



# Letterkenny University Hospital **BIOCHEMISTRY USER MANUAL**

## Change Description:

CHANGES FOR REV 13:

1. Update to Table 1 Biochemistry tests
2. Update to Table 5 Biochemistry referral tests
3. Paediatric ranges added for calcium: creatinine ratio in table 1.
4. eGFR based on 2009 CKD-EPI creatinine equation.

**Effective Date: 06.03.2024**

**Due for Review: 06.03.2026**

## **GUIDE TO USING THIS MANUAL**

This User Manual has been prepared in conjunction with The Pathology Department User Manual (MP-GEN-0064) to inform the users of the Saolta University Health Care Group, Letterkenny University Hospital, Pathology Department of which services are available within the Pathology Department and how to obtain the services required.

**PLEASE REFER TO DOCUMENT MP-GEN-0064, THE PATHOLOGY DEPARTMENT GENERAL USER MANUAL FOR GUIDANCE ON USING THESE DOCUMENTS.**

Documents are available on Q-Pulse and also on the HSE website <http://www.hse.ie/luhPathology>.



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## 1. INTRODUCTION

### Service Description

The Biochemistry Department is responsible for measurement of clinical constituents (ranging from ions to complex proteins) of body fluids, for use not only in diagnosis of disease, but also in monitoring the course of disease, the effect of treatment, prognosis and screening. This Department also provides analysis of hormones, drugs and tumour markers. The Biochemistry Laboratory is INAB accredited to ISO15189 since March 2020. The scope of accreditation can be accessed on the INAB website [www.inab.ie](http://www.inab.ie). Reference 210MT.

The Biochemistry Medical Scientist on-call can be contacted in the laboratory on 173-814 or via switchboard (by dialling "0").

This is a guide to the Biochemistry laboratory in Letterkenny University hospital and aims to detail sample requirements for the repertoire of tests that are performed in house or sent out to referral laboratories. This handbook has been prepared to familiarize the user with departmental structure and policies as well as specific test requirements.

### Contact Details

<b>Laboratory Phone Numbers</b>	<b>On call</b>	<b>173814</b>
	<b>Biochemistry Reception</b>	<b>074 91 23557</b>
	<b>Main Laboratory</b>	<b>074 91 23559</b>
	<b>Point of Care Office</b>	<b>074 91 04614</b>
<b>Name</b>	<b>Job title</b>	<b>Contact / Email</b>
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## 2. BIOCHEMISTRY LABORATORY TESTS SAMPLE ACCEPTANCE POLICY

Please refer to the **General Information User Guide, MP-GEN-0064, Section 8 for sample** and request form labeling requirements. This manual is available on Q-Pulse and the HSE website <http://www.hse.ie/luhPathology>

## 3. BIOCHEMISTRY TEST INDEX AND REFERENCE RANGES

### Routine Biochemistry Tests (Time dependent analytes highlighted in Purple)

#### Laboratory Accreditation

The Biochemistry Laboratory is accredited to ISO15189 since March 2020.

The scope of accreditation for the Biochemistry Laboratory, Pathology department at Letterkenny University Hospital is controlled by the Irish National Accreditation Board (INAB) and detailed in Scope Registration Number 210MT on the INAB website [www.inab.ie](http://www.inab.ie).

### 3.1 EXPECTED VALUES/REFERENCE RANGES

**Table 1:** Biochemistry Tests including sample type, reference ranges and turnaround time. All tests listed in this table are INAB accredited unless indicated (§). This does not affect the validity of the result.

Test	Specimen type		Reference Range	Additional Information	Turnaround time
<b>Albumin</b>	Blood	Serum (Gold top tube)	35 - 52 g/L	See report for paediatric ranges	<24Hours or STAT samples <75mins
<b>Alcohol</b>	Blood	Serum (Gold top tube)	<10 mg/dl	Not for medico-legal purposes	<24Hours or STAT samples <75mins
<b>Alk.Phosphatase</b>	Blood	Serum (Gold top tube)	40-129 U/L (Male) 35-104 U/L (Female)	See report for paediatric ranges.	<24Hours or STAT samples <75mins
<b>ALT</b>	Blood	Serum (Gold top tube)	0-41 UL (Male) 0- 33 U/L (Female)		<24Hours or STAT samples <75mins

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Test	Specimen type		Reference Range	Additional Information	Turnaround time
Alpha-1 Anti Trypsin§	Blood	Serum (Gold top tube)	0.9 – 2.00 g/l	**AAT <1.00g/l are sent to Royal College of Surgeons for Phenotyping analysis	<24Hours*
Alpha Fetoprotein	Blood	Serum (Gold top tube)	0-7.0 ng/ml	Should not be used as a screening test.	<24Hours *
Hepatitis B antibody (AHB) §	Blood	Serum (Gold top tube)	Refer to interpretation on report		<24Hours*
Ammonia	Blood	EDTA (purple top tube)	Range (umol/l) Male 16-60 Female 11-51	On ice and transported to Lab immediately. <u>Must inform Lab before taking sample</u>	<24Hours *
Amylase	Blood	Serum (Gold top tube)	28-100 U/L		<24Hours or STAT samples <75mins
AST	Blood	Serum (Gold top tube)	0-40 U/L (Male) 0-32 U/L (Female)		<24Hours or STAT samples <75mins
Anti Streptolysin O (ASO)	Blood	Serum (Gold top tube)	IU/ml <18 0 – 150 >18 0 – 200		<24Hours*
Beta HCG	Blood	Serum (Gold top tube)	<i>Please contact the Biochemistry laboratory for gestational ranges if required</i> (mIU/ml) Male <2 Non-pregnant premenopausal females <1 Post-menopausal females <7.0	Tumour Marker and to exclude ectopic pregnancy	<24Hours or STAT samples <120mins
Bence Jones Protein	Full EMU	Plain 24H Urine Container	See report form	24 hr Collection container (Available from Laboratory)	7 Days
Beta 2 Microglobulin	Blood	Serum (Gold top)	<60 0.8-2.4 mg/L >60 0.2 - 3.0 mg/L		<24Hours*



Test	Specimen type		Reference Range	Additional Information	Turnaround time
Bicarbonate	Blood	Serum (Gold top tube)	22-29 mmol/L		<24Hours or STAT samples <75mins
Bilirubin (Total)	Blood	Serum (Gold top tube)	Range (umol/L) Male <24 Female <15 <4D old <290		<24Hours or STAT samples <75mins
Bilirubin (Direct)	Blood	Serum (Gold top tube)	<5.0 umol/L		<24Hours or STAT samples <75mins
Blood Gases	Arterial Blood	Arterial Blood Balanced Heparinised Syringe.	(kPa) PH: 7.35-7.45 PO2: 4.5-6.1 pCO2: 12.0-15.0 (mmol/L) HCO3: 20-26 TCO2: 23-27 BE: +/-2.0	Must inform Lab before taking sample Expel any air bubble. Mix sample. <u>Send to the lab immediately.</u> <u>Needle must NOT be left in syringe.</u> <u>Label sample clearly</u>	STAT sample <20mins
C3/C4	Blood	Serum (Gold top tube)	(g/L) C3 0.90 – 1.80 C4 0.10 – 0.40		24Hours*
Calcium	Blood	Serum (Gold top tube)	<b>Age Range (mmol/l)</b> 18-60 2.15 - 2.50 60-90 2.20 - 2.55 >90 2.05 - 2.40	See report for paediatric ranges	<24Hours or STAT samples <75mins
	24H Urine	Acid added to 24H container	Adult 2.5–7.5 mmol/24hr Male 9000 – 19000µmol/24Hrs Female 6000-13000µmol/24Hrs	24 hr urine required 24 hr Collection container (Available from Laboratory)	<24Hours



Test	Specimen type		Reference Range	Additional Information	Turnaround time
Calcium/Creatinine ratio urine	Random Urine (only for Paeds)	<b>NB</b> Universal will only be accepted for paediatric patients. Send to lab immediately after collection.	Age Range(mmol/mmol) (years) >18 0.14 - 0.76 >10 0.03 - 0.68 >7 0.03 - 0.70 >5 0.03 - 0.85 >3 0.06 - 1.16 >2 0.06 - 1.14 >1 0.08 - 1.58 0 0.08 - 2.28  Calcium:Creatinine ratio is calculated.	Results must be considered in conjunction with age, sex and clinical status of the patient.	<24Hours*
CCP (Citrullinated Cyclic Peptide)	Blood	Serum (Gold Top)	0-17 U/ml		<24Hours*
CEA	Blood	Serum (Gold top tube)	Age Range(ng/ml) <40 0 - 4.7 >40 0 - 5.2	Should not be used as a screening test.	<24Hours*
CA-15.3	Blood	Serum (Gold top tube)	0 – 28.5 U/ml		<24Hours*
CA-19.9	Blood	Serum (Gold top tube)	0 - 39 U/ml		<24Hours*
CA-125	Blood	Serum (Gold top tube)	0 - 35 U/ml  <i>Based on NCCP Guidelines. Refer to NCCP for more details.</i>		<24Hours*
Carbamazepine	Blood	Serum (Gold top tube)	4 - 12 ug/ml Therapeutic range		<24Hours*
Chloride	Blood	Serum (Gold top tube)	98 - 106 (mmol/l)	See report for paediatric ranges	<24Hours or STAT samples <75mins
Cholesterol	Blood	Serum (Gold top tube)	< 5.2 mmol/L	Fasting	<24Hours *
HDL Cholesterol	Blood	Serum (Gold top tube)	Sex Range (mmol/L) No Risk Moderate Risk High Risk Male >1.45 0.90 – 1.45 <0.90 Female >1.68 1.15 – 1.68 <1.15  Fasting Sample		<24Hours*
LDL Cholesterol	Blood	Serum (Gold top tube)	0 – 2.59 mmol/L	Fasting	<24Hours



Test	Specimen type		Reference Range	Additional Information	Turnaround time
Cortisol	Blood	Timed Serum (Gold top tube)	Morning 0600-1000hrs 133 – 537nmol/L Afternoon 1600-2000hrs 68.2– 327nmol/L  Note: Due to Circadian rhythm of Cortisol levels, in serum and plasma, sample collection time must be noted.		<24Hours*
Cortisol (Short Synacthen Investigation: Investigation of suspected adrenal insufficiency)	Blood	Timed Serum (Gold top tube) at pre dose, 30 minute and 60 minutes post synacthen dose	Adrenal insufficiency is excluded by a rise in basal cortisol >200nmol/L and a 30 min and 60 min value >450nmol/L.  Baseline and post Synacthen cortisol values do not apply to women on oral contraceptives		<24Hours*
Cortisol (Low dose overnight dexamethasone suppression test; Investigation of suspected Cushing Syndrome)	Blood	Timed Serum (Gold top tube) at 0900hrs	A normal response is suppression of cortisol at 0900hrs to <50nmol/L. Failure to suppress is indicative of Cushing's syndrome.		<24Hours*
C-Reactive Protein	Blood	Serum (Gold top tube)	< 5 mg/L		<24Hours or STAT samples <75mins
Creatinine Kinase	Blood	Serum (Gold top tube)	39-308 IU/L (M) 26-192 IU/L (F)		<24Hours or STAT samples <75mins
Creatinine	Blood	Serum (Gold top tube)	59 -104 umol/L (M) 45 - 84 umol/L (F)	See report for paediatric ranges	<24Hours or STAT samples <75mins
Creatinine Clearance	Blood and Urine	Serum (Gold top tube) and Urine (Beige top tube) or 24H container	66 - 143 ml/min	Blood & 24 hr collection of urine. Blood sample should be taken during the urine collection period. 24 hr collection container (Available from Laboratory)	<24Hours *





Test	Specimen type		Reference Range	Additional Information	Turnaround time
CSF Protein	CSF	Universal	60YRS+ 0.15-0.60	Contact Laboratory	STAT sample <75mins
			18YRS+ 0.15-0.45		
			57D 0.05-0.35		
			29D 0.50-0.90		
			0 0.65-1.50		
			<i>Based on: UK Standards for Microbiology Investigations.</i>		
CSF Glucose	CSF	Universal	1 YRS+ 2.22-4.44		STAT sample <75mins
			59D 1.94-5.00		
			29D 1.55-5.55		
			0 1.94-5.55		
Digoxin	Blood	Serum (Gold top tube)	0.70 – 1.50 nmol/L	Contact Laboratory Specimen should be taken at least 6 hours after last oral dose.	<24Hours*
Electrophoresis (Blood/Urine)	EMU or 24H Urine	24Hr container (plain)	See report	EMU- full morning void or complete 24h collection	Fortnightly
	Blood	Serum (Gold top tube)	See report	24 hr collection container (Available from Laboratory)	
Ferritin	Blood	Serum (Gold top tube)	Range (ug/l) Male 30 – 400 Female 13 - 150		<24Hours*
Folate	Blood	Serum (Gold top tube)	Range (ng/ml) 3.9 – 26.8		<24Hours*
FSH	Blood	Serum (Gold top tube)	<b>Phase</b>	<b>Range (mIU/ml)</b>	<24Hours*
			Follicular	3.5 – 12.5	
			Mid-cycle peak	4.7 – 21.5	
			Luteal phase	1.7 – 7.7	
			Post-Menopausal	25.8 - 134.8	
Males	1.5 - 12.4				



Test	Specimen type		Reference Range	Additional Information	Turnaround time
Gamma GT	Blood	Serum (Gold top tube)	Male 8 – 61 U/L Female 5 – 36 U/L		<24Hours or STAT samples <75mins
Gentamycin	Blood	Serum (Gold top tube)	(ug/ml) <b>Once &lt;24Hours:</b> Trough <1 Peak >10 <b>Multiple:</b> Trough <2 Peak 5-10 <b>Endocarditis:</b> Trough <1 Peak 3 - 5	Refer to "LUH Empiric Antibiotic Guidelines". Contact Dr M Mulhern, Cons. Microbiologist, if necessary.	<24Hours
Glucose	Blood	Fluoride EDTA; Adult and Paediatric Grey top	Range (mmol/l) Fasting: 4.11 – 6.05  Age Children 3.33-5.55 <60 4.11 – 5.89 60-90 4.56 – 6.38 >90 4.16 – 6.72  1hr PP <7.8mmol/l 2hrPP <6.7mmol/l	Fast for at least 10 hours.	<24Hours or STAT samples <75mins
Haemochromotosis	Blood	EDTA (purple top tube)	See report for interpretation	Consent Request form (MF-BIO-0058) required from Biochemistry Department.	5 Weeks
Haemoglobin A1c	Blood	EDTA (purple top tube)	NOTE: Reporting in IFCC (mmol/mol). See <a href="http://www.hse.ie/go/diabetes">www.hse.ie/go/diabetes</a>  19-40 mmol/mol 3.9-5.8 %	No diabetic range	<24Hours*
Haptoglobin §	Blood	Serum (Gold top tube)	0.3 – 2.0(g/L)		<24Hours*
Hepatitis A IgM **	Blood	Serum (Gold top tube)		Sent to the Virus Reference Laboratory for Confirmation	<24Hours*
Hepatitis B Surface Antigen (HBsAg) **	Blood	Serum (Gold top tube)		Sent to the Virus Reference Laboratory for Confirmation	<24Hours*



Test	Specimen type		Reference Range	Additional Information	Turnaround time
Hepatitis C (anti HCV) **	Blood	Serum (Gold top tube)		Sent to the Virus Reference Laboratory for Confirmation	<24Hours*
HIV Duo **	Blood	Serum (Gold top tube)		Sent to the Virus Reference Laboratory for Confirmation	<24Hours*
IgG IgM IgA	Blood	Serum (Gold top tube)	(Adult) (Range g/L) IgG 7.0 – 16 IgA 0.7 – 4.0 IgM 0.4 - 2.3	See report for paediatric ranges.	<24Hours*
Iron	Blood	Serum (Gold top tube)	5.8 – 34.5 umol/L		<24Hours*
Interleukin-6	Blood	Serum (Gold top tube)	0-7pg/ml	Request to be made by Consultant Haematologist by telephone.	<24Hours or STAT samples <75mins
Lactate	Blood	Fluoride EDTA; Adult or Paediatric Grey top tube. (ICE)	0.5 – 2.2 mmol/L	<b>Available on Blood Gas</b>	<24Hours
LDH	Blood	Serum (Gold top tube)	Age Range (U/L) >18 135 - 214(F) >18 135 –225(M)	See report for paediatric ranges.	<24Hours or STAT samples <90mins
LH	Blood	Serum (Gold top tube)	Phase (mIU/ml) Follicular 2.4 -12.6 Mid-cycle 14.0 -95.6 Luteal 1.0 -11.4 Post Menopausal 7.7 – 58.5 Males 1.7 -8.6		<24Hours *
Lithium	Blood	Serum (Gold top tube)	(mmol/L) Therapeutic 0.6 -1.2 Toxic > 2.0	Specimen should be taken 12 hours post dose	<24Hours*
Magnesium (Blood)	Blood	Serum (Gold top tube)	Adults, (mmol/L) <60y 0.66 - 1.07 60-90y 0.66 - 0.99 >90y 0.70 - 0.95	See report for paediatric ranges	<24Hours or STAT samples <75mins



Test	Specimen type		Reference Range	Additional Information	Turnaround time
Magnesium (Urine) §	24hr Urine	Plain	3.0 – 5.0 mmol/24Hr	24 hr Collection container (Available from Laboratory)	<24Hours*
Magnesium (Urine) §	Random Urine	Urine (Yellow top tube)	2.5 – 8.5 mmol		<24Hours*
Microalbumin/ Creatinine Ratio	Random Urine	Urine (Yellow top tube)	< 2.26 g albumin/ mol creatinine		<24Hours*
Microalbumin Excretion Rate	24hr Urine	Plain Bottle	< 30 mg / 24hr	24 hr Collection container (Available from Laboratory)	<24Hours*
NT-Pro BNP	Blood	Serum (Gold top tube)	Refer to report for interpretation		<24Hours*
Oestradiol	Blood	Serum (Gold top tube)	(pg/ml) Follicular: 30.9-90.4 Ovulation: 60.4-533 Luteal: 60.4-232 Post Menopausal Males <5.0 - 138 11.3 – 43.2		<24Hours*
Osmolality (Blood)	Blood	Serum (Gold top tube)	mOsm/Kg >60 280 – 300 >42D 275 - 295 >1D 265 - 275		<24Hours*
Osmolality (Urine)	Urine	Urine (Yellow top tube)	mOsm/Kg 50 - 1250		<24Hours *
Paracetamol	Blood	Serum (Gold top tube)	Therapeutic 10-30 (mg/L)		<24Hours or STAT samples <75mins
Phenytoin	Blood	Serum (Gold top tube)	Therapeutic 10-20 (ug/ml)		<24Hours *
Phosphate (Blood)	Blood	Serum (Gold top tube)	0.81 - 1.45 (mmol/L)	See report for paediatric ranges	<24Hours or STAT samples <75mins
Phosphate (Urine)	24H Urine	24H Urine Container	13.00 – 42.00 mmol/24Hrs		<24Hours



Test	Specimen type		Reference Range	Additional Information	Turnaround time
Potassium (Blood)	Blood	Serum (Gold top tube)	3.5 – 5.3 (mmol/L)	Potassium >6hrs old are unsuitable for analysis.  See report for paediatric ranges	<24Hours or STAT samples <75mins
Potassium (Urine)	urine	Random Urine (Yellow) top tube  24hr (Plain container)	20 – 80 mmol/l  25 – 125 mmol/24hr	24 hr Collection container (Available from Laboratory)	<24Hours*
Progesterone	Blood	Serum (Gold top tube)	(ng/ml) Follicular: 0.05 - 0.193 Ovulation: 0.055 - 4.14 Luteal: 4.11 - 14.5  Post Menopausal <0.05 – 0.126  Males <0.05 – 0.149		<24Hours*
Prolactin	Blood	Serum (Gold top tube)	<b>m IU/L</b> Female 102-496 Male 86-324		<24Hours*
Total Protein (Blood)	Blood	Serum (Gold top tube)	66 – 87(g/L)	See report for paediatric ranges	<24Hours or STAT samples <75mins
Total Protein (Urine 24 hour)	24H Urine	24H Urine Container	<0.14 g/24HR		24Hours*
Total Protein (Random Urine)	Urine	Random (yellow top tube)	<0.15g/l		<24Hours*
Toxicology Screen (Urine) §	Urine	Random (yellow top tube)			4 weeks
Protein/Creatinine Ratio	Urine	Random (yellow top tube)	3 - 14 mg/mmol		<24Hours*



Test	Specimen type		Reference Range	Additional Information	Turnaround time
PSA (Total)	Blood	Serum (Gold top tube)	Male (ng/ml) <50 <2.0 50-59 <3.0 60-69 <4.0 >70 <5.0 <i>Based on NCCP Guidelines. Refer to NCCP for more details.</i>		<24Hours*
PTH	Blood	EDTA (purple top tube)	15 - 65 pg/ml	Transport immediately to lab	<24Hours*
Rheumatoid factor	Blood	Serum (Gold top tube)	0-14 IU/mL		<24Hours*
Rubella IgG Abs	Blood	Serum (Gold top tube)	< 10 IU/MI: No Evidence of Immunity. ≥ 10 IU/mL: Evidence of Immunity	Results are obtained with the Elecsys Rubella IgG assay. Results of assays from other manufacturers should not be used interchangeably	<24Hours*
Salicylate	Blood	Serum (Gold top tube)	Therapeutic <300 mg/L		<24Hours or STAT samples <75mins
Sodium (Blood)	Blood	Serum (Gold top tube)	136 – 145 (mmol/L)	See report for paediatric ranges	<24Hours or STAT samples <75mins
Sodium (Urine)	Urine	Random Urine Yellow top tube 24 hour sample	54 - 150 mmol/L 40.0 – 220.0mmol/24Hrs		<24Hours



Test	Specimen type		Reference Range	Additional Information	Turnaround time
Sweat Test §	Sweat	Collected by Medical Scientist. Must arrange with Biochemistry Lab ext 3559 in advance.	Sweat Chloride mmol/L Not Elevated <30 Intermediate* 30-60 Elevated** > 60  Sweat Conductivity mmol/L Not Elevated <50 Intermediate* 50 - 90 Elevated** > 90  *Requires further CF assessment **Supports Diagnosis of CF.	Cystic fibrosis should not be diagnosed based on conductivity measurement alone. Confirmation should be sought using sweat chloride or genotyping. Intermediate values between 60 and 90 mmol/l require further investigation by sweat chloride and/or genotyping.	By appointment only. Please call Biochemistry on ext 3559 to arrange
Syphilis **	Blood	Serum (Gold top tube)		Sent to the Virus Reference Laboratory for Confirmation	<24Hours*
Testosterone	Blood	Serum (Gold top tube)	Male: (nmol/L) >18 9.9 – 27.8 >20 8.6 – 29.0 >50 6.7 – 25.7 Female >18 0.3 – 1.7 >50 0.1 – 1.4		<24Hours*
T4 (Free)	Blood	Serum (Gold top tube)	<b>AGE NORMAL</b> 20 11.0-21.0 1 13.0-21.0 1M 14.0-22.0 0 16.0-50.0	Source of reference: <a href="https://caliper.research.sickkids.ca/#/search">https://caliper.research.sickkids.ca/#/search</a>	<24Hours*
T3 (Free)	Blood	Serum (Gold top tube)	2.0-4.4 pg/mL		<24Hours*
Total Iron Binding Capacity (Calculated)	Blood	Serum (Gold top tube)	40.8 – 76.6 umol/L		<24Hours*



Test	Specimen type		Reference Range	Additional Information	Turnaround time
<b>Transferrin</b>	Blood	Serum (Gold top tube)	2.0 – 3.6 (g/L)		<24Hours*
<b>Transferrin saturation (calculated)</b>	Blood	Serum (Gold top tube)	(%) Female 20 – 55 Male 15 - 50		<24Hours*
<b>Triglyceride</b>	Blood	Serum (Gold top tube)	0.4 – 2.3 mmol/L	<b>Fasting</b> specimen	<24Hours*
<b>Troponin T Hs</b>	Blood	Serum (Gold top tube)	FEMALE [0-9] ng/L MALE [0-17] ng/L	Analysis on Roche e801 Haemolysed samples unsuitable	STAT samples <75mins
<b>TSH</b>	Blood	Serum (Gold top tube)	0.270 – 4.20 uIU/ml		<24Hours*
<b>Uric acid</b>	Blood	Serum (Gold top tube)	(umol/L) (F) 142.8 - 339.2 (M) 202.3 - 416.5		<24Hours*
<b>Uric acid (Random Urine)</b>	Random Urine	Urine (Yellow top tube)	2200 - 5475(umol/L)		<24Hours *
<b>Uric acid (24 hour Urine)</b>	24 HR Urine	24 hr collection (Plain container)	1200 - 5900 umol/24H	24 hr Collection container (Available from Laboratory)	<24Hours *
<b>Urea</b>	Blood	Serum (Gold top tube)	(mmol/L) >18 2.1 – 7.1 >60 2.9 – 8.2	See report for paediatric ranges 24 hr Collection container (Available from Laboratory)	<24Hours or STAT samples <75mins
<b>Urea (Urine)</b>	24HR Urine	24 hr Collection (Plain container)	428 - 714 mmol/24 H		<24Hours*
<b>Vancomycin</b>	Blood	Serum (Gold top tube)	Non-severe infection: Trough 10-15(ug/ml)  Severe infection: Trough 15-20 If trough <5 or >15,  contact: Cons.Microbiologist	24 hr Collection container (Available from Laboratory) Refer to "LGH Empiric Antibiotic Guidelines". Contact Dr M Mulhern, Cons. Microbiologist, if necessary.	<24Hours*





Test	Specimen type		Reference Range	Additional Information	Turnaround time
Vitamin B12	Blood	Serum (Gold top tube)	197-771 pg/ml		<24Hours*
Vitamin D 25OH	Blood	Serum (Gold top tube)	Adequate Vitamin D >/50nmol/L Insufficient Vitamin D >/30nmol/L Deficient Vitamin D <30nmol/L Vitamin D excess >125nmol/	No retesting <3 months after commencing supplementation Reference:IOM 2011: Dietary reference intakes for calcium and Vitamin D. Washington, DC: The National Academies Press. <a href="https://www.hse.ie/eng/about/who/cspd/n-cps/pathology/resources/lab-testing-for-vit-d-deficiency11.pdf">https://www.hse.ie/eng/about/who/cspd/n-cps/pathology/resources/lab-testing-for-vit-d-deficiency11.pdf</a>	<24Hours*
Globulin (Calculated)	Blood	Serum (Gold top tube)	20-35 (g/L) †		<24Hours or STAT samples <75mins
Albumin corrected calcium (Calculated)	Blood	Serum (Gold top tube)	2.10-2.60 (mmol/L) †		<24Hours or STAT samples <75mins
Estimated Glomerular filtration rate (Calculated)	Blood	Serum (Gold top tube)	Refer to interpretation on report* This calculation is based on: <b>2009 CKD-EPI equation*</b>		<24Hours or STAT samples <75mins

**NOTE:** \* Tests requested outside the scope of on call tests (after 8pm or at weekends) will be separated, stored and processed during next routine working hours.

\*\*If sample needs to be sent to referral Lab for supplemental/confirmatory testing Turnaround Time will be longer. Days are expressed as Calendar days. †See Section 9 for sources of references range



### 3.2 Pregnancy Related Reference Ranges

Table.2 Pregnancy related reference ranges

TEST NAME	UNITS	FIRST TRIMESTER	SECOND TRIMESTER	THIRD TRIMESTER
*Vitamin D, 25-hydroxy	nmol/L	45 - 67	25 - 55	25 - 45
*Alanine aminotransferase , ALT	U/L	3 - 30	2 - 33	2 - 25
*Albumin	g/L	31 - 51	26 - 45	23- 42
*Alkaline phosphatase	U/L	17 - 88	25 - 126	38 - 229
*Alpha-fetoprotein	ng/mL	18 - 119	96 - 302	160 - 550
*Amylase	U/L	24 -83	16 -73	15 - 81
*Aspartate aminotransferase ,AST	U/L	3 -23	3 - 33	4 -32
*Bicarbonate	mmol/L	18 - 26	18 - 26	18 - 26
*Bilirubin , conjugated , direct	µmol/L <5	0 - 1.7	0 - 1.7	0 - 1.7
*Bilirubin , total	µmol/L	1.7 - 6.8	1.7 - 13.7	1.7 - 18.8
Cancer Antigen (CA) 125	U/ml	0 - 51.5	0 - 30.8	0 - 56.3
*Calcium, ionized	mmol/L	1.13 - 1.28	1.1 - 1.25	1.1 - 1.33
*Calcium, total	mmol/L	2.2 - 2.65	2.05 - 2.25	2.05 - 2.43
*Chloride	mmol/L	101 - 105	97 -109	97 - 109
*Cholesterol, HDL	mmol/L	1.04 - 2.02	1.35 - 2.25	1.24 - 2.25
*Cholesterol, LDL	mmol/L	1.55 -3.96	1.99- 4.77	2.62 - 5.8
*Cholesterol, Total	mmol/L	3.65 - 5.44	4.56 - 7.74	5.67 - 9.04
Complement, C3	g/L	0.44 - 1.16	0.58 - 1.18	0.6 - 1.26
Complement, C4	g/L	0.09 - 0.45	0.10 - 0.42	0.17 - 0.37
*Creatinine	µmol/L	35 - 62	35 - 71	35 - 80
*Creatinine Kinase, CK	U/L	27 - 83	25 -75	13 - 101
*Ferritin	ng/mL	6 - 130	2 - 230	0 - 166
*Folate	nmol/L	6 - 34	1.8 - 54	3 - 47
*GGT	U/L	2 - 23	4 - 22	3 - 26
*Haemoglobin A <sub>1c</sub> , glycated haemoglobin	%	4 - 6	4 - 6	4 - 7
*Immunoglobulin A	g/L	0.21 - 3.17	0.3 - 3.06	0.43 -3.19
*Immunoglobulin G	g/L	8.38 - 14.1	6.54 - 12.9	5.22 - 11.46
*Immunoglobulin M	g/L	0.01 -3.09	0.02 - 2.90	0 - 3.61
*IRON	µmol/L	13 - 26	8- 32	5 - 35
*Lactate dehydrogenase	U/L	78 - 433	80 - 447	82 - 524
*Magnesium	mmol/L	0.67 - 0.92	0.63 - 0.92	0.46- 0.92

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*Osmolality (Serum)	mmol/kg	275 - 280	276 - 289	278 - 280
*Parathyroid hormone	pg/mL	10 - 15	18 - 25	9 - 26
*Phosphorus	mmol /L	1 - 1.49	0.81 - 1.49	0.9 - 1.49
*Potassium	mmol /L	3.6 - 5	3.3 - 5	3.3 - 5.1
*Total Protein	g /L	62 - 76	57 - 69	56 - 67
*Sodium	mmol/L	133 - 148	129 - 148	130 - 148
*Testosterone	mmol/L	0.9 -7.32	1.2 - 8.4	2.2 - 10.7
*TSH	µIU/mL	0.6 - 3.4	0.37 - 3.6	0.38 - 4.04
*TIBC	µmol/L	42 - 73	54 - 93	68 - 107
*Transferrin	µmol/L	3.1 - 4.2	2.7 - 5.4	3.5 - 6.5
*Triglycerides	mmol/L	0.5 - 1.8	0.9 - 4.3	1.5 - 5.1
*Uric Acid	µmol/L	119 - 250	143 - 292	184 - 375
*Vitamin B12	pmol/L	87 - 323	96 - 484	73 - 388
*24 hour creatinine clearance (serum creatinine, urine 24 hour collection)	mL/min	69 - 140	55 - 136	50 - 166
*24 hour protein excretion, total , quantitative, (urine 24 hour collection)	g / 24 hr	-	0 - 0.26	0 - 0.25
*Progesterone	ng/mL	8 - 48	-	99 - 342
*Prolactin	m IU/L	763.2-4515.6	2332-6996	2904.4-7886.4
		Fasting	1hr PP	2hr PP
Glucose Tolerance Test		4.1 – 5.0	2.5 – 9.9	2.5 – 8.4



### 3.3 Test availability and On-Call Service

- Routine tests are available between 8-8 on a Monday-Friday Daily basis.
- Medical Laboratory Scientists provide an emergency On Call service outside of the routine working hours for in -patients. This service is intended to respond to urgent test requests and provide results, where there is an immediate clinical requirement for decision making in the patients care.
- Any other tests required should be requested as normal. These non On-call tests will be processed during next routine hours.

**Table 3. Biochemistry On-call tests**

Biochemistry On-Call tests (On-Call Telephone number <b>173-814</b> )	
Blood gases * (including carbon monoxide) - Point of care	
Renal Profile	Alcohol
Cardiac enzymes	Paracetamol
Amylase	Salicylate
Bone Profile	Glucose
Liver Profile	CRP
Troponin	bHCG**(8am -8pm, 7 days)
Uric Acid (Antenatal samples only)	Lactate***
Xanthochromia****	Iron (for Overdose)
Antibiotic assays- assayed 08.00 -20.00, 7 days. Renal assays are tested up to 12 midnight	Interleukin-6
Procalcitonin- orderable by Consultant phone request only	Urine Sodium

\*Biochemistry On call MUST be contacted prior to sending blood gas specimen. Failure to do so may result in specimen not being processed. Blood Gas is available on the wards as part of Point of care testing.

\*\* 8am – 8 pm, 7 days

\*\*\*Lactate available on Blood gas

\*\*\*\*Processed in Altnagelvin, must contact lab immediately

- For further requests, tests may be performed if the Consultant Pathologist has been contacted by the requesting clinician, and the Pathologist On-call has determined that the tests are sufficiently urgent to perform on-call.
- Otherwise, tests other than those listed above will be separated, stored, and processed during the next routine hours.
- However, in the event that specialised tests are required to be processed during On-call hours e.g. Urine Organic Acids or any specimens that must be sent on ice, clinicians MUST contact Biochemistry On-Call to pre arrange.

### 3.4 Turnaround Times



- Expected turnaround times for common requests are identified in Table 1 above.
- Turnaround time is defined as the time from specimen receipt in the Pathology Department to the time results are available.
- The times stated are deliverable in 90% of instances in normal circumstances. There are times, due to factors outside the laboratory's control, that the stated turnaround times may be exceeded. These events are infrequent and will be explained to users at the time.
- Sending a specimen without notification to relevant on-call staff may result in delay in the specimen being processed and increased turnaround times.
- If the laboratory fails to meet expected turn around times please contact Chief Medical Scientist or Laboratory Manager (see contact list).

### 3.5 Transport of Specimens

Please refer to the **General Information User Guide, MP-GEN-0064, Section 13/ Sample Transport procedure MP-GEN-0060** for sample transport requirements. This manual is available on Q-Pulse and the HSE website <http://www.hse.ie/luhPathology>

Specimens must be transported in such a manner that:

- Patient confidentiality is maintained during transportation and on receipt of specimens.
- STAT and routine in house specimens are transported to the lab ASAP.
- GP or outside locations must be transported to the lab within 48 hours (72 hours for Serology specimens) or in accordance with criteria for time dependant analytes.
- Extremes of temperature are avoided during transport and specimens should be ideally transported at ambient temperature in the appropriate specimen container.
- Specimens will be required to be packed and transported in accordance with the European Agreement concerning the International Carriage of Dangerous Goods by Road (UN ADR).

### 3.6 High Risk Patients and Danger of Infection Specimens

- All biological specimens are handled as though each specimen is a high-risk danger of infection specimen. However in known cases of high risk, please advise laboratory of the risk by using the yellow high risk labels, attach to request form and specimen.
- Transport of specimens to the laboratory must be done to minimise risk of infection to all those who come into contact with specimen.
- All specimens should be treated as potentially bio-hazardous and standard precautions should apply.
- Infection Prevention and Control guidelines are available on Q-pulse for dealing with biological spills should be followed in the event of leak or spill during transport or handling.



### 3.7 Internal transport of specimens

- Specimens must be placed within the specimen bag attached to the request form and sealed. The request form is either attached to bag or sits into bag envelope compartment.
- Transport of specimens to laboratory from within hospital, is by use of portering service, Healthcare assistants or/and pneumatic tube system.
- Many wards/departments in the hospital have a pneumatic tube system linked to all the departments.
- Each chute station displays the operating instructions and a problem guide.
- Report all faults with pneumatics to 173-503

### 3.8 Specimens on ice

- If specimen is required to be stored on ice, place ice into a specimen bag, place specimen into another specimen bag and place into ice specimen bag, this ensures the sample label is not damaged by ice water.
- Send specimens on ice to laboratory immediately. Specimens on ice should **NEVER** be sent via pneumatic tube system.

### 3.9 Procedure for the Out of Hours Delivery and Storage of Specimens to Pathology

- Urgent specimens may be sent by chute to 3557, alternatively the specimen may be delivered to the scientist “on-call”. The person generating the request must contact the scientist “on-call”.

#### 3.9.1 External transport of specimens

- Outside Routine hours specimens may be deposited in the laboratory specimen box located opposite the Pathology laboratory main door.
- Specimens may be hand delivered to laboratory central reception office without arrangement during routine hours.

### 3.10 GP collections

- A courier service is arranged with Laboratory Manager for predefined days and is done by taxi companies. Service users have been instructed on the transport requirements (MP-GEN-0060) Transport of specimens to the laboratory.

### 3.11 Contamination, interfering factors and specimen storage

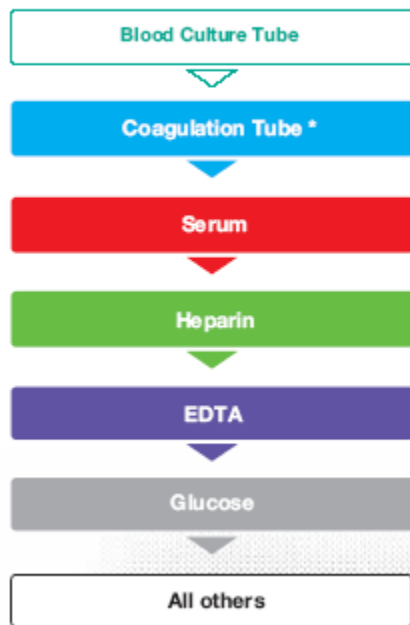
#### !!! AVOID CONTAMINATION !!!

- When taking a series of blood specimens, it essential that the Order of Draw is followed.
- Failure to adhere to this sequence will lead to contamination of blood specimens with anticoagulants/preservatives.



- This contamination produces spurious and invalid results in major biochemical parameters.

Recommended Order of Draw for  
Multiple Specimen Collection:



- Avoid haemolysis, drip contamination, over-heating and prolonged venous constriction.
- Ensure thorough and instant mixing of blood with anticoagulant (heparin, fluoride EDTA or potassium EDTA) for plasma specimens.
- Do not transfer blood from one tube to another, ex. EDTA to Lithium heparin.
- Do not leave Clinical Biochemistry blood specimens in the fridge (4°C) or overnight at room temperature without prior centrifugation.

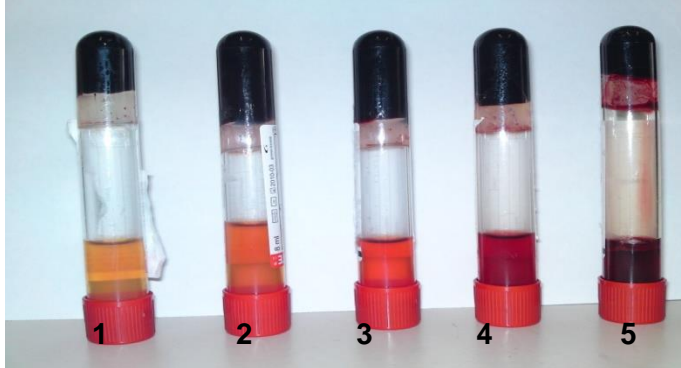
### 3.12 Factors affecting Biochemistry laboratory results

#### 3.12.1 Haemolysis

- Haemolysis is defined as red blood cell break down and the release of haemoglobin and intracellular contents, ex. potassium into the serum. Haemolysis is most frequently an in vitro phenomenon caused by trauma in specimen collection or processing, although slow leakage may also occur.
- Haemolysis is graded as slight, moderate or gross.

- Slight haemolysis has little effect on most test values.
- Gross haemolysis causes a slight dilutional effect on analytes present at a lower concentration in the red cells compared to plasma. However, a marked elevation may be observed for analytes present at a higher concentration in red cells than in plasma.
- Some tests are affected more than others. Notable examples of tests affected by haemolysis are found in LP-CHEM-004.

There are varying degrees of haemolysis, examples shown below;



- Normal sample, (2) slightly haemolysed, (3) haemolysed, (4) haemolysed (5) grossly haemolysed
- Test results on specimens with non interfering levels of haemolysis are usually processed.
- Haemolysed samples that interfere with the quality of the analyte requested, will NOT be processed by the laboratory and every effort to inform the requesting clinician is made, and reported on the LIS as, Unsuitable for analysis (UFA) as soon as detected.

### 3.13 Neonatal Specimens

- When requesting investigations on new born babies, to prevent specimen rejection the baby's PCN, date of birth and name must be used, not the mother's details.
- Request forms and specimens must be labelled with the baby's current details at the time of sampling.
- For multiple births, the mandatory requirements are surname, DOB, unique identification number (Hospital number) PLUS twin/triplet number.

## 4. PATIENT INSTRUCTIONS FOR 24 HOUR URINE COLLECTION





## PLEASE DO NOT URINATE DIRECTLY INTO THE SAMPLE CONTAINER

Your doctor has requested tests, which require the collection of all urine you pass over a 24-hour period.

1. On the day that the collection is to start, empty your bladder at 8:00 am and **DISCARD THIS URINE**.
2. All urine passed over the next 24 hours should be collected into the labelled bottle provided by the laboratory, Collect **ALL** further urine passed during the day and night **UP TO AND INCLUDING** the following morning. You must empty the bladder at 8:00am. The collection is then finished.
3. Whenever possible, please keep the collection bottle in fridge or a suitable cool place. (**ENSURE THE LID IS ON TIGHTLY**)
4. On the morning the collection is completed, hand the bottle and request form to the staff at the laboratory or clinic that provided you with the collection bottle. Please check that your name, date, start time and finish time are recorded on the collection bottle.
5. If you forget and lose a sample down the toilet, then please **THROW AWAY ALL THE URINE** collected until that time and start again the following morning. If you are making an acid collection, you need to obtain a new container from the laboratory.
6. Please note that a request form **MUST** accompany the sample.

### 5. **Some 24hour urine containers contain acid**

These are labelled: -



**This bottle contains a small quantity of Acid as a preservative**  
**6. Handle with care**

These collection containers contain 20mls of 50% hydrochloric acid and must be kept out of reach of children. Exercise extreme care when adding urine to the container to avoid any splashes of acid or leaks from the top.

#### 1.1.1.1 Hydrochloric Acid – Hazard identification

Causes burns. Irritating fumes to the respiratory system.

#### 1.1.1.2 First aid measures

<u>Eye contact</u>	Irrigate thoroughly with water for at least 10 minutes. Obtain medical attention.
<u>Skin contact</u>	Drench the skin thoroughly with water for at least 10minutes. Remove contaminated clothing and wash before reuse. Obtain medical attention.

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## 5 BIOCHEMISTRY REFERRAL LABORATORIES

- Referral tests are specialised investigations that are processed by the Biochemistry laboratory and are transported to various referral laboratories.
- Results and reports are returned directly to the requesting clinician, so please ensure request forms are completed clearly stating return address or location.
- Please note that referral may take in excess of 2 weeks for turnaround of results.
- Any result enquiries should be made to the appropriate referral laboratory.
- Please contact Biochemistry on 0749123559 to discuss the referral request if necessary.
- Some referral tests require consent form and clinical information forms which are available from the Pathology Department Reception.

**Table 4. Biochemistry Referral Laboratory Details**

Laboratory	Address	Contact details
<b>Alpha 1 Antitrypsin Deficiency Targeted Detection Program (A1AT)</b>	Respiratory Research Dept of Medicine Royal College of Surgeons Ireland Smurfit Education and Research Centre Beaumont Hospital Dublin 9,	Results and Test Enquiries  <b>01 8093871</b>
<b>Altnagelvin Hospital</b>	Dept of Biochemistry, Altnagelvin Hospital Derry	Results and Test Enquiries  <b>048-71313036</b>
<b>Eurofins Biomnis</b>	34 Three Rock Road, Sandyford Business Estate, Sandyford, Dublin 18, D18A4C0,	Results and Test Enquiries <b>1800 252966</b>  Telephone enquiries 09:00 - 17:30 GMT Web link; main website <a href="https://www.eurofins.ie/biomnis/">https://www.eurofins.ie/biomnis/</a>
<b>Blackrock Clinic</b>	Dept of Pathology Blackrock Co.Dublin	Results and Test Enquiries  012832222



Laboratory	Address	Contact details
<b>Beaumont Hospital</b>	PO Box 1297 Beaumont Road Dublin 9	Telephone <b>01-8093000</b>
<b>CytoGenetics Crumlin</b>	Crumlin Molecular Genetics National Centre for Medical Genetics, Our Lady's Hospital for Sick Children Crumlin Dublin 12 Ireland	Cytogenetic enquiries <b>01-409 6970</b>
<b>Cherry Orchard Hospital</b>	Public Health Laboratory, Dublin	Results and Test Enquiries <b>01-6264702</b>
<b>City Hospital Belfast</b>	Lisburn Rd, Belfast BT97AB	Results and Test Enquiries <b>048-90329241</b>
<b>Our ladys Hospital for sick children</b>	Dept of Pathology Crumlin, Dublin 12	Results and Test Enquiries <b>01-455811</b>
<b>The Doctors Laboratory</b>	55, Wimpole Street, London W1G 7DF	Results and Test Enquiries <b>0044-207-307-7383</b>
<b>Guy and St.Thomas Hospital trust</b>	Medical Toxicology Unit, Avonley Rd, London SE145ER	Results and Test Enquiries <b>0044-207-771-5371</b>
<b>Glasgow Royal Infirmary</b>	Biochemistry Department,  Glasgow 0405F	



Laboratory	Address	Contact details
<b>Great Ormond St. Childrens Hospital</b>	Gt.Ormond St, London WC1N 3JH	Results and Test Enquiries <b>0044-2078138321</b>
<b>Virus Reference Laboratory</b>	National Virus Reference Laboratory, University College, Belfield,Dublin 4	Results and Test Enquiries <b>01-7161323</b>
<b>State Laboratory</b>	Environmental section, Youngs Cross,Celbridge, Co.Kildare	Results and Test Enquiries <b>01-8217700</b>
<b>Royal Victoria Hospital Endocrine Laboratory</b>	Kelvin Building RVH, Belfast	Results and Test Enquiries <b>048-90-240503</b>
<b>PRU Sheffield</b>	PRU Service Agency, Dept of Immunology POBox 894 Sheffield	Results and Test Enquiries <b>0044-1142715552</b>
<b>National Tissue Typing Reference Laboratory</b>	National Blood Centre, James Street, Dublin 8	Results and Test Enquiries <b>01-4322975</b>
<b>Mater Hospital Dublin</b>	Dept of Pathology, Eccles St, Dublin 7	Results and Test Enquiries <b>01-8031122</b>
<b>Nottingham University Hospital</b>	Department of Clinical Pathology, City campus, Hucknall rd, Nottingham NG51PB	Results and Test Enquiries <b>0044-115-9627907</b>
<b>Manchester Royal Infirmary</b>	Clinical Research Dept, Oxford Road, Manchester M139WL	Results and Test Enquiries <b>0044-161-276-4179</b>
<b>Med Lab Pathology IRL</b>	Unit 3, Sandyford Business centre, Dublin 18	Results and Test Enquiries <b>01-2933690</b> <b>info@medlabpathology.ie</b>



Laboratory	Address	Contact details
<b>Kings College Hospital</b>	Denmark Hill, London, SE5905	Results and Test Enquiries <b>0044-1713463147</b>
<b>John Radcliffe Hospital</b>	Immunology Dept, The church hill hospital, Oxford Radcliff NHS Trust, Old Road, Headington, Oxford	Results and Test Enquiries <b>0044-1865-741166</b>
<b>St Vincents Hospital</b>	Pathology Department, Elm Park, Dublin 4	Results and Test Enquiries <b>01-2694533</b>
<b>St.James,Hospital</b>	Central Pathology Laboratory, Dublin 8	Results and Test Enquiries <b>01-4162038</b>



## 6 BIOCHEMISTRY REFERRAL TESTS

- Sample requirements and Referral Laboratory
- Contact **Biochemistry on 0749123559** to discuss the referral request if necessary.

Table 5. Biochemistry Referral Tests

Test	Sample Type	Sample Handling	Sent to:
<b>Alpha 1 Antitrypsin</b>	Serum	Refrigerated	Beaumont RSCI Research
<b>ACE</b>	Serum	Refrigerated	St. Vincent's Hospital
<b>ACTH</b>	2 EDTA <b>must be on ice</b>	Separate into plain tube <b>Frozen &lt;1hr</b>	RVHE
<b>ADH</b>	EDTA preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Aldolase</b>	Serum	Refrigerated	Biomnis
<b>Aldosterone</b>	EDTA preferably on ice	<b>Frozen &lt;4hrs Include sample timing.</b>	RVHE
<b>Aluminium</b>	Navy/Trace element tubes	Refrigerated	Public Analyst Lab
<b>Androgens</b>	Serum	Refrigerated	Biomnis
<b>Anti-Mullerian Hormone</b>	Serum <b>on ice</b>	<b>Frozen &lt;4hr</b>	Biomnis
<b>Anti-neuronal nuclei AB (ANNA)</b>	Serum	Refrigerated	John Radcliff
<b>(ANMDA)NMDA receptor antibodies</b>	Serum and CSF	Refrigerated	John Radcliff
<b>Amino Acids</b>	Lithium Heparin plasma preferably on ice	Refrigerated	Temple St
<b>Amiodarone</b>	Serum preferably on ice	<b>Frozen &lt;4hr</b>	Biomnis
<b>Amyloid</b>	Serum <b>must be on ice</b>	<b>Frozen &lt;1hr</b>	Biomnis
<b>Azathioprine</b>	2 x Lithium Heparin whole blood	<b>Do NOT spin. Refrigerated</b>	Biomnis



Test	Sample Type	Sample Handling	Sent to:
<b>Bile acids</b>	Serum	Refrigerated	Biomnis
<b>B.burdorferi/Lyme disease</b>	Serum	Refrigerated	VRL
<b>BRCA</b>	EDTA & consent form	Room temperature	Beaumont/St. James'
<b>C- Peptide</b>	Serum non-gel tube preferably on ice	<b>Frozen &lt;4hrs</b>	RVHE
<b>C1 Esterase</b>	Serum on ice	Frozen	PRU Sheffield
<b>C1 Esterase (quantitation only)</b>	Serum	Refrigerated	Biomnis
<b>C1 Esterase Inhibitor (functional and quantitation)</b>	1 x Citrated tube (Coag bottle) 1 x Serum - Both on ice	Centrifuge and freezer plasma and serum. <b>Freeze &lt;3hrs</b>	Biomnis
<b>Caeruloplasmin</b>	Serum	Refrigerated	University Hosp, Galway
<b>Caffeine</b>	Serum non-gel tube	<b>Frozen</b>	Biomnis
<b>Calcitriol</b>	Serum preferably on ice	Refrigerated	Biomnis
<b>Calcitonin</b>	Serum preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Carnitine</b>	Lithium Heparin <b>must be on ice</b>	<b>Frozen &lt;1hr</b>	Biomnis
<b>Catecholamines</b>	24 Urine - <b>Acid container</b>	Measure pH <b>Freeze aliquot &lt;1hr</b>	Beaumont Hospital
<b>Cholinesterase</b>	Serum	Refrigerated	Biomnis
<b>Chromosome Analysis</b>	2 x Lithium Heparin/2xEDTA & Consent form	Adults – Room Temp	Biomnis
		<5yrs - Room Temp	Crumlin
<b>Chromium (Blood)</b>	Navy/Trace element tube	Refrigerated	Biomnis
<b>Chromium (Urine)</b>	10mls urine taken at end of working day/week	Refrigerated	Biomnis



Test	Sample Type	Sample Handling	Sent to:
<b>Chromogranin A</b>	Serum preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Clobazam</b>	Serum non-gel tube preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Clonazepam</b>	Serum non-gel tube preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Cobalt</b>	Navy/Trace element tube	Refrigerated	Biomnis
<b>Copper</b>	Navy/Trace element tube	Refrigerated	Biomnis
<b>Cystic Fibrosis</b>	2 EDTA + Consent form	DO NOT SPIN Room temperature	Molecular Genetics, Crumlin
<b>CMV IgG</b>	Serum	Separate and Refrigerated	VRL
<b>Cyclosporin</b>	EDTA	Refrigerated	Beaumont/St James's (Patient dependent)
<b>DHEA</b>	Serum	Refrigerated	Biomnis
<b>Diazepam</b>	Serum non gel tube preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Dihydropyrimidine dehydrogenase (DPD) Genotyping, 5-FU toxicity</b>	2 x Lithium Heparin <b>on ice</b> <b>PLUS</b> 2 x Lithium Heparin at room temp **Consent required**	<b>Spin 2 lithium heparin and Freeze and send plasma separately.</b>  <b>Send 2 whole blood lithium heparin refrigerated</b>	Biomnis **Consent form required available on Biomnis website
<b>Erythropoietin</b>	Serum	Refrigerated	St.James Hospital
<b>EBV (Epstein Barr)</b>	Serum	Refrigerated	VRL
<b>Free Fatty Acids</b>	Fluoride Oxalate tube (grey top)	Refrigerated	Children's Hospital Sheffield
<b>Fatty acids (non esterefied)</b>	Serum <b>must be on ice</b>	<b>Frozen &lt;1hr</b>	Biomnis





Test	Sample Type	Sample Handling	Sent to:
<b>Fatty Acids (very long chain)</b>	EDTA or Lithium Heparin <b>on ice</b>	Spin and <b>Freeze &lt;1hr</b>	Biomnis
<b>Faecal Elastase ELF</b>	Faeces	Refrigerated	Biomnis
<b>Faecal Fats</b>	Min 24hr max 72hr Faecal collection taken Mon-Tues	Refrigerated	Biomnis
<b>Faecal Reducing Substances/Sugars</b>	Random Faecal sample	<b>Frozen</b>	Biomnis
<b>Felbamate</b>	Serum non-gel tube	<b>Frozen</b>	Biomnis
<b>Flecainide</b>	Serum non-gel tube	<b>Frozen</b>	Biomnis
<b>Fragile X</b>	2 x EDTA and 2x lithum Hep	<b>DO NOT SPIN</b> Refrigerated	Molecular Genetics, Crumlin
<b>Free Light chains</b>	Serum	Refrigerated	University Hosp, Galway
<b>Fructosamine</b>	Serum	Refrigerated	Biomnis
<b>FK506</b>	EDTA	Refrigerated	Beaumont/St James's (patient dependent)
<b>G6PD</b>	Contact Haematology Dept. for sample type details		
<b>Gabapentin</b>	Serum non-gel tube	<b>Frozen</b>	Biomnis
<b>Gastrin</b>	Serum <b>must be on ice</b>	<b>Frozen &lt;1hr</b>	Biomnis
<b>GAD Antibody</b>	Serum	Refrigerated	PRU Sheffield
<b>Glucagon</b>	EDTA Aprotinin tubes <b>on ice</b> . Available on request from Biochemistry. Do not send tubes through the chute system.	Separate into plain tube <b>Frozen &lt;1hr</b>	Biomnis



Test	Sample Type	Sample Handling	Sent to:
<b>Growth Hormone</b>	Serum non gel tube preferably on ice Random levels are not useful.	<b>Frozen &lt;4hrs</b>	Royal Victoria(RVHE)
<b>Gut Hormone</b>	1 <i>EDTA Aprotinin</i> tube <b>on ice</b> . Available on request from Biochemistry. Do not send tubes through the chute system.	Separate and <b>freeze &lt;1hr</b>	Biomnis
<b>Gut Hormone Profile (glucagon/pancreatic polypeptide/vasoactive intestinal polypeptide/ Gastrin)</b>	1 serum on ICE 1 non-gel serum on ICE 3 <i>EDTA Aprotinin</i> tubes <b>on ice</b> . Available on request from Biochemistry. Do not send tubes through the chute system.	<b>All Frozen &lt;1hr</b>	Biomnis
<b>Herpes</b>	Serum	Refrigerated	VRL
<b>Hep B Core antigen</b>	Serum	Refrigerated	VRL
<b>Hep B Viral Load</b>	Serum	<b>Frozen &lt;1hr</b>	VRL
<b>Hep C PCR</b>	Serum	<b>Frozen &lt;1hr</b>	VRL
<b>Hep C Viral Load</b>	Serum	<b>Frozen &lt;1hr</b>	VRL
<b>Homocysteine (cardiovascular events)</b>	Fasting Serum/ EDTA (clinical details MUST be provided) <b>must be on ice</b>	<b>Separated and Frozen &lt;1hr</b>	Biomnis



Test	Sample Type	Sample Handling	Sent to:
<b>Total homocysteine</b> screen (Free not done but methionine and cysteine included)	Lithium Heparin on ice	Treated and untreated sample required, separate within 20 minutes. Freeze.	Temple Street
<b>Total homocysteine</b>	HCY-Z tube Light grey (Patient has sample)	Separated and Frozen	Mater* Certain patients attend the mater
<b>17-Hydroxyprogesterone</b>	Serum	Refrigerated	Biomnis
<b>Hydroxyproline</b>	Lithium Heparin <b>must be on ice</b>	Frozen <1hrs	Biomnis
<b>5-HIAA</b>	Urine - 24 hour acid container	Refrigerated	Beaumont
<b>Islet cell Ab (ICA)</b>	Serum	Refrigerated	PRU Sheffield
<b>IG subclasses</b>	Serum	Refrigerated	University Hosp, Galway
<b>ILGF (insulin like growth factor)</b>	Serum on ice	Freeze <1hr	RVHE
<b>ILGF 1 (insulin like growth factor)</b>	Serum on ice	Frozen <1hrs	Guilford, Royal Surrey Hospital
<b>ILGF 2</b>	Serum on ice	Frozen <1hrs	Guilford, Royal Surrey Hospital
<b>ILGF 3</b>	Serum on ice	Frozen <1hrs	Guilford, Royal Surrey Hospital
<b>Insulin like Growth Factor binding protein 3 (IGF 1 BP3)</b>	Serum on ice	Frozen <1hr	Biomnis
<b>Infliximab</b>	Serum	Refrigerated	Biomnis
<b>Inhibin (A and B)</b>	Serum on ice	Frozen <4hrs	Biomnis
<b>Insulin</b>	Serum on ice. Haemolysed samples unsuitable	Frozen <1hr	Biomnis



Test	Sample Type	Sample Handling	Sent to:
<b>Iodine</b>	Serum non-gel tube	Refrigerated	Biomnis
<b>Karotyping (chromosome analysis) ADULT</b>	2 x Lithium Heparin 2xEDTA & Consent form	Room temperature	Biomnis
<b>Karotyping (chromosome analysis) CHILD &lt;5 YEARS</b>	2 x Lithium Heparin, 2xEDTA & Consent form	Room temperature	Crumlin
<b>Ketones</b>	Urine (20 mls universal) / 2 Lithium Heparin, send to Biochemistry reception immediately. Record Glucose result with request for BHB	<b>(<math>\beta</math> hydroxybutyrate (BHB))</b> Spin 1 lithium Hep and freeze <b>(Acetoacetate (AOA))</b> 2nd Lithium hep-take 2ml whole blood add to PCA tube (4ml perchloric acid), centrifuge 5mins, freeze supernatant. PCA tubes in bio cold rm, left top shelf	Biomnis
<b>Ketone Blood POC</b>	Finger Prick	<b>Ketone Meters</b>	Ward
<b>Ketone Urine POC</b>	Urine	<b>Urinalysis Meter</b>	Ward
<b>Lamotrigine</b>	Serum non gel tube <b>on ice</b>	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Largactil</b>	Serum non gel tube <b>on ice</b>	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Lead</b>	Lithium Heparin, whole blood	<b>DO NOT SPIN</b> Refrigerated	Biomnis
<b>Levetiracetam / Keppra</b>	Serum non gel tube preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis



Test	Sample Type	Sample Handling	Sent to:
<b>Levodopa (Sinemit)</b>	Lithium Heparin preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Leptospira</b>	Serum	Refrigerated	VRL
<b>Free Light Chains</b>	Serum - provide clinical information	Refrigerated	University Hosp, Galway
<b>Lipase</b>	Serum	Refrigerated	Biomnis
<b>Lipoprotein A</b>	Serum / Lithium Heparin	Refrigerated	Biomnis
<b>Lorazepam</b>	Serum non gel tube preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Manganese</b>	Serum non gel tube preferably on ice	<b>Frozen</b>	Biomnis
<b>Mercury DO NOT SPIN</b>	5ml EDTA whole blood	Refrigerated	Biomnis
<b>Metabolic Screen (Urine organic acid and Urine Amino acids)</b>	Random Urine on <b>ICE</b> . *Special form required	<b>Frozen &lt;1hr</b>	Temple Street
<b>Metanephrines Plasma</b>	Fasting 3mL lithium heparin	<b>Spin and Frozen &lt;1hr</b>	Biomnis.
<b>Metanephrines Urine (Adult)</b>	24hr urine (1 aliquot)	<b>Keep refrigerated during collection Frozen &lt;1hrs</b>	Biomnis
<b>Metanephrines Urine (Child)</b>	Random urine (2 aliquots)	<b>Frozen &lt;1hrs</b>	Biomnis.
<b>Microarray DNA Genetic Testing</b>	2 x EDTA whole blood and consent form	<b>DO NOT SPIN</b> Store at room temperature	Crumlin
<b>Myoglobin</b>	Serum / Urine	<b>Frozen</b>	Biomnis
<b>Mycoplasma</b>	Serum	Refrigerated	Biomnis
<b>Mumps</b>	Serum	Refrigerated	VRL
<b>Measles</b>	Serum	Refrigerated	VRL



Test	Sample Type	Sample Handling	Sent to:
<b>Newcastle Workup/Persistent Hypoglycaemia Workup.</b>  Samples must be collected when blood glucose is <2.6mmol/L  (Refer to protocol in Referral folder in Biochemistry reception for further details)	Cortisol	1 x Serum	LUH
<b>Newcastle Workup/Persistent Hypoglycaemia Workup.</b>  Samples must be collected when blood glucose is <2.6mmol/L  (Refer to protocol in Referral folder in Biochemistry reception for further details)	Ammonia	1 x EDTA (on ICE)	LUH
<b>Nickel Newcastle Workup/Persistent Hypoglycaemia Workup.</b>	Glucose/Lactate	1 x fluoride oxalate	LUH
Samples must be collected when blood glucose is <2.6mmol/L	Venous Gas	Blood gas syringe/capillary syringe	Performed at ward level on point of care device (blood gas)



Test	Sample Type	Sample Handling	Sent to:
<b>(Refer to protocol in Referral folder in Biochemistry reception for further details)</b> <b>Nitrazepam</b>	Blood Ketones	Finger prick	Performed at ward level on point of care device (ketone meter)
	Urinary Ketones	Urine	Performed at ward level on point of care device (urinalysis meter)
	$\beta$ OH butyrate/ Non esterified fatty acids	1mL EDTA plasma (on ICE)	Newcastle
	Growth Hormone/Insulin/C-Peptide	3 x Serum (on ICE)	Newcastle
	Plasma amino acids	1 X Lithium Heparin (on ICE)	Temple Street
	Acylcarnitine	Dried Blood spot (Newborn Screening Card)	Temple Street
	Organic Acids	Urine (on ICE)	Temple Street
<b>Nickel</b>	Serum	Refrigerated	Biomnis
<b>Nitrazepam</b>	Serum non gel tube preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis



Test	Sample Type	Sample Handling	Sent to:
<b>Olanzapine</b>	Serum non gel tube preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Oligoclonal band</b>	Serum + CSF	Refrigerated, include CSF Glucose / CSF protein	University Hosp, Galway
<b>Organic Acids</b>	Urine *Special form required	<b>Frozen &lt;1hr</b>	Temple street
<b>Organic Acids</b>	Urine *Special form required.	<b>Frozen &lt;1hr</b>	Sent to Bionmis when clinical details are developmental delay/ASD.
<b>Oxalate (serum)</b>	Serum <b>must be on ice</b>	<b>Frozen &lt;1hr</b>	Biomnis
<b>Oxalate (urine)</b>	24 hour urine collection plain container	<b>Adjust pH to 2-3</b>	Biomnis
<b>Oxcarbazepine</b>	Serum non gel tube on ice	<b>Frozen &lt;1hr</b>	Biomnis
<b>Parvovirus</b>	Serum	Refrigerated	VRL
<b>Pancreatic polypeptide</b>	1 EDTA Aprotinin tube <b>on ice</b> . Available on request from Biochemistry. Do not send tubes through the chute system.	Separate into plain tube <b>Frozen &lt;30mins</b>	Biomnis
<b>Phenylalanine</b>	Lithium Heparin, plasma	Refrigerated	Temple Street
<b>Porphyrin Screen</b>	2 EDTA 1 Lit Hep, 1 Faecal sample, 1 24hr urine collection (plain container) <b>Protect all from light</b>	Protect from light, spin Lith Hep. Take 100ml aliquot from urine collection	St James'





Test	Sample Type	Sample Handling	Sent to:
<b>Primidone</b>	Serum non gel tube on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Pro- Insulin</b>	Serum preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Procollagen PPT3 (P3P)</b>	Serum preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Prozac</b>	Serum non gel tube on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Pyruvic Acid/Pyruvate</b>	Inform Biochemistry before collection. Lithium heparin – transport to laboratory <b>on ice immediately, without delay.</b>	Transfer whole blood to perchloric acid tubes. Spin at 4°C and freeze supernatant.	Biomnis
<b>Pyruvate Kinase</b>	Contact Haematology Dept. for sample type details		
<b>Reducing substances</b>	Random Faecal sample	<b>Frozen</b>	Biomnis
<b>Renin</b>	EDTA preferably on ice	<b>Frozen &lt;4hrs</b>	RVHE
<b>Risperadone</b>	Lithium heparin preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Rufinamide (Innovlen)</b>	Serum non gel tube on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Selenium</b>	Navy/Trace element tubes	Separate immediately. Refrigerated	Biomnis
<b>Sirolimus (Rapumune)</b>	EDTA whole blood	<b>DO NOT SPIN</b> Refrigerated	Biomnis
<b>Serotonin</b>	Whole Blood Lithium Heparin /10ml 24Hr Urine (dietary restrictions apply) <b>must be on ice</b>	<b>DO NOT SPIN blood Sample</b> <b>Frozen &lt;1hr / (Urine) frozen</b>	Biomnis
<b>SHBG</b>	Serum	Refrigerated	Biomnis



Test	Sample Type	Sample Handling	Sent to:
<b>Tacrolimus (Prograf) FK506 DO NOT SPIN</b>	EDTA whole blood	Refrigerated	Beaumont
<b>Testosterone Female / boys &lt;14</b>	Serum	Refrigerated	Biomnis
<b>Theophylline</b>	Serum	Refrigerated	Biomnis
<b>Thyroglobulin</b>	Serum	Refrigerated	Biomnis
<b>Thyroid receptor AB</b>	Serum	Refrigerated	PRU Sheffield
<b>Thyroglobulin binding AB</b>	Serum preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Tiagabine</b>	Serum non gel tube preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Titanium</b>	Lithium Hep plasma	Refrigerated	Biomnis
<b>Topiramate</b>	Serum non gel tube preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Toxoplasma</b>	Serum	Refrigerated	VRL
<b>TORCH Screen</b>	Serum	Refrigerated	VRL
<b>Transplant Workup</b>	Serum x 2	Refrigerated	VRL
<b>Trileptal (10- Hydroxy-carbazepine)</b>	Serum non gel tube preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis
<b>Tryptase</b>	Serum	Refrigerated	Biomnis
<b>Valproic Acid</b>	Serum	Refrigerated	Biomnis
<b>Vasoactive Intestinal polypeptide (VIP)</b>	EDTA Aprotinin tube <b>on ice</b> . Available on request from Biochemistry. Do not send tubes through the chute system.	Separate into plain tube <b>Frozen &lt;30mins</b>	Biomnis
<b>Vigabatrin</b>	Serum non-gel tube preferably on ice	<b>Frozen &lt;4hrs</b>	Biomnis



Test	Sample Type	Sample Handling	Sent to:
<b>Varicella</b>	Serum	Refrigerated	VRL
<b>Vitamin A, K1</b>	Lithium Heparin <b>protect from light and on ice</b>	<b>Protect from light, spin and freeze &lt;1hr</b>	Biomnis
<b>Vitamin B1 Thiamine, B6</b>	EDTA whole blood, protect from light	<b>DO NOT SPIN- freeze &lt;4hrs</b>	Biomnis
<b>Vitamin C</b>	Lithium Heparin only, protect from light <b>must be on ice</b>	<b>Protect from light, spin and freeze &lt;1hr</b>	Biomnis
<b>Vitamin E</b>	Lithium Heparin only, protect from light <b>must be on ice</b>	<b>Protect from light, spin and freeze &lt;1hr</b>	Biomnis
<b>Xanthochromia</b>	CSF protected from light	CSF protected from light, include Serum Bilirubin and Protein result	Altnagelvin Hospital
<b>Zinc</b>	Navy/Trace element tubes	Separate and refrigerate	Biomnis
<b>Zonisamide</b>	Serum non gel tube on ice	Separate immediately - Freeze.	Biomnis
<b>7-dehydrocholesterol</b>	Serum on ice protected from light	<b>Frozen &lt;1hr</b>	Biomnis

## 7. AVAILABILITY OF UNCERTAINTY OF MEASUREMENT FOR USERS

All calculated data for uncertainty of measurement is available to users on request. (LP-CHEM-0022). Specimens should be transported to the laboratory without delay to ensure optimal results. Please see Policy on Transport of Specimens to the Laboratory MP-GEN-0060.

## 8. SAFE DISPOSAL OF SAMPLES AND MATERIAL USED IN SAMPLE COLLECTION

‘The laboratory will provide means for safe collection, storage and disposal of waste by workers, including the use of secure and identifiable containers, after suitable treatment where appropriate. The Laboratory will be guided in this matter by the regulations laid down in the document ‘Healthcare Waste Packaging Guidelines’ issued by the Department of Health and Children.’



## 9. REFERENCES

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