South Eastern Health and Social Care Trust

LABORATORY HANDBOOK 2011

Edition 2

PREFACE

This handbook is a guide to the use of laboratory services in the South Eastern Health and Social Care Trust. It is hoped that it will provide the laboratory user with a quick and easy reference to the services available in the Trust Laboratory. Information is provided on types of sample required, interpretation of results and common interferences in test results. If you wish further advice please contact the appropriate Laboratory department.

The Laboratory endeavours to produce high quality results in a timely manner. We welcome comments from our users about the services currently available, which may lead to future improvements of the service.

Dr TR Trinick

Laboratory Clinical Director
2011

South Eastern Health and Social Care Trust
Clinical Pathology Laboratory
Ulster Hospital
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GENERAL INFORMATION

USEFUL CONTACT DETAILS

Ulster Hospital

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Routine Referral Laboratories

Royal Victoria Hospital	Switchboard:	028 9024 0503
	Biochemistry:	028 9063 3798
	Cytopathology:	028 9063 3019
	Haematology:	028 9063 3619
	Histopathology:	028 9063 2170
	Immunology:	028 9063 2689
	Microbiology:	028 9063 4140 / 4179 / 4158
	Virology:	028 9063 2662
Belfast City Hospital	Switchboard:	028 9032 9241
	Cytogenetics:	Ext: 2067 / 2449 / 3351
	Cytopathology:	Ext: 2132
	Haematology:	Ext: 2369
	Histocompatability & Immunogenetics:	Ext: 3246 / 2444
	Histopathology:	Ext: 2722
	Molecular Genetics:	Ext: 3173 / 2139

Northern Ireland Blood Transfusion Service	Direct Line:	028 9032 1414
	Reference Laboratory:	028 9063 4605

USEFUL ELECTRONIC LINKS

SEHSCT Intranet: ***http://setintranet/***

SEHSCT Laboratory Internet Page: ***http://www.setrust.hscni.net/labs/ucht%20services/labstoc.html#P-1_0***

BHSCT Lab. User Manual: ***http://www.belfasttrust.hscni.net/pdf/Lab_UserManual_2010.pdf***

LABORATORY HOURS OF SERVICE

Normal Laboratory Hours	Monday - Friday	9am – 5pm
Service on Public Holidays and Weekends	Saturday	9am – 12noon
	Sunday	9am – 1pm
	Public Holidays	9am – 1pm

There is only a restricted service provided on Public Holidays and weekends. Requests should be confined to essential investigations and specimens should reach the laboratory by 10:30am. An emergency out-of-hours service operates outside of these hours throughout the year.

LOCATION OF LABORATORY

The Laboratory is located on the 4th floor of the Critical Care Complex at the Ulster Hospital. The Critical Care Complex can be accessed through the main entrance to the Critical Care Complex, opposite the multi-story car park, or from the main entrance at the Ulster Hospital Ward block, at the front car park. If entering from the main entrance at the Ulster Hospital Ward block, follow the signs for the Critical Care Complex along the main corridor. Once in the foyer of the Critical Care Complex, you can either take the lift or the stairs to the Laboratory, which is located on the 4th floor.

TEST REQUESTING

Tests must be requested using the appropriate SEHSCT request form:

- Bacteriology request form
- Blood Transfusion request form
- Clinical Biochemistry urgent request form
- Coagulation urgent request form
- Haematology urgent request form
- Joint Routine Clinical Biochemistry / Haematology request form
- Microbiology request form
- MRSA request form
- Semen Analysis: Fertility Investigation request form
- Semen Analysis: Post Vasectomy request form
- Serology request form
- Urine Bacteriology request form

Request forms **must contain** the following essential criteria:

- Patient's forename and surname
- Patient's DOB or Hospital number or Health and Care number
  (Both the patient's DOB and Hospital/Health and Care number are required for Blood Transfusion requests)
- Date and time
- Consultant/GP name or code
- Destination for report
- Test request(s)

Patient labels should be used if available – the label must be placed within the space provided on the form and details of the source (ward or health centre) and consultant/GP should be written on by hand if not included on the patient label. ***Addressograph labels may be used on Blood Transfusion request forms, however, all sample tubes for blood grouping and cross-matching must be hand written. Both the request form and sample tube must be signed.***

Select Wards in the Ulster Hospital are able to request tests using Ward Order Coms.

Out-of-Hours Emergency Requests

Only certain tests are available as an emergency request, please see each department's individual section in this handbook for the list of tests available as an emergency request. In **Clinical Biochemistry**, emergency requests before midnight can be sent on a Clinical Biochemistry yellow urgent request form. After midnight, the requestor must bleep 274 and arrange the request with the on-call Clinical Biochemistry BMS. Emergency requests for **Haematology** and **Microbiology must always** be arranged with the on-call Haematology or Microbiology BMS. For Haematology and Blood Transfusion requests the requestor must bleep 262 and arrange the requests with the on-call Haematology and Blood Transfusion BMS. For **Microbiology**, contact the department via the Ulster Hospital switchboard, 028 9048 4511.

If you experience any difficulty in directly contacting one of the on-call BMS', please contact switchboard.

The Consultant Chemical Pathologists, Haematologists, and Microbiologists each carry a bleep and provide a 24-hour consultation service. Out of hours contact may be made via the Ulster Hospital switchboard.

Referrals

For all routine referrals the Ulster Hospital Laboratory only acts as a post office. Analysis and result reporting is the responsibility of the referral laboratory.

SPECIMEN COLLECTION

Health and Safety

All biological samples represent a potential health hazard to Healthcare staff. Please ensure that specimens are properly sealed before transportation and that needles are removed from all blood gas syringe specimens. Leaking or contaminated samples must not be sent to the laboratory. Drivers and laboratory porters must follow the model rules contained in the Laboratory Health and Safety Manual [LAB MAN-18] and the Specimen Transport Guidelines [LAB MAN-48] (both available on the Trust Intranet and on request from the Ulster Hospital Laboratory).

Pneumatic Tube System

There is a pneumatic tube system in place to transport samples from A&E, the Critical Care Complex and Outpatients to the Laboratory. However, there are limitations to its use and the following samples **must not** be sent by the pneumatic tube system:

- Blood cultures
- Blood gases
- CSF samples
- Large volume samples (e.g. 24 hour urine)
- Known/suspected samples containing Cat. 3 Pathogens (i.e. TB, HIV, Hep. B)
- Samples that cannot be repeated
- Units of blood or blood products

If the pneumatic tube system is down, alternative transport with porters must be arranged.

High Risk Specimens

Specimens from patients known or suspected to be infected with a Category 3 Pathogen, for

example Mycobacterium tuberculosis, Hepatitis B virus, HIV or the Enteric fevers must have a hazard warning Category 3 Pathogen label, “Danger of infection – take special care”, affixed to both specimen container and request form.

Phlebotomy Service

A phlebotomy service is provided for certain Directorates during routine weekday operating hours.

Laboratory Supplies

Orders for laboratory supplies, such as bottles, tubes etc, must be placed by Friday to allow supplies to be dispatched on Monday to Wednesday of the following week. Orders can be faxed to the Laboratory (Fax number: **028 9048 7131**).

Times of Specimen Collection

Ulster Hospital:	Weekdays (wards)	09:15 – 10:15; 11:15 – 12:15; 13:30 – 15:00
	Weekdays (outpatients)	11:15; 16:00 – 16:30
	Saturday	09:00 – 13:00
	Sunday	10:30 – 11:00
Ards & Bangor Hospitals:	Weekdays	10:15 – 11:15; 13:00 – 14:00; 16:00

Emergency Specimens: Bleep portering service. Specimens are transported from Ulster Hospital to Belfast Trust Laboratories at 10am and 12.30pm. Transport can be arranged by special request.

GP Surgeries: Specimens are collected daily Monday to Friday. Details of individual times are held with the Trust Transport Manager. For enquiries contact Ext 2675.

LABORATORY REPORTS

For all specialities, clinically significant abnormal results will be telephoned to the point of request. All results will be available on computerised ward recall as soon as results have been authorised in the laboratory. Interim printed reports are available in A&E and acute wards equipped with a suitable printer. Porters will deliver any printed reports between 2 – 3pm and at 5pm (Ulster Hospital only). In wards where Ward Order Coms has been implemented, they may request that paper reports no longer be delivered as they can electronically sign the reports (Contact the Laboratory Administrative manager, EXT 88563). Reports to GP Surgeries are posted daily (weekdays) or sent by an electronic mailing system (GP Link) at 10am, 1.15pm, 3pm, 4pm, 5.15pm and 8pm.

Consultative Service: A consultative service is available in all laboratory disciplines to advise on interpretation of results, further investigation and patient management.

Time Limits for Requesting Additional Examination: All add on requests must be received within 4 hours of original receipt of the sample in the laboratory. For Ward Order Coms add on requests, the requestor must print a new request label and send this to the laboratory. For all other add on requests the requestor must ring the laboratory. The requestor must ensure that they have the laboratory accession number (from Result Recall) available before contacting the laboratory.

Delayed Examinations: If there is a serious delay in performing a diagnostic test that may compromise patient care the relevant departmental Head BMS or Section Head will ensure that the service user is notified of the delay.

CLINICAL BIOCHEMISTRY

CONTACT DETAILS

Ulster Hospital Switchboard	Tel: 028 9048 4511
Clinical Biochemistry General Enquiries	Tel: 028 9041 1530 / 028 9041 1711 Ext: 88530 / 88711
Clinical Biochemistry POCT Enquiries	Tel: 028 9041 1541 / 028 9041 1542 / 028 9041 1581 Ext: 88541 / 88542 / 88581
Consultant Head of Clinical Biochemistry / Laboratory Clinical Director Dr Tom Trinick	Tel: 028 9041 1580 Ext: 88580 Email: tom.trinick@setrust.hscni.net
Consultant Clinical Biochemist / POCT Manager Mrs Ellie Duly	Tel: 028 9041 1706 Ext: 88706 Email: ellie.duly@setrust.hscni.net
Clinical Biochemistry Head BMS Mr David McBride	Tel: 028 9041 1576 Ext: 88576 Email: david.mcbride@setrust.hscni.net
On-Call Biomedical Scientist	On-Call Bleep: 7314 274

TURNAROUND TIMES

Results for **emergency** requests are available **1 hour** after receipt by the laboratory. **Ward requests** received between 9am and 4pm will have results within **4 hours of** sample receipt. Where possible most **routine requests** are reported **within 1 working day** or within the result availability stated in the test section overleaf. However the frequency and turnaround times of some investigations, including referrals, are of necessity, longer.

EMERGENCY REQUESTS

As stated in the general information section, only certain tests are available as emergency requests. The tests in Clinical Biochemistry that are available as emergency requests are shown below.

CLINICAL BIOCHEMISTRY TESTS AVAILABLE AS EMERGENCY REQUESTS		
Alcohol	Digoxin	Paracetamol
Ammonia	Electrolytes-creatinine	Paraquat
Amylase	HCG (if clinically necessary)	Phenytoin
Bilirubin – neonatal	Liver function tests	Salicylate
Blood gases	Magnesium	Theophylline
Blood glucose	Osmolality	Troponin T (restricted service)
Bone profile		
Calcium		
Cardiac enzymes		
CSF glucose protein & scan for Bilirubin (Xanthochromia)		

TESTS AND REFERENCE VALUES

Please note that some reference ranges are age-related. For these reference ranges please refer to the Age Related Reference Ranges section.

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
ACID BASE / BLOOD GAS ANALYSIS	 1.6 ml arterial blood in BD Preset™ Syringe Cap the syringe Send sample to Lab on ice immediately	Adult: PO_2: 12-15 kPa PCO_2: 4.7-6.0 kPa pH: 7.35-7.45 Base excess: –2 to +2 STD Bicarb: 22-26 mmol/l Actual Bicarb: 22-30 mmol/l Paed: PO_2: 8.0-11.0 kPa PCO_2: 4.0-6.0 kPa pH: 7.35-7.40 Base excess: -4 to +4 mmol/l Bicarb: 18-25 mmol/l	On request
ACTH	 EDTA tube Sample preferably taken between 9 – 10am Send sample to Lab on ice immediately	<55 ng/l	R[2]
ADH	 Lithium heparin tube Send sample to Lab on ice immediately	Contact RVH Ext 3180	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
ADMISSION PROFILE Sodium Potassium Urea Creatinine Total Protein Albumin Bilirubin ALP AST GGT Cholesterol Glucose Calcium eGFR	 Adult: Gel tube Paediatric:  Lithium heparin tube	 133-146 mmol/l 3.5-5.3 mmol/l (Also age related) 2.5-7.8 mmol/l (Also age related) Male: 59-104 umol/l (Also age related) Female: 45-84 umol/l (Also age related) 60-80 g/l 35-50 g/l (Also age related) <21 umol/l 30-130 U/l (Also age related) <40 U/l Male: 8-61 U/l, Female: 5-36 U/l <4.0 mmol/l 4.0-7.8 mmol/l 2.15-2.55 mmol/l >60ml/min/1.73m^2	Daily
ADRENAL STIMULATION TEST		See Synacthen test	R[2]
ADRENAL SUPPRESSION TEST		See Dexamethasone test	R[2]
ALCOHOL	 Gel tube		Daily
ALDOSTERONE Serum Urine	Contact Lab (Ext 88556)  Clotted blood tube  24h urine collection – no preservative	 Supine: <400 pmol/l Upright: <820 pmol/l Saline suppression test (2L in 4hrs): <120 pmol/l 14-55 nmol/24h	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
ALKALINE PHOPHATASE ISOENZYMES	 Gel tube	Qualitative report	R[2]
ALPHA-1-ACID GLYCOPROTEIN	 Gel tube	0.47-1.25 g/l	R[2]
ALPHA-1 -ANTICHYMOTRYPSIN	 Gel tube	0.30-0.69 g/l	R[2]
ALPHA-1- ANTITRYPSIN	Adult:  Gel tube Paediatrics:  Lithium heparin tube X 2	0.89-1.89 g/l 0.9002.20 g/l *(phenotype should be assessed if <1.6 g/l in babies with prolonged jaundice)*	R[2]
ALPHA-1-MICROGLOBULIN	 Random urine (white topped universal)	0-12.5 mg/l	R[2]
ALPHA-2-MACROGLOBULIN	 Gel tube	1.09-2.83 g/l	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
ALPHA-FETO PROTEINS Serum Amniotic fluid	 Gel tube  5ml amniotic fluid (white topped universal)	<10 Ku/l	Daily
17 ALPHA HYDROXY-PROGESTERONE	Adult:  Clotted blood tube Paediatric:  Clotted blood tube X 2 – **must be filled completely**	Adult: 2.0-10.5 nmol/l (M) 2.0-12.0 nmol/l (F) Paediatric: <20 nmol/l	R[2]
ALPHA SUB UNIT (ASUI)	 Clotted blood (Gel tube not suitable)	<1 IU/l menopause mid cycle peak <3 IU/l	R[2]
ALUMINIUM	 5ml blood (royal blue topped tube - Ext 88556)	<10 ug/l	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
AMINO ACID CHROMATOGRAM	Paediatric:  Lithium heparin tube  Random urine (White topped universal) Send samples to Lab immediately		
AMINOLAEVULINATE	By special request only – contact Ext 88556  24h collection of urine	11.4-57.2 umol/24h	R[2]
AMITRYPTILINE	 Clotted blood Sample with patient at steady state immediately pre-dose.	120-250 ug/l	R[2]
AMMONIA	Adult:  EDTA tube Send sample to Lab on ice immediately Paediatric:  Lithium heparin tube Send sample to Lab on ice immediately	Male: 16-60 umol/l Female: 11-51 umol/l (Also age related)	Daily

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
AMNIOTIC FLUID INVESTIGATIONS	 5ml amniotic fluid (white topped universal) Contact RVH (Ext 2643/2593)		R[2]
AMPHETAMINE	 Random 30ml urine (White topped universal) Send samples to Lab immediately		R[2]
AMYLASE	 Gel tube	28-100 U/l	Daily
AMYLASE/ CREATININE RATIO	 Random urine in yellow Monovette syringe	2-5%	Daily
ANTI CARDIOLIPIN	 Gel tube		R[2]
ANGIOTENSIN CONVERTING ENZYMES (ACE)	 Gel tube – fasting preferred	12-68 U/l	R[2]
ANAPHYLACTIC REACTIONS	See Test Protocols. Contact Lab (Ext 88556) for Anaphylaxis Pack		R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
ANDROGEN PROFILE Androstenedione Dehydroepiandrosterone sulphate (DHEAS) 17-hydroxyprogesterone Testosterone Sex Hormone Binding Globulin (SHBG) Free Androgen Index	 Clotted blood tube must be filled to top (Gel tube not suitable)	 Males: 3.0-15.0 nmol/l Females: 3.0-12.5 nmol/l Varies with age – contact BHSCT Clinical Biochemistry Laboratory Adult: Male: 2.0-10.5 nmol/l Female: 2.0-12.0 nmol/l Male: 10.5-30 nmol/l Female: 0.7-2.8 nmol/l Female: <100 nmol/l Female: <7	R[2]
APO E PHENOTYPING	 EDTA tube		R[2]
APOLIPROTEINS ApoA1 ApoB	 Gel tube	 Male: 102-202mg/100ml Female: 108-225mg/100ml Male: 66-133mg/100ml Female: 60-117mg/100ml	R[2]
AST/ALT RATIO AST ALT	 Adult:  Gel tube Paediatric:  Lithium heparin tube	>1.5 suggests liver damage <40 U/l <40 U/l	Daily
B2 MICROGLOBULIN	 Gel tube	0.8-2.2 mg/l	2-3 Days
BARBITONE	 Clotted blood tube	Contact BCH (Ext 3168)	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
BARBITURATE SCREEN	 Clotted blood tube	Contact BCH (Ext 3168)	R[2]
BENCE JONES PROTEIN	 Early morning urine in yellow Monovette syringe	Not normally detected	4 Days
BENZODIAZEPINE	 Clotted blood tube	Contact BCH (Ext 3168)	R[2]
BILE ACIDS/SALTS	 Gel tube	<14 umol/l	Daily
BILIRUBIN Total Direct	Adult:  Gel tube Paediatric:  Lithium heparin tube	Total: <21 umol/l Direct: <3.4 umol/l Total: <10 days of age: <200 mmol/l Direct: >14 days of age: <40 mmol/l	Daily
BONE MARKERS Resorption: Crosslaps Formation: Bone Specific ALP (ostase), Osteocalcin, P1NP	 Gel tube – **fasting sample, must reach the Laboratory within 3 hours**	Age / sex related	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
BONE PROFILE Albumin Alkaline Phosphatase Calcium Phosphate	Adult:  Gel tube Paediatric:  Lithium heparin tube	35-50 g/l (Also age related) 30-130 U/l (Also age related) 2.15-2.55 mmol/l 0.8-1.5 mmol/l (Also age related)	Daily
β-HYDROXYBUTYRATE	 Gel tube	0.1-0.3 mmol/l	Daily
BNP	 Gel tube	Age related – contact BHSCT Clinical Biochemistry Laboratory	R[2]
BROMIDE	 Gel tube		R[2]
C1 ESTERASE INHIBITOR	 Gel tube Send sample to Lab immediately	0.15-0.35 g/l	R[2]
C3 NEPHRITIC FACTOR	 Gel tube	Not normally detected	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
CADMIUM Serum Urine	 5ml blood (royal blue top tube - Ext 88556)  Random urine (White topped universal)		R[2]
CAERULOPLASMIN	 Gel tube	0.21-0.58 g/l	R[2]
CAFFEINE	Paediatric:  Lithium heparin tube	5-20 mg/l	
CALCITONIN	 Lithium heparin tube Send sample to Lab on ice immediately	Male: <8.4 ng/l Female: <5.0 ng/l	R[2]
CALCIUM (Adjusted) Blood Urine	Adult:  Gel tube Paediatric:  Lithium heparin tube 24h collection in special bottle Contact Lab (Ext 88556)	2.2-2.6 mmol/l (often a marked fall after birth with lowest level at 24-48h of age) 2.5-8.0 mmol/24h 1.7-5.3 mmol/l	Daily
CALCIUM/ CREATININE RATIO	 Random urine in yellow Monovette syringe	Ref range age related	Daily

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
CALCULI	Send to Lab in sterile container		R[2]
CANNABANOIDS	 Random 30ml urine (White topped universal)	Contact BCH (Ext 3168)	R[2]
CARBAMAZAPINE	 Gel tube	8-12 mg/l (single dose) 4-12 mg/l (multiple dose)	Daily
CARBON MONOXIDE	 EDTA tube must be filled to top	Toxic symptoms >10%	On request
CARBOXYHAEMOGLOBIN	 EDTA tube must be filled to top	<2% (smokers >10%, severe toxicity >30%)	On request
CARCINO-EMBRYONIC ANTIGEN (CEA)	 Gel tube	<5 ug/l	Daily
CA-125	 Gel tube	<35 U/ml	Daily
CA-19-9	 Gel tube	<37 U/ml	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
CARDIAC PROFILE Creatine kinase Creatine kinase MB Isoenzyme (CK-MB)	 Adult: Gel tube  Paediatric: Lithium heparin tube	 Male: 40-320 U/l Female: 25-170 U/l Paediatric: <2000 u/l (marked fall during first week of life, following 24-48h peak) Male: 4.9-6.7ug/l Female: 2.9-3.8 ug/l	Daily
CAROTENE	 or  Gel tube Clotted blood tube	0.74-3.72 umol/l	R[2]
CATECHOLAMINES Adrenaline Noradrenaline Dopamine	 24h collection of urine Bottle must contain 40ml 30% HCl Contact Lab (Ext 88556)	 5-120 nmol/24h 50-560 nmol/24h 300-3900 nmol/24h	R[2]
CHLORIDE Urine	 24h collection of urine – no preservative	55-125 mmol/l	Daily
CHOLINESTERASE	 EDTA tube		R[2]
CHOLINESTERASE Phenotyping	 Gel tube	3.0-9.3 Ku/l	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
CHROMIUM	 Random urine in yellow Monovette syringe	0-2.0 nmol/mmol creatinine	R[2]
CHROMOSOME STUDIES Fragile X Syndrome	 Lithium heparin tube – 5ml blood Special EDTA tube – 5-10ml blood Contact Lab (Ext 88556)		R[2]
COBALT	 Random urine in yellow Monovette syringe	0-3.0 nmol/mmol Creatinine	R[2]
COMPLEMENT C3	 Gel tube	0.75-1.65 g/l	2-3 Days
COMPLEMENT C4	 Gel tube	0.14-0.54 g/l	2-3 Days
COPPER Serum Urine	 5ml blood (royal blue topped tube - Ext 88556)  24h collection of urine – no preservative	12.6-26.7 umol/l 0-0.6 umol/24h	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
CORTISOL Serum Urine	 Gel tube  24h collection of urine – no preservative	Ciracdian rhythmn 171-536 nmol/l (am) 64-327 nmol/l (pm) <350 nmol/24hr	Daily R[2]
C-PEPTIDE	 Clotted blood tube – fasting sample (Gel tube not suitable) Send sample to Lab immediately	<4 ug/l	R[2]
C-REACTIVE PROTEIN	Adult:  Gel tube Paediatric:  Lithium heparin tube	<5 mg/l <3 weeks: 0.1-4.1mg/l >3weeks-15yrs: 0.1-2.8 mg/l	Daily
CREATININE Serum	Adult:  Gel tube Paediatric:  Lithium heparin tube	 Male: 59-104 umol/l Female: 45-84 umol/l Age related	Daily

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
CREATININE CLEARANCE	 24h collection of urine – no preservative  Gel tube	85-140 ml/min	Daily
CREATININE KINASE ISOENZYMES MM, MB, BB (Adults)	Adult:  Gel tube Paediatric:  Lithium heparin tube X 2		Daily
CRYOBLOBULINS	Contact Lab (Ext 88556)	Not normally detected	On request
CSF Protein Glucose Xanthochromia	See Test Protocols Sterile container	 Adult: 0.15-0.40 g/l Neonate: 0.2-0.8 g/l Newborn: 0.4-1.2 g/l Adult: 2.2-3.3 mmol/l Child: 3.33-4.44 mmol/l (60-70% plasma glucose) Not normally detected (Bilirubin)	Daily
CYCLOSPORIN	 EDTA tube	100-250 ug/l	R[2]
CYSTIC FIBROSIS Genetic Studies	1 special purple topped tube Contact Lab (Ext 88556)		R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
CYSTINE Urine	 Random urine (White topped universal)		R[2]
DIBUCAINE NUMBERS	 Gel tube	Normal: 70% Inhibition Heterozygotes:40-70% Inhibition Homozygotes: 20% Inhibition	R[2]
DIGOXIN	Adult:  Gel tube – **taken >6hrs post dose** Paediatric:  Lithium heparin tube – **must be filled completely and taken >6hrs post dose**	0.9-2.0 ug/l	Daily
DIHYDROCODEINE	 Clotted blood tube	Toxic: >0.5 mg/l	R[2]
DNA (Double Standard)	Adult:  Gel tube Paediatric:  Gel tube		R[2]
DNA (Genetic Studies)	 Special EDTA tube – Contact Lab(Ext 88566)		R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
DRUGS OF ABUSE SCREEN Cannabanoids Cocaine Metabolites LSD Opiates	 Random 30ml urine (White topped universal) Send sample to Lab immediately If there is a delay in sending sample to Lab, check urine pH (separate aliquot from that sent to Lab) and record it on the request form.		R[2]
ELECTROLYTES Serum Sodium Potassium Chloride Total protein Bicarbonate Urea Creatinine Urine Sodium Potassium Chloride Urea	Adult:  Gel tube Paediatric:  Lithium heparin tube  Random urine in yellow Monovette syringe	133-146 mmol/l 3.5-5.3 mmol/l (Also age related) 95-108 mmol/l 60-80 g/l 22-29 g/l 2.5-7.8 mmol/l (Also age related) Male: 59-104 umol/l (Also age related) Female: 45-84 umol/l(Also age related) 20-110 mmol/l 12-60 mmol/l 55-125 mmol/l 150-500 mmol/l	Daily
ETHYLENE GLYCOL	 Clotted blood tube	For levels >0.5g/l, haemodialysis should be seriously considered	R[2]
FAECAL PH & CLINITEST	 Random faeces specimen Send sample to Lab immediately	pH 5-9	Daily

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
FAECAL ELASTASE	 Random faeces specimen	See Test Protocols	R[2]
FERRITIN	Adult:  Gel tube Paediatric:  Lithium heparin tube – **must be filled completely**	Male: 30-300 ug/l Female <55yrs old: 13-150 ug/l Female >55yrs old: 13-300 ug/l	Daily
FRACTIONAL EXCRETION OF SODIUM	Adult:  Gel tube Paediatric:  Lithium heparin tube  Random urine in yellow Monovette syringe	<1% Neonates: <2% >1 month old: <0.1%	On request
FREE ANDROGEN INDEX (see androgen profile)	 Clotted blood tube (Gel tube not suitable)	<7	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
FREE LIGHT CHAINS	 Gel tube		R[2]
FSH	 Gel tube	Male: 1.5 – 12.4 U/l Female: 1.7 – 21.5 U/l Post Menopausal: >25 U/l	Daily
GALACTOSE-1-PHOSPHATE	Adult:  Gel tube Paediatric:  Lithium heparin tube – **must be filled completely**	<4mg/100ml RBC	R[2]
GALACTOSE-1-PHOSPHATE URIDYL TRANSFERASE	Adult:  Gel tube Paediatric:  Lithium heparin tube – **filled to 400 if screening shows**		R[2]
GENETICS STUDIES	See Chromosome Studies		R[2]
GENTAMICIN	Adult:  Gel tube Paediatric:  Lithium heparin tube – **filled to 400**	Divided Dosing: Peak: 4-10 mg/l Trough: <2 mg/l Single Dosing: <1 mg/l	Daily

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
GLUCOSE Serum	 Adult: Fluoride EDTA tube Paediatric:  Gel tube – **filled to 0.2 line**	4.0-7.8 mmol/l	Daily
GLUCOSE-6-PHOSPHATE DEHYDROGENASE	 EDTA tube Specimen must **not** be refrigerated		R[2]
GLUCAGON	 Lithium heparin tube Send sample to Lab on ice immediately Contact RVH (Ext 2753)	N-terminal: 0-70pmol/l, 0-250ng/l C-terminal: 0-45pmol/l, 0-150ng/l	R[2]
GLUCAGON STIMULATION TEST	Contact RVH (Ext 3180)		R[2]
GLUCOSE SUPPRESSION TEST	Contact RVH (Ext 3180)		R[2]
GLUCOSE TOLERANCE TEST	See Test Protocols		Daily
GOLD	 5ml blood (royal blue topped tube - Ext 88556)		R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
GROWTH HORMONE	 Clotted blood tube (Gel tube not suitable) Contact RVH (Ext 3230)		R[2]
GUT AND ISLET HORMONE ASSAYS Gastrin Insulin Glucagon (N term.) Glucagon (C term.) Vasoactive Intestinal Polypeptide (VIP) Pancreatic Polypeptide Somatostatin Calcitonin gene related Peptide Gastrin releasing Peptide (GRP) Neurokinin K (NKA) Chromogranin A DAKO Pancreastatin Trypsin	 EDTA tube X 4 – fasting samples Send sample to Lab on ice immediately Contact RVH (Ext 2533/2735) for further interpretation. Other Peptide assays available by special arrangement with RVH only.	0 - 40 pmol/l <10 mU/l 0 - 70 pmol/l 0 - 45 pmol/l 0 - 25 pmol/l 0 - 50 pmol/l 0 - 30 pmol/l 0 - 2.5 pmol/l 0 - 10 pmol/l 0 - 20 pmol/l 0 - 30 u/l 0 - 25 pmol/l 120 - 540 u/l	R[2]
HAEMATOLOGY PROFILE	 Gel tube		Daily
HAEMOGLOBIN A1c	 EDTA tube	<6.5% Target <7% Target <53 mmol/mol	Daily

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
HAEMOCHROMATOSIS GENE	 EDTA tube X 2 & signed request form/tissue typing form		R[2]
HAEMOSIDERIN Urine	Contact BCH (Ext 2670)		R[2]
HEAVY METAL SCREEN	 5ml blood (royal blue topped tube - Ext 88556)  Random urine in yellow Monovette syringe		R[2]
HIGH DENSITY LIPOPROTEIN (HDL)	 Gel tube	Male: >1.45 mmol/l Female: >1.68 mmol/l	Daily
HOMOCYSTEINE	 EDTA tube Send sample to Lab on ice immediately	6-13 umol/l	R[2]
HOMOGENTISIC ACID	 Random urine (White topped universal)	Not normally detected	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
HORMONE PROFILE FSH LH OESTRADIOL PROGESTERONE PROLACTIN	 Gel tube	 Male: 1.5 – 12.4 U/l Female: 1.7 – 21.5 U/l Post Menopausal: >25 U/l Male: 4.0-8.6U/l Female: Follicular: 2.4-12.6 U/l Luteal: 1.01-11.4 u/l Ovulatory peak: 14-95.6 U/l Male: 28-156 pmol/l Female: Follicular: 46-607 pmol/l Luteal: 161-774 pmol/l Ovul Peak: 315-1828 pmol/l Female: Follicular: <4 nmol/l Luteal: 6-80 nmol/l Ovul. Peak: >30 nmol/l Male: 86-324 mU/l Female: 102-496 mU/l	Daily
HUMAN CHORIONIC GONADOTROPHIN (BHCG) Serum	 Gel tube	< 5 U/l	Daily
B- HYDROXYBUTYRATE	 Gel tube	0.1 – 0.3 mmol/l	Daily
HYDROXYINDOLE ACETIC ACID (5-HIAA)	 24h collection of urine – no preservative	10 - 47 umol/24h	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
HYDROXYPROLINE	 24h collection of urine – no preservative Avoid foods such as meat, fish and gelatine for 24h before collection Contact Lab for full protocol (Ext 88556)	0.11 - 0.35 mmol/24h	R[2]
HYPOGLYCAEMIC ADMISSIONS	See Test Protocols		Daily R[2]
5 HYDROXYTRYPTAMINE	 24h collection of urine – no preservative Can be analysed on same specimen as 5-HIAA	0.3-1.3 umol/24h	R[2]
ICU PROFILE (ICU Ward)	 Lithium heparin tube		Daily
IgE (Total)	 Gel tube	10-120 Ku/l	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
IMMUNOGLOBULINS IgG IgA IgM Ig subclasses IgG1 IgG2 IgG3 IgG4	Adult:  Gel tube Paediatrics:  Lithium heparin tube – **must be filled completely** Adult:  Clotted blood tube Paediatric:  Clotted blood tube X 2 – **must be filled completely**	6.0-16.0 g/l (also age related) 0.8-4.0 g/l (also age related) 0.5-2.0 g/l (also age related) 4.2-12.9 g/l 1.2-7.5 g/l 0.4-11.3 g/l 0.01-2.9 g/l	2-3 Days R[2]
IMMUNOREACTIVE TRYPSIN	Guthrie card Contact RVH (Ext 3230)		R[2]
INDICAN	 Random urine (White topped universal)		R[2]
INSULIN	 Clotted blood tube – fasting sample	< 10 mU/l	R[2]
INSULIN-LIKE GROWTH FACTOR (IGF-1)	 Clotted blood tube – fasting sample Send sample to Lab on ice immediately Contact RVH (Ext 3230)	Varies with age – contact BHSCT Clinical Biochemistry Laboratory	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
IRON	Adult:  Gel tube Paediatric:  Lithium heparin tube X 2 – **must be filled completely** Overdose: levels at 2 hrs (children) or levels at 4-6 hrs (adults)	10-30 umol/l <90umol/l – mild overdose, 90-180umol/l – severe overdose >180umol/l – very severe overdose	Daily
IRON STUDIES Iron Transferrin % Saturation Ferritin	Adult:  Gel tube Paediatric:  Lithium heparin tube X 2 – **must be filled completely**	10-30 umol/l 2.0-3.6 g/l <55% Male: 30-300 ug/l Female: <55 yrs old: 13-150 ug/l >55 yrs old: 13 –300 ug/l	Daily
LACTATE	Adult:  Fluoride EDTA tube Paediatric:  Fluoride EDTA tube	0.5-2.2 mmol/l	Daily
LACTIC DEHYDROGENASE	 Gel tube	240-480 U/l	Daily
LAMOTRIGINE	 Clotted blood tube	1-4 mg/l	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
LAXATIVE SCREEN	 Random faeces/urine (White topped universal)		R[2]
LEAD Whole blood Urine	 5ml blood (royal blue topped tube - Ext 88556)  24h collection of urine – no preservative Contact BCH (Ext 2017)	0.03-0.5 umol/l <0.3 nmol/24h	R[2]
LIPID PROFILE Triglyceride Cholesterol HDL cholesterol LDL cholesterol CHOL: HDL ratio	 Gel tube – fasting sample	 <2.26 mmol/l <4.0 mmol/l Male: > 1.45 mmol/l Female: >1.68 mmol/l <3 mmol/l <5	Daily
LIPOPROTEIN (A)	 Gel tube		R[2]
LIPOPROTEIN ELECTROPHORESIS	 Gel tube – fasting sample		R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
LIPOSOMES	 Lithium heparin tube Send sample to Lab on ice immediately Contact BCH (Ext 3173)		R[2]
LITHIUM	 Gel tube – **Sample 12h after dose**	Prophylaxis: 0.4-1.0 mmol/l Acute mania: <1.2 mmol/l >5mmol/l: haemodialysis required >3mmol/l: consider haemodialysis if patient toxic	Daily
LIVER PROFILE Total Bilirubin ALP AST GGT Albumin	Adult:  Gel tube Paediatric:  Lithium heparin tube	<21 umol/l 30-130 U/l (Also age related) <40 U/l Male: 8-61 U/l Female: 5-36 U/l 35-50 g/l (Also age related)	Daily
LUTENISING HORMONE (LH)	 Gel tube	Male: 4.0-8.6 U/l Female: Follicular: 2.4-12.6 U/l Luteal: 1.01-11.4 U/l Ovulatory peak: 14-95.6 U/l	Daily
LYSOSOMAL ENZYMES	 Lithium heparin tube Send sample to Lab on ice immediately Contact RVH (Ext 2169)		R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
MAGNESIUM Serum	Adult:  Gel tube	0.7-1.0 mmol/l	Daily
	Paediatric:  Lithium heparin tube	Also age related	
Urine	 24h collection of urine – no preservative	2.20-3.26 mmol/l	
MANGANESE	Contact Lab (Ext 88556)	76-396 nmol/l	R[2]
MELANIN	 Random urine (White topped universal)	Not normally detected	R[2]
MERCURY Urine	 Random urine in yellow Monovette syringe	<10 umol/l creatinine	R[2]
METHAEMOGLOBIN	 EDTA tube		On request
METHANOL	 Lithium heparin tube	If >0.5g/l consider haemodialysis	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
METHOTREXATE	 Clotted blood tube Contact BCH (Ext 3168) prior to beginning therapy. Samples should be taken at 24hr intervals after high dose therapy until serum level is <0.1umol/l.	Contact BCH (Ext 3168)	R[2]
MICROALBUMINURIA	 Random urine in yellow Monovette syringe	<30 mg/mmol creatinine (non-diabetic) <2.5 mg/mmol creatinine (diabetic male) <3.5 mg/mmol creatinine (diabetic female)	2-3 Days
MUCOPOLY-SACCHARIDES	 Random urine (White topped universal)		R[2]
NICKEL	 Random urine in yellow Monovette syringe	0-13 nmol/mmol creatinine	R[2]
NORTRYPTILINE	 Clotted blood Sample with patient at steady state immediately pre-dose.	120-250 ug/l	R[2]
OCCULT BLOOD	Sample on Seracult card (see Test Protocols)		Weekly
OESTRADIOL	 Gel tube	Male: 28-156 pmol/l Female: Follicular: 46-607 pmol/l Luteal: 161-774 pmol/l Ovul Peak: 315-1828 pmol/l	Daily

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
OESTROGEN RECEPTOR	Put tissue in plastic bag. Put on ice in insulated container Contact RVH (Ext 3180)		R[2]
OPAITES	 Random 30ml urine (White topped universal)		R[2]
ORGANIC ACIDS	 Random urine (White topped universal) Send sample to Lab immediately		R[2]
OSMOLALITY Serum	Adult:  Gel tube Paediatric:  Lithium heparin tube	275-295 mosm/kg	Daily
Urine	 Random urine in yellow Monovette syringe	250-1000 mosm/kg	

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
OVERDOSE SCREEN	 Clotted blood tube  Gastric aspirate urine (White topped universal) *Note: This test involves complex chromatograph analysis for unknown drugs and takes a long time to complete. It is unsuitable for out-of-hours.*		R[2]
OXALATE Adult: Paediatric:	 24h collection of urine – containing 30ml 4M HCl Contact Lab (Ext 88556)  Random urine (White topped universal)	0.2 - 0.6 mmol/24h	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
PARACETAMOL	 Gel tube – **sample >4hrs post-overdose** (if >24hrs post-overdose, paracetamol will likely have disappeared from serum except in massive overdose). *Transaminases and prothrombin time should be measured in this case, although the effect on these is usually not maximal until day 3-4.*	Therapeutic level (4hrs): 5-12 mg/l	Daily
PARAQUAT	 Clotted blood tube – **sample >4hrs after overdose** Screening:  Random urine (White topped universal)		On Request
PHENOBARBITONE	Adult:  Gel tube Paediatric:  Lithium heparin tube – **Sample >6hrs post dose**	10-40 mg/l	Daily

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
PHENYTOIN	Adult:  Gel tube Paediatric:  Lithium heparin tube – **Sample >8hrs post dose**	5 -20 mg/l	Daily
PHOSPHATE Serum Urine	Adult:  Gel tube Paediatirc:  Lithium heparin tube X 2 – **must be filled completely**  24h collection of urine – special preservative Contact Lab (Ext 88556)	0.8-1.5 mmol/l (Also age related) 10.0-33.0 mmol/l	Daily

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
PORPHYRINS Blood Urine Faeces	Contact Lab (Ext 88541)  EDTA tube  Random urine in yellow Monovette syringe  Random fresh faeces specimen Shield all samples from light with foil Send to Lab immediately	Cardiff Porphyria Service Cardiff - Porphyria Information	On request
POTASSIUM Urine	 24h collection of urine – no preservative	12-60 mmol/l	Daily
PREALBUMIN	 Gel tube	0.18-0.44 g/l	R[2]
PRIMIDONE	 Gel tube	5-12 mg/l	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
PROGESTERONE	 Gel tube	Female: Follicular: <4 nmol/l Luteal: 6-80 nmol/l Ovul. Peak: >30 nmol/l	Daily
PROLACTIN	 Gel tube	Male: 86-324 mu/l Female: 102-496 mu/l	Daily
PROSTATIC SPECIFIC ANTIGEN (PSA)	 Gel tube	<40y: <1.4 ng/ml 40-49y: <2.0 ng/ml 50-59y: <3.1 ng/ml 60-69y: <4.1 ng/ml >70y: <4.4 ng/ml Levels of 2-20 ug/L may be seen in BPH Contact Lab (Ext 88581) for further interpretation	Daily
PROTEIN Urine	 24h collection of urine – no preservative  Random urine in yellow Monovette syringe	<0.15 g/l	Daily

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
PROTEIN/ CREATININE RATIO	Adult:  Random urine in yellow Monovette syringe Paediatric:  Random urine (White topped universal)	<14 mg/mmol	Daily
PROTEIN ELECTROPHORESIS Total protein Albumin	Adult:  Gel tube Paediatric:  Clotted blood tube	Adult: 60-80 g/l, Paediatric: 64-70 g/l 35-50 g/l (Also age related)	4 Days
PTH	 EDTA tube Send sample to Lab immediately	15-65 pg/ml	Daily
PYRUVATE KINASE	 EDTA tube Paediatric: Special tube – Contact Lab (Ext 88556). Contact RVH (Ext 3663)	0.03 - 0.08 mmol/l	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
QUINIDINE	 Clotted blood tube Contact BCH for sample times (Ext 3168)	2.0-5.0 mg/l	R[2]
RED CELL FOLATE	 EDTA tube	110 - 700 ng/ml	R[2]
REDUCING SUBSTANCES (Urine Sugars)	 Random urine (White topped universal) Send sample to Lab immediately		R[2]
RENAL CALCULI	Send stones in sterile container		R[2]
RENAL FAILURE INDEX Serum Urine	 Gel tube  Random urine in yellow Monovette syringe		On request
RENIN ACTIVITY	 EDTA tube Send sample to Lab on ice immediately	Supine: <3.24 ng/ml/h Upright: 1.8 - 6.7 ng/ml/h	R[2]
SALICYLATE	 Gel tube – **sample >4h post-overdose**	<300 ug/l	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
SELECTIVITY OF PROTEINURIA	 Lithium heparin tube  Random urine (White topped universal)	Selective: <0.16 Moderately Selective: 0.16-0.30 Non-selective: >0.30	On request
SELENIUM	 5ml blood (royal blue topped tube - Ext 88556)	0.6-1.3 umol/l	R[2]
SEX HORMONE BINDING GLOBULIN (SHBG)	 Gel tube	Female: <100 nmol/l	R[2]
SODIUM Urine	 24h collection of urine – no preservative	20-110mmol/l	Daily
SWEAT TEST	Contact Lab (Ext 88556)		On request
SUPHAEMOGLOBIN	Contact RVH (Ext 2569)		R[2]
TACROLIMUS	 EDTA tube	5.0-15.0 ug/l	R[2]
TESTOSTERONE	 Gel tube	Male: 20-49 yr: 8.64 –29.0 nmol/l 50yr>: 6.68-25.7 nmol/l Female: 20-49 yr: 0.29-1.67nmol/l 50yr>: 0.10-1.42 nmol/l	Daily

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
THALLIUM	 24h collection of urine – no preservative	<2ug/l	R[2]
THEOPHYLLINE	Adult:  Gel tube Paediatric:  Lithium heparin tube – **Peak levels** Pre-dose (trough levels) or 8-12 hr post-dose (peak levels). Patients on IV infusions should be monitored in the first 12 hrs (plus a base-line level if there is a likelihood of prior administration). Ideally the infusion should be stopped for 15 mins before sampling. Patients with an acute **overdose** (serum levels >100mg/l) or a chronic **overdose** require earlier intervention. Repeat serum theophylline & potassium levels every 2-3 hrs.	10-20 mg/l	Daily
THYROID FUNCTION Free T3 Free T4 Thyroid Stimulating Hormone (TSH)	Adult:  Gel tube Paediatric:  Clotted blood tube X 2 – **must be filled completely**	3.1-6.8 pmol/l (Also age related) 12-22 pmol/l (Also age related) 0.3-4.2 mU/l (Also age related)	Daily

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
TOTAL PARENTERAL NUTRITION SCREEN Albumin ALP AST Calcium Cholesterol CO_2 Sodium Phosphate Potassium Total Protein Triglyceride Urea	Adult:  Gel tube Paediatric:  Lithium heparin tube – **must be filled completely**	 35-50 g/l (Also age related) 30-130 U/l (Also age related) <40 U/l 2.15-2.55 mmol/l <4.0 mmol/l 18-25 mmol/l 133-146 mmol/l 0.8-1.5 mmol/l (Also age related) 3.5-5.3 mmol/l (Also age related) Adult: 60-80 g/l, Paediatric: 54-70 g/l <2.26 mmol/l 2.5-7.8 mmol/l (Also age related)	Daily
TPMT	 EDTA tube		R[2]
TRANSFERRIN	 Gel tube	2.0-3.6 g/l	R[2]
TROPONIN T HS	 Gel tube Taken12 hours post-chest pain	<14ng/l	Daily
TUMOUR MARKERS CA –125 CA –199 CEA HCG PSA	 Gel tube CA-199 requires separate form and sample	 <35 U/ml <37 U/ml <5ug/l Age related (see individual PSA test)	 Daily R[2] Daily Daily Daily

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
URATE Serum Urine	 Gel tube  24h collection of urine – no preservative	Male: 200-430 umol/l Female: 140-360 umol/l 2.2-5.4 mmol/l 1.2-5.9 mmol/24h	Daily
UREA Urine	 24h collection of urine – no preservative	167-290 mmol/l	Daily
URINARY SUGARS	See Reducing Substances		On request
VALPROATE	 Gel tube	No range – comment on result	Daily
VANCOMYCIN	All requestors, excluding Renal Unit:  Gel tube Renal Unit resquests:  EDTA tube	Trough: 10-15 mg/l	Daily
VIT. A & VIT. E Vitamin A Vitamin E	Adult:  Clotted blood tube Paediatrics:  Lithium heparin tube X2 Place specimens in brown envelope	1.1-3.5 mmol/l 16-35 umol/l	R[2]

TEST	SPECIMEN	REFERENCE RANGE	AVAILABILITY [1]
VIT. B12 & FOLATE Vitamin B12 Folate	 Gel tube	Normal: 191-663ng/l Normal: >4.6ug/l	Daily
VITAMIN C	 EDTA tube Send sample to Lab on ice immediately	>32 umol/l	R[2]
VITAMIN D (25 DHCC)	 Clotted blood tube (Gel tube not suitable) Send sample to Lab immediately	50-100 nmol/l 25-50 nmol/l = insufficient <25 nmol/l = deficient	R[2]
ZINC	 5ml blood (royal blue topped tube - Ext 88556)  24h collection of urine – acid washed container	8-15 umol/l	R[2]

Note*:*

1) ***Availability is only during routine laboratory hours. Non-urgent requests may take longer outside of these times***
2) ***R refers to tests that are sent away for analysis and thus result availability is dependent on the referral laboratory. For all referrals the Ulster Hospital Laboratory only acts as a post office. Analysis and result reporting is the responsibility of the referral laboratory.***

AGE RELATED REFERENCE RANGES

TEST	AGE	REFERENCE RANGE
Albumin	Neonate / Infant	30 - 45 g/L
	1 - 16yrs old	30 - 50 g/L
Alkaline Phosphatase	1 – 30days old	Male: 75-316 U/L, Female: 48-406 U/L
	31 – 365days old	Male: 82-383 U/L, Female: 124-314 U/L
	1 – 3yrs old	Male: 104-345 U/L, Female: 108-317 U/L
	4 – 6yrs old	Male: 93-309 U/L, Female: 96-297 U/L
	7 – 9yrs old	Male: 86-315 U/L, Female: 69-325 U/L
	10-12yrs old	Male: 42-362 U/L, Female: 51-332 U/L
	13-15yrs old	Male: 74-390 U/L, Female: 50-162 U/L
	16-18yrs old	Male: 51-171 U/L, Female: 47-119 U/L
Ammonia	Sick/premature	<150 umol/L
	Neonate	<100 umol/L
	Infant - 16yrs old	<50 umol/L
Calcium	Neonate	2.0 - 2.7 mmol/L
	Infant - 16yrs old	2.2 - 2.7 mmol/L
Creatinine	Neonate (prem.)	25 - 91 umol/L
	Neonate (full term)	21 - 75 umol/L
	2 - 12months old	15 - 37 umol/L
	1 - <3yrs old	21 - 36 umol/L
	3 - <5yrs old	27 - 42 umol/L
	5 - <7yrs old	28 - 52 umol/L
	7 - <9yrs old	35 - 53 umol/L
	9 - <11yrs old	34 - 65 umol/L
	11 - <13yrs old	46 - 70 umol/L
	13 - <15yrs old	50 - 77 umol/L
FT3	<6dys	2.65 - 9.68 pmol/L
	6dys - <3mths	3.00 - 9.28 pmol/L
	3mths - <12mths	3.30 - 8.95 pmol/L
	1yr - <6yrs	3.69 - 8.46 pmol/L
	6yrs - <11yrs	3.88 - 8.02 pmol/L
	11yrs - <20yrs	3.39 - 7.70 pmol/L
FT4	<6dys	11.0 - 32.0 pmol/L
	6dys - <3mths	11.5 - 28.3 pmol/L
	3mths - <12mths	11.9 - 25.6 pmol/L
	1yr - <6yrs	12.3 - 22.8 pmol/L
	6yrs - <11yrs	12.5 - 21.5 pmol/L

TEST	AGE	REFERENCE RANGE
FT4	11yrs - <20yrs	12.6 - 21.0 pmol/L
IgA	0 - 2 weeks old	0.01 - 0.08 g/L
	2 - 6 weeks old	0.02 - 0.15 g/L
	6 - 12 weeks old	0.05 - 0.40 g/L
	3 - 6 months old	0.10 - 0.50 g/L
	6 - 9 months old	0.15 - 0.70 g/L
IgA	9 - 12 months old	0.20 - 0.70 g/L
	1 - 2 yrs old	0.30 - 1.20 g/L
	2 - 3 yrs old	0.30 - 1.30 g/L
	3 - 6 yrs old	0.40 - 2.00 g/L
	6 - 9 yrs old	0.50 - 2.40 g/L
	9 - 12 yrs old	0.70 - 2.50 g/L
	12 - 45 yrs old	0.80 - 2.80 g/L
	Over 45 yrs old	0.80 - 4.00 g/L
IgG	0 - 2 weeks old	5.0 - 17.0 g/L
	2 - 6 weeks old	3.9 - 13.0 g/L
	6 - 12 weeks old	2.1 - 7.7 g/L
	3 - 6 months old	2.4 - 8.8 g/L
	6 - 9 months old	3.0 - 9.0 g/L
	9 - 12 months old	3.0 - 10.9 g/L
	1 - 2 yrs old	3.1 - 13.8 g/L
	2 - 3 yrs old	3.7 - 15.8 g/L
	3 - 6 yrs old	4.9 - 16.1 g/L
	6 - 15 yrs old	5.4 - 16.1 g/L
	Over 15 yrs old	6.0 - 16.0 g/L
IgM	0 - 2 weeks old	0.05 - 0.20 g/L
	2 - 6 weeks old	0.08 - 0.40 g/L
	6 - 12 weeks old	0.15 - 0.70 g/L
	3 - 6 months old	0.20 - 1.00 g/L
	6 - 9 months old	0.40 - 1.60 g/L
	9 - 12 months old	0.60 - 2.10 g/L
	1 - 3 yrs old	0.50 - 2.20 g/L
	3 - 6 yrs old	0.50 - 2.00 g/L
	6 - 12 yrs old	0.50 - 1.80 g/L
	12 - 45 yrs old	0.50 - 1.90 g/L
	Over 45 yrs old	0.50 - 2.00 g/L
Lithium	Elderly	0.4 - 0.8 mmol/L

TEST	AGE	REFERENCE RANGE
Magnesium	Neonate	0.6 - 1.0 mmol/L
	Infant - 16yrs old	0.7 - 1.0 mmol/L
NT ProBNP	<45yrs old	Male: <86 pg/ml Female: <130 pg/ml
	45 - 54yrs old	Male: <121 pg/ml Female: <249 pg/ml
NT ProBNP	55 - 64yrs old	Male: <210 pg/ml Female: <287 pg/ml
	65 - 74 yrs old	Male: <376 pg/ml Female: <301 pg/ml
	>74yrs old	<738 pg/ml
Phosphate	Neonate	1.3 - 2.6 mmol/L
	Infant	1.3 - 2.4 mmol/L
	1 - 16yrs old	0.9 - 1.8 mmol/L
Potassium (plasma)	Neonate	3.4 - 6.0 mmol/L
	Infant	3.5 - 5.7 mmol/L
	1 - 16yrs old	2.5 - 6.5 mmol/L
TSH	<6dys	0.70 - 15.20 mu/L
	6dys - <3mths	0.72 - 11.00 mu/L
	3mths - <12mths	0.73 - 8.35 mu/L
	1yr - <6yrs	0.70 - 5.97 mu/L
	6yrs - <11yrs	0.60 - 4.84 mu/L
	11yrs - <20yrs	051 - 4.30 mu/L
Urea	Neonate	0.8 - 1.5 mmol/L
	Infant	1.0 - 5.5 mmol/L
	1 - 16yrs old	2.5 - 6.5 mmol/L
Urine Calcium / Creatinine Ratio	6-12mths	0.09 - 2.20 mmol/mmol CR
	1-2yrs	0.07 - 1.50 mmol/mmol CR
	2-3yrs	0.06 - 1.40 mmol/mmol CR
	3-5yrs	0.05 - 1.10 mmol/mmol CR
	5-7yrs	0.04 - 0.80 mmol/mmol CR
	7-17yrs	0.04 - 0.70 mmol/mmol CR
Urine Magnesium / Creatinine Ratio	6-12mths	0.4 -2.2 mmol/mmol CR
	1-2yrs	0.4 -1.7 mmol/mmol CR
	2-3yrs	0.3 -1.6 mmol/mmol CR
Urine Magnesium / Creatinine Ratio	3-5yrs	0.3 -1.3 mmol/mmol CR
	5-7yrs	0.3 -1.0 mmol/mmol CR
	7-10yrs	0.3 -0.9 mmol/mmol CR

TEST	AGE	REFERENCE RANGE
Urine Magnesium / Creatinine Ratio	10-14yrs	0.2 -0.7 mmol/mmol CR
	14-17yrs	0.2 -0.6 mmol/mmol CR
Urine Phosphate / Creatinine Ratio	6-12mths	1.2 -19 mmol/mmol CR
	1-2yrs	1.2 -14 mmol/mmol CR
	2-3yrs	1.2 -12 mmol/mmol CR
Urine Phosphate / Creatinine Ratio	3-5yrs	1.2 -8.0 mmol/mmol CR
	5-7yrs	1.2 -5.0 mmol/mmol CR
	7-10yrs	1.2 -3.6 mmol/mmol CR
	10-14yrs	0.8 -3.2 mmol/mmol CR
	14-17yrs	0.8 -2.7 mmol/mmol CR

COMMON SPECIMEN ARTEFACTS

PROBLEM	COMMON CAUSES	CONSEQUENCES
Bubbles in blood gas samples	Leaking syringe/needle junctions Inadequate stoppering of syringe in transit	Low PCO_2 Increased PO_2
Contamination by infused fluids	High MW dextrans Dextrose Crystalloid solutions	Elevated total proteins High glucose Spurious Na^+, K^+, Cl^-, etc. Low calcium High Na^+
Haemolysis	Expelling blood sample through a needle into container Over vigorous mixing of sample Sample stored in deep freeze Excessive delay in transit Sample left in hot place	High K^+ High phosphate Low Na^+ and Cl^- High AST and LD High Mg^{2+}
Incorrect container/ anticoagulant	No enzyme inhibitor EDTA tube Excess liquid heparin	Low glucose and ethanol High K^+ Low calcium Abnormal blood gases and analytes
Lipaemia	Taken before intra-lipid is cleared Taken after fatty meals Anxiety and stress	Interferes with many assays because of turbidity of sample. May cause low sodium concentration
Serum or plasma separation delay	Overnight storage Delay in transit	High K^+, AST, LD, Mg^{2+} Low Na^+ (occasionally)

TEST PROTOCOLS

The Laboratory has protocols for patient investigation available. These protocols can be seen on the following pages.

Anaphylactic Reactions

Anaphylaxis packs are available from Clinical Chemistry Specimen Reception – to request a pack call Ext 2358. The packs consist of the Royal Immunology laboratory request form, which details the procedure for the investigation and **must be filled in completely** to include times and dates of reaction and patient's medical history, etc, and the blood collection bottles required. Completed packs should be sent to the Biochemistry laboratory for forwarding to the RVH, Immunology.

CSF

Please indicate on the request form the **clinical indication for the request**, the **result of the CT scan**, the **time of onset of symptoms/event**, the **time of lumbar puncture** and **if the differential diagnosis includes meningitis**.

Specimens
Cerebrospinal fluid may also be required for microbiological examination and for protein and glucose estimation. Sufficient CSF will therefore be needed for all of these required investigations.
Label three 28-mL sterile universal containers and one *grey-top fluoride EDTA tube* with the patient's name, hospital number, ward, date of birth, the time that the CSF was obtained and the sequence order of sampling. The first specimen should be a *minimum of 0.5 ml* of CSF placed in a *grey-top fluoride EDTA tube for glucose* and *protein* estimations. *Microbiology* requires *at least 5 ml* of CSF divided into *two* sequentially numbered, sterile universal containers labeled `second' and `third'. A further minimum of*1mL* of CSF should be placed in the final (labeled `fourth') sterile universal container for the spectrophotometric scan (NB 1mL is about 20 drops from the Luer connector on a needle). Protect this sample from the light by placing it in a thick brown envelope outside the usual plastic specimen bag.

A blood specimen should be taken at the same time for serum bilirubin, total protein and glucose estimation, which are needed to aid interpretation. NB: All samples must be delivered to the *Microbiology Department* as soon as possible. They will forward samples and analyse and telephone results. Results of the spectrophotometric scan are available on ward lookup. If this procedure is not followed, analysis is likely to be compromised.

Dexamethasone Suppression Test

These tests should be preceded by urinary free cortisol and baseline 08.00 and 23.00h serum cortisol estimations if Cushing's Disease is seriously suspected.

Overnight Lose Dose Test
Dexamethasone (1mg) is given orally at 23.00h-24.00h. Serum cortisol is sampled between 08.00h-09.00h the following morning. A serum cortisol of 50 nmol/l or less excludes Cushing's syndrome.

High Dose Test
Dexamethasone (2mg) is given orally every 6 hours starting 08.00h. Serum cortisol is sampled at 08/00h and at 48 hours after starting the dexamethasone. Adequate suppression is usually defined as a serum cortisol <50% of previously measured basal level. This test can be performed immediately following the low dose test.

Faecal Elastase

Faecal elastase has been shown to discriminate between diarrhoea of pancreatic and non-pancreatic origin. A single, formed, walnut sized random stool sample (taken in fecon container) is required. Samples will be forwarded to Children's Lab, Kelvin building in the normal transport runs.

Faecal Occult Blood

Test to be done on a specimen of bowel motions on THREE separate days. Ideally during those three days, and for the two days before them, the patient MUST ***NOT eat any red meat (whether cooked or not), turnips, broccoli, cauliflower, parsnips, red radish, cantaloupe or horseradish.*** But you may eat raw or cooked vegetables (especially lettuce, spinach and corn), fruit (especially apples, prunes, plums and grapes) and a small amount of chicken, tuna fish, bran cereal, popcorn or peanuts.
The doctor may tell you to avoid some medicines ***such as aspirin, corticosteroids, reserpine, phenylbutazone, indamethacin*** and ***you must not take any vitamin C. Iron should be discontinued two days before and during the test.***
Do not start the test if there is bleeding from piles or menstrual period. After two days, when you have a bowel motion the patient must follow this procedure:

- Prior to defecation, the toilet should be flushed.
- Using one end of the applicator stick, collect a small stool sample from the toilet bowl by stabbing the stool and applying a thin smear to the centre of the Hema Screen slide.
- Close flap and make sure to keep the cardboard slide out of direct sunlight.
- Do the same for the next two motions and bring the slides to the clinic or post using the two envelopes.

Diagnostic kit in use: Seracult Plus faecal occult blood test

Gilberts Syndrome

Ensure patient is not taking drugs that will affect bilirubin metabolism. Obtain a 400 calorie diet sheet from a dietician. Collect blood samples between 9am and 10.30am on three successive days for the following:

Day 1 – normal diet – Full blood count, blood firm,
liver function tests, direct bilirubin haptoglobin.
Day 2 – 400 calorie diet – Total and direct bilirubin.
Day 3 – 400 calorie diet – Total and direct bilirubin.

Interpretation: Unconjugated bilirubin (total – direct) usually rises by more than 90% within 48 hours in patients with Gilbert's syndrome, on a restricted diet. In patients with liver disease or haemolytic anaemia the rise is usually less than 50%.

Glucose Tolerance Test (GTT)

The GTT should be performed in cases where random or fasting plasma glucose measurements are unable to categorise an individual. The test should be administered in the morning after an overnight fast of between 10 hours and 16 hours, during which only water may be drunk. For at least three days prior to the test, the patient should have had a normal unrestricted diet containing at least 150g of carbohydrate and should have been normally physically active. Any recent infections or current medication should be noted. Ideally any medication known to influence blood glucose should be discontinued, if possible, for a period equivalent to five times the effective half-life of the drug. Smoking should be discouraged at all stages, but should be prohibited on the morning of the test.

During the test, the patient should be encouraged to sit quietly. A fasting blood specimen should be collected and an adult patient given a solution of 75g of glucose to drink in a volume of approximately 300ml over 5 minutes. Current WHO opinion is that this should be 75g of anhydrous glucose or 82/5g of monohydrate. The test load for a child should be 1.75g per kg up to a maximum total of 75g of glucose. Equivalent solutions of partial hydrolysates of starch in similar volumes are also considered acceptable.

A further blood sample is collected at 2 hours. Blood samples are spun and plasma glucose is analysed by the Laboratory as soon as possible.

Strip testing methods must not be used for diagnostic glucose measurements.
Urine collected at start and at 2 hours and checked on wards.

Growth Hormone Excess

Follow the protocol for Glucose Tolerance Test as above. In addition to samples for blood glucose, take samples for Growth Hormone in red topped tubes at the stated times. Urine samples are not required.

Growth Hormone Deficiency

Take a 2ml basal sample in a red topped tube for growth hormone. Ask patient to exercise for 30 minutes. Take another sample for growth hormone.

Hydrogen Breath Test

This protocol is for establishing oro-caecal transit time, establishing non-H2 producers, small intestinal bacterial overgrowth syndrome or investigation of constipation. The technique is as follows:

- Fast for 12 hours overnight, allowed water to drink.
- At 8.45am make three separate breath hydrogen measurements in a seated position to establish a baseline. Assuming a good technique, the values should not vary by more than 5 ppm. If they do, then contact the laboratory to have them re-calibrate the instrument.
- At 9am ingest 20 ml of Lactulose within two minutes.
- Measure breath hydrogen at 15-minute intervals for three to five hours. Subjects remain seated quietly during the test and should not eat or drink.
- Have a meal (this indicates the end of the test).

Results for this test should be recorded on the Hydrogen Breath Test Results Sheet, which is available on the Trust Intranet in the Policies and Guidelines section.

Interpretation
The normal breath hydrogen varies, but in general is less than ten ppm. The three baseline values should not vary by more than 5 ppm. If within 3 hours there is no change in hydrogen values the patient is a non-H2 producer. The orocaecal transit time is between 70 and 90 minutes for most patients and when the Lactulose reaches the large bowel there will be a rise in hydrogen. If there is a small intestinal bacterial overgrowth syndrome there will be two peaks. The first will be when the Lactulose meets the bacterial overgrowth and the second will be when the Lactulose meets the caecum. A rise of 5 ppm within 60 minutes along with symptoms of tiredness, light-headedness or abdominal pain suggests intestinal bacterial overgrowth. In the absence of symptoms a rise of at least 10 ppm diagnoses intestinal bacterial overgrowth. This is carried out in the Medical Day Procedure Unit by Sister Pauline Doherty (Ulster Hospital October 2010).

If the start measurements differ by more than 5ppm contact Mrs E Duly in the Biochemistry Laboratory (Ext 88581)

5 Hydroxyindole Acetic Acid (5-HIAA)

Specimen Collection and Patient Preparation:
24hr urine using plain plastic container – no preservative.
Instruct the patient to void urine at 8.00am and discard the specimen. Then collect all urine for 24 hours, including the final specimen voided (i.e. 8.00am the next morning). Screw the lid on to the container securely, label the container with patient's details and the date and time. Send sample to lab accompanied by appropriately completed form.

Interference:
The following foods are rich in 5-Hydroxyteyptamine (5-HT) and increase substantially the urinary output of 5-HIAA and should not be eaten for 3 days before urine collection:
Pineapples, tomatoes, plums, walnuts, bananas, chocolate, kiwi fruit, and avocados
The following drug preparations may also affect results:
Imipramine, isoniazid, isocarboxazid, methyldopa, levadopa, MOA inhibitors

Hypoglycaemic Admissions

Please phone Biochemistry Lab, (Ext 88557 / 88558), to request a hypopack. Some wards in the hospital have a hypopack stored permanently on the ward for immediate use. These wards are:

- A/E
- Jaffe Rapid Response
- Maynard Sinclair
- Special Care Baby Unit

The above packs are maintained and checked on a monthly basis by laboratory staff. The pack contains appropriately labelled sample tubes and forms for your convenience. There is also a large double sided form from the Belfast Link Labs explaining the protocol to follow and the request form. Samples should be forwarded to the laboratory as soon as possible for processing. Samples received in the laboratory will be sent to the Regional Paediatric Laboratory, Clinical Chemistry, Kelvin Building, Royal Hospitals, Belfast Link labs on 10.30 am run.

Hypomagnesaemia

Low serum levels of magnesium have been noted in up to 10% of hospitalised patients particularly in malabsorption, chronic diarrhoea/excess stoma loss/vomiting/NG aspiration, renal tubular disorders and due to some drugs (particularly chemotherapeutic agents such as cis-platin and loop aminoglycosides alcohol).

Magnesium has several significant biological roles. It is a co-factor in many metabolic pathways including inspiration, glycolysis and a Na/K ATPase reactions and is also important in the maintenance of cell membrane electrical properties. Magnesium is necessary for parathormone secretion as well as for its action.

Symptoms of magnesium depletion are non-specific and are often unrecognised.

Mild (0. 5-0.7 mmol/l) hypomagnesaemia
Does not generally give rise to problems in the short-term, however chronic suboptimal serum magnesium levels may predispose to dysrhythmias in cardiovascular disease and intractable heart failure. This is particularly important in those on chronic diuretic therapy who may have coexisting hypokalaemia. Correction of magnesium deficiency is necessary in order to correct hypokalaemia.

Magnesium deficiency must also be corrected (and looked for) in hypercalcaemic patients. Muscle weakness, cramp, carpopedal spasm or seizures may accompany hypomagnesaemia with or without hypocalcaemia. Mental changes and cerebellar signs may be associated with more severe Magnesium depletion.

Oral magnesium is poorly absorbed and larger doses are poorly tolerated (GI side effects) Prophylactic low dose oral therapy may be indicated in at risk subjects, e.g. patients with refractory hypokalaemia on diuretics (particularly if there is concurrent IHD). Magnesium carbonate, sulphate, chloride, glycerophosphate and oxide salts are all effective for this purpose – a total of 24 mmol magnesium daily in divided doses is recommended.

Symptomatic or severe (<0.3 mmol/l) hypomagnesaemia
Should be treated by intravenous infusion, i.e. 30 mmol magnesium in 5% dextrose or normal saline over 24 hours if renal function is normal. A 50% solution of magnesium sulphate (2 mmol) is available from Pharmacy. The average total deficit in symptomatic hypomagnesaemia is 1 mmol/kg body weight. Subsequent replacement doses should be titrated with the serum magnesium level and the clinical state (usually between 5 - 30 mmol Mg). Magnesium should be administered with caution to patients with renal impairment, and also in recurrent renal stones, severe bradycardia, respiratory insufficiency or myasthenia gravis

Blood testing:
Requires a yellow-topped SST tube for adults and a green-topped tube for paediatrics

Hypophosphataemia

Hypophosphataemia is a relatively common problem among hospitalised patients and is encountered particularly in alcohol abusers, patients receiving TPN/enteral feeds/IV dextrose, diabetic ketoacidosis (especially recovering), and re-feeding of malnourished patients.

Mild hypophosphataemia (0.50-0.80 mmol/l)
Of little clinical consequence

Moderate hypophosphataemia (0.30-0.50 mmol/l)
Should be treated if symptomatic, e.g. muscular weakness. Consideration should also be given to treatment of hypophosphataemia in "sick" patients as phosphate is essential for cell oxygen carriage, white cell chemotaxis and phagocytosis, myocardial contractility and diaphragmatic function

Severe hypophosphataemia (<0.30 mmol/l)
Life-threatening (respiratory insufficiency and cardiomyopathy) and should be treated without delay

The recommended regime is 20 mmol of sodium dihydrogen phosphate (10 ml amps 1 mmol Na, 1 mmol PO_4^{2-} / 1 ml) in 500ml saline (or dextrose) over 24 hours. This is obtainable in ampoule form from Pharmacy. Less fluid may also be used if necessary, however the rate of infusion must not be exceeded, as this carries a real risk of causing metastatic calcification with hypocalcaemia. For the same reason, phosphate infusions should not be administered to hypercalcaemic patients. Correction of the primary cause where possible, is also important. Serum phosphate should be measured daily if treatment is being given, or considered. Measurement of potassium and magnesium is also useful.

Blood testing
Requires a yellow-topped SST tube for adults and a green-topped tube for paediatrics

Renin and Aldosterone Suppression Test

Mineralocorticoid Excess
Patient Preparation and Procedure: Samples must be taken under rigidly controlled conditions if results are to be meaningful.

1. All hypertensive drugs should be discontinued for 2 weeks prior to testing, if possible, and the patient should be on an adequate intake of sodium (100-150 mmol/day) and potassium (50-100 mmol/day).
2. Administer potassium to restore plasma levels to the reference range or as near as possible. Discontinue supplementation 24hr before blood samples are taken.
3. Patient must be admitted to ensure **strict** overnight recumbency.
4. After waking , the patient **must** remain lying down and not alter posture in any way until after the initial blood samples have been taken as follows:

BLOOD SAMPLES REQUIRED:

08.00h (before breakfast)	Red topped clotted blood tube for **Aldosterone** Purple topped EDTA tube on ice for **Renin**

Allow patient to rise and keep ambulatory for 2 hours

10.00h (ambulatory)	Repeat the sampling for **Aldosterone** and **Renin**

Please inform Lab (Ext 88556) when sending specimens on ice that require prompt separation of plasma.

Mineralocorticoid Deficiency
Patient Preparation and Procedure: After waking, the patient **must** remain lying down and not alter posture in any way until after the initial blood samples have been taken as follows:

08.00h (before breakfast)	Red topped clotted blood tube for **Aldosterone** Purple topped EDTA tube on ice for **Renin**

Allow patient to rise, take breakfast and keep ambulatory for 2 hours

10.00h (ambulatory)	Repeat the sampling for **Aldosterone** and **Renin**

Please inform Lab when sending specimens on ice that require prompt separation of plasma.

Reference Ranges	Serum Aldosterone	supine	<400 pmol/L
		ambulatory	<820 pmol/L
	Plasma Renin Activity	supine	<3.2 ng/ml/h
		ambulatory	1.8-6.7ng/ml/h

Saline Suppression Test

This can follow on from the above sampling procedure:

10am	Begin an infusion of saline (2L of 0.9%) over 4 hours.
12noon	Take blood sample as above for **Aldosterone**
2pm	Take blood sample as above for **Aldosterone**

Reference ranges	Serum Aldosterone	supine	<400 pmol/L
		ambulatory	<820 pmol/L
	Plasma Renin Activity	supine	<3.2 ng/mL/h
		ambulatory	1.8 - 6.7 ng/mL/h

Rhabdomyolysis

Blood sample	0 hour	Collect blood sample for initial CK level using yellow top SST
	12 hours	Collect blood sample for CK level

Synacthen Test – The 30 minute Synacthen Test Procedure

30 Minute Test: The patient should rest quietly but need not be in bed. Take a caseline sample for cortisol estimation. Give 0/25 mg Synacthen IM. Take a further sample at 30 minutes.

Short Synacthen Test For Children

When booking the child, inform biochemistry of the date/time (Child does NOT need fasted). Inform biochemistry that the child is in and test is about to begin (ACTH is unstable and lab need to be ready for it). Put 4ml of ACTH into a cold EDTA tube (put it in ice before taking blood) and then bring sample urgently to Biochemistry for spinning/freezing. Collect a sample for cortisol at 30 (T30) and 60 (T60) minutes through the cannula, flushing with saline.

Trace Metal Sample Containers

ADULT SAMPLES:	ALUMINIUM	Z10 plastic
	COPPER	Dark Blue Na Heparin
	GOLD	Z10 plastic/PCT
	SELENIUM	Dark Blue Na Heparin / PCT
	ZINC	Dark Blue Na Heparin – **no green**

Note: The Trace Metal Laboratory in the Belfast City Hospital supplies the plastic lithium heparin tubes and bottles for aluminum Ext. 2017 (Tie-line 7111)

PAEDIATRIC SAMPLES: 2 green tubes (min 200µl plasma per test)

WHOLE BLOOD SAMPLES:	CADMIUM	EDTA
	LEAD	Dark Blue Na Heparin OR 2 green paediatric tubes (min 200µl plasma per test)
	MANGANESE	Sarstedt Monovette LH-Metall-Analytik tube with a Sarstedt Monovette Needle (Instructions for use available with needle).

URINE:	CHROMIUM	Random urine
	COBALT	Random urine
	COPPER	24 hr urine
	CADMIUM	Random urine
	LEAD	Random/24 hr urine
	IRON / Desferrioxamine	24 hr or 6hr collection in 24 hr bottle

MERCURY	Random/24 hr urine
NICKEL	Random urine
THALLIUM	24 hr urine
ZINC	24hr urine in acid-washed (10% nitric acid) plastic bottle

Water Deprivation Test (Adults)

Note: IT IS IMPERATIVE THAT THE LABORATORY IS INFORMED IN ADVANCE OF COMMENCING THE TEST TO ENSURE PRIORITY PROCESSING OF SAMPLES.

Preparation Up to 8.30hrs

- No tobacco/ alcohol for at least 24 hrs before the test
- Stop interfering medication (e.g. DDAVP and diuretics) but not hormone replacement
- Give a light breakfast (do not fast or limit fluids overnight)

Method
Stage 1: Exclusion of Primary Polydipsia: 8.30 – 16.30 hrs

1. No fluid allowed but dry food permitted, e.g. toast.
2. Weigh patient at time 0 and hourly intervals, stop test if >3% weight loss (positive result)
3. Urine passed and discarded at time 0, urine then passed hourly and hourly volume estimated
4. Urine specimen taken for osmolality from the total hourly collection on 4 occasions during procedure.

U1: 8.30 – 9.30 hrs
U2: 11.30 – 12.30 hrs
U3: 14.30 – 15.30 hrs
U4: 15.30 – 16.30 hrs

5. Blood taken for Osmolality at:
S1: 9.00 hrs
S2: 12.00 hrs
S3: 15.00 hrs
S4: 16.00 hrs

6. Note down urine volumes at:
U1: 9.30 hrs
U2: 12.30 hrs
U3: 15.30 hrs
U4 16.30 hrs

Stage 2: Differential Diagnosis of Cranial Diabetes Insipidus from Nephrogenic Diabetes Insipidus: 16.30 – 20.30 hrs

7. Patient may now eat and drink freely
8. At 16.30 hrs administer DDAVP: 20 mcg intra-nasally or 2 mcg i.m.
9. Continue to measure hourly urine volumes and take samples for urine osmolality from these. Blood samples for osmolality are not required as the only purpose now is to see the effects of the DDAVP on urine volume and osmolality.
10. Note down urine volumes at:
U5: 17:30 hrs
U6: 18:30 hrs
U7: 19:30 hrs
U8: 20:30 hrs

Therapeutic Trial of DDAVP

Method

1. Admit to hospital
2. Monitor daily: fluid input and output, bodyweight, U&E, blood test and urine osmolality
3. Patient observed for 2 days and then 10mcg DDAVP given intranasally for at least 2-3 days.

Water Deprivation Test (Children)

Do not proceed with the test if the patient is already dehydrated. Check early morning urine osmolality if > 750 mosm/kg, test unnecessary. Weigh the patient at the start of the test and hourly.

Urine Samples
Collect all urine passed after starting water deprivation test – record time and volume of these samples.

Send urine for osmolality at the following times:

U1	0-1 hour
U2	3-4 hours
U3	6-7 hours
U4	7-8 hours

Send urine in plain white top biochemistry urine bottles.
Blood Samples

Send samples in green top biochemistry paediatric tubes for *serum osmolality* and *U&E* at the following times after commencing the test:
Blood 1 - 30 minutes, Blood 2 - 3½ hours, Blood 3 - 6½ hours, and Blood 4 - 7½ hours

NOTE: Stop the test if:

- *Weight loss > 4kg or > 3% of body weight, proceed to vasopressin test*
- *Urinary osmolality > 800 mOsm/kg, test unnecessary no need to proceed to vasopressin test.*
- *After 8 hours if test still proceeding*

Vasopressin Test

This is carried out if water deprivation test is abnormal, e.g. urinary osmolality <600 mOsm/kg.

- Give aqueous vasopressin (Pitressin) 1u/m² subcutaneous.
- Allow patient to eat and drink.
- Repeat serum U&E and osmolality and urine osmolality hourly for 4 hours.
- In diabetes insipidus serum osmolality rises >300mOsm/kg and urine remains <270 mOsm/kg.

THERAPEUTIC DRUG MONITORING

The clinical application of therapeutic drug monitoring is limited to those drugs where a correlation between plasma concentration and therapeutic effect has been demonstrated. Drug plasma levels should be monitored when a patient exhibits toxicity on a 'normal' dosage regimen, when adjusting a dosage regimen, changing formation or adding a drug, for confirmation of adequacy of treatment or when non-compliance or overdose is suspected.

The **timing of the sample in relation to dosage is critical** for correct interpretation of the result. Collection times should be based on the individual pharmacokinetic properties of the drug, formulation and route of administration.

The following are general guidelines only:-

Sample type	**Sampling time**
Trough level	Immediately before next dose
Peak level (IV)	15-30 minutes after a 30 minute infusion
	0-15 minutes after a 60 minute infusion
	0-15 minutes after a bolus injection
Peak level (IM)	30-60 minutes after injection
Peak level (oral)	1-3 hours after oral dose
	4 hours after sustained release preparation
Steady state level	Drawn after five elimination half-lives (t) have elapsed.

Interpretation of results should be in light of the clinical situation using information which includes:-

- Renal function (i.e. serum creatinine/creatinine clearance)
- Hepatic function
- Patient age, weight and sex
- Dosage regimen and dosage form of drug
- List of concurrent drug therapy
- Time the sample was obtained
- Clinical status of the patient

The specimen requirements and therapeutic ranges for drug monitoring can be found in the test and reference range section. For further information on sampling times or interpretation or drug plasma levels, please contact the Pharmacy Department (Ext 2484). The Pharmacy Department can advise on the dosage level required to achieve a 'therapeutic' drug level when the above information is provided.

DRUG	ELIMINATION HALF-LIFE [t½] (HOURS)
Amphetamine	5-21
Amitryptiline	19
Carbamazepine	Long Term Use: 7-25, Single Dose: 25-45
Diazepam	24 – 48
Digoxin	40
Nortryptiline	28
Paracetemol	2.5
Phenobarbitone	50-140
Phenytoin	Chronic Administration: 15-100, Single Dose: 9-22
Quinidine	Approx. 6.0
Salicylate	2-30
Theophylline	Adults: 9.3, Neonates: >8.3
Valproic acid	7-14

Table 1: Drug Half-Life

Serum assays are required for certain antibiotic agents to ensure therapeutic but non-toxic levels are achieved. Gentamicin and Vancomycin assays are carried out in Clinical Biochemistry, and as such any samples for these assays should be sent directly to the Clinical Biochemistry Laboratory. ***However, clinical advice in regards to the above antibiotic assays can only be obtained from the Consultant Microbiologists.***

Sample: Adult: 5-10ml peripheral venous blood in yellow topped tube
Children: 0.4ml peripheral venous blood in green topped tube

Note – Trough levels should be taken just before the next dose and peak levels taken 60 minutes after the dose, unless indicated otherwise in accompanying table.

For all assays it is essential that the following information be provided on the request form:

- Time and date of commencement
- Record on both forms & samples whether samples are pre- or post-dose or peak related

ANTIBIOTIC	DOSAGE	TIMING OF FIRST LEVEL	EXPECTED LEVELS (mg/l)	RE-ASSAY INTERVAL (days)
Gentamicin (Once daily regimen)	5mg/kg (in 100ml 5% glucose or 0.9% NaCl over 1 hour)	Trough before 2nd dose, i.e. 19-24 hrs after first infusion	<1 ***Levels sent <19 hrs after last dose are not suitable***	6 – 8*
Gentamicin (Divided dosing)	Refer to local guidance	After 2-3 doses	Trough <2 Peak 5-10	2 – 3*
Vancomycin	Creatinine Clearance (Cr Cl) >50ml/min: 25mg/kg (up to 1g) 12 hourly Cr Cl < 50ml/min: 25mg/kg (up to 1g) stat then **check levels at 24 hrs before adjusting 2nd dosing interval/dose accordingly** **NB:** *slow infusion at a max rate of 10mg/min*	Cr Cl > 50ml/min only Trough before 3rd or 4th dose, i.e. >10 hours after 2nd or 3rd dose **Give dose while awaiting results of levels and adjust subsequent dose accordingly**	Trough 10-15 Trough 10-20 for more severe infections ***Levels sent <10 hrs after last dose are not suitable***	6 – 8*

*Assuming renal function not impaired and initial results are within expected range and/or no other changes affecting levels, e.g. changes in renal/hepatic function, drug interactions etc.
Aim to take samples within office hours.

Contraindications to once daily regimen for Gentamicin ***(seek advice)***

1. Serum Creatinine >300µM/L**
2. Rise in serum Creatinine >30µM/L in last 3 days**
3. Ascites
4. Burns >20%
5. Dialysis
6. Endocarditis
7. Myasthenia
8. Pregnancy

***** In septic shock/severe sepsis discuss with Consultant Microbiologist***

For further information, please consult the Adult Empirical Antimicrobial (Antibiotic) Therapy Guidelines for Inpatients, available on the SEHSCT Intranet.

Drug Information Service

Regional Centre:	Belfast	02890 248095	
Area Centres:	Londonderry	02871 45171	Ext 3262
	Craigavon	02838 334444	Ext 2976
	Antrim	02894 424278	
Local Centres:	Ulster Hospital	02890 484511	Ext 2484
	Belfast City Hospital	02890 329241	Ext 2600

Poison Information Service

Belfast:	02890 632032/633847
Birmingham:	0121 5543801
Cardiff:	02920 709901 or poisons.information@cardiffandvale.wales.nhs.uk
Dublin:	003531 379964 or Dublin: 003531 379966
Edinburgh:	0131 2421381 or spib@luht.scot.nhs.uk
Leeds:	0113 430715 or 0113 316838
London:	0207 6359191 or 0207 9555095
Newcastle:	0191 2325131

Specialist Information and Advisory Services Available Via Regional Centre:

Drugs in breast milk
Drugs in pregnancy
Drugs in dentistry
Alternative medicine
Drugs in renal failure
Toxicology and poisoning
Drugs in liver disease
Acquired immune deficiency syndrome
Press index
Drugs in psychiatry
Medicines Resource Centre (MeReC)
Community Services Information
Scottish Medicines Resource Centre (SMRC)
Viewdata Drug Information Service (VADIS)
Welsh Medicines Resource Centre
German translations
Porphyria Safe List (available from http://www.wmic.wales.nhs.uk/)

Please note – if advice rather than simple information retrieval is required then the full clinical background is required.

MICROBIOLOGY

CONTACT DETAILS

Ulster Hospital Switchboard		028 9048 4511
Consultant Head of Medical Microbiology	Dr C Hugh Webb hugh.webb@setrust.hscni.net	
Consultant Medical Microbiologist	Dr Ciaran O'Gorman ciaran.ogorman@setrust.hscni.net	
Consultant Clinical Microbiologist	Dr Paul Boreland paul.boreland@setrust.hscni.net	
Consultant's Secretary	Lorraine Moreland lorraine.moreland@setrust.hscni.net	Ext 88561
Head Biomedical Scientist	David Miller david.miller@setrust.hscni.net	Ext 88575
Main Microbiology		Ext 88526 / 88547
Serology		Ext 88553 / 88554
Urine Examination laboratory		Ext 88548
Enteric Pathogen laboratory		Ext 88551 / 88552
Out of Hours	Contact the Hospital switchboard	028 9048 4511
Senior Infection Prevention And Control Nurse	Isobel King isobel.king@setrust.hscni.net	Ext 88570
Senior Infection Prevention And Control Nurse	Monica Merron monica.merron@setrust.hscni.net	Ext 88567
Infection Prevention and Control Nurse	Janine Norrie janine.norrie@setrust.hscni.net	Ext 88569
Infection Prevention and Control Nurse	Amy Bradley amy.bradley@setrust.hscni.net	Ext 88568
Infection Prevention and Control Nurse	Juliann Reid juliann.reid@setrust.hscni.net	Ext 88569
Infection Prevention and Control Nurse	Karen McCormick karen.mccormick@setrust.hscni.net	Ext 88568

SPECIMEN COLLECTION

General information

The prompt and accurate isolation of infecting agents is directly influenced by the quality of the specimen. With the exception of suspected meningitis it is almost always possible to obtain appropriate specimens before commencing antibiotic therapy.

The following points should be adhered to:

- Collect specimen before administration of antibiotic therapy
- Specimen should be transported to the laboratory as soon as possible
- Ensure that the specimen container is clearly labelled with the patient's details
- Remember that you may be dealing with pathogenic microorganisms and care should be taken while obtaining and handling the specimen (see Infection Control Guidelines)

Specimen containers:

SAMPLE	CONTAINER
Antibiotic Assay	Red topped clotted specimen tube
Chlamydia	Chlamydia specimen collection kit
Faeces	Blue topped universal container with plastic spoon
Microscopy	Plain swab or prepared slide
Routine Culture	Charcoal swab
Semen	Yellow topped wide neck 60ml container
Serological Test	Yellow topped clotted specimen tube
Sputum	Red topped wide neck 60ml container
Urine	Red topped universal with Boric acid – filled to line indicated For small samples use a sterile white capped universal *(if there is a delay in sending this type of urine to the laboratory, the specimen must be refrigerated and a comment of refrigeration recorded on the request form)*
Urinary Antigen Testing	White topped universal container
Urine for TB / AAFB	4 white topped universal of early morning urine for *Mycobacterium tuberculosis*

If you are in any doubt about the most appropriate specimen or container, please contact the laboratory for advice (see contact details).

Infection control

- Wash hands thoroughly or use sanitizer (the latter if hands are visibly clean) before obtaining the specimen and after it has been prepared for collection
- Gloves should always be worn when handling bodily fluids
- Do not overfill container
- Ensure container is securely closed and outside of container is not contaminated by the specimen
- Place the specimen in a polyethene bag for transport to the laboratory
  Note: Where the request form is not attached to a polyethene bag, e.g. Virology, a separate biohazard bag should be used (obtained from the laboratory).

High Risk: ***All specimens from suspected or proven cases of HIV, Hepatitis B and C, and Tuberculosis must be labelled with a special biohazard label "Danger of Infection - Take special care". These labels are available from the laboratory and should be attached to the specimen container and to both copies of the request form. For Needle stick injuries please refer to the SEHSCT Guidelines.***

The Request Form

Please fill this in correctly and with relevant clinical details (many requests provide no relevant clinical details) these ensure appropriate laboratory processing and reporting.

Please use addressograph labels ensuring details of the source, i.e. ward/health centre, and consultant/GP are provided. Please apply "Danger of Infection" labels as appropriate.

*The following sections of the request form **must** be completed.*

1. Patient Identification Data (PID)
Full surname and forename in block letters
Unit number
Consultant/GP and cypher code

2. Specimen details
Date and time collected
Nature and site of sample
Test/s requested

3. Requesting details
Name of requestor
Return address (ward/health centre)
Bleep/telephone number for urgent reports

4. Clinical information
Clinical information relevant to investigation
Current/proposed antibiotics

If the request is of an urgent nature, please indicate this by writing 'URGENT' on the request form and TELEPHONE THE MICROBIOLOGY LABORATORY, Ext 88526 / 88547, to make them aware of the request.

Reasons for rejecting specimens for bacteriological examination

- Improperly labelled samples and samples from patients whose details do not correspond with the request form
- Incomplete or illegible request form
- Specimens received in a non-sterile container
- Specimens which have leaked or where the container has been damaged during transport to the laboratory
- Tissue/specimen received in formalin or other fixative
- Blood cultures that have been refrigerated

NOTE: Select Wards in the Ulster Hospital are able to request tests using Ward Order Coms.

Collection of Specific Specimen Types

1. Blood Cultures

These should form part of the investigation of every pyrexial illness. Samples of blood should be taken as soon as possible after a "spike" of fever and, in almost all cases, should be performed **before** initiation of antibiotic therapy.

Ideally a minimum of 2 sets of blood cultures should be collected (preferably not less that 1 hour apart). A single blood culture set may miss intermittently occurring bacteraemia and make it difficult to interpret the clinical significance of certain isolated organisms.

Endocarditis – bacteraemia is continuous in this condition so blood cultures do not have to be related to pyrexial episode. At least 3 sets of cultures should be collected and as the density of bacteraemia

may be very low the maximum volume of blood should be inoculated into the culture bottles – see below.

Blood culture bottles can be ordered using the weekly lab order form. These bottles have a limited shelf life and should not be stored in large quantities at ward level. Blood culture bottles are also available from the lobby at Specimen Reception.

Blood Culture Bottles:	Aerobic	Blue top – recommended 10ml blood fill
	Anaerobic	Purple top – recommended 10ml blood fill
	Pedi-Bact	Yellow top – recommended maximum 4ml blood fill

Note that this bottle is for aerobic culture and normally to be used with babies or infants. If clinical details suggest the possibility of an anaerobic infection, also send a purple top anaerobic bottle.

Procedure

1. Use a hand wash solution to wash and dry your hands before commencing procedure.

2. Inspect the venepuncture site, wash with soap and water if visibly soiled and palpate the vein. Carefully clean the venepuncture area with alcohol soaked swabs. ALLOW THE ALCOHOL TO DRY.

3. Do not re-palpate the vein after skin disinfection.

4. Inspect broth and the sensor located on the bottom of each bottle. Ensure that the broth is straw-coloured and transparent, for aerobic and anaerobic bottles, and that the sensor is intact and a blue-green colour. Remove the centre plastic flip top lids from the BacT/Alert bottles and sterilise the exposed rubber diaphragms with alcohol.

5. Put on sterile gloves, take the sample of blood and inoculate recommended volume.

If blood has been obtained for other purposes it is essential to inoculate the blood culture bottle first to avoid cross contamination from non-sterile specimen containers. Inoculate the anaerobic bottle first.

6. Dispose of syringe and needle carefully directly to a sharps waste container at the point of use - DO NOT RESHEATH.

7. Label each bottle separately with patient's name, his/her hospital ID, ward, date and time of collection. If two sets of blood cultures are taken at the same time from a central line and a peripheral site please mark the site sampled on all 4 bottles. ***NOTE: If paper labels are used, stick on bottom half of the bottle not over the Bar Code as this is needed for bottle identification. DO NOT REMOVE THE BARCODE STRIPS FROM THE BOTTLE.***

Blood cultures must be transported to the laboratory sample reception immediately.

Reporting: The ward will be informed immediately any blood culture is found positive and a gram stain result will be provided. Preliminary identification and sensitivity test results will also be telephoned as soon as they are available and will be followed by a final report. It is important to note that these early sensitivities are **preliminary** and may be limited. If in any doubt about the most appropriate antibiotic agent seek advice from the Medical Microbiologist.

2. Cerebrospinal fluid (CSF)

CSF investigations are usually multidisciplinary so in order to ensure the precious samples are handled correctly please follow the instructions overleaf:

- Please inform the Microbiology laboratory in advance of a request for a CSF examination. Outside of routine Laboratory hours, contact the Microbiology BMS through the Ulster Hospital switchboard.

- **All CSF samples must be delivered by hand, without delay, to the Microbiology laboratory.**

- **The clinical reason for the request must be written on the request forms**

- Following cannulation of the spinal canal collect 2ml of CSF into 3 plastic universal containers. In addition take a **grey top** sample for blood glucose and a **yellow top** blood sample for total protein and bilirubin.

  For suspected meningitis fill out a **Microbiology** (blue) request form.

  If **viral aetiology suspected,** fill out a BHSCT **Virology** (white) request form. An additional throat swab in a transport medium plus a faeces sample must be sent.

  For **suspected subarachnoid haemorrhage** fill out an **urgent Clinical Biochemistry** (yellow) request form.

- For neurological investigations such as multiple sclerosis, paired CSF and a yellow top blood must be taken and a BHSCT Immunology (brown) request form completed.

- Transport the specimens to the laboratory without delay.

The following analysis is undertaken routinely:

- Cell counts, gram stain and culture for bacteria (Microbiology)
- CSF sugar and protein level (in Clinical Biochemistry)

If indicated by the clinical history and/or cell count/sugar/protein profile, cell differential antigen detection testing may also be carried out.

Examination for tubercle bacilli is only undertaken if indicated by cell count/protein level/sugar level profile or on request.

Oligoclonal banding requires an accompanying yellow-topped blood sample and an immunology request form.

The Clinical Biochemistry laboratory undertakes spectrophotometry for xanthochromia.

3. Eye swab

Purulent material should be collected from behind the lower eye-lid or from the inner canthus. If neonatal gonococcal conjunctivitis is suspected transport the specimen to the Lab as quickly as possible. For suspected **Chlamydial conjunctivitis**, wipe away any muco-purulent material and swab the affected eye(s) using the swab provided in the Chlamydia specimen kit. Send to the Lab with a completed **Chlamydia PCR testing form** for each patient.

4. Faeces

Stools may be collected in a clean bedpan and must not be contaminated with urine/residual soap/disinfectant. Collect a portion into a sterile faeces container using the spoon attached to the lid.

Include material containing pus/mucus/blood if present. Minimum volume of 5ml required for Clostridium difficile testing. In keeping with National guidelines, only diarrhoeal samples will be tested for C.difficile toxins. Formed stool will not be tested.

Culture for the following enteric pathogens is undertaken routinely - *Salmonella spp, Shigella spp., Campylobacter spp and E. coli O157.* Additional examination (particularly microscopy for enteric parasites, toxin testing for *Clostridium difficil*e, or examination for unusual pathogens) will be performed on clinical request or patient's history. Where relevant, provide travel history.

Where a ward outbreak of gastrointestinal illness is suspected please contact the Infection Control Department (Ext 88562). If food poisoning is suspected remember this is a notifiable illness and should be reported to the Public Health Agency.

For thread worm ova, a cotton wool swab in a dry container is required. This should be pre-moistened and applied to the peri-anal skin area. This is best done late at night or in the early morning before bathing. Specimens should be transported and examined as soon as possible.

**Outbreak of vomiting and/or diarrhoea: See appendix A*

5. Genital Tract

High vaginal swabs: swabs should be taken using a speculum as contaminating material from the lower vagina may affect results. NOTE CLINICAL DETAILS ON THE FORM ARE ESSENTIAL FOR CORRECT PROCESSING.

Gonococci:* Swabs should be obtained from the endocervix, urethra and rectum from female patients and from the urethra and rectum in male patients. Swabs should be sent in charcoal transport medium ideally within 30 minutes and the laboratory informed. Direct microscopy for *N. gonorrhoeae* in the female urethra is of limited value but a smear from samples from the male urethra should be prepared. **Request forms should specify culture for Gonococcus.

**Chlamydia trachomatis:* (molecular nucleic acid amplification test – NAT). Chlamydia collection kit available from the lab.

Suitable specimens:

1. Urine (male and female) *or*
2. Endocervical, vaginal and male urethral swabs.

If using a swab remove cervical mucus before collecting columnar and squamous epithelial cells from the endocervix. The presence of blood, mucus, some spermicidal agents, feminine powder sprays and treatments for vaginal conditions such as yeast infection may interfere with NAT based assays.

Request form: A Chlamydia PCR testing form must be completed for each patient

Specimen collection:

Urine: The patient should be advised not to urinate for at least one hour prior to specimen collection. Collect 20-30ml of **first-catch** urine. Unscrew the transport tube cap, taking care not to spill the transport buffer. Use the plastic transfer pipette to transfer approx of 3 ml urine until the liquid level in the tube falls within the clear fill window of the transport tube label. Do not over fill. Tightly close and label sample container. After collection, the tube can be stored at 2 - 30 °C before transport to the lab.

Endocervical swab: Remove the sterile swab from the wrapper taking care not to touch swab tip. Insert the white tip of the specimen swab into the endocervix canal. Gently rotate the swab for 15 to 30 secs to ensure adequate sampling. Withdraw carefully and place the swab into the transport tube. Break the swab at the scored line on the shaft. Re cap and label the tube.

Vaginal swab: Insert the tip of the collection swab about 5cm into the opening of the vagina. Gently rotate the swab for 15 to 30 secs against the side of the vagina. Withdraw carefully and place the swab into the transport tube. Break the swab at the scored line on the shaft. Re cap and label the tube.

Male urethral swab: The patient should not have urinated for at least one hour prior to sample collection. Insert the tip of the swab 2 to 4 cm into the urethra. Gently rotate for 2 to 3 secs to ensure adequate sampling. Withdraw carefully and place the swab into the transport tube. Break the swab at the scored line on the shaft. Re cap and label the tube.

6. Bacterial vaginosis

Gardnerella vaginalis:- Two high vaginal swabs should be taken, one sent in charcoal transport medium and the other plain swab used to make a glass slide smear. This will be examined in the laboratory for the presence of “clue cells”. Alternatively send an air dried smear in a slide box to the laboratory.

Trichomonas vaginalis:- A high vaginal swab should be sent in specific trichomonas transport medium. Allow transport medium to come to room temperature before use.

** Consider referral to Genito Urinary Medicine*

7. Intravenous Catheter Tip

Clean insertion site with alcohol and allow to dry. Aseptically remove catheter and send a maximum of a **5cm** tip to laboratory in sterile universal container. If there is purulent material at the exit site please also send swab for culture.

8. Nose and Throat Swab

Throat swab: (e.g. for Group A streptococci) Rub a sterile swab over tonsillar areas, posterior pharyngeal wall and any areas of ulceration, exudation or membrane formation. *NB If diphtheria is considered as a diagnosis, please state this clearly on the request form.*

Pernasal/nasopharyngeal swab:- (for detection of *Bordetella pertussis/N. meningitidi*s). These cotton alginate tipped flexible wire swabs are available from the laboratory. Gently insert the swab along the floor of the nose into the nasopharynx, rotate it there and withdraw. Notify the laboratory in advance and transport swab to laboratory immediately.

Nasopharyngeal secretions:- (for detection of *Respiratory syncytial virus/ influenza* etc). Pass sterile catheter tip through each nostril to the nasopharynx intermittently applying suction as the catheter is slowly withdrawn. Send 0.2-0.8 ml secretions in the trap container to the laboratory. If insufficient secretions are obtained 0.5-1ml of sterile saline may be introduced into the posterior nares and re-suctioned into the trap container.

9. Pus / Inflammatory Exudates

If there is any volume of pus present **please do not send a swab.** Aspirate the pus/exudate with a sterile syringe and transfer to a sterile universal container. If there is only a very small volume of material in the syringe, add some sterile preservative-free saline, mix and transfer to the sterile container. The site of origin of the material must be clearly stated. Send to laboratory immediately. Out-of-hours, please notify on-call Biomedical Scientist of any urgent specimens.

10. Semen Analysis

The form must be fully completed by medical staff before giving to the patient. Comprehensive instructions are provided with the form.

a) **Fertility investigation** - the semen sample should be collected after a minimum of 2 days and not longer than 7 days of sexual abstinence. A second sample, after an interval of 2 -4 weeks may be helpful as sperm counts may fluctuate widely. ***Patients must phone the Microbiology Department (028 9041 1526) in advance to book in their sample for analysis***

The sample should be obtained by masturbation and ejaculation into a wide mouthed sterile, yellow-topped container. Condoms **must** not be used for semen collection. During transit to the laboratory specimen reception, the container must be kept warm eg in a trouser pocket and handed to a member of the laboratory staff as soon as possible within one hour of collection.

Normal values

Volume	>2ml
pH	>7.2
Concentration ($x10^6$ml)	>20
Total sperm number (concentration x volume) ($x10^6$ml)	>40
Motility % grades rapid + sluggish progressive	>50
Vitality (% alive)	>75
White blood cells ($x10^6$ml)	<1.0

b) **Post vasectomy** - Samples should be tested at 12 weeks post vasectomy after at lest 24 ejaculations. If sperm are still present, another sample 6 weeks later, after a further 12 ejaculations is requested. Samples should be collected as above and brought directly to the laboratory specimen reception (9am – 1pm Monday to Friday excluding bank holidays).

11. Sputum

All patients treated for lower respiratory tract infection should have a sputum sample sent for culture prior to commencing antibiotics. Patients should be asked to rinse out their mouths (using tap water only. If TB is suspected, use sterile preservative free water) and provide only material resulting from a deep cough. Physiotherapy assistance may be helpful if a patient has difficulty producing a suitable sample (salivary samples are unsuitable and may be rejected). Specimens should be collected into a sterile wide mouthed sputum jar and sent to the laboratory without delay.

12. Urine

Mid stream specimens are collected in Boric acid/white topped universal containers as follows:

Male: The glans penis is cleaned with soap and water. Micturition is commenced and after a few mls of urine have been passed, a sterile urine container is held under the stream and the container filled.

Female: Separate the labia and clean the vulva from front to back with cotton wool moistened with sterile water. With the labia separated micturition is commenced and after a few mls have been passed, without stopping, allow urine to pass into a sterile foil dish. Transfer into a sterile urine container.

Urine is an excellent growth medium for microorganisms. It is important that if there is to be any delay in transporting the specimen to the laboratory, it should be refrigerated.

Catheterised patients: Samples should only be obtained if there are any systemic signs of infection. The sample should be obtained from a sampling port or sleeve. This should be disinfected with alcohol prior to aspirating the sample with a syringe and needle. Never obtain the sample from the drainage bag.

Paediatric practice: Suprapubic aspirates are the best samples for establishing the diagnosis of bacteriuria in infants and small children. Otherwise, clean catch specimens are preferable to a bag collection. If washing is required because the perineum is soiled, an initial soap and water wash followed by a rinse with clean water and careful drying is all that is required.

13. Wound Swabs

Surface wounds and sinuses are often colonised with environmental bacteria and superficial swabs may not reflect the cause of the infectious process. Wherever possible, pus from the base of the wound should be aspirated by syringe and transferred to a sterile container. Only when this is not possible should a swab be used. First remove superficial slough, then extend the tip of the swab deep into the wound taking care to avoid the skin margins. The wound site and nature must be clearly stated on the request form.

14. MRSA Screen

The normal sites to be swabbed for an MRSA screen are nasal and groin. A throat swab should also be included if the patient has dentures. Axilla swabs and sputum samples will not be processed as part of an MRSA screen. Swabs from infected sites may be submitted as part of an MRSA screen but it is important to note that no other pathogens will be detected when a swab is processed as part of an MRSA screen.

It is advisable to send swabs from infected sites for O&S. MRSA and other pathogens can both be identified when processed this way.

RESULT REPORTING

Final reports will be issued as soon as possible. The medical or laboratory staff will telephone urgent reports. Telephone requests should be kept to a minimum in the interest of safety, as verbal reports may lead to transcription errors. Telephone calls for provisional culture results should be made after 11am. These interim reports will be subject to an audit trail.

TURNAROUND TIMES

These turnaround times are from receipt by the laboratory to result availability. It is anticipated that these turnaround times will be achieved for the majority of specimens, however the nature of microbiology investigations means that some results may take longer.

SPECIMEN	TURNAROUND TIME
Blood Culture	Up to 9 days (As cultures may be incubated for 7 days) *Positive culture results will be telephoned to the ward*
CSF	Gram Stain & Cell count: Ward telephoned when results available Preliminary culture result: 2 days Final report: 3 days
Faeces	Culture results: 5 days *Positive culture results will be telephoned to the ward* C. difficile: These tests are batched and results are available after 4 pm on the day specimen sent if received by Laboratory before 2 pm. If not, results are available after 4pm the following day. *Note that negative results are not reported at weekends and turnaround times may be elongated by 2 days* Parasitology: 2 days *Please be aware that Parasitology examinations are not performed at weekends and turnaround times may be elongated by 2 days*
MRSA Screens	3 – 4 days
Semen Analysis	3 – 5 days
Serology	Pregnancy tests: The majority are available by 4 pm on the day the specimen was received. The remainder are available within 24 hours Routine investigations: 2 – 3 days *Please be aware that Serology examinations are not performed at weekends and turnaround times may be elongated by 2 days*
Swab	2 – 3 days *Please be aware that turnaround times may be elongated by up to 2 days if specimens require work over the weekend*
Sputum	3 – 4 days
Urine	2 – 3 days

EMERGENCY REQUESTS

As stated in the general information section, only certain tests are available as emergency requests. The tests in Microbiology that are available as emergency requests are shown below.

MICROBIOLOGY TESTS AVAILABLE AS EMERGENCY REQUESTS
CSF examination (Gram stain, cell count & culture)
Gram stain & culture of pus or body fluid from normally sterile sites
Urine microscopy
RSV
Legionella & Pneumococcal Urinary Antigen tests
Immediate plating and processing of urgent specimens including those where the culture is required for the next working day and where the clinical management could be altered by results.

THERAPEUTIC DRUG MONITORING

Serum assays are required for certain antibiotic agents to ensure therapeutic but non-toxic levels are achieved. Seek the advice of Medical Microbiologist for the monitoring of other antimicrobials.

Please note that the Clinical Biochemistry laboratory performs Gentamicin and Vancomycin assays (see page 36 and 37), and requests for these assays should be sent directly to the Clinical Biochemistry laboratory.

Also note that both Amikacin and Tobramycin assays are referred to the Mater Hospital Clinical Chemistry laboratory, part of the Belfast Health and Social Care Trust, for analysis. Any samples for these assays should be sent to the Ulster Hospital Microbiology laboratory, where they will be referred on to the Mater Hospital Clinical Chemistry laboratory.

For collection of samples for Amikacin, Teicoplanin or Tobramycin levels, 5 - 10ml blood should be taken from a peripheral vein and placed in red-topped specimen tube. In children, a green-topped tube filled to 0.4 ml is sufficient. Trough levels should be taken just before the next dose and peak levels taken 60 minutes after the dose, unless indicated otherwise in accompanying table.

Monitoring once daily Teicoplanin therapy – samples obtained out of hours will not normally be processed until the following morning. This should still allow sufficient time for dose adjustment prior to next due dose. To facilitate this arrangement it is best to avoid dosing times between 9-11am.

Urgent assay levels can be processed outside of routine Laboratory hours. If you require an urgent assay level please contact the Microbiology BMS On-Call via the Ulster Hospital switchboard.

For all assays it is essential that the following information be provided on the request form:

- Time and date of commencement
- Clearly record on both forms and samples whether samples are pre-dose or post-dose/peak related
- For aminoglycoside Multiple daily/once daily regimen – if on once daily dosing and a single level is requested, the exact time of the sample must be recorded
- Random samples are usually impossible to interpret

ANTIBIOTIC	DOSAGE	TIMING OF FIRST LEVEL	EXPECTED LEVELS (mg/l)	RE-ASSAY INTERVAL (days)
Amikacin* (once daily regimen)	15mg/kg (in 100ml 5% glucose or 0.9% NaCl over 1 hr)	Trough before 2nd dose, i.e. 19-24 hrs after first infusion	<5 ***Levels sent <19 hrs after last dose are not suitable***	6 – 8**
Teicoplanin	**Loading dose** 10 mg/kg 12-hourly for 3 doses **Maintenance dose** 10mg/kg 24-hourly in normal renal function. Adjust dosing interval/ dose according to levels in patients with renal failure – including those receiving dialysis	Trough taken 19 - 24 hrs post dose **Give dose while awaiting results** **Normal renal function;** No levels until D7 **Impaired renal function**; Trough before 4th dose	Trough >20 but <60 ***Levels sent <19 hrs after last dose are not suitable***	6 – 8**
Tobramycin* (once daily regimen for Adult Bronchiectatic patients)	5mg/kg (in 100ml 5% glucose or 0.9% NaCl over 1 hour)	Trough before 2nd dose, i.e. 19-24 hrs after first infusion	<1 ***Levels sent <19 hrs after last dose are not suitable***	6 – 8**

*Assay referred to Mater Hospital Clinical Chemistry laboratory for analysis
**Assuming renal function not impaired and initial results are within expected range and/or no other changes affecting levels eg changes in renal/hepatic function, drug interactions etc.

Aim to take samples within office hours.

Contraindications to once daily regimen for Amikacin ***(seek advice)***

1. Serum Creatinine >300µM/L***
2. Rise in serum Creatinine >30µM/L in last 3 days***
3. Ascites
4. Burns >20%
5. Dialysis
6. Endocarditis
7. Myasthenia
8. Pregnancy

****** In septic shock/severe sepsis discuss with Consultant Microbiologist***

For further information, please consult the Adult Empirical Antimicrobial (Antibiotic) Therapy Guidelines for Inpatients, available on the SEHSCT Intranet.

INVESTIGATION OF INFECTIOUS DISEASES

DIAGNOSIS	SPECIMEN	COMMENTS
Actinomycosis	Pus with "sulphur granules" if present	Actinomyces-like organisms are occasionally seen in cervical smears. These may be ignored in healthy women with no symptoms of pelvic Actinomyces
AIDS	Clotted blood. See how to take an HIV test in Trust document "Guidelines Prior to Taking Blood for HIV Testing in Hospital"	**Treat as high-risk specimen.** The specimen must be labelled with patient's hospital / health & care no., date of birth, first initials of forename and surname only, and return address of sender.
Amoebiasis	Clotted blood for serology. Warm specimen of faeces for trophozoites (<1 hour)	
Anthrax	Swab of cutaneous lesions and blood cultures	Consult medical microbiologist before sending specimen. **Treat as high risk specimen**
Antistreptolysin Titre (ASOT)	Clotted blood	Acute and convalescent sera
Aspergillosis	Clotted blood for precipitins (especially allergic aspergillosis) Sputum culture Bronchoalveolar lavage	Organism is Aspergillus
Bornholm disease	Throat swab in virus transport medium, faeces for virus isolation	Virology form
Bronchiolitis	Nasopharyngeal aspirate	
Brucellosis	Blood culture Clotted blood for serology	Treat as high risk specimen
Candidiasis	Blood culture Swab from suspected lesions	
Chickenpox	Swab from vesicle or scraping of base of lesion in viral transport medium	Usually clinical diagnosis
Chlamydia	See Genital tract specimens	
Cholangitis	Blood cultures Specimen of bile in universal container where available	
Croup	Nasopharyngeal aspirate	Usually clinical diagnosis
Cryptosporidiosis	Faecal sample EDTA blood sample (IgM available)	Stained for Oocysts of Cryptosporidium Virology form
Crystal Analysis	Joint fluid	Send to Belfast Trust. **Not suitable for Rh. Factor screen**
Culture Negative Endocarditis	Clotted blood for Q fever and *C. psittaci* serology	Virology form

DIAGNOSIS	SPECIMEN	COMMENTS
Dengue	Clotted blood	Please supply full clinical details
Endocarditis	Obtain 3 sets of blood cultures before starting therapy - this may be within a 2-4 hour period regardless of any pyrexia.	See also collection of blood cultures
Epiglottitis	Blood cultures	
Enteric fever	Blood cultures Faeces and urine for culture	**Treat as high risk specimen** Widal tests are no longer recommended for the diagnosis of typhoid as the results may be affected by previous immunisation and by non-specific reactions
Farmer's lung	Clotted blood	
Filariasis	Clotted blood for ELISA Thick blood films - Haematology	
Fungal Infection of Skin/Hair/Nails	Skin scraping in universal container Portion of nail or hair stump for fungal examination	For further advice contact Mycology (RVH)
Giardiasis	Faeces examination for cysts Duodenal aspirate for trophozoites (transport to laboratory immediately)	
Glandular Fever	Clotted blood for Paul Bunnell	Also see Virology guide
Gonorrhoea	See Genital tract specimens	Consider referral to Genitourinary Medicine
H. pylori	Clotted blood for antibody *or* Urease breath tests (refer to gastroenterologist)	Antibody levels may remain elevated for prolonged period after successful eradication therapy
Hepatitis A, B, C	Clotted blood	**Treat Hepatitis B and C as high risk specimens** IgM available for Hepatitis A Virology form
Herpes Simplex	Vesicle fluid in virus transport medium Clotted blood	IgM available Virology form
Herpes Zoster	See chicken-pox	
HIV	See HIV testing Clotted blood for serology	
Influenza	Paired clotted blood samples for "atypical pneumonia" Respiratory secretions	Also see Virology guide
Legionnaire's Disease (Legionellosis)	Sputum/bronchoalveolar lavage for culture Paired clotted blood samples Urine for antigen EDTA blood sample for PCR	Please discuss culture with medical microbiologist before sending samples
Leishmaniasis	Clotted blood for IFAT Biopsy of lesion for histopathology	

DIAGNOSIS	SPECIMEN	COMMENTS
Leptospiral infection	Clotted blood for serology	
Lyme disease	Clotted blood for ELISA for *Borellia burgdorferi*	Please supply full clinical details for reference laboratory
Malaria	Thick & thin films – processed by Haematology Clotted blood for serology	Serology may be useful for retrospective diagnosis or investigation of splenomegaly or nephrotic syndrome with appropriate travel history
Measles	Clotted blood (IgM available)	Virology form
Meningitis (bacterial)	Blood culture CSF for culture/PCR (see P47) Throat/Nasopharyngeal swab Aspirate from skin lesions for culture EDTA blood sample for Meningococcal PCR	Please specifically request Meningococcal culture for throat swab
Mumps	Clotted blood (IgM available)	Virology form
Mycoplasma Infections	Paired clotted blood	Virology form
Parvovirus B19	Clotted blood (IgM available)	Virology form
Pneumocystis carinii	Bronchoalveolar lavage	
Pneumonia (Severe)	(Urinary Antigen Detection) Urine in a white capped sterile universal container Sputum/throat swab in viral transport medium (Respiratory PCR)	Can detect Streptococcus pneumonia and Legionella pneumophilia Can detect Mycoplasma pneumoniae, Chlamydia pneumoniae and 12 other viral respiratory pathogens
Poliomyelitis	Faeces sample	
Pregnancy	Early morning urine in white universal container	Tested for levels of HCG ≥ 25 IU/ml
Q Fever (Coxiella burnetii)	Clotted blood in yellow or red topped tube	Only request if patient's may have contact with rural animals
Rheumatoid Disease	Clotted blood	Both tests performed: 1 RA Latex 2 Rheumatoid arthritis particle agglutination (RAPA) titre
Respiratory Syncytial Virus	See Nasopharyngeal aspirate	
Rotavirus	Faecal specimen	
Rubella	Clotted blood (IgM available)	Virology Form
Schistosomiasis	Clotted blood Urine for ova Rectal biopsy Faecal specimen	Please include full clinical details for reference laboratory
Strongyloides	Clotted blood	Please include full clinical details for reference laboratory
Syphilis (VDRL/TPHA)	Clotted blood	VDRL and T. pallidum ELISA are two standard screening tests for syphilis. Positive results are given a third confirmatory test, EIA

DIAGNOSIS	SPECIMEN	COMMENTS
Tetanus		Clinical diagnosis
Toxocara	Clotted blood	
Toxoplasmosis	Clotted blood Clotted blood for IFAT clinical	Please include full clinical details for reference laboratory
Tuberculosis (pulmonary)	3 (minimum) early morning sputum samples Pleural fluid - up to 250mls in plain sterile container	**Treat as high risk specimen**
Tuberculosis (non-pulmonary)	4 consecutive urine samples split into 4 universal containers Swabs are rarely satisfactory and excised tissue or pus should be sent in universal containers Small biopsies may be sent in sterile saline to prevent drying out CSF where clinically indicated	**Treat as high risk specimen**
Vincent's Angina	Throat swab or swab of inflamed gum margins	State suspected diagnosis on request form
Whooping Cough	See pernasal swab	
Worms	Faecal specimen for ova & cysts Full worms/tapeworm segments may be sent to the laboratory in a universal container for ID	
Yersinia enterocolitica	Faecal sample Clotted blood	Please supply full clinical details. Faecal culture for Yersinia is undertaken on request/with appropriate clinical history.

HAEMATOLOGY & BLOOD BANK

CONTACT DETAILS

Ulster Hospital Switchboard		028 9048 4511
Blood Transfusion Direct Line		028 9041 1529
Consultant Head of Haematology	Dr M. El-Agnaf moulod.el-agnaf@setrust.hscni.net	
Consultant Haematologist	Dr M. Bowers margaret.bowers@setrust.hscni.net	
Consultant Haematologist	Dr J. Hamilton jeremy.hamilton@setrust.hscni.net	
Consultant Haematologist	Dr Y. L. Ong yonglee.ong@setrust.hscni.net	
Consultant's Secretary (Dr El-Agnaf & Dr Bowers)	Tracey Dickson	Ext 88696
Consultant's Secretary (Dr Hamilton & Dr Ong)	Catherine White	Ext 88697
Head Biomedical Scientist	Ken McLoughlin ken.mcloughlin@setrust.hscni.net	Ext 88577
Haematology Enquiries		Ext 88539
Coagulation Enquiries		Ext 88532 / 88533
Hospital Transfusion Enquiries		Ext 88529
Haemovigilance		Ext 88571
Out-of-Hours On-Call Bleep	On-Call Biomedical Scientist	7314 262

GENERAL INFORMATION

Specimens

All **routine samples** must be labelled, placed in the special plastic bag attached to the appropriate request form, and sealed. Samples must not be sent in standard envelopes via the internal post. All **high-risk samples** from suspected or known cases of TB, CJD, Hepatitis B & C, and HIV infection, etc must be treated as potentially infectious. They must be sent to the laboratory in an appropriate container, which must be labelled with a biohazard label "Danger of Infection - Take special care". **The biohazard label must be attached to both the specimen and request form**. All persons who use the laboratory service are reminded that they must comply with the legal requirements under the Health and Safety at Work Order (NI 1978) and COSHH regulations (2002).

Request Forms

Please complete these fully with as much clinical details as possible. Without full patient details computers cannot store accurate records and without full clinical details the laboratory cannot make useful comments and may perform inappropriate tests.
Patient labels should be used if available – the label must be placed within the space provided on the form. ***Addressograph labels may be used on Blood Transfusion request forms, however, all sample tubes for blood grouping and cross-matching must be hand written. Both the request form and sample tube must be signed.***

Request forms must contain the following essential criteria:

- Patient's forename and surname
- Patient's DOB and Hospital number and/or Health and Care number
- Date and time
- Consultant/GP name or code
- Destination for report
- Test request

TURNAROUND TIMES

Results for **emergency** requests are available **60 minutes** after receipt by the laboratory. **Ward requests** received between 9am and 4pm will have results available within **4 hours** of sample receipt. Where possible most **routine requests** are reported **within 1 working day** or within the turnaround time stated for a specific test. However the frequency and turnaround times of some investigations, including referrals, are of necessity, longer.

OUT-OF-HOURS EMERGENCY SERVICE

Do not use joint request forms for urgent haematology or coagulation requests, please use the urgent haematology (pink) or urgent coagulation (white) request forms. Outside of normal laboratory hours a medical officer can request all emergency blood tests by contacting the On-Call Haematology BMS. Please indicate where and to whom these reports should be returned or telephoned. To contact the On-Call Haematology BMS bleep number 262. The table below shows the tests that are available as an emergency.

HAEMATOLOGY & BLOOD TRANSFUSION TESTS AVAILABLE AS EMERGENCY REQUESTS
Activated Partial Thromboplastin Time (APTT) for unfractionated heparin monitoring
Blood Grouping, Antibody screening and Cross-matching
Blood and Blood Product Issue
Coagulation Screen
D-Dimer (specific request) for exclusion of VTE – needs a Wells score
Direct Coombs Test
Emergency Grouping of Maternal and Fetal samples for the Issue of Anti-D Immunoglobulin
ESR for suspected temporal arteritis
Estimation of Feto-Maternal Haemorrhage (Kleihauer)
Full Blood Count including platelets, automated differential and Manual DWCC
International Normalised Ratio (INR) – oral anticoagulant monitoring
Malaria Parasites
Sickle Cell Screen

GENERAL HAEMATOLOGY & SPECIAL INVESTIGATIONS

1. FBC & DWCC

Specimen Requirements: Adult: 1 x purple topped EDTA sample tube
Paediatric: 1 x pink topped tube

Adult Reference Ranges

FBC	UNIT	REFERENCE RANGE	
		MALE	FEMALE
Hb	g/dl	12 - 17	11.5 – 15.0
RCC	10^{12}/l	4.5 - 6.0	3.8 - 5.8
HCT / PCV	l/l	0.40 - 0.54	0.37 - 0.49
MCV	fl	84 - 101	84 - 101
MCH	pg	27 - 32	27 - 32
MCHC	g/dl	30 - 35	30 - 35
Platelet	10^9/l	150 - 400	150 - 400
WBC	10^9/l	4 - 11	4 - 11

DWCC	UNIT	REFERENCE RANGE	
		MALE	FEMALE
Neutrophil	x10^9/l	2.0 - 7.5	2.0 - 7.5
Lymphocyte	x10^9/l	1.5 - 4.0	1.5 - 4.0
Monocytes	x10^9/l	0.2 - 1.0	0.2 - 1.0
Eosinophils	x10^9/l	0.04 - 0.50	0.04 - 0.50
Basophils	x10^9/l	<0.01 - 0.10	<0.01 - 0.10

Paediatric Reference Ranges

FBC	UNIT	REFERENCE RANGE				
		AT BIRTH	DAY 3	1 MONTH	2-6 MONTHS	6-12 YEARS
Hb	g/dl	16.5 ± 3	18.5 ± 4	14 ± 3	11.5 ± 2	13.5 ± 2
RCC	10^{12}/l	6 ± 1	5.3 ± 1.3	4.2 ± 1.2	3.8 ± 0.8	4.6 ± 0.6
HCT / PCV	l/l	0.54 ± 0.1	0.56 ± 0.11	0.43 ± 0.12	0.35 ± 0.07	0.40 ± 0.05
MCV	fl	110 ± 10	108 ± 13	104 ± 19	91 ± 17	86 ± 8
MCH	pg	34 ± 3	34 ± 3	34 ± 6	30 ± 5	29 ± 4
MCHC	g/dl	33 ± 3	33 ± 4	33 ± 3	33 ± 3	34 ± 3
WBC	10^9/l	18 ± 8	15 ± 8	12 ± 7	12 ± 6	9 ± 4

DWCC	UNIT	REFERENCE RANGE				
		AT BIRTH		AT BIRTH		AT BIRTH
Neutrophil	x10^9/l	5 - 13	3 - 5	3 - 9	1.5 - 9.0	2 - 8
Lymphocyte	x10^9/l	3 - 10	2 - 8	3 - 16	4 - 10	1 - 5
Monocytes	x10^9/l	0.7 - 1.5	0.5 - 1.0	0.3 - 1.0	0.1 - 1.0	0.1 - 1.0
Eosinophils	x10^9/l	0.2 –-1.0	0.1 - 2.5	0.2 - 1.0	0.2 - 1.0	0.1 - 1.0

The values of haematology parameters change markedly during the first weeks and months of life. Reference data for the paediatric age groups should be referred to until the age at which normal adult ranges can be applied.

2. ESR

Specimen Requirements: Completed on FBC sample
Reference Range: 0 - 15 mm/hour (increases with age)

3. Reticulocytes

Specimen Requirements: Completed on FBC sample
Reference Range: 0 - 2 %

4. Malarial Parasites

Specimen Requirements: 1 x purple topped EDTA sample
Blood films will be made in the laboratory

5. Haptoglobins

Specimen Requirements: 1 x red topped clotted sample (sample must not be haemolysed)
Reference Range: Male 300 - 1700 mg/l Female 387 - 2108 mg/l

6. Sickle Cell Screen

Specimen Requirements: 1 x purple topped EDTA sample

7. Haemoglobin A_2, F

Specimen Requirements: 1 x purple topped EDTA sample
Reference Range: HbA_2 1.5 - 3.5% HbF <1%

8. Urinary Haemosiderin

Specimen Requirements: 20 ml urine in a universal container

9. Tests Available Following Consultation

The following tests are only available by arrangement with the laboratory BMS or Consultant Haematologist. This list is not exhaustive.

- PNH screen by flow cytometry — EDTA (1 x purple-topped sample tube)
- Red cell osmotic fragility — Heparinised or defibrinated blood
- Red blood cell membrane studies — EDTA (1 x purple -topped sample tube)
- Autohaemolysis — Defibrinated blood
- RBC enzymes (G6PD, PK) — EDTA (1 x purple -topped sample tube)
- Peripheral blood markers (flowcytometry) — EDTA (2 x purple -topped sample tube)
- Haemoglobin electrophoresis — EDTA (1 x purple -topped sample tube)
- Plasma viscosity — EDTA (1 x purple -topped sample tube)

10. Bone Marrow Examination

Morphological, Immunophenotypic and Cytogenetic features of blood cells and their precursors may contribute to the diagnosis, staging and monitoring of various haematological conditions. Bone marrow examinations (aspiration and trephine biopsy) are carried out under local anaesthetic and / or sedation. The test is by arrangement with a Consultant Haematologist.

COAGULATION

The website for Warfarin guidance can be accessed by typing
http://www.bcshguidelines.com/pdf/oralanticoagulation.pdf

For all coagulation tests addition of the correct volume of blood to the coagulation sample container is essential.

The following tests are routinely available:

- International Normalised Ratio (INR) for Warfarin monitoring.
- Activated Partial Thromboplastin Time (APTT) (unfractionated heparin monitoring)
- Coagulation Screen which includes:
    - Prothrombin time (PT)
    - Activated partial thromboplastin time (APTT)
    - Fibrinogen
- D-Dimer for VTE exclusion (Guidelines for the Treatment of Deep Vein Thrombosis 2009)

Other clotting tests, available on prior arrangement with Laboratory are:

- Thrombin clotting time (TCT) Reptilase time — 1 x blue top citrated sample
- Anti Xa assay — 1 x blue top citrated sample
- Lupus inhibitor — 2 x blue top citrated sample

Reference Ranges

TEST	REFERENCE RANGE
Prothrombin time	10 -14 seconds
APTT	23 - 34 seconds
Fibrinogen	1.8 - 3.5g/l
Thrombin time	15 - 22 seconds
D-Dimer	For VTE exclusion, result below lab cut off (Range on report – for details contact the Laboratory)

Paediatric Coagulation Studies
To minimise iatrogenic blood loss, small volume paediatric tubes (1 green topped sodium citrate tube filled to 1.3 ml mark) are available for Coagulation Studies. Normal Coagulation Parameters from birth to 18 years are shown below.

TEST (Unit)	REFERENCE RANGE				
	DAY 1	DAY 30	DAY 90	DAY 180	ADULT
PT (s)	13.0 (10.1-19.5)	11.8 (10.0-14.2)	11.9 (10.0-14.2)	12.3 (10.7-13.9)	10 - 14
INR	1.00 (0.53-1.62)	0.79 (0.53-1.26)	0.81 (0.53-1.26)	0.88 (0.61-1.17)	For warfarin, target variable
APTT (s)	42.9 (31.3-54.5)	40.4 (32.0-55.2)	37.1 (29.0-50.1)	35.5 (28.1-42.9)	23 - 34
TCT (s)	23.5 (19.0-28.3)	24.3 (19.4-29.2)	25.1 (20.5-29.7)	25.5 (19.8-31.2)	15 - 22
Fibrinogen (g/l)	2.83 (1.67-3.99)	2.70 (1.62-3.78)	2.43 (1.50-3.79)	2.51 (1.50-3.87)	1.8 - 3.5

The following coagulation tests are also available but must first be discussed with the On-Call Consultant Haematologist.

- Thrombophilia screen
  - Antithrombin
  - Protein C
  - Protein S
  - Activated protein C resistance
  - Lupus anticoagulant

  3 x blue top citrated samples
  - Factor V Leiden gene mutation
  - Prothrombin 20210 gene mutation

  1 x purple top EDTA sample
  - Anticardiolipin antibodies

  1 x yellow top clotted sample
- Platelet aggregation — 5 x blue top citrated samples
- Specific coagulation factor assays — 2 x blue top citrated samples
- HIT assay — 1 x red top clotted sample
- Platelet Function (PFA-100) — 2 x blue top citrated samples
- Von Willebrand Antigen — 2 x blue top citrated samples

  Von Willebrand Activity

BLOOD TRANSFUSION

Addressograph labels may be used on request forms, however, all sample tubes must be hand written. Both request form and sample tube must be signed.

A Blood Bank request form, complete with clinical details and full patient identification information, must accompany all specimens sent to the Blood Bank as per Trust Blood Transfusion Policy

All samples sent for blood grouping or cross matching will be held in the laboratory for 7 days. Plasma samples may be stored for longer if specifically requested.
Note: Minimum 4mls of blood sample is required

When requesting blood products it is vital to state the urgency with which those products are required, for example distinguish between next day routine operation, same day use or immediate use e.g. massive transfusion protocol (refer to maximum surgical blood ordering schedule).

Most requests will be dealt with on the same day, however where problems arise, e.g. patients with atypical red cell antibodies, a request may take longer. Where such problems are known to exist, the Blood Bank should be notified in advance.

Samples Required for Blood Transfusion and Turnaround Times

Emergency crossmatched blood is available **20 minutes*** after receipt by the laboratory. *This is dependent on a group and hold sample having been received and tested with no atypical antibodies.* Turnaround times for routine requests are shown below.

TEST	CONTAINER	ROUTINE TURNAROUND TIME
Antenatal Group and Antibody Screen	1 x NIBTS sample container (green)	R*
Antibody Investigations	2 x pink topped EDTA crossmatch sample container	4 working days*
Blood Group and Antibody Screen	1 x pink topped EDTA crossmatch sample container	1 working day
Cord Blood for Group and Direct Coombs	1 x purple topped sample	1 working day
Crossmatching	1 x pink topped EDTA crossmatch sample container	1 working day
Direct Coombs Test	1 x pink topped sample container	1 working day
Kleihauer Test	1 x purple topped sample	1 working day
Paediatric Sample	Group & Hold and Direct Coombs 1 x red topped sample container	1 working day
Rubella Screening	1 x NIBTS sample container (red)	R*

**Turnaround time dependant on referral laboratory – Northern Ireland Blood Transfusion Service*

Note: Adult blood group, antibody screen and cross match blood sample is required for all children over 4 months old.

Emergency Blood

Four units of Group O Rh(D) negative and Kell negative blood are held in the laboratory Blood Bank Issue Fridge. These units are clearly marked and if required in a dire emergency the Blood Bank must be contacted.

Crest Guidelines for Blood Transfusion Practice

All those who are involved in the transfusion process (sampling, prescribing, administration etc.) should be familiar with the current guidelines on safe transfusion practice that are listed below. The Hospital Transfusion laboratory has a copy of each of the following policies, procedures or guidelines for consultation if required.

- Blood Transfusion Policy
- Guidelines for Red Cell Transfusion
- Guidelines for the Management of Massive Blood Loss
- Guidelines for Neonates and Older Children
- Surgical Blood ordering tariff for elective Procedures in the Ulster Hospital
- Massive Blood Transfusion Protocol
- Jehovah Witness Information – Treatment without Blood Transfusion
- Blood Transfusion in Obstetrics Royal College of Obstetricians and Gynaecologists Guidelines

Transfusion Reactions (refer to Trust Blood Transfusion Policy)

If it is suspected that deterioration in the condition of a patient is related to transfusion of any blood product, please contact the Hospital Transfusion laboratory **without delay** to arrange investigation. The following samples will be required:

- The blood packs involved
- Blood sample: 2 x pink topped EDTA crossmatch tube.
- 10 mls urine in a universal container
- 1 x yellow topped SST sample container for urea and electrolyte and liver function tests.
- Complete Blood Transfusion reaction form.

All serious hazards of blood transfusion are the subject of a national anonymised reporting system (SABRE/SHOT)

The Handbook of Transfusion Medicine contains more detailed information about serious transfusion reactions. A copy is available for consultation in Hospital Transfusion laboratory, and an electronic version is available on the Trust intranet. Please report all suspected incidents to Blood Bank staff.

Surgical Blood Ordering Tariff for Elective Procedures

The following are suggested blood ordering tariffs for surgery in patients who have adequate pre-operative Haemoglobin. Anaemic patients may require pre-operative transfusion or additional blood cross-matched prior to surgery. In addition, if the Consultant in charge feels that in certain cases heavy blood loss might be expected, they may order blood prior to surgery.

G&S = group and screen *Number = units cross-matched*

General Surgery

- Cholecystectomy and exploration of common duct G&S
- Splenectomy G&S
- Laparotomy (Planned exploration) G&S
- Liver biopsy G&S
- Gastrostomy, ileostomy, colostomy G&S
- Oesophageal dilation G&S
- Oesophagectomy 2 units
- Hiatus hernia G&S

- Partial gastrectomy G&S
- Oesophagogastrectomy 2 units
- Hepatectomy 4 units
- Mastectomy (simple) G&S

Endocrine

- Thyroidectomy - partial/total G&S
- Parathyroidectomy G&S
- Adrenalectomy 3 units
- Pancreatectomy-partial / Whipple 4 units

Colorectal Surgery

- Rectum-pouch; resection/excision etc. 2 units
- Antero-perineal resection 2 units
- Intra-abdominal colectomy etc. 2 units
- Rectoplexy G&S

Orthopaedics

- Removal hip pin or femoral nail (nailing fractured neck of femur) G&S
- Hemiarthroplasty 2 units
- Internal fixation of femur G&S
- Internal fixation-tibia or ankle G&S
- Arthroplasty-total knee or shoulder G&S
- Changing hip prosthesis 2 units
- Dynamic hip screw 2 units
- Osteotomy/bone biopsy (except upper femur) G&S
- Bone graft from iliac crest G&S

Urology

- Cystectomy 4 units
- Nephrectomy 2 units
- Nephrectomy and exploration of Vena Cava 6 units
- Open Prostatectomy 2 units
- TURP G&S
- TUR bladder tumour G&S
- Cystotomy G&S
- Reimplantation of ureter G&S
- Urethroplasty 2 units

Endoscopy

- ERCP G&S

Plastic Surgery

- Major head and neck dissection G&S
- Other head and neck procedure G&S
- Abdominoplasty G&S
- Mammoplasty G&S
- Breast reduction G&S
- Tram Flap 2 units

Maxillo-facial Surgery

- Bimaxillary Osteotomy 2 units

Obstetrics and Gynaecology

- LSCS G&S
- ERPC G&S
- Hydatiform mole G&S
- Placenta praevia 2 units
- Retained Placenta G&S
- APH/PPH G&S
- Hysterectomy: abdominal or vaginal G&S
- Operative Laparotomy G&S

Blood Products Available from Blood Bank

The following table provides a guide to the products available from the hospital Blood Bank, along with a brief summary of their respective characteristics and clinical use. Readers are referred to the Handbook of Transfusion Medicine 4th Edition (available from Blood Bank and on the Hospital Intranet) for further details.

The use of the following products must be discussed with a Consultant Haematologist.

- Coagulation factor replacement products
- Immunoglobulin therapy in immune thrombocytopenia

Traceability (refer to Trust Traceability of Blood and Blood Products Policy on Trust intranet)

Traceability forms are required for:
Red Cells
Fresh frozen plasma
Cryoprecipitate
Platelet concentrate

Product Characteristics and Use

PRODUCT	CHARACTERISTICS AND USE
Cryoprecipitate	Pooled, product from five donors (Adult therapeutic dose 2 packs) Shelf life 2 years (frozen) at -30°C Once thawed infusion must be completed within 4 hours Product contains Factor VIII > 350 iu. Fibrinogen > 700 mg Source of Fibrinogen
Fresh Frozen Plasma	Shelf life 1 year (frozen) at -30°C Once thawed infusion must be completed within 24 hours Should be ABO compatible Used for specific indications only: 1. Replacement of coagulation factors where a specific or combined factor concentrate is unavailable 2. DIC (Disseminated Intravascular coagulation) 3. TTP (Thrombotic thrombocytopenic purpura) 4. In severe bleeding for reversal of Warfarin where activated factors are unavailable 5. Disturbed coagulation in massive transfusion, liver failure, CABG, surgery and some paediatric indications

PRODUCT	CHARACTERISTICS AND USE
Human Albumin 4.5% solution	Issued in 500ml bottle Stored between 2-25°C Specific requests for this product require Consultant request
Human Albumin 20% Solution	Issued in 50/100ml bottles This product is requested on Blood Transfusion Request form and is issued with similar documentation to all other blood components Stored between 2-25°C Mostly used in hypoproteinaemia *Please return any unused bottles immediately to Blood Bank*
Human Immunoglobulin	For intravenous use only. Unit varies with supplier, normally 2.5/5/10g amounts Storage usually at 4°C but check manufacturer's information
Platelet Concentrate	Shelf life 5 days when stored on a platelet agitator at 22°C Should be infused immediately after removal from controlled storage
Prothrombin Complex Concentrate	For rapid reversal of Warfarin Trust Guidelines: Guidelines for the rapid reversal of warfarin coagulopathy in patients with life threatening haemorrhage and intracranial haemorrhage (a) Intracranial bleed (b) Retroperitoneal bleed (c) Intra-ocular bleed (d) Muscle bleed with compartment syndrome (e) Pericardial (f) Active bleed with hypotension or 2g fall in Hb **Contact Haematologist ASAP** PCC (octaplex) 30iu/kg – INR > 4 PCC (octaplex) 15iu/kg – INR < 4 Vitamin K 5mg IV Check INR and APTT post infusion and at 4 hours PCC is relatively contra-indicated in DIC, acute liver failure and thrombosis. Discuss with Haematologist
Red Cells	Storage temperature 2 to 6°C Shelf life 35 days Longest time from leaving controlled storage temperature to completing infusion 4 hours Must be compatible with recipients ABO and Rh(D) type ORh negative available for specific emergency situations CMV negative available for specific indications Irradiated red cells available for specific indications

For all other products, call Blood Bank, Ext 88529.

POINT OF CARE TESTING (POCT)

The laboratory supports POCT in line with the Trust Point of Care Policy. Whilst the use of POCT devices can aid successful outcomes for patients, there is also a significant potential for causing patient harm. The Trust POCT Committee oversees POCT within the Trust and the Clinical Biochemistry Department will assist with ensuring that the analytical performance of devices and user training is adequate and quality controlled. All applications for new or replacement POCT devices must be sent to the POCT Committee for approval. Please contact the laboratory for advice relating to POCT (Ext 88706 / 88541 / 88542).

All policies, standard operating procedures and competency assessments for POCT are available on the Trust Intranet. These include:

- Point of Care Testing Policy [LABC POCT-1]
- Blood Gas Measurement (SCBU/DSS) [LABC POCT-2]
- Bayer Clinitek Status [LABC POCT-11]
- Blood Gas Measurement (ICU) [LABC POCT-12]
- Blood Gas 18 Month Competency Assessment [LABC POCT-13]
- Clinitek Status Urinalysis Competency [LABC POCT-14]
- I-Stat Competency [LABC POCT-15]
- POCT Pregnancy Competency [LABC POCT-16]
- Clinitest hCG Pregnancy Test [LABC POCT-17]
- hCG Pregnancy Test Result Log [LABC POCT-18]
- Abbott I-Stat [LABC POCT-19]
- DCA 2000+ HbA1c Analyser [LABC POCT-20]
- Inform II [LABC POCT-21]
- Performa Glucose Meter [LABC POCT-24]

To access these policies, standard operating procedures and competency assessments, either click on the hyperlinks above or follow these steps:

- Bring up the Trust Intranet, http://setintranet/, in Internet Explorer
- Select Policies & Guidelines on the left hand tab
- Select Service Specific
- Select Hospital Services
- Select Labs
- Use the search window to search for the specific document or select one of the sub-categories and this will give you a list of documents.
- Select the document, and then select it again to open it.

VIROLOGY

The Regional Virus Reference Laboratory (RVL) is based at the Royal Victoria Hospital (RVH), and is part of the Belfast Health and Social Care Trust. All virology requests will be transported to the RVL from the Ulster Hospital Laboratory. The Ulster Hospital Laboratory only acts as a post office for these samples. Normal laboratory hours are between 9am and 5.30pm, Monday to Thursday, and between 9am and 5pm on Friday. Contact details can be found below:

RVH Switchboard	028 9024 0503	
Consultant Virologists	Dr Peter Coyle peter.coyle@belfasttrust.hscni.net	Ext 35239
Consultant Virologist	Dr Conall McCaughey conall.mccaughey@belfasttrust.hscni.net	Ext 35239
Principal Virologist	Ms Dorothy Wyatt dorothy.wyatt@belfasttrust.hscni.net	Ext 34498
Out-of-Hours Emergency Service	Contact RVH Switchboard and ask for the On-Call Virology BMS	028 9024 0503

For the further details on the service provided by the Regional Virus Reference Laboratory, including tests and specimen types, please see the Belfast Health and Social Care Trust Laboratory User Manual, available from the Belfast Health and Social Care Trust website. To access the User Manual:

- Go to the Belfast Health and Social Care Trust website http://www.belfasttrust.hscni.net/
- Select Services
- Select L
- Select Laboratory and Mortuary Services
- Select the link for the User Manual

Alternatively, use this link http://www.belfasttrust.hscni.net/pdf/Lab_UserManual_2010.pdf

TISSUE PATHOLOGY

The Belfast Health and Social Care Trust Laboratories, based at the Belfast City Hospital (BCH) and Royal Victoria Hospital (RVH), provides the Tissue Pathology service. All tissue pathology requests will be transported to BCH/RVH from the Ulster Hospital Laboratory. The Ulster Hospital Laboratory only acts as a post office for these samples. The Belfast Health and Social Care Trust Tissue Pathology provides the following services at the following sites:

- BCH – Cytopathology (Gynae and Non-Gynae) and Histopathology
- RVH – Cytopathology (Non-Gynae), Histopathology and Neuropathology

Histopathology and Cytopathology samples from GP surgeries and hospital inpatients and outpatients collected from the Ulster Hospital are analysed in RVH. Those collected from Ards Hospital are analysed in BCH. Contact details can be found below:

BCH Switchboard	028 9032 9241	
RVH Switchboard	028 9024 0503	
Histopathology	BCH Consultants	Ext 2281 / 2497 / 3090 / 2606
	BCH Laboratory	Ext 2722
	RVH Consultants	Ext 32676 / 33324 / 33274
	RVH Laboratory	Ext 32170
Cytopathology	BCH Consultants – Cervical	Ext 3101 / 2987 / 2214
	BCH Consultants – Non-cervical	Ext 3090 / 2035 / 2606 / 2332
	BCH Laboratory – Non-cervical	Ext 2132
	RVH Consultants – Non-cervical	Ext 32676 / 32536 / 32563
	RVH Laboratory – Non-cervical	Ext 33019
Neuropathology	RVH Consultants	Ext 32584 / 32613
	RVH Laboratory	Ext 32119

For the further details on the service provided by the Belfast Health and Social Care Trust Tissue Pathology Laboratories, including tests and specimen requirements, please see the Belfast Health and Social Care Trust Laboratory User Manual, available from the Belfast Health and Social Care Trust website. To access the User Manual:

- Go to the Belfast Health and Social Care Trust website http://www.belfasttrust.hscni.net/
- Select Services
- Select L
- Select Laboratory and Mortuary Services
- Select the link for the User Manual

Alternatively, use this link http://www.belfasttrust.hscni.net/pdf/Lab_UserManual_2010.pdf

IMMUNOLOGY

The Belfast Health and Social Care Trust Regional Immunology Laboratory, based at the Royal Victoria Hospital (RVH), provides the Immunology service for the whole of Northern Ireland. All immunology requests will be transported to the RVH from the Ulster Hospital Laboratory. The Ulster Hospital Laboratory only acts as a post office for these samples.

For laboratory enquiries, the Laboratory may be contacted via its direct line (028 906 32689).
For advice and interpretation, contact the Consultant Immunologist, Dr JDM Edgar (028 906 32663), or one of the Consultant Clinical Scientists, Dr AD Crockard (02890 633853), or Dr SA McMillan (02890 632664).

The immunology request form has a light brown strip along the top, middle and bottom. Supplies may be obtained by telephoning the laboratory (028 906 32689 / 32642). It is essential that full patient identification is provided. Samples with inadequate identifying information will be discarded. Clinical information is essential to ensure the highest quality service.

For the further details on the service provided by the Belfast Health and Social Care Trust Immunology Laboratory, including tests and specimen requirements, please see the Belfast Health and Social Care Trust Laboratory User Manual, available from the Belfast Health and Social Care Trust website. To access the User Manual:

- Go to the Belfast Health and Social Care Trust website http://www.belfasttrust.hscni.net/
- Select Services
- Select L
- Select Laboratory and Mortuary Services
- Select the link for the User Manual

Alternatively, use this link http://www.belfasttrust.hscni.net/pdf/Lab_UserManual_2010.pdf

REFERENCE DATA

Guidelines for Body Weight

Values given are without clothes. For light dress (without coat) add approximately 0.5 kg.

Body Mass Index (BMI) = weight (kg) / height^2 (m)

MEN

Height (m)	Acceptable average (kg)	Acceptable weight range (kg)	Obese (kg)*
1.58	55.8	51-64	77
1.60	57.6	52-65	78
1.62	58.6	53-66	79
1.64	59.6	54-67	80
1.66	60.6	55-69	83
1.68	61.7	56-71	85
1.70	63.5	58-73	88
1.72	65.0	59-74	89
1.74	66.5	60-75	90
1.76	68.0	62-77	92
1.78	69.4	64-79	95
1.80	71.0	65-80	96
1.82	72.6	66-82	98
1.84	74.2	67-84	103
1.88	77.6	71-88	106
1.90	79.3	73-90	108
1.92	81.0	75-93	112
BMI	22.0	20.1- 25.0	30.0

WOMEN

Height (m)	Acceptable average (kg)	Acceptable weight range (kg)	Obese (kg)*
1.45	46.0	42-53	64
1.48	46.5	42-54	65
1.50	47.0	43-55	66
1.52	48.5	44-57	68
1.54	49.5	44-58	70
1.56	50.4	45-58	70
1.58	51.3	46-59	71
1.60	52.6	48-61	73
1.62	54.0	49-62	74
1.64	55.4	50-64	77
1.66	56.8	51-65	78
1.68	58.1	52-66	79
1.70	60.0	53-67	80
1.72	61.3	55-69	83
1.74	62.6	56-70	84
1.76	64.0	58-72	86
1.78	65.3	59-74	89
BMI	20.8	18.7-23.8	28.6

* Value and above for all entries.

Prefixes and Symbols

Prefix	Symbol	Factor	Numerical value
tera	T	10^{12}	1 000 000 000 000
giga	G	10^{9}	1 000 000 000
mega	M	10^{6}	1 000 000
kilo	k	10^{3}	1 000
hecto	h	10^{2}	100
deka	da	10^{1}	10
deci	d	10^{-1}	0.1
centi	c	10^{-2}	0.01
milli	m	10^{-3}	0.001
micro	µ	10^{-6}	0.000 001
nano	n	10^{-9}	0.000 000 001
pico	p	10^{-12}	0.000 000 000 001
femto	f	10^{-15}	0.000 000 000 000 001
atto	a	10^{-18}	0.000 000 000 000 000 001

Conversion Factors

1 inch = 2.54 centimetres
1 foot = 0.3048 metre
1 yard = 0.9144 metre

1 millimetre = 0.03937 inch
1 centimetre = 0.3937 inch
1 decimetre = 0.3281 foot

1 square inch = 6.4516 square centimetres
1 square centimetre = 0.1550 square inch

1 cubic inch = 16.387 cubic centimetres
1 cubic centimetre = 0.061 cubic inch

1 ounce = 28.35 grams
1 pound = 453.59 grams

1 gram = 0.035 ounce
1 hectogram = 3.527 ounces

Temperature conversion. $\text{Celsius}^0 = 5/9\ (F^0 - 32^0)$

$\text{Fahrenheit}^0 = 9/5\ C^0 + 32^0$

Concentration conversion 1 micromol / litre = $\frac{\text{molecular weight}}{1000}$ mg / litre

Conversion formulae for mg.% to mEq.L. $\frac{\text{mg.\% x 10 x valence}}{\text{atomic weight}} = \text{mEq.L.}$

In the case of gases $\frac{\text{vol.\% x 10}}{22.4} = \text{mM./L.}$

To convert mEq./L. to mg.% $\frac{\text{mEq./L. x atomic wt.}}{10 \times \text{valence}} = \text{mg.\%}$

In the case of gases $\frac{\text{mM./L. x 22.4}}{10} = \text{vol.\%}$

Pounds to Kilograms

lb	kg	stones	kg	mL	fl.oz	inch	cm
1	0.45	1	6.35	50	1.8	1/8	0.32
2	0.91	2	12.70	100	3.5	1/4	0.64
3	1.36	3	19.05	150	5.3	1/2	1.27
4	1.81	4	25.40	200	7.0	3/4	1.91
5	2.27	5	31.75	500	17.6	1	2.54
6	2.72	6	38.10	1000	35.2	2	5.08
7	3.18	7	44.45			3	7.62
8	3.63	8	50.80			4	10.16
9	4.08	9	57.15			5	12.70
10	4.54	10	63.50			6	15.24
11	4.99	11	69.85			7	17.78
12	5.44	12	76.20			8	20.32
13	5.90	13	82.55			9	22.86
14	6.35	14	88.90			10	25.40
		15	95.25			20	50.80
		16	101.6			30	76.20
		17	107.95			40	101.60
		18	114.31			50	127.00
		19	120.66			60	152.40
		20	127.01			70	177.80
						80	203.20

Mass
1 kilogram (kg) = 1000 grams (g)
1 gram (g) = 1000 milligrams (mg)
1 milligram (mg) = 1000 micrograms
1 microgram (mg) = 1000 nanograms
1 nanogram = 1000 picograms

Volume
1 litre = 1000 millilitres (ml)
1 millilitre = 1000 microlitres
1 pint is approximately 575 ml

Other units
1 kilocalorie (kcal) = 4186.8 joules (J)
1000 kilocalories (kcal) = 4.1868 megajoules (MJ)
1 megajoule (MJ) = 238.8 kilocalories (kcal)
1 millimetre of mercury (mmHg) = 133.3 pascals (Pa)
1 kilopascal (kPa) = 7.5 mmHg (pressure)

Table of Weights for Males

HEIGHT (without shoes)	Desirable Weight (Age 25 and over)		
	Minimum	Mean	Maximum
5' 2" 1.58 m	8 st 3 lb 115 lb 52 kg	9 st 1 lb 127 lb 58 kg	10 st 4 lb 114 lb 65 kg
5' 3" 1.60 m	8 st 6 lb 118 lb 54 kg	9 st 4 lb 130 lb 59 kg	10 st 8 lb 148 lb 67 kg
5' 4" 1.63 m	8 st 9 lb 121 lb 55 kg	9 st 7 lb 133 lb 60 kg	10 st 12 lb 152 lb 69 kg
5' 5" 1.65 m	8 st 12 lb 124 lb 56 kg	9 st 11 lb 137 lb 62 kg	11 st 2 lb 156 lb 71 kg
5' 6" 1.68 m	9 st 2 lb 128 lb 58 kg	10 st 1 lb 141 lb 64 kg	11 st 7 lb 161 lb 73 kg
5' 7" 1.70 m	9 st 6 lb 132 lb 60 kg	10 st 5 lb 145 lb 66 kg	11 st 12 lb 166 lb 75 kg
5' 8" 1.73 m	9 st 10 lb 136 lb 62 kg	10 st 9 lb 149 lb 68 kg	12 st 2 lb 170 lb 77 kg
5' 9" 1.75 m	10 st 0 lb 140 lb 64 kg	10 st 13 lb 153 lb 69 kg	12 st 6 lb 174 lb 79 kg
5' 10" 1.75 m	10 st 4 lb 144 lb 65 kg	11 st 4 lb 158 lb 72 kg	12 st 11 lb 179 lb 81 kg
5' 11" 1.80 m	10 st 8 lb 148 lb 67 kg	11 st 8 lb 162 lb 73 kg	13 st 2 lb 184 lb 83 kg
6' 0" 1.83 m	10 st 12 lb 152 lb 69 kg	11 st 13 lb 167 lb 76 kg	13 st 7 lb 189 lb 86 kg
6' 1" 1.85 m	11 st 2 lb 156 lb 71 kg	12 st 3 lb 171 lb 78 kg	13 st 12 lb 194 lb 88 kg
6' 2" 1.88 m	11 st 6 lb 160 lb 73 kg	12 st 8 lb 176 lb 80 kg	14 st 3 lb 199 lb 90 kg

Table of Weights for Females

HEIGHT (without shoes)	DESIRABLE WEIGHT (Age 25 and over)		
	Minimum	**Mean**	**Maximun**
4' 10" 1.47 m	6 st 12 lb 96 lb 44 kg	7 st 9 lb 107 lb 49 kg	9 st 13 lb 125 lb 57 kg
4' 11" 1.50 m	7 st 1 lb 99 lb 45 kg	7 st 12 lb 110 lb 50 kg	9 st 2 lb 128 lb 58 kg
5' 0" 1.52 m	7 st 4 lb 102 lb 46 kg	9 st 1 lb 113 lb 51 kg	9 st 5 lb 131 lb 59 kg
5' 1" 1.54 m	7 st 7 lb 105 lb 48 kg	8 st 4 lb 116 lb 53 kg	9 st 8 lb 134 lb 61 kg
5' 2" 1.58 m	7 st 10 lb 108 lb 49 kg	8 st 8 lb 120 lb 54 kg	9 st 12 lb 138 lb 63 kg
5' 3" 1.60 m	7 st 13 lb 111 lb 50 kg	8 st 11 lb 123 lb 56 kg	10 st 2lb 142 lb 65 kg
5' 4" 1.63 ,	8 st 2 lb 114 lb 52 kg	9 st 2 lb 128 lb 58 kg	10 st 6 lb 146 lb 66 kg
5' 5" 1.65 m	8 st 6 lb 118 lb 54 kg	9 st 6 lb 132 lb 60 kg	10 st 10 lb 150 lb 68 kg
5' 6" 1.68 m	8 st 10 lb 122 lb 55 kg	9st 10 lb 136 lb 62 kg	11 st 0 lb 154 lb 70 kg
5' 7" 1.70 m	9 st 0 lb 126 lb 57 kg	10 st 0 lb 140 lb 64 kg	11 st 4 lb 158 lb 72 kg
5' 8" 1.73 m	9 st 4 lb 130 lb 59 kg	10 st 4 lb 144 lb 65 kg	11 st 9 lb 163 lb 74 kg
5' 9" 1.75 m	9 st 8 lb 134 lb 61 kg	10 st 8 lb 148 lb 67 kg	12 st 0 lb 168 lb 76 kg
5' 10"	9 st 12 lb 138 lb	10 st 12 lb 152 lb	12 st 6 lb 174 lb

APPENDIX A: Outbreak of Vomiting and Diarrhoea

In the event of a vomiting and/or diarrhoea outbreak, contact the Infection Prevention Control team (Ext 88562). Faeces samples should be obtained using the protocol in the Microbiology section and sent for organisms/sensitivities (for investigations of food poisoning) and Clostridium difficle.

In the event that a viral outbreak is suspected the following applies:

Vomitus samples should be obtained using a clean kidney dish or other clean receptacle and put into a universal container. Both faeces and vomitus samples should have a virology form completed then sent to the laboratory for onward transfer to the Regional Virus Reference Laboratory (RVL) based at the Royal Victoria Hospital. The Laboratory /Infection Control team should be contacted by telephone so that the RVL can be requested to process the samples as an outbreak.

APPENDIX B: Referral Laboratory Addresses

Clinical Biochemistry Laboratory
Belfast City Hospital
Lisburn Road
Belfast
BT9 7AB

Clinical Biochemistry Laboratory
Royal Victoria Hospital
Grosvenor Road
Belfast
BT12 6BA

Haematology Laboratory
Belfast City Hospital
Lisburn Road
Belfast
BT9 7AB

Haematology Laboratory
Royal Victoria Hospital
Grosvenor Road
Belfast
BT12 6BA

Immunology Laboratory
Royal Victoria Hospital
Grosvenor Road
Belfast
BT12 6BA

Microbiology Laboratory
Royal Victoria Hospital
Grosvenor Road
Belfast
BT12 6BA

Northern Ireland Blood Transfusion Service (NIBTS)
Belfast City Hospital Complex
Lisburn Road
Belfast
BT9 7TS

Regional Virus Reference Laboratory
Royal Victoria Hospital
Grosvenor Road
Belfast
BT12 6BA