma must include both serum and urine electrophoresis	1 week
	Urine	Universal pot	Also known as Bence Jones Protein (BJP). Minimum 5 mL early morning urine - no preservative required, boric acid tube unsuitable. See also serum free light chains.	1 week
Rheumatoid factor (RF)	Blood	Serum (SST) or LiHep (PST)		24 hours
Salicylate	Blood	Serum (SST) or LiHep (PST)	For investigation of aspirin overdose	6 hours
Serum Free Light Chains	Blood	Serum (SST) or LiHep (PST)	For use in the diagnosis and monitoring of plasma cell dyscrasia	1 week
Sex Hormone Binding Globulin (SHBG)	Blood	Serum (SST) or LiHep (PST)		24 hours (Mon-Fri)
Sodium	Blood	Serum (SST) or LiHep (PST)	Requested as part of U&E	6 hours

Tacrolimus	Blood	EDTA tube	A separate EDTA tube is required, sample should be taken as pre-dose	24 hours (Mon-Fri)
Testosterone **	Blood	Serum (SST) or LiHep (PST)	Note that some exogenous steroids such as norethisterone can cause falsely raised results.Significantly elevated results in females can be confirmed using a more specific method if required.	24 hours (Mon-Fri only)
Free androgen index	Blood	Serum (SST) or LiHep (PST)	For investigation of possible hyperandrogenism in adult females	24 hours (Mon-Fri)
Calculated free testosterone	Blood	Serum (SST) or LiHep (PST)	For investigation of possible hypogonadism in adult males. Vermeulen equation used.	24 hours (Mon-Fri)
Theophylline	Blood	Serum (SST) or LiHep (PST)	Pre dose sample	24 hours
Thyroglobulin (including thyroglobulin antibodies)	Blood	Serum (SST) or LiHep (PST)	For monitoring of thyroid cancer patients after total thyroidectomy and I-131 ablation.	48 hours
Thyroid peroxidase antibodies (TPO)	Blood	Serum (SST) or LiHep (PST)	TPO positivity may indicate a slightly higher likelihood of progression from sub-clinical to overt hypothyroidism.	24 hours (Mon-Fri)
Thyroid stimulating hormone (TSH) **	Blood	Serum (SST) or LiHep (PST)		6 hours
Free T3 **	Blood	Serum (SST) or LiHep (PST)	Only requestable by laboratory. Please request TFT and provide full clinical details. Assay will be performed if indicated.	6 hours
Free T4 **	Blood	Serum (SST) or LiHep (PST)	Included as part of TFT in children, in known/suspected pituitary disease, and if TSH is abnormal. Please provide clinical details.	6 hours
Tissue transglutaminase IgA (coeliac screen)	Blood	Serum (SST) or LiHep (PST)	Anti-tissue transglutaminase (TTG) is the most useful biochemical test for the diagnosis of coeliac. Total IgA will also be measured. In conjunction with European guidelines (NICE/BSG/ESPGHAN) HLA DQ2/DQ8 is available as a separate request in children with strong positive coeliac serology to avoid the need for biopsy. Patients must be a on a normal (gluten-containing) diet for at least one month before testing.	1 week
Total protein	Blood	Serum (SST) or LiHep (PST)		6 hours
	CSF	Universal pot		6 hours
	Urine	24h bottle (plain)	A plain bottle is required (acid collection is UNSUITABLE)	6 hours
	Urine	Universal pot	For calculation of protein:creatinine ratio (PCR). Note that ACR is recommended in preference to PCR for proteinuria screening in patients with risk factors for the development of CKD	6 hours
Triglyceride	Blood	Serum (SST) or LiHep (PST)		6 hours

	Fluid	Universal pot	Not validated in this sample type	6 hours
Troponin I *	Blood	Serum (SST) or LiHep (PST)	Please refer to the Trust ACS protocol. Highly Sensitive to Haemolysis	6 hours
Urea, Electrolytes and Creatinine (UE)	Blood	Serum (SST) or LiHep (PST)	In vitro haemolysis raises serum potassium, and difficult venesection can cause a high potassium. EDTA contamination will also cause falsely raised results; please observe correct order of draw.	6 hours
Urea	Blood	Serum (SST) or LiHep (PST)	Part of U&E	6 hours
Uric Acid / Urate	Blood	Serum (SST) or LiHep (PST)		6 hours
	Urine	Universal pot		6 hours
		24h collection (plain)		6 hours
Urine Drug Screen	Urine	Universal pot		48 hours
Urine Electrolytes	Urine	Universal pot		24 hours
Urine Amino Acids	Urine	Universal pot		14 days
Urine Organic Acids	Urine	Universal pot		14 days
Vancomycin	Blood	Serum (SST) or LiHep (PST)	Please refer to Trust guideline	24 hours
Vitamin B12	Blood	Serum (SST) or LiHep (PST)		24 hours
Vitamin A, E, B1 & B6	Blood	Serum (SST) or lithium heparin (PST)	**MUST** be protected from light	2 weeks
Vitamin D (25-OH-vitD)	Blood	Serum (SST) or LiHep (PST)	https://remedy.bnssg.icb.nhs.uk/media/rorpnazk/bnssg-vitamin-d-guidelines-2024.pdf	24 hours (Mon-Fri)
Xanthochromia (CSF pigments)	CSF	Universal pot (forth or last pot collected)	Samples should be taken >12 hours but <14 days post initial symptoms. Samples should arrive in the lab within an hour of collection and not sent by pneumatic tube system. **CSF must be collected according to protocol and protected from light.** **Sent to the BRI** Please contact the on-call Biochemist if results are required more urgently. Refer to https://uhbw.mystaffapp.org/document/show_document/11496 for more information.	24 hours

PLEASE NOTE

* These assays are highly sensitive to haemolysis

**These assays require clinical validation and will not appear on ICE until they have been reviewed by a Duty Biochemist

*** Result will appear on ICE, Duty Biochemist may add an additional comment based on result.

- Quoted turnaround time is defined as the time from sample receipt to result availability in ICE.
- All samples from ED, ITU, SDEC, Oncology and Seashore are treated as URGENT.

- Routine biochemistry requests from an urgent location, or marked as urgent, will aim to be turned around within **90 minutes** of sample receipt. From other locations please mark the as urgent on ICE and ring the laboratory if necessary.
- Low- and high-level results will take longer as they are automatically rerun for confirmation.
- The frequency of batching and the assay days can vary. Please contact the lab for more information on turnaround times of these assays.
- Samples are kept for approximately 7 days. Within this period additional tests may be added to those already requested. See Extra Test requesting chart for stability of samples for a particular test. Hospital staff should send an Extra Test Request form, whereas GPs may request additional tests by telephoning the laboratory.

4.2 Reference Ranges

Please refer to Appendix One.

4.3 Antibiotic Levels

4.3.1 Monitoring Antibiotic Levels

For guidance on Monitoring Antibiotic levels please contact the Microbiology department.

All samples submitted for assay must have the following information.

- Date and time that the level was taken
- Drug was last administered.
- Indication (i.e. diagnosis) for the antibiotic
- Dose and frequency of the prescribed antibiotic

Failure to provide this information will make it impossible to interpret the result.

4.4 Paediatric Bilirubin Levels

4.4.1 Paediatric Serum Bilirubin (SBR)

Paediatric bilirubin samples must be collected in a green-top paediatric lithium heparin bottle. All requests for paediatric bilirubin are treated as urgent. All community requests must have an accompanying telephone number for receipt of result. Paper requests are acceptable but requesting on ICE is preferred. It is important that the requestor informs the laboratory about the pending incoming of a sample prior to processing. Contact information is as above in section 2.2.

5.0 Haematology, Coagulation & Blood Transfusion

The Haematology laboratory provides a comprehensive, high quality, general Haematology service, which involves processing and analysing the majority of tests requested on site. A Blood Group Serology & Blood Compatibility service is provided by the Transfusion laboratory.

The Haematology & Blood Transfusion service is provided by a small team of BMSs and MLAs, under the direction of Consultant Haematologists working across the Weston Bristol sites of the University Hospitals Bristol and Weston (UHBW) Trust.

Results are reviewed by senior laboratory staff, and where appropriate, abnormal results are referred to laboratory Consultants.

The Haematology Consultants are available daily to discuss problems and review patients in addition to supporting a Clinical Haematology Out-Patient service. They are contactable by telephone at any time during the routine working week for advice. Consultant On Call Haematology advice is provided out of hours from UHBW.

5.1 Haematology (Section Lead: Alex Macphie)

Please note that time limit for additional tests is dependent on sample availability as general retention time for haematology EDTA samples is 48-72hrs

Please contact the laboratory for any reference ranges if not listed below, all relevant ranges can be found on patient reports and/or ICE system

5.1.1 Haematology Investigations and Turnaround Times

Test	Specimen type	Reference Ranges	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Blood Film	EDTA (can be performed on same sample as FBC)	Not applicable	Delay in receiving sample Sample not kept at room temperature	Send sample ASAP to the laboratory as prolonged storage affects cell morphology. Please give clinical details/reason for the request.	Service for clinically urgent requests	Within 24hrs	24hrs
Citrated Platelet Count (performed for platelet clumping in EDTA)	Sodium Citrate	150-400 $x10^9$/L	Clot in sample Platelet aggregation in citrate	Please indicate clearly on the request form that the sample is for a citrated platelet count. Notify Haematology ex3307 that sample is en route: sample must not be centrifuged. **Sample(s) must be filled to correct filling line**	Service for clinically urgent requests	Within 24hrs	24hrs
ESR Erythrocyte Sedimentation Rate	EDTA (can be performed on same sample as FBC)	**Male:** 17 -50 (<10mm/hr) 51-60 (<12mm/hr) 61-70 (<14mm/hr) >70 (<30mm/hr)	**Female:** 17-50 (<12mm/hr) 51-60 (<19mm/hr) 61-70 (<20mm/hr) >70 (<35mm/hr)	Clot in sample Insufficient sample Delay in receiving sample	>1mL of EDTA blood is required to perform ESR	Service for clinically urgent requests	Within 24hrs

Test	Specimen type	Reference Ranges	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Full Blood Count	EDTA	**Adult WBC:** 4-11 $x10^9$/L **Neutrophils:** 1.5-8 $x10^9$/L **Haemoglobin:** 120-150g/L (F) 130-170 g/L (M) **MCV:** 83-100 fL **Platelets:** 150-400 $x10^9$/L	Clotted sample. Insufficient sample. Lipaemic, icteric, haemolysed samples. Delayed sample receipt.	Adult samples >1mL of blood required. Paediatric/neonate >500µL of blood required.	Service for clinically urgent requests	Within 24hrs	24hrs
G6PD (Glucose-6-Phosphate Dehydrogenase Assay)	EDTA (can be performed on same sample as FBC)	4.6-13.5 U/gHb Values for new-borns maybe somewhat higher (up to 150%)	Copper & sulphate ions decrease G6PD activity. Certain drugs interfere with circulating levels. Clotted sample.	Sample referred to UHBW-Bristol Royal Infirmary Reticulocytes have increased G6PDH levels than mature red cells. NOT recommended that assays be performed after severe haemolytic crisis due to falsely elevated levels.	Not available	6 days (if stored at 4°C)	3 working days
Haemoglobin A1c (HbA1c)	EDTA (can be performed on same sample as FBC)	**20-42 mmol/mol** (not consistent with diabetes mellitus) **42-48 mmol/mol** (high diabetes risk) **>48 mmol/mol** (diagnostic of diabetes mellitus)	Unstable haemoglobins e.g. Hb Raleigh. Presence of interfering haemoglobin variants. Reduced red cell lifespan – e.g. HbSS, HbCC, HbSC. Clotted and insufficient samples.	Retrospective indicator of mean plasma glucose concentration during the last 6-8 weeks. Does not detect hypoglycaemic episodes and falsely low results may be found with haemolytic disease.	Not available	5 days	3 working days

Test	Specimen type	Reference Ranges	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Haemoglobinopathy screen and DNA analysis	EDTA (can be performed on same sample as FBC)	Normal: HbA_2 <4% HbF <1% Normal red cell indices MCH≥27pg Hb ≥80g/L	Severe iron deficiency can reduce HbA_2 levels. Clotted sample.	Sample referred to UHBW-Bristol Royal Infirmary Laboratory will process all requests but note that with patients under 1 year of age – unable to exclude α/β-thalassaemia, repeat suggested after 1 year of age. Results may be misleading if patient transfused within the last 4 months. *DNA – sendaway performed at Oxford University Hospital[1]	Not available	7 days (if stored at 4°C)	3 working days
Plasma Viscosity (PV)	EDTA (can be performed on same sample as FBC)	1.5-1.72 mPa/s	None known	*Send away test – Performed at NBT Southmead[2]	Not available	5 days	3 weeks for report (SEND-AWAY)
Pyruvate Kinase Assay	EDTA (can be performed on same sample as FBC)	11-19 IU/g Hb	Age of sample Clotted sample	Sample referred to UHBW-Bristol Royal Infirmary Samples subsequently sent for testing at King's College Hospital, London[7.2]	Not available	72hrs (if stored at RT)	3 weeks for report (SEND-AWAY)

Test	Specimen type	Reference Ranges	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Malaria Screen	EDTA (can be performed on same sample as FBC)	Not applicable	Age of sample	URGENT REQUESTS: Contact Haematology where rapid test can be used alongside priority thick & thin blood film analysis. Please fill all clinical information when prompted when submitting ICE request. All positives are sent to London School of Hygiene & Tropical medicine[4] for confirmation.	Service for clinically urgent requests	Within 24hrs	24hrs (note all POSITIVE's confirmed at LSHTM)
Rapid Sickle Screen	EDTA (can be performed on same sample as FBC)	Not applicable	Erythrocytosis, hyperglobunaemia, leucocytosis, lipaemia – can give false positives. Children <6months can give false negatives. Recent blood transfusion can give false positive/negatives.	If Pre-op and URGENTLY required, contact the laboratory. Sickle screen performed alongside full haemoglobinopathy screen for all requests.	Service for clinically urgent requests	7 days (if stored at 4°C)	72hrs
Reticulocyte Count (Retic)	EDTA (can be performed on same sample as FBC)	>18 years 50-100 $x10^9$L	Clotted sample. Insufficient sample. Lipaemic, icteric, haemolysed samples. Delayed sample receipt.	Adult samples >1mL of blood required. Paediatric/neonate >500µL of blood required. Reticulocyte count performed alongside FBC.	Service for clinically urgent requests	Within 24hrs	24hrs

5.1.2 Factors Affecting Haematology Tests

- **Blood Film**: Delay in receiving sample, Sample not kept at room temperature
- **Citrated Platelet Count** (performed for platelet clumping in EDTA): Clot in sample, underfilled sample, Platelet aggregation in citrate.
- **ESR - Erythrocyte Sedimentation Rate**: Clot in sample, Insufficient sample, Delay in receiving sample.
- **Full Blood Count:** Clotted sample. Insufficient sample. Lipaemic, icteric, haemolysed samples. Delayed sample receipt.
- **G6PD (Glucose-6-Phosphate Dehydrogenase Assay)**: Copper & sulphate ions decrease G6PD activity. Certain drugs interfere with circulating levels. Clotted sample.
- **Malaria Screen**: Age of sample
- **Reticulocyte Count (Retic):** Clotted sample. Insufficient sample. Lipaemic, icteric, haemolysed samples. Delayed sample receipt.
- **Zinc Protoporphyrin (ZPP):** Haemolysed samples. Abnormally elevated bilirubin will create positive interference due to its spectral qualities.

5.2 Haemostasis Information (Section Lead: Chris Doherty)

- Citrated samples must be adequately filled to the correct marked line (2.7mL adult/1.3mL paediatric/650µL neonate). Tests cannot be performed on underfilled, overfilled, or clotted samples.
- Grossly lipaemic samples may require manual testing and a delay in results.
- Telephone the laboratory on ext3307 during routine hours if required. Please note due to the nature of the sample volume, clotting tests may be limited or unavailable if plasma levels are too low.
- Include clinical details on the request form/ICE order e.g. ‘patient on …….. anticoagulation (warfarin/heparin etc.)’ or ‘post-op sample’; to facilitate appropriate testing and interpretation of results.
- Send request form (if used) and sample to the laboratory as quickly as possible. Any critically urgent requests telephone the laboratory on ext3307.
- Abnormal results that require further laboratory testing may result in delayed reporting.
- ADAMTS-13, HIT, Antithrombin 3 and one stage factor assay testing is available to be performed as an urgent out of hours testing (out of 09:00 – 17:00 Monday to Friday) providing it has been approved by the Clinical Haemostasis team requiring at minimum Haematology SpR agreement with Haemostasis on call Consultant, contact Haematology registrar via switchboard. In hours (09:00 – 17:00 Monday to Friday) these tests can be approved by the UHBW Haem Reg on 0117 923 0000, Bleep 2677 (Bristol Royal Infirmary).
- The laboratory provides the testing for the UHBW WGH Pharmacy dosed Warfarin patients. For enquiries about doses for these patients contact the Pharmacy helpline on 01934 647061 during routine hours (Mon-Fri 09:00-17:00).

5.2.1 Haemostasis Investigations and Turnaround Times

Test	Specimen type	Reference Ranges	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Antithrombin 3 (AT3)	Sodium citrate	0.83-1.28 IU/ml	Delayed receipt of sample	Sample referred to UHBW-Bristol Royal Infirmary *Available outside of thrombophilia screening on agreement with minimum Haematology SpR but may require Haemostasis Consultant on call approval – both contactable via switchboard	Service for clinically urgent requests*	Within 24hrs	2 weeks (unless clinically agreed)
Anti-Xa assay For the monitoring of Low Molecular Weight Heparin (LMW)	Sodium citrate	Once daily regime: 0.80-1.60 IU/mL Twice daily regime:0.50-1.10 IU/mL	Delayed receipt of sample	Please state the anticoagulation of the patient. Common LMW's – Clexane, Enoxaparin	Service for clinically urgent requests	Within 24hrs	2hrs
Anti-Xa used in the monitoring of Unfractionated Heparin (UFH)	Sodium citrate	0.35-0.70 IU/mL	Delayed receipt of sample	Please state the anticoagulation of the patient.	Service for clinically urgent requests	Within 24hrs	2 hrs

Test	Specimen type	Reference Ranges	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Clotting Screen (PT/APTT – Prothrombin Time, Activated Partial Thromboplastin Time)	Sodium citrate	PT: 10.0-13.2 secs APTT: 25.1-36.5 secs	Anticoagulation Delayed receipt of sample Grossly lipaemic, icteric or haemolysed samples	**Heparin & Warfarin therapy affects results and determines appropriate testing** please state that the patient is on Heparin and/or Warfarin on the request form.	Service for clinically urgent requests	PT within Within 24hrs	6 hrs
D-Dimers (DDV)	Sodium citrate (can be added to Clotting screen sample)	Normal cut off <500ng/mL (FEU)	Grossly lipaemic, icteric or haemolysed samples		Service for clinically urgent requests	Within 24hrs	6hrs
Fibrinogen - Clauss (FIB)	Sodium citrate (can be added to Clotting screen sample)	Normal: 2.0-4.0 g/L	Grossly lipaemic, icteric or haemolysed samples		Service for clinically urgent requests	Within 24hrs	6hrs
Heparin (unfractionated) Monitoring (HEP, APTTR)	Sodium citrate	Therapeutic range: 1.5-3.5 (APTT ratio)	Grossly lipaemic, icteric or haemolysed samples Other anticoagulation		Service for clinically urgent requests	Within 24hrs	1hr

Test	Specimen type	Reference Ranges	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Thrombin Clotting Time (TCT)	Sodium citrate	Normal: 15.0-22.0 secs	Delayed receipt of sample	Sample referred to UHBW-Bristol Royal Infirmary Test is used in combination with protamine to check for the presence of heparin within a sample.	Service for clinically urgent requests	Within 24hrs	2 weeks
Warfarin Monitoring (INR)	Sodium citrate	Ranges – are determined on an individual basis as decided by clinical decision. Contact the Laboratory for further information.	Delayed receipt of sample	Please inform of anticoagulation on request form.	Service for clinically urgent requests	Within 24hrs	6 hrs

5.2.2 Specialist Haemostasis Investigations and Turnaround Times

Test	Specimen type	Reference Ranges	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
ADAMTS-13	Sodium citrate	Normal 60.6 - 130.6%	Delay in receipt of sample	Sample referred to UHBW-Bristol Royal Infirmary Consultant approval required for urgent testing, otherwise routine weekly testing.	Service for clinically urgent requests	Within 24hrs	Urgent 24 hours; Routine 2 weeks
Apixaban / Edoxaban	Sodium citrate	Not established, contact Haemostasis consultant for advice	Delay in receipt of sample	Sample referred to UHBW-Bristol Royal Infirmary	Not available	Within 24hrs	72hrs
Bethesda Assay (F8C Inhibitor) (F9C Inhibitor)	Sodium citrate 2 x 2.7ml	Normal = Negative	Delay in receipt of sample	Sample referred to UHBW-Bristol Royal Infirmary	Not available	Within 24hrs	2 weeks
Dabigatran	Sodium citrate	Not established, contact Haemostasis consultant for advice	Delay in receipt of sample	Sample referred to UHBW-Bristol Royal Infirmary	Not available	Within 24hrs	72hrs

Test	Specimen type	Reference Ranges	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Factor Assays F2, F5, F7, F8, F9, F10, F11, F12, F13	Sodium citrate 2 x 2.7mL	All factors except F11 and 13 Normal: 0.5-2.0 IU/mL F11 Normal: 0.7-2.0 IU/mL F13 Normal: 0.7-1.4 IU/mL	Anticoagulation: Warfarin/Heparin Delay in receipt of sample	Sample referred to UHBW-Bristol Royal Infirmary *Urgent tests require Haemostasis Consultant approval. For Pre/Post factor samples please keep in separate bags and mark on sample tubes which are the Pre/Post	Service for clinically urgent requests*	Contact the Laboratory	2 weeks
Factor 8/9 specialist tests: F8 Bovine F8/9 Chromogenic	Sodium citrate 2 x 2.7mL	Normal: 0.5-2.0 IU/ml	Delay in receipt of sample. Anticoagulants especially Heparin.	Sample referred to UHBW-Bristol Royal Infirmary All require Consultant approval	Not available	Contact the Laboratory	2 weeks
Lupus Anticoagulant/ Screen (Antiphospholipid antibodies)	Sodium citrate 2 x 2.7mL	Normal = Negative.	Anticoagulant therapy	Sample referred to UHBW-Bristol Royal Infirmary If screen for antiphospholipid/lupus Then send SST sample also for Anticardiolipin antibody testing.	Not available	Within 24 hours	2 weeks

Test	Specimen type	Reference Ranges	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Platelet Aggregation Studies	Sodium citrate 10 x 2.7mL	Contact the Laboratory	Aspirin affects platelet aggregation Delayed receipt of samples	Test is only organised with Haemostasis Consultants as requires specific planning. Platelet Aggregation Studies, including patient venepuncture, carried out at UHBW-Bristol Royal Infirmary Samples must be kept at room temperature and taken immediately to the Laboratory	Not available	Not applicable	2 weeks
Rabbit Brain Thromboplastin	Sodium citrate	Ranges – are determined on an individual basis as decided by clinical decision. Contact the Laboratory for further information.	Delayed receipt of sample	Sample referred to UHBW-Bristol Royal Infirmary	Service for clinically urgent requests	Within 24hrs	72hrs
Rivaroxaban	Sodium citrate	Not established, contact Haemostasis consultant for advice	Delay in receipt of sample	Sample referred to UHBW-Bristol Royal Infirmary	Not available	Within 24hrs	72hrs

Test	Specimen type	Reference Ranges	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Thrombophilia Screen Antithrombin 3, Protein C activity, Free Protein S, Lupus Anticoagulant, Cardiolipin Antibodies, Anti-β2 glycoprotein antibodies	Sodium citrate 2 x 2.7mL	Contact the laboratory	Delay in receipt of sample Warfarin & Heparin (Anticoagulant therapy)	Sample referred to UHBW-Bristol Royal Infirmary Note the tests can be requested individually if specific measuring is required. All screens are vetted by the Haemostasis Consultants, contact prior to venesection to ensure test completion. *Protein C/S can be arranged if Urgent clinical need, with Haemostasis Consultant approval	Service for clinically urgent requests*	Not applicable	2 weeks
Von Willebrands Screen VWF Antigen VWF Activity VWF Rco F8	Sodium citrate 2 x 2.7mL	Normal: 0.42-1.76 IU/mL Normal: 0.40-1.63 IU/mL Normal: 0.48-2.40 IU/mL Normal: 0.5-2.0 IU/mL	Delay in receipt of sample Heparin therapy (F8)	Sample referred to UHBW-Bristol Royal Infirmary Can be performed individually or as part of a Haemophilia screen.	Service for clinically urgent requests	Within 24hrs	2 weeks

Test	Specimen type	Reference Ranges	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
ADAMTS-13 Inhibitor	SST	Normal 0 – 6.1%	Delay in receipt of sample	Sample referred to UHBW-Bristol Royal Infirmary Samples subsequently sent for testing at HSL[7.3]	Not available	Within 24hrs	4 weeks
Coagulation Genetics	EDTA	N/A	N/A	Consultant approval required. Sample referred to UHBW-Bristol Royal Infirmary Samples subsequently sent for testing at Oxford[7.3]	Not available	If sample available	N/A
VWF Collagen binding	Sodium citrate	Normal 0.49 – 1.32 IU/mL	Delay in receipt of sample	Sample referred to UHBW-Bristol Royal Infirmary Samples subsequently sent for testing at Royal Free Hospital, London[7.3]	Not available	Within 24hrs	4 weeks

Test	Specimen type	Reference Ranges	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Heparin Induced Thrombocytopenia (HIT) Screen	SST 1 x 3.5mL	Negative: Less than 1 U/mL Positive: More than 1 U/mL	Delay in sample receipt	Sample referred to UHBW-Bristol Royal Infirmary. Positive results are confirmed by send away test to NHSBT Filton[8] Routine transports to NHSBT daily, test ONLY performed daily Mon-Fri.	Service for clinically urgent requests On cons request	Not applicable	24 hours
Lupus Anticoagulant Extended Screen	Sodium citrate 2 x 2.7mL	Contact Laboratory	Delay in sample receipt	Sample referred to UHBW-Bristol Royal Infirmary Samples subsequently sent for testing at UCLH[7.3]	Not available	Not applicable	2 weeks

5.2.3 Factors Affecting Coagulation Tests

Clotting Screen (PT/APTT – Prothrombin Time, Activated Partial Thromboplastin Time) D-Dimer & Fibrinogen:

- Anticoagulation
- Delayed receipt of sample
- Grossly Lipaemic sample
- Grossly Haemolysed sample
- Underfilled / Overfilled sample
-

5.2.4 Coagulation – Requesting Guidelines

The Clotting screen comprises Prothrombin time (PT), APTT, a Clauss Fibrinogen assay and the PT and APTT expressed as ratios.

The indications for a clotting screen are:

1. A significant history of abnormal bleeding or bruising.
2. A significant family history of abnormal bleeding if the patient is to undergo surgery or an invasive procedure.
3. Monitoring a coagulopathy associated with massive blood transfusion.
4. Investigation of DIC.
5. Known liver disease especially prior to biopsy.
6. Pre ERCP.
7. SLE.
8. Intra-uterine death.
9. GI bleed or PR bleed.

The clinical details section on the laboratory request form should reflect, in summary, relevant indications supporting the clotting screen request.

Requests for clotting screens that do not fulfil the above criteria may not be processed.

The following also qualify as **inappropriate** reasons for requesting a coagulation screen:

1. Routine pre-operative unless there is a reason to suspect abnormal bleeding.
2. Monitoring anticoagulants Warfarin and Heparin (please request INR or APTR as appropriate)
3. Paracetamol overdose (please request INR only).
4. Salicylate overdose (please request INR only).

5.3 Haematology and Coagulation Reference Ranges

- Please refer to Appendix Two

5.4 Blood Transfusion Laboratory Service Provision (Section Lead: Stephen White)

The supply of blood for transfusion by the Transfusion laboratory is subject to the following conditions:

- A full service is only available between 09.00 - 17.30, Monday to Friday.
- At all other times, including Public Holidays, compatibility testing (crossmatching) is only available for emergencies. This service is staffed by multidisciplinary personnel and by its nature restricts the repertoire of investigations available out of normal hours. Supply of blood for transfusion must be reserved for patients whose immediate management would be severely compromised without the administration of blood and or blood components during this period. (refer to Blood Transfusion Policy).
- Requests for supply of blood for normal day theatre lists should be submitted more than 24 hours in advance. For Monday lists, requests must be received the previous Friday, where appropriate.
- Requests for cross matched blood should not be arranged during the out of hours period unless urgent.
- Service constraints (i.e. staffing, blood supply and special requirements) may cause requests to be processed on the next normal working day.
- When ordering blood & blood components, the type (including special product requirements), quantity, date & time, and NBS indication code are required (refer to Blood Transfusion Policy).

The need for special blood requirements (e.g. irradiated, Hepatitis E neg) must be highlighted to lab staff and stored on the hospital Blood Transfusion laboratory computer. Blood Transfusion laboratory staff should check whether there are any special requirements whenever blood or blood components are requested. Any request made without acknowledging whether special requirements are required or not, will not be processed until this has been confirmed.

Samples from patients receiving medication that may affect blood grouping and/or antibody screen results, should include details of this medication (e.g. patient on Daratumumab or Camelia). It may not be possible to process these samples on site. Therefore, specimens should be sent sufficiently in advance to allow for testing to occur at NHSBT, Filton

5.4.1 Crossmatch/Group & Screen Policy

- If possible, requests for crossmatching should give at least 24 hours' notice. If a crossmatch request for transfusion is to be made with less than 24 hours' notice, please telephone the Blood Bank; as, **ONLY** telephone requests are given priority.
- All requests for crossmatching blood to cover Monday morning operations should be received in the laboratory on or before the preceding Friday morning.
- All requests for platelet transfusion should be discussed with a Clinical Haematologist.
- Inappropriate requests for Group and Save will not be processed. The request form and sample will be stored until the sample is 7 days old. Further information is available in the current Trust Blood Transfusion Policy via the Trust Intranet transfusion web pages.

- Samples not meeting the fill criteria may not be tested. Grossly haemolysed samples will not be tested.

5.4.2 Maximum Surgical Blood Order Schedule

- The guidelines reflect current Trust recommendations for Weston General, which have been ratified by the Hospital Blood Transfusion Committee. When the clinical condition of the patient necessitates blood where none is indicated on the schedule, or more blood than stated to be reserved, it is imperative that the Blood transfusion laboratory is contacted to discuss additional requirements.
- Maximum notice is essential to avoid delay in supply of compatible product. All requests for blood for transfusion involve compatibility testing by the Blood Transfusion laboratory.
- Further information is available in the current Weston Maximum Surgical Blood Order Schedule on the MyStaffApp.

5.4.3 Major Haemorrhage Procedure

- The major haemorrhage procedure is designed to provide blood products in the minimum time to the site of a major haemorrhage.
- Major haemorrhage is considered as any situation where immediate delivery of blood is required for a patient with rapid blood loss. All clinical and laboratory staff can activate the procedure if immediate emergency delivery of blood is deemed necessary.

- The procedure is activated with one phone call. Calls will be recorded as routine.

1. Call 2222 “I would like to trigger the major haemorrhage procedure in location x extension xxxx”.
2. Switchboard will trigger the major haemorrhage protocol via speech bleep.
3. Transfusion laboratory will call you back on the extension provided. Provide patient identification details (name, trust ID, DOB / age, weight (if child), if anything other than red cells are required, clinicians name).

For further in formation refer to the Trust Major Haemorrhage Procedure via MyStaffApp, scanning the QR Code with your mobile phone, or link underneath.

https://uhbw.mystaffapp.org/12839/document_view.pdf

5.4.4 Blood Transfusion Test Information

Test	Specimen type	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Cross match	EDTA 6ml (Pink top) 1.3ml Paed 500µl Neonate	Incorrectly labelled, insufficient, unsigned, clotted samples will be rejected	Primary samples from previously ungrouped patients can only receive Group O Blood until confirmatory sample received.	Service for clinically urgent requests	Up to 7 days dependent upon sample validity. Not transfused patient sample valid 7 days If transfused within 90 days or pregnant, sample validity 72hrs	Routine Crossmatch 2hrs* Telephone the laboratory if Blood urgently required *For patients with antibodies, provision time may be significantly longer.
Group & Save In-Patient	EDTA 6ml (Pink top) 1.3ml Paed 500µl Neonate	Incorrectly labelled, insufficient, unsigned, clotted samples will be rejected	To add a blood product request, telephone blood bank	Service for clinically urgent requests	Up to 7 days dependent upon sample validity. Not transfused patient sample valid 7 days If transfused within 90 days or pregnant, sample validity 72hrs	8 hrs

Test	Specimen type	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Group & Save Ante-Natal	EDTA 6ml (Pink top) 1.3ml Paed 500µl Neonate	Incorrectly labelled, insufficient, unsigned, clotted samples will be rejected				5 days
Direct Antiglobulin Test (DAT)	EDTA (can be performed on FBC sample) 6ml (Pink top) 1.3ml Paed 500µl Neonate		Can be added on to existing Group & Save or Haematology FBC sample	Service for clinically urgent requests	7 days	24hrs
Kleihauer	EDTA	Delay in receipt of sample	Samples should be taken minimum 30-45mins POST sensitising/delivery event	Service for clinically urgent requests	Dependent on indication – telephone the laboratory	72hrs (sent to the BRI)
Phenotyping	EDTA		Can be added to a G&S. Full phenotyping will be referred to RCI	N/A	7 Days	48hrs

5.4.5 Blood Transfusion Referrals

Test	Specimen type	Key factors affecting tests	Notes	Out of hours service	Time limit for add on tests from time of venesection	Turn-around time from receipt of sample
Reference serology Antibody Quantification (Anti-D/c), AlloAb investigation Compatibility testing Quantification of FMH Extended RBC Phenotype	EDTA 6ml (Pink top) more may be required		Send away referral to RCI NHSBT Filton[7.4] Further samples may be required depending on tests to be undertaken – Laboratory will phone if needed.	Service for clinically urgent requests	Blood Transfusion Laboratory referral	Dependent on tests required 5-7 working days
ffDNA	EDTA 6ml (Pink top) more may be required	Incorrectly labelled, insufficient, unsigned, clotted samples will be rejected	Send away referral to M.D NHSBT Filton[7.4]		Cannot be added on. The sample should not be used for any other test	14 working days

6.0 Urgent Requests

Discipline	What is treated as Urgent, during working hours 09.00-17.30	What is treated as Urgent, Out of Hours 17.30-09.00 and weekends
Chemical Pathology	ED, ITU, SDEC, Theatres, OPAU, Seashore, Haematology Clinic, Oncology. Those marked "Urgent" or specifically discussed	All Inpatient requests
Haematology		
Blood Transfusion	Telephone Requests inc. blood groups for organ donation	All urgent crossmatch requests and major haemorrhage

6.1 Time Limits For Specimen Processing (Extra Test Requests)

Blood Transfusion

In Blood transfusion most tests can be performed up to a week after sample collection. Crossmatching depends on previous transfusions - see table below:

Patient Transfusion Within	Sample to be taken not more than
3 - 14 days	24hr before transfusion
15 - 28 days	72hr before transfusion
29 days to 3 months	1 week before transfusion

Patient Type	Sample Validity (from time taken to subsequent transfusion)
Patient transfused or pregnant in last 3 months	Up to 3 days (72 hrs)
Patient **not** transfused or pregnant in last 3 months	Up to 7 days

Chemical Pathology and Haematology

Samples are held for approximately **one week** in Chemical Pathology, and **approximately 3-5 days** in Haematology. Different tests have different degradation rates. Due to this we will not be able to provide additional testing on samples after they have exceeded the times stated below. **Test requests on samples older than 7 days cannot be processed.**

All extra tests requests must be completed on an 'extra test request' form and sent to the laboratory. Verbal requests are not acceptable without a request form, unless during airtube downtime.

If you have any queries, please contact the laboratory on 01934 647050. Alternatively contact switchboard on 01934 636363 and ask for Pathology Laboratory (Extension: 5308).

Up to 24 hours	**Up to 2 days**	**Up to 3 days**	**Up to 7 days the following tests can be added**
FBC	Troponin I	Beta HCG	Amylase and Lipase
ESR	B12		Creatine Kinase (CK)
Reticulocytes	Folate		AIP
Clotting Screen	Salicylate		Uric Acid (Urate)
XDP (D-Dimer)	Oestradiol		Renal Function (excluding Glucose)
Procalcitonin	Paracetamol		Calcium & Magnesium
Up to 4 days	**Up to 5 days**	**Up to 6 days**	LH/FSH/ Progesterone/ Prolactin/Testosterone
LDH	PSA	Urine Total Protein	CRP
Phenytoin	CA 125		TSH/ FT4/ FT3
Phosphate	HbA1c		Lipids
Cortisol			Liver Function test (LFT)
Vitamin D			Osmolality
			CEA
			RF
			Gamma GT (GGT)
			Gentamicin & Vancomycin
			Iron and Ferritin
			AFP

7.0 Samples Sent to Referral Laboratories for Testing

Tests requested that are not performed at Weston General Pathology will be referred to another laboratory for testing. Where appropriate, local hospitals are used and turnaround times are monitored.

Accreditation status of referral laboratories is checked regularly to confirm that these laboratories are working to recognised standards and are thus participating in approved EQA schemes for the tests we send them.

For more detail and addresses of our referral laboratories please see lists in the Appendices.

7.1 Chemistry

Most referred samples are tested at:

Bristol Royal Infirmary (UHBW-Bristol) Level 8 Upper Maudlin St Bristol BS28HW	Southmead Hospital (NBT) Westbury on Trym Bristol BS10 5NB

7.2 Haematology

Most referred samples are tested at:

Department of Laboratory Haematology, Level 4 Oxford Radcliffe Hospital Oxford University Hospitals NHS Trust Headley way Headington OX3 9DU Tel: 01865 572769	Severn Pathology, Southmead Hospital, Pathology Sciences Building, Westbury On Trym, Bristol BS10 5NB Main switchboard: 01179505050 Haematology: 01174148351
Red Cell Centre - Protein Laboratory Tel: 020 3299 2455 kch-tr.redcelllab@nhs.net c/o Central Specimen Reception Blood Sciences Laboratory Ground Floor Bessemer Wing King's College Hospital Denmark Hill	PHE Malaria Reference Laboratory Faculty of Infectious & Tropical Diseases London School of Hygiene & Tropical Medicine Keppel Street London WC1E 7HT Laboratory: 020 7927 2427

7.3 Coagulation

Most referred samples are tested at:

HSL Haemostasis Laboratory Haematology Department 60 Whitfield Street London W1T 4EU Tel: 020 3912 0298	Oxford Regional Genetics Laboratories Churchill Hospital Old Road Headington Oxford OX3 7LE Tel: 01865 226001
Royal Free Hospital First Floor, Pond Street London NW3 2QG Tel: 020 7830 2274	H&I Diagnostic Specimens NHSBT Filton 500 North Bristol Park Northway Bristol BS34 7QH Tel: 0117 921 7372
Haemostasis Laboratory UCLH 2nd Floor 60 Whitfield Street London W1T 4EU Tel: 0203 447 8545	

7.4 Blood Transfusion

Most referred samples are tested at:

NHSBT North Bristol Park FILTON Bristol BS34 7QH

8.0 Out of Hours Service

A Blood Sciences 24/7 service is available during the following times:

- 17.30 through to 09.00 Weekdays
- Weekends
- Public Holidays

There will be some overlap of staff but for most of the time the BMS is working alone.
The shift BMS can be contacted if urgent on bleep 4017 or through switchboard during the above hours and supplies a multi-disciplinary service for essential urgent requests.

Results of all Out of hours investigations will be entered on completion, onto the Pathology computer system and can be accessed on ICE, with the appropriate password, from any network PC terminal in the hospital.

8.1 Chemical Pathology tests routinely available out of hours

All automated Biochemistry in house tests are available out of hours, except for some chemistry tests such as Urine or some hormones tests, this is due to machine maintenance overnight. Any abnormal results will be phoned accordingly.

Other tests that are not routinely performed out of hours may occasionally be required urgently on clinical grounds. Such requests must be discussed with the Consultant On Call for the relevant specialty. On Call Consultants are also happy to discuss any aspect of patient investigation or results interpretation as well as to give clinical advice within their specialty area. Contact is via Switchboard.

Specimen Type	Test
Serum (SST)	See section 4.1 for a list of tests processed routinely as part of the 24/7 service
Li/Hep blood	Neonatal Bilirubin
Urine	Sodium
CSF	Glucose/Protein
Arterial Blood Gases	Analysers are available for near-patient testing by trained users. These instruments also measure carboxyhaemoglobin and methaemoglobin - lactate.
Other tests must be discussed with the On Call Chemical Pathologist, who is also available for clinical advice	

8.2 Haematology tests routinely available out of hours

Tests	
FBC	On demand
ESR	Only for the differential diagnosis of temporal arteritis
GF Screen	Dependant on differential WBC
INR, APTT, PT, D-Dimer, FIB	On demand
Abnormal Haemoglobin	Sickle cell screening only
Malaria Screen	Only on request received by consultant

XDP	Only for DIC ?DVT/PE
Crossmatch	If the immediate management of the patient will be adversely influenced should the transfusion of blood components not be carried out during that out of hours session
Other tests must be discussed with the On Call Consultant Haematologist, who is also available for clinical advice	

8.3 Transport of Samples Out of Hours

Transport of samples to the laboratory is the responsibility of the requesting clinician. In the event of failure of the Air Tube System, contact the **hospital porters** to take urgent samples to the laboratory.

9.0 Results

9.1 UHBW – Weston

24-hour access to current and historical result data is available as part of the pathology ICE system. Users can access results by a terminal connected to the UHBW-Weston computer network and logging into ICE. Please do this before contacting the laboratory.

Passwords and training for result access on ICE are provided by “Clinical Systems” during routine hours and by the Radiology Department Out of Hours.

Apart from abnormal results (Appendix 4), results are not telephoned.

9.2 GP

Results will be sent from Pathology at regular intervals throughout the day and are imported to the practice computer at intervals decided by the practice; users will be able to access results through their own order comms system. All abnormal results for GP samples outside of routine surgery hours will be telephoned to BRISDOC out of hours service or 111.

9.3 Urgent Requests

During normal working hours, abnormal Chemical Pathology and Haematology results from inpatients, ED cases and General Practitioners will usually be telephoned to the location stated on the request form. Other departments will be phoned if appropriate.
It is Trust policy that results telephoned be recorded electronically on Winpath and transferred to ICE.

Results for outpatients will be telephoned either to the Outpatient Department, if the requesting doctor is still likely to be in clinic, or the relevant consultant secretary

9.4 Clinical Enquires

Clinical advice is available from a medical consultant during normal working hours. See Pathology Contact List. Out of Hours, advice should be sought from the on-call clinician for that discipline via switchboard.

9.5 Patient Results Enquiry Service

Results are available from the ICE system soon after they are released from the Pathology computer system (LIMS), and as printed reports for Outpatients. All users are encouraged to use this service rather than telephone the laboratory.

10.0 Governance

The Blood Sciences laboratories at Weston General Hospital are working towards full accreditation with United Kingdom Accreditation Service (UKAS) for compliance with ISO 15189:2022 for all new assays. The department is going through a Managed Services Contract and therefore disbanded accreditation with our Roche equipment. We have now moved to a Beckman Coulter contract and are working towards applying for extension to scopes to evidence our compliance with accreditation standards.

11.0 Appendixes

Appendix 1	Chemistry Reference Ranges
Appendix 2	Haematology and Coagulation Reference Ranges
Appendix 3	Sample Tubes chart
Appendix 4	Telephone Limits Chart (Blood Sciences)

11.1 Appendix 1 - Chemistry Reference Ranges

General Chemistry				
Test	**Age**	**Reference Intervals**		**Units**
		Lower	**Upper**	
Albumin		35	50	g/l
Albumin Children	0 – 1 year	30	45	g/l
Alkaline Phosphatase Adult		30	130	U/l
Alkaline Phosphatase Children	0-13 days	90	273	U/l

	14d- 11mths	134	518	U/l
	1yr- 9yrs	156	369	U/l
	10 – 12yrs	141	460	U/l
Alkaline Phosphatase Male	13 – 14yrs	127	517	U/l
	15-16yrs	89	365	U/l
Alkaline Phosphatase Female	13 – 14yrs	62	280	U/l
	15-19yrs	54	130	U/l
ALT (Alanine Transaminase)		10	50	U/l
Amylase		28	100	U/l
B12		180	900	pg/ml
Bicarbonate		22	29	mmol/l
Bilirubin (total)			<21	µmol/l
Bilirubin (Uncongugated)			<3.4	µmol/l
Calcium Adult		2.20	2.60	mmol/l
Calcium Children	<4 weeks	2.00	2.70	mmol/l
	1mth-16yrs	2.20	2.70	mmol/l
Chloride		93	108	mmol/l
Cholersterol (total)		Clinical decision limits		mmol/l
CK (Creatine Kinase) Male		40	320	U/l
CK (Creatine Kinase) Female		25	200	U/l
Creatinine Adult Male		59	104	µmol/l
Creatinine Adult Female		45	84	µmol/l
Creatinine Children	0-14 days	27	77	µmol/l
	15d-1y	14	34	µmol/l
	4 – 5yrs	23	37	µmol/l
	6 – 7yrs	25	42	µmol/l
	8 – 9 yrs	30	47	µmol/l
	10 – 11yrs	29	56	µmol/l
	12yrs	36	64	µmol/l
	13 yrs	36	67	µmol/l
Creatinine Male	14yrs	38	76	
	15yrs	40	83	
	16yrs	47	98	
	17yrs	54	99	
Creatinine Female	14yrs	38	74	
	15yrs	43	75	
	16yrs	44	79	
	17yrs	48	81	
CRP (C-Reactive Protein)			<6.0	mg/l
Ferritin Male		33	490	ng/ml
Ferritin Female	<44yrs	15	445	ng/ml
	> 45yrs	30	470	ng/ml
Folate		2.5	19.5	ng/ml

GGT (g-glutamyl transferase) Male		10	71	U/l
GGT (g-glutamyl transferase) Female		6	42	U/l
GGT (g-glutamyl transferase) Children	< 2wks		<165	U/l
	3wks – 3mths		<177	U/l
	3mths – 1yr		<145	U/l
	1-15yrs		<37	U/l
Glucose (fasting)		3.0	6.0	mmol/l
HDL Cholesterol		Clinical decision limits		mmol/l
Iron		6.0	35.0	µmol/l
LDH (Lactate dehydrogenase)		0	250	U/l
LDH (Lactate dehydrogenase) Children	0 – 14days	0	1130	U/l
	15 days - 1yr	0	420	U/l
	1 – 9 yr	0	310	U/l
	10 – 14yr	0	270	U/l
Lipase		13	60	U/l
Magnesium		0.70	1.00	mmol/l
Phosphate Adult		0.80	1.50	mmol/l
Phosphate Children	<1mth	1.30	2.60	mmol/l
	1mth – 1yr	1.30	2.40	mmol/l
	1 – 16yrs	0.90	1.80	mmol/l
Potassium (k) Adult		3.5	5.3	mmol/l
Potassium (k) Children	< 4wks	3.4	6.0	mmol/l
	1mth – 1yr	3.5	5.7	mmol/l
Protein (total) serum		60	80	g/l
Protein (CSF) Adult			<0.54	g/l
Protein (CSF) Children	<30days	0.15	1.30	g/l
PSA	<59 years		<3.0	µg/l
	<69 years		<4.0	µg/l
	<79 years		<5.0	µg/l
Sodium		133	146	mmol/l
Triglycerides Adult		0.5	1.70	mmol/l
Triglycerides Children	<13wks	1.1	2.3	mmol/l
	13wks – 14yrs	0.4	1.70	mmol/l
Troponin T			<14	ng/l
Urate Male	8 – 10yrs	70	350	µmol/l
	11 – 15yrs	120	460	µmol/l
	16 yrs+	200	430	µmol/l
Urate Female	8 – 10yrs	130	370	µmol/l
	11 – 15 yrs	150	390	µmol/l
	16 – 50yrs	190	360	µmol/l

	50yrs+	140	360	µmol/l
Urate Children	<8yrs	60	240	µmol/l
Urea Adult		2.5	7.8	mmol/l
Urea Children	<28days	0.8	5.5	mmol/l
	28d – 1yr	1.0	5.5	mmol/l
	1 – 16yrs	2.5	6.5	mmol/l

Endocrine Chemistry				
Test	**Age**	**Reference Intervals**		**Units**
		Lower	**Upper**	
Cortisol			>350	nmol/l
LH Follicular		2.4	12.6	IU/l
LH Luteal		1	11.4	IU/l
LH Male		1.6	9.6	IU/l
FSH Follicular		3.5	12.5	IU/l
FSH Luteal		1.7	7.7	IU/l
FSH Post menopausal			>30	IU/l
FSH Male		0	6	IU/l
HCG (non-pregnant)			<6	IU/l
Oestradiol Follicular		60	850	pmol/l
Oestradiol Luteal		80	1250	pmol/l
Oestradiol Post menopausal		<500		pmol/l
Oestradiol Male			<160	pmol/l
Progesterone Follicular		<4		nmol/l
Progesterone Luteal			>30	nmol/l
	Progesterone >30 nmol/l indicates ovulation			
Prolactin Male		<700		mIU/l
Prolactin Female		<700		mIU/l
	Prolactin <700mIU/l unlikely of clinical significance			
PTH		1.6	6.9	pmol/l
Testosterone Male		8.6	29.0	nmol/l
Testosterone Female		0.3	1.7	nmol/l
Thyroid – fT3 Adult		3.1	6.8	pmol/l
Thyroid – fT3 Children	0 – 5 days	2.6	9.6	pmol/l
	6 – 14days	3.0	9.2	pmol/l
Thyroid – fT4 Adult		12.0	22.0	pmol/l
Thyroid – fT4 Children	0 – 5 days	11.0	32.0	pmol/l
	6 – 14days	11.5	28.3	pmol/l
Thyroid – TSH Adult		0.27	4.2	mU/l
Thyroid – TSH Children	0 – 5 days	0.7	15.2	mU/l
	6 – 14days	0.72	11.0	mU/l

Drugs						
Drug	**Therapeutic Range**	**Units**	**Half Life**	**Sampling Time**	**Sample type**	**Time to Steady State**
Carbamazepine	4.0-12.0	mg/l	12hrs	Pre-dose	SST (yellow)	2 – 6 days
Ciclosporin	100 – 225 (maintenance)	µg/l	2 – 6hrs	Pre-dose	EDTA (purple)	2 – 3 days
Digoxin	0.8 – 2.0	µg/l	36 – 48hrs	Pre-dose (or >6hrs post-dose)	SST (yellow)	5 – 7 days
Gentamicin		mg/l		Pre-dose	SST (yellow)	
Lamotrigine		mg/l	20 – 30hrs	Pre-dose	SST (yellow)	4 – 15 days
Lithium	0.4 – 1.0	mmol/l	18 – 36hrs	12 hrs post-dose	SST (yellow)	3 – 7 days
Paracetamol	See BNF for toxicity	mg/l				
Phenobarbitone		mg/l	96 hrs	Pre-dose	SST (yellow)	10 – 25 days
Phenytoin	5 - 20	mg/l	7 – 42 hrs	Pre-dose	SST (yellow)	7 – 35 days
Salicylate	See BNF for toxicity	mg/l				
Theophylline	10.0 – 20.0	mg/l	3 – 13 hrs	Oral: pre-dose IV: >2 hrs into infusion	SST (yellow)	2 – 3 days
Valproate	N/A (Toxicity at >100)	mg/l	8 – 20 hrs	Pre-dose	SST (yellow)	2 – 4 days
Vancomycin		mg/l		Pre-dose	SST (yellow)	

Drug concentrations outside the ranges quoted may be appropriate in specific clinical circumstances. Toxic effects for some drugs may be observed at high-therapeutic levels Pathology Consultants are available for clinical advice if required

Immunoglobulins				
Test	**Age**	**Reference Intervals**		**Units**
		Lower	**Upper**	
IgG Adult		6.0	16.0	g/L
IgG Children	<14days	5.0	17.0	g/L
	2 – 6wks	3.9	15.0	g/L
	6wks – 3mths	2.1	7.7	g/L
	3 – 6mths	2.4	8.8	g/L
	6 – 9mths	3.0	10.9	g/L
	9mths – 2yrs	3.1	13.8	g/L
	3yrs	3.7	15.8	g/L
	4-6yrs	5.4	16.1	g/L
	7-15yrs	6.0	16.0	g/L
IgM Adults	60yrs+	0.4	2.0	g/L
	18 -60yrs	0.5	2.0	g/L
IgM Children	<14 days	0.02	0.20	g/L
	2 – 6wks	0.08	0.40	g/L
	6wks – 3mths	0.15	0.70	g/L
	3 – 6mths	0.2	1.0	g/L
	6 – 9mths	0.4	1.6	g/L
	9mths – 1yr	0.6	2.1	g/L
	1-18rs	0.5	2.0	g/L
IgA Adults	45+ yrs	0.8	4.0	g/L
	18 -45yrs	0.8	2.8	g/L
IgA Children	<14 days	0.01	0.08	g/L
	2 – 6 wks	0.02	1.5	g/L
	3 – 6mths	0.15	0.7	g/L
	6 – 9mths	0.15	0.7	g/L
	9mths – 1yr	0.2	0.7	g/L
	2 - 3 yrs	0.3	1.3	g/L
	4 – 6yrs	0.4	2.0	g/L
	1 – 12yrs	0.5	2.5	g/L
	13 – 18yrs	0.8	2.8	g/L

Urines			
Test	**Reference Interval**		**Units**
	Lower	**Upper**	
Albumin			g/l
Calcium (24hr)			mmol/24hrs
Magnesium (24hr)			mmol/24hrs
Phosphate (24hr)			mmol/24hrs
Protein (Total)			g/l
Sodium, Potassium, Urea, Creatinine			mmol/l
Urate (24hr)			mmol/24hrs

Tumour Markers			
Test	**Clinical Decision Values**		**Units**
	Lower	**Upper**	
AFP (Alpha Feto Protein)		<6	kU/l
CA125		<35	U/ml
CEA (Carcinoembryonic Antigen)		<5	µg/l

11.2 **Appendix 2 -** Haematology Reference Ranges

BLOOD COUNTS* & ESR

TEST	NORMAL RANGE	UNITS
Haemoglobin	M 130 - 170 F 115 - 150	g/L
RBC	M 4.50 - 6.0 F 3.80 - 5.3	10^{12}/L
Haematocrit [HCT]	M 0.400 – 0.520 F 1.370 – 0.470	
MCV	83 - 100	fL
MCH	27.0 - 32.0	pg
MCHC	310 - 350	g/L
WBC [total]	4.0 - 11.0	10^{9}/L
Neutrophils	1.5 - 8.0	10^{9}/L
Lymphocytes	1.0 - 4.0	10^{9}/L
Monocytes	0.2 - 1.0	10^{9}/L
Eosinophils	0.0 - 0.5	10^{9}/L
Basophils	0.0 - 0.2	10^{9}/L
Platelets	150 - 450	10^{9}/L
Reticulocytes	0.01 - 0.12	10^{12}/L
ESR		
Age up to 16	1 - 10	mm/hr
Age 16 - 49	F 1 - 12 M 1 - 10	mm/hr
Age 49 - 59	F 1 - 12 M 1 - 10	mm/hr
Age 59 - 69	F 1 - 20 M 1 - 14	mm/hr
Age over 69	F 1 - 36 M 1 - 31	mm/hr

COAGULATION

TEST	NORMAL RANGE [outside these ranges the results will be flagged red on WinPath]	UNITS
Prothrombin Time	9.5 -12.0	secs
APTT	23.0 - 32.0	secs
Fibrinogen	1.5 - 4.0	g/L
D Dimers	Generally <500 However age related range apply which are given with the result	ng/mL
INR for patients on Warfarin	Condition dependant However generally 1.8 - 4.5	n/a
APTR for patients on heparin	1.5 - 3.5	n/a

OTHERS TESTS

TEST	NORMAL RANGE [outside these ranges the results will be flagged red on WinPath]	UNITS
Hb A2	1.5 – 3.5	%
Hb F	Up to 0.9	%
Ferritin	**M** 33 – 400 **F** Pre-menopausal 15 – 150 **F** Post-menopausal 33 - 400	% % %

These reference ranges have been developed over time, sourced from BSCH guidelines, neighbouring Haematology Labs and in consultation with the relevant manufacturers and Haematology Consultants.

*Note the FBC ranges shown are based on adult ranges. Paediatrics ranges vary with age. For age correct values all appropriate ranges are assigned against patient in ICE.

11.3 **Appendix 3 -** Sample Tubes chart

Test Name	Test Code	Sample Type	Additional Information		Test Name	Test Code	Sample Type	Additional Information
ACTH – BRI	ACTH	x 2 PURPLE	MUST ARRIVE ON ICE with 30mins of blood collection. Separate Immediately & Freeze		Apolipoprotein E – Cardiff	MISC	PURPLE	Send Whole blood
Alanine Transferase	ALT	YELLOW			APTT Ratio	APTR	BLUE	
Albumin	ALB	YELLOW			Aspartate Transaminase	AST	YELLOW	Haemolysis needs to be <20
Alcohol - Ethanol -	ET	GREY	AKA Ethanol Confirm with BMS		Autoimmune Profile - BRI	UAIP	YELLOW	
Alkaline Phosphatase	ALP	YELLOW			Aquapourin 4 antibodies – Oxford	AQP	YELLOW	Or CSF
ALP Isoenzymes - BRI	UAPI	YELLOW			B12	B12	YELLOW	
Alpha Feto Protein	AFP	YELLOW			BCR-ABL	BCR	4 X PURPLE	AKA Philadelphia Chromosome
Alpha-1 Antitrypsin - BRI	A1T	YELLOW			Beta-2-Microglobulin - NBT	B2M	YELLOW	
AAT Phenotype - BRI	AAP	YELLOW			Beta- HCG	HCG	YELLOW	HCG, β-HCG
Alpha Galctosidase - BRI	FAB	PURPLE	AKA Fabrys Disease		Bicarbonate (HCO_3^-)	CO2	YELLOW	
Aluminium – NBT	AL	DARK BLUE			Bile Acids – BRI	TBA	YELLOW	Urgent - Send same day
Amino Acids – BRI	BAA	GREEN	Separate & Freeze ASAP		Biotinidase – BRI	BIO	PURPLE	Separate & Freeze ASAP
Amino Acids (Urine) BRI	UAA	URINE	Freeze ASAP		Calcitonin – Synnovis	NCLT	YELL/ GREEN	Separate Immediately & Freeze
Amiodarone - Llandough	AMIO	PURPLE			Cardiolipin – BRI	UACA	YELLOW	
Ammonia - BRI	AMM	PURPLE	Separate Immediately & Freeze		Calcium	CA	YELLOW	
Amylase	AMY	YELLOW			Carbamazepine	CARB	YELLOW	
Amyloid Protein – UCL	SAA	YELLOW			Carboxyhaemoglobin	COHB	PURPLE	
Androstenedione - Synnovis	AND	YELLOW			CEA	CEA	YELLOW	
Angiotensin Converting Enzyme- BRI	ACE	YELLOW			Chloride	CL	YELLOW	
ANTIBODIES (Various)		YELLOW	See 'Send-away test database' for full list		Cholesterol	CHOL	YELLOW	
Anti- GAD – Exeter Hospital	GAD	YELLOW	Glutamic Acid Decarboxylase		Chromagranin A&B – Imperial College	CGA	2 X PURPLE	Separate & Freeze ASAP
Antiphospholipid antibody - BRI	UACA	BLUE	AKA Cardiolipin		Chromium – NBT	COCR	PURPLE	
Anti MUSK antibodies	MSK	YELLOW	Muscle specific kinase		Cobalt – NBT	COCR	PURPLE	
Apolipoprotein (A1 or B) RVI – Newcastle	APB	PURPLE			Clotting Screen	CST	BLUE	

Test Name	Test Code	Sample Type	Additional Information		Test Name	Test Code	Sample Type	Additional Information
Complement Studies (C3, C4) -BRI	COMP	YELLOW			Factor VIII – BRI	F8	BLUE	
Copper – NBT	CU	YELLOW			Factor V Leiden – BRI	FSL	BLUE	Treat like Thrombophillia
Cortisol	CORT	YELLOW			Ferritin	FER	YELLOW	
Creatine Kinase	CK	YELLOW			FH Genotype – Great Ormond Street	FHG	2 X PURPLE	
Creatinine	CR	YELLOW	**Includes eGFR** (>18yrs old)		FK506 – NBT	FK5	PURPLE	AKA Tacrolimus
Cryoglobulins - NBT	CRYG	YELLOW	Inform BMS. Place at 37 ºC for 2-4hours then separate and send.		Folate	FOL	YELLOW	
CSF Spec (Xanthochromia) – BRI	XAN	CSF	Protect from light		Follicle Stimulating Hormone (FSH) - Sheffield PRU	FSHU	YELLOW	
Cyclosporin – BRI	CYC	PURPLE	Send Whole Blood		Free PSA- Sheffield PRU	FPSA	YELLOW	
Cytogenetics (karyotype)- NBT	CYTO	GREEN & PURPLE	NOT Fridays AKA Genetics		Free Light chains- Birm Uni	FLC	YELLOW	
C1-Esterase Inhibitor – NBT	C1I	YELLOW	Or Heparin sample Separate & Freeze		Free Thyroxine	FT4	YELLOW	
CA 125	C125	YELLOW			Free Triiodothyronine	FT3	YELLOW	
CA 19-9 – BRI / CA 15-3 – BRI	C199/C153	YELLOW			Fructosamine – RUH Bath	FRUC	YELLOW	
Cadmium – NBT	CD	PURPLE			Full Blood Count	FBC	PURPLE	
Caeruloplasmin – NBT	CAE	YELLOW			Glandular Fever Screen	GF	PURPLE	AKA Paul Bunnell
C-Peptide (treat as Insulin)	PCPT	PURPLE	Separate Immediately & Freeze		Glucose / Glucose tolerance test	GLU / GTT	YELLOW/ GREY	(GTT – baseline+ 2hr)
C-Reactive Protein	CRP	YELLOW			Growth Hormone – BRI	GH	YELLOW	
CD3/CD4 count – NBT	TSUB	PURPLE	T cell subsets		G6PD – BRI	G6PD	PURPLE	
D-dimer, DVT, FDP, XDP	DDV	BLUE			Gamma-glutamyl transpeptidase	GGT	YELLOW	γ-GT, GGT, GGTP
Dexamethasone Suppression Test	DEXA	YELLOW	1 tube taken at 9:00 AM		Gastrin - CCH (Inc VIP, GIP)	GAST	2 x PURPLE	Arrives on ice, Spin, Separate and Freeze immediately
DHEAS – BRI	DHES	YELLOW			Gentamicin	GENR	YELLOW	
Digoxin	DIG	YELLOW			Haemoglobin A1c	A1C	PURPLE	HBA1c, A1c
Electrolytes	UE	YELLOW	Sodium & Potassium / Creatinine		Haemoglobin Electrophoresis	HEL	PURPLE	Includes FBC
Endomysial Antibodies – NBT	ENDO	YELLOW			HFE Gene – Exeter Hospital	HGA	PURPLE	AKA Haemochromatosis
Erythrocyte Sedimentation Rate	ESR	PURPLE			HDL Cholesterol	HDL	YELLOW	
Erythropoietin – SMH	EPO	YELLOW	Separate Immediately & Freeze		HLA Typing – NHSBT	HLA	2 X PURPLE	NOT Fridays (full pink tube)

Test Name	Test Code	Sample Type	Additional Information		Test Name	Test Code	Sample Type	Additional Information
HLA B27 - NBT	B27	2 X PURPLE	Add B27 to clinical details		Liver Function Tests	ULFT	YELLOW	
Homocysteine – BRI	HCY	PURPLE	Freeze plasma within 30mins of taking		Lupus Anticoagulant - BRI	LLA	4 X BLUE	Full clinical details required
IGF-1 - PEP	NIF3	YELLOW	Spin, separate and freeze immediately		Lysosomal Enzymes - NBT	WCE	2 x PURPLE	Send Whole Blood with 24 hours AKA White Cell Enzymes
IgG Subclasses - NBT	IG	YELLOW			Luteinising Hormone	LHU	YELLOW	
Immunoglobulin E (IgE) - NBT	IE	YELLOW	(Included in RAST)		Magnesium	MG	YELLOW	
Immunoglobulins (IgG, IgA, IgM)	IGS	YELLOW			Malarial Parasites	MP	PURPLE	Inform Haematology BMS
Inhibin B – Sheffield PRU	INB	YELLOW			Manganese - Synnovis	NMNR	PURPLE	
INR	WAR	BLUE			Mast Cell Tryptase - NBT	MAS	YELLOW	AKA Tryptase
Insulin - BRI	INSU	YELLOW	Separate Immediately & Freeze		Mercury – Guildford Trace	HG/UHG	PURP / URINE	Send Whole Blood or random urine
Infliximab – Exeter Pathology	NIFL	YELLOW			Oestradiol (E2)	OESU	YELLOW	
Iron	FE	YELLOW			Oligoclonal Bands - NBT	OLI	YELLOW	Send spun CSF & serum ASAP
Islet cell antibodies - BRI	ICA	YELLOW			Organic Acids – BRI	OAU	URINE	Freeze ASAP
Jak-2 Mutation - BRI	JK2	2 X PURPLE			Osmolality	OSMU	YELLOW	
Lactate (Blood Gas Analyser)		GREEN	**Test within 20 mins on ITU ABG**		Protein S (part of Thromb screen)	TPR	4 X BLUE	Minimum of 2 bottles required
Lactate (Blood or CSF)	LACT	GREY	Spin, Separate and send to the BRI		RAST - NBT	RAST	YELLOW	Include specific allergen request
Lactate Dehydrogenase (Blood)	LDH	YELLOW			Reticulocytes	RET	PURPLE	
Lactate Dehydrogenase (CSF)	LDH	**UNIVERSAL**	(Universal pot for CSF – test at WGH)		Renin/Aldosterone - Synnovis	NRAR	2 X PURPLE	Spin, separate and freeze immediately
Lamotrigine - send to Llandough	LAMO	PURPLE			Salicylate	SAL	YELLOW	AKA Aspirin
LDL Lipid Profile	LIP	YELLOW			Selenium - NBT	SEL	YELLOW	GREEN also acceptable Spin and separate
Lead - NBT	PB	PURPLE	Send Whole Blood		Serum Protein Electrophoresis	SPE	YELLOW	
Lipid screen	LIP	YELLOW			SHBG – BRI	SHBG	YELLOW	
Lipase – NBT	LPS	YELLOW	Check with BMS: May require Amylase		Short Synacthen Test	SYNW	YELLOW	(Cortisol tests) Baseline, 30min, 60min
Lipoprotein a - BIR	LPA	YELLOW			T Cell Subsets (CD4/CD8) – NBT	TSUB	PURPLE	
Lipoprotein Electrophoresis - BRI	LEP	YELLOW			Tacrolimus (FK506)	FK5	PURPLE	
Lithium	LI	YELLOW			Testosterone	TEST	YELLOW	

Test Name	Test Code	Sample Type	Additional Information
Theophylline	THEO	YELLOW	
TIBC - BRI	TBC	YELLOW	AKA Iron Studies
Thrombophilia Screen	TPR	4 X BLUE	Minimum of 2 bottles required. Full clinical details required
Thyroglobulin - Sheffield PRU	THYG	YELLOW	
Thyroid Antibodies – BRI	TAB	YELLOW	TPO
Thyroid Function Test Sheffield PRU	TSH	YELLOW	Thyroid (formally TFT)
Tissue Transglutaminase	UTTG	YELLOW	Coeliac Screen
Total + Direct Bilirubin	DBIL	YELLOW	
Total Bilirubin	TBIL	YELLOW	
Total Protein	TP	YELLOW	
Osmolality	OSMO	YELLOW	
Paracetamol	PARA	YELLOW	
Parathyroid Hormone	PTH	PURPLE	Spin and separate plasma from EDTA. Analyse within 4hrs (Do not Freeze).
Paroxysmal nocturnal hemoglobinuria	PNH	PURPLE	AKA PNH
Porphyrins	**Ensure that all samples are protected from light**		
Plasma Porphyrins - BRI	**QPB**	**PURPLE**	**Send whole Blood**
Urine Porphyrins – BRI	**QPU**	**URINE**	
Faecal Porphyrins – BRI	**QPF**	**FAECES**	
Porphyrin screen – BRI	**PORS**	**As above**	**Send whole blood, Urine and Faeces**
Phenylalanine - NBT	PHAL	GREEN	
Phenobarbitone - BRI	POB	YELLOW	
Phenytoin	PHEW	YELLOW	
Procollagen III - Synnovis	NP3N	YELLOW	Separate Immediately & Freeze
Progesterone	PROG	YELLOW	

Test Name	Test Code	Sample Type	Additional Information
Prolactin	PROL	YELLOW	
Prostate specific antigen	PSA	YELLOW	
Thiopurine Metabolites - Synnovis	XTGN	2 x PURPLE	Send Whole Blood
TPMT - Synnovis	XTMT	2 x PURPLE	Send Whole Blood
Transferrin – BRI	TBC	YELLOW	
Triglycerides	TRIG	YELLOW	
Troponin T (Tn T, cTn T)	TNI	YELLOW	
Urea	UREA	YELLOW	
Uric Acid (Urate)	UA	YELLOW	
Valproate - Synnovis	NVAL	YELLOW	
Vancomycin	VANR	YELLOW	
Very Long Chain Fatty acids - NBT	VLC	YELLOW	
Vitamin B1 (Thiamine) / Vitamin C	MISC	GREEN or PURPLE	Protect from Light. Send to GSST
Vitamin B6 (Pyridoxal-5-phosphate)	MMIS	PURPLE	Protect from Light. Send to Glasow
Vitamin A + E – BRI	VIT	YELLOW	
Vitamin D	25D	YELLOW	
Von Willebrand Factor - BRI	VWF	4 X BLUE	
White Cell Markers - BRI	MARK	PURPLE	AKA Flow Cytometry, Markers. immunophenotyping
Zinc – NBT	ZN	DARK BLUE	
SARS COV 2 Antibodies	COVA	YELLOW	Total Covid Antibody
SARS COV 2 S Antibodies - BRI	COVS	YELLOW	Spike Protein Antibody – 24 hr turnaround

All Microbiology requests MUST have a separate YELLOW (SST) and PURPLE (EDTA) - **add on microbiology requests are not permitted**
CMV viral load = EDTA blood.
Azole Anti-fungal assays = Plain red tubes
Please refer to UKHSA user guide for further information (Bacteriology reference department user manual - GOV.UK)
Blood Bank require PINK top 6ml EDTA samples (Tall sample tubes). New samples may be required depending on patient transfusion history

11.4 Appendix 4 - Telephone Limits Chart (Blood Sciences)

Test	Action Limits		Comments
	Less than or	Greater than or	
Sodium	120 mmol/L *130 mmol/L if <16 years old*	160 mmol/L	*± 5 mmol respectively (Rule applies to Inpatient only. Phone each GP/OP occurrence)*
Potassium		*6.0 mmol/L*	*GP patients **ONLY** (between 08.30 and 18.30hrs - Routine working days)*
	2.5 mmol/L	6.5 mmol/L	Must be phoned on **EVERY** occasion
Bicarbonate	10 mmol/L		Unless within 2 mmo/L on previous 24 hours or patient on ITU
Urea		30.0 mmol/L *10.0 mmol/L <16 yrs*	Unless within 20% of previous test
Glucose	2.5 mmol/L	25.0 mmol/L *15 mmol/L <16 yrs*	
Creatinine		354 µmol/L *200 <16 yrs*	Unless within 20% of previous test
AKI Score		*2 or 3*	*GP patients*
ALT	Female	600 U/L	Unless previously >500 in the last 48 hours
	Male	900 U/L	
Total Bilirubin		300 µmol/L	Age <1month, Unless previously elevated. Check for midwife mobile, if no response, on-call community midwife can be contacted via switch board
Conjugated Bilirubin		25 µmol/L	
Amylase		500 U/L	Unless elevated in last 72 hours
Calcium (adjusted)	1.90 mmol/L	3.50 mmol/L	Unless ± 0.2 mmol within last 24 hours
CK		5000 U/L	Unless >5000 U/L on this admission
Lipase		200 U/L	Unless higher in previous 72 hrs

Magnesium	0.40 mmol/L		Unless within 0.1 mmol/L in previous 24 hours
Paracetamol			**Any** detectable paracetamols from GP/OP **ONLY**
Phosphate	0.30 mmol/L		Unless within 0.1 mmol/L in previous 24 hours
Triglycerides		20 mmol/L	+ 20 mmol
Cortisol	*GP/OP: 50 nmol/L 150		*Between 17:30 Fri and 09:00 Sun/BH Monday Exception: if request states dexamethasone suppression test
Troponin I	*Female*	*12 ng/L*	*ONLY phone for GP patients*
	Male	*20 ng/L*	*ONLY phone for GP patients*
CRP		*300 mg/L*	*ONLY phone for GP patients*
		200 mg/L	*GP patients **ONLY** (between 08.30 and 18.30hrs - Routine working days)*
Digoxin		2.5 µg/L	
Lithium		1.5 mmol/L	
Phenytoin		25 mg/L	
Theophylline		25 mg/L	
Vancomycin		30 mg/L	

Test	Action Limits		Comments
	Lower limits	Higher limits	
Haemoglobin	<70* g/L	>190 g/L	*Normochromic/normocytic (suggestive of bleeding)
	<50 g/L		Microcytic and hypochromic
	<50 g/L		macrocytic
WBC	<0.5 (10^9/L)	>50.0 (10^9/L)	
Neutrophils	<0.5 (10^9/L)	>50 (10^9/L)	Unless known patient on chemo/haem patient's
Lymphocytes		>50.0 (10^9/L)	Requires urgent but not immediate referral
Platelets	<30 (10^9/L)	>1000* (10^9/L)	*only needs urgent referral if compounding medical problems

INR		≥5.0*	*If GP warfarin request: phone to haematology registrar
APTTR		≥5.0	
Fibrinogen	≤1.0 g/L		

Results to be phoned to Haematology Registrar or Consultant alongside urgent film review (via BRI switchboard if OOH)

- **A new presentation of leukaemia or other haematology emergency e.g. TTP**
- **Severe pancytopenia**
- **Marked thrombocytopenia**
- **A marked change in a known case (must be considered on an individual basis)**

Results outside the above limits must be telephoned in accordance with Trust Clinical Governance policy "Telephone Transmission of abnormal results". Date and time of phoning and the person to whom the result is given must be recorded on LIMS. Comments in italics are the recommended repeat telephone limits. Chemistry results without recommendations must be phoned each time the limit is breached. All information is available in the Blood Sciences User guide.

These limits are set as minimum guidance. Be advised that some results may still require phoning irrespective of this chart.

References: G158. *The communication of critical and unexpected pathology results.* RCPath October 2017. Accessed **here**