Laboratory User Manual

21st Edition, October 2023

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1 CHANGES SINCE LAST REVISION

Section	Details of Change
Throughout	Updated website for lab documents
Section 3	Quality policy updated
Section 5.2	Staff names contact details updated
Section 6.2	All request forms updated to current version
Section 12.3	Instructions on ordering suppliers for GP users included
Section 12.4	NPACC guideline updated to current version
Section 14.5.6	Androgen free index can be calculated as per MEMO-M/CC/131
Section 14.5.8	Hb variants detected during HbA1c analysis are no longer referred
Section 15.5	Samples with low Alpha-1 Antitrypsin will be referred for phenotyping unless already done so in the past
Section 16.1	Added Haematology senior medical scientist contact details
Section 17	Link for flexible scope list added
Section 17	Sample types and frequency of testing updated as required
Section 17	The ESR test should be carried out within four hours of the blood being phlebotomised. The DDimer and Fibrinogen test should be carried out within eight hours of the blood being phlebotomised.
Section 17	A malaria request form must be submitted with general request form and the Haematology Lab phoned prior to sending malaria screen.
Section 17	Minicap analyser replaced by the Capillarys 3 Octa
Section 17	BN ProSpec analyser replaced by Siemens Atellica NEPH 630
Section 18.1	Removal of Dr O'Sullivan due to retirement. Comment added from CC-23/13 to contact the Consultant Microbiologist for advice on antibiotic results
Section 18.2.2	During the routine day positive blood cultures are phoned to the clinical teams within 2 hours of flagging positive. After 20:00 Monday to Friday and 14:00 Saturdays, Sundays and BH Mondays positive blood cultures are phoned to the clinical teams before 11:30 the following day.
Section 18.2.13	Extended respiratory PCR panel requests are accepted from ICU & paediatric consultants
Section 18.2.15	TAT for Covid testing added. All references to Covid batch testing removed
Section 19	Blood Transfusion and Haemovigilance section was completely overhauled. The order of this section was redesigned to assist with accessing information for the user
Section 19	Advised to use shared drive for most current PPPG or use MEG eGuide for most current MBOS, triggers for RCC transfusion with advice on TACO risks, special requirements, information on Blood products and components, compatibility tables and Factor Concentrates
Section 19.2	Antenatal antibody titration and Transfusion reaction investigation added to blood transfusion test list
Section 19.4.1	Updated testing times for the RhD Negative post-delivery cord bundle
Section 19.4.4	Add-on request form no longer in use advice changed to complete BT request form for add on requests
Section 19.6	New section Factors affecting test results/interpretation
Section 19.7	Blood Transfusion laboratory request form no. added
Section 19.11	Addition of a website link to access patient information leaflets in other languages
Section 19.13	Transport boxes are now the MT8 Blood transport boxes and validated for up to six hours
Section 19.17	Advice to use prompt guide for transfusion reactions found on shared drive or MEG e Guide , fig 19.6 removed not current

Section	Details of Change
Section 19.19.2	Added clarification on anti-D Ig for Intrauterine Death
Section 22	Link for flexible scope list added

2 INTRODUCTION

Regional Hospital Mullingar is part of the Ireland East Hospital Group comprising of the following hospitals: Mater Misericordiae University Hospital; St. Vincent's University Hospital; Regional Hospital Mullingar; St. Luke's General Hospital, Kilkenny; Wexford General Hospital; National Maternity Hospital, Holles Street; Our Lady's Hospital, Navan; St. Columcille's Hospital, Loughlinstown; St. Michael's Hospital, Dun Laoghaire; Cappagh National Orthopaedic Hospital and Royal Victoria Eye and Ear Hospital.

The Pathology Department at Regional Hospital Mullingar comprises of the following disciplines: Clinical Chemistry, Immunology, Haematology, Blood Transfusion and Microbiology. The laboratory offers a wide range of pathology tests to all hospital doctors and general practitioners in the Longford/Westmeath area and specialist services to clinicians in Laois/Offaly.

The purpose of this manual is to act as a quick reference guide for all users of the pathology services. This manual contains details of the analytical services available, advice of sample collection and transport, reference ranges, contact numbers and the present analytical cost of selected tests for your information. Also included is a guide to appropriate use of Blood and Blood Products and guidelines on endocrine testing. Every effort has been made to ensure that information provided in this manual is current and accurate at the time of publishing. It is updated on at least an annual basis. Please refer to the following websites for the most recent version:

Internet:
https://www.hse.ie/eng/services/list/3/acutehospitals/hospitals/regional-hospital-mullingar/publications/

It is also available as a button on Ward Enquiry and through the hospital App – MEG e-guide. Should you have any queries or suggestions for improvements in connection with any aspect of the pathology service, staff members will be pleased to discuss these with you, see list of contact numbers in Section 5.

Fran Walsh, Laboratory Manager, Regional Hospital Mullingar.

2.1 Mission Statement

The mission of the Pathology Laboratory, Regional Hospital Mullingar is the provision of an equitable, high-quality diagnostic, treatment and monitoring service to the population we serve.

2.2 Accreditation Status

The Pathology Laboratory, Regional Hospital Mullingar is accredited by the Irish National Accreditation Board (INAB) under registration number 195MT. For full scope of accreditation, refer to the following website:
https://www.inab.ie/Directory-of-Accredited-Bodies/Laboratory-Accreditation/Medical-Testing/
Blood Transfusion department incorporating Haemovigilance also complies with the AML-BB guidelines, EU directives 2002/98/EC and 2005/61/EC and Statutory Instruments 360 and 547.

As of April 2017, the Pathology Laboratory operates a flexible scope of accreditation. This allows the laboratory to make defined changes to our accreditation scope without first receiving approval from INAB. These tests can be marked as accredited prior to our next inspection. INAB then retrospectively assesses any changes during the next assessment. The scope available on the website will be updated on an annual basis. A list will be kept in the laboratory detailing any changes since the previous inspection. An up to date version of this list is also publically available at:
https://www.hse.ie/eng/services/list/3/acutehospitals/hospitals/regional-hospital-mullingar/publications/

2.3 Patient Consent

All procedures carried out on a patient need the informed consent of the patient. This should be obtained as per EXT-M/HOSPQ/24 'National Consent Policy'. It is the responsibility of the clinician to explain the clinical procedure to be performed to the patient. For most routine procedures, consent can be inferred when the patient presents himself or herself with a request form and willingly submits to the collecting procedure e.g. venepuncture. Patients in a hospital bed should normally be given the opportunity to refuse. Special procedures, including more invasive procedures, or those with an increased risk of complications to the procedure will need a more detailed explanation and in some cases, written consent. In emergency situations, consent might not be possible; under these circumstances, it is acceptable to carry out the procedure, provided they are in the patient's best interest.

For a number of tests, specific consent forms are required, primarily genetic tests. Refer to Section 6 for the Haemochromatosis request form. For external tests, these can be downloaded from the internet e.g. thrombophilia - http://www.stjames.ie/GPsHealthcareProfessionals/Referral/ReferralForms/
Alternatively, contact External Tests on 044-9394345.

2.4 Data Protection

The laboratory at RHM compiles with EXT-M/L/232 'HSE Personal Data Protection Policy' pertaining to the rights of the patient and staff and to act in an ethical and responsible manner in maintaining the security and integrity of all personal information. All laboratory staff have signed job descriptions which include a confidentiality agreement. In addition, the HSE will ensure that data subject's rights are protected as set out in the GDPR. For further information on the above, refer to https://www.hse.ie/eng/gdpr

2.5 Privacy Notice

The following is adapted from EXT-M/L/257 'HSE Privacy Notice – Patients & Service Users' available from https://www.hse.ie/eng/gdpr:
To allow us to provide our services to you, we collect and process various categories of personal information. Information we collect may include:

- Personal details about you e.g. date of birth, address, contact details (mobile phone number) etc.
- Notes and reports about your health needs

- Results of investigations, such as X-Rays and scans
- Relevant information from other health and social care professionals, your carers or relatives

We may also process certain special categories of information, which may include racial or ethnic origin, religious or philosophical beliefs, and the processing of genetic data, biometric data for the purpose of uniquely identifying a person, data concerning health or data concerning a person's sex life.
In general, we receive your information from your clinician, either as part of a hospital team or a GP service. We may also obtain information from you.

The data controller for hospital patients is the HSE. However, when services are requested directly by private hospital, voluntary hospitals, agencies, GPs or private contractors, the private hospital, voluntary hospital, agency, GP or private contractor may be the data controller.

Your Information may be used to

- Review the care we provide for you to ensure it is of the highest standard
- Investigate complaints, legal claims or adverse incidents
- Protect wider public health interests
- Provide information for planning so we can meet future needs for health and social care services
- Provide information to prepare statistics on Health Service performance
- Carry out health audit
- Provide training and development

Please note that your information will be anonymised where possible e.g. for planning or statistical purposes.

Some tests are referred to laboratories outside of the HSE, i.e. private or voluntary hospitals, specialists etc. This requires the need to share your personal information with those providers. We are careful only to share the information that is necessary for this purpose. Anyone who receives this information is also bound by confidentiality and the data protection laws. Some external laboratories used may be overseas. Overseas transfers are within the EEA and on the basis that anyone to whom we pass it protects it in the same way we would and in accordance with applicable laws. In certain situations, we may have to disclose your personal information to other agencies, in accordance with legal requirements, i.e. Department of Social welfare, Department of Health, the Courts etc., or in an emergency situation to prevent injury to other persons.

A number of Consultants are shared between Regional Hospital Mullingar, Midland Regional Hospital Tullamore and Midland Regional Hospital Portlaoise. As a result, there is access to the Mullingar laboratory IT system in MRHT and MRHP. This system is password protected and access is only given to relevant staff members.

3 QUALITY POLICY

The Laboratory at Regional Hospital Mullingar is committed to providing a service of the highest quality and shall be aware and take into consideration the needs and requirements of the users.

In order to ensure that the needs and requirements of users are met, the Laboratory will:

- Operate a quality management system to integrate the organisation, procedures, processes and resources.
- Set quality objectives and plans in order to implement this quality policy.
- Ensure that all personnel are familiar with this quality policy to ensure user satisfaction.
- Commit to the health, safety and welfare of its entire staff.
- Ensure visitors to the department will be treated with respect and due consideration will be given to their safety while on site.

- Uphold professional values and is committed to good professional practice and conduct.

All departments within the Laboratory will comply with the Irish National Accreditation Board (INAB), International Standard ISO 15189:2012 (Requirements for Quality & Competence), in addition to this standard the Blood Transfusion and haemovigilance departments adhere to the EU Directives 2002/98/EC and 2005/61/EC and Statutory Instrument 360 (Quality & Safety of Human Blood & Blood Components) & 547 (Traceability Requirements and Notification of Serious Adverse Reactions and Events). The Laboratory will also comply with National Standards for Safer Better Healthcare, 2012. All Infectious diseases are reported to public health & the Health Protection Surveillance Centre (HSPC) as per S.I. No. 245 of 2023. The Blood Transfusion & Haemovigilance departments at RHM have been INAB accredited since June 2008. An extension to scope of accreditation was awarded in April 2010 to include testing in Biochemistry, Regional Endocrinology, Regional Immunology & Haematology. Microbiology was successfully added to the scope in February 2016. A flexible scope of accreditation was achieved in Clinical Chemistry, Haematology, Immunology and Blood Transfusion in April 2017 and in Microbiology in April 2020. Microbiology accreditation is currently suspended.

The laboratory is committed to:

- Staff recruitment, training, development and retention at all levels to provide a full and effective service to its users.
- The proper procurement and maintenance of the equipment and other resources as are needed for the provision of the service.
- The collection, transport and handling of all specimens in such a way as to ensure the correct performance of laboratory examinations.
- The use of examination procedures are fit for intended use and that will ensure the highest achievable quality of all tests performed.
- Reporting results of examinations in ways which are timely, confidential, accurate and clinically useful.
- Providing a framework for establishing and reviewing quality objectives.
- The assessment of user satisfaction, in addition to internal audit and external quality assessment, in order to produce continual quality improvement.
- The safe testing, distribution and transfusion of Blood and Blood Components.

4 Hours of Operation & Location of Laboratory Services

4.1 Hours of Operation

Day	Routine Hours	Emergency On-call Service
Monday – Friday	08:00 – 20:00*	20:00 – 08:00
Saturday/Sunday/Bank Holidays	No routine service**	24 hours

* Immunology service is 09:00 – 17:30.

** Routine Microbiology service on Saturday, Sunday and Bank Holiday mornings from 09:00 – 14:00.

Please note samples from GPs should be delivered no later than 16:00 Mon-Thurs and no later than 15:30 on Fridays

4.2 Postal Address

Pathology Laboratory
Regional Hospital Mullingar
Longford Road
Mullingar
Co. Westmeath
N91 NA43

4.3 On-call Contact Details

Haematology/Blood Transfusion		Clinical Chemistry		Microbiology	
Direct	**Telephone**	**Direct**	**Telephone**	**Direct**	**Telephone**
*51836	086-0081395	*51835	086-0081394	*51875	086-0319078

5 PATHOLOGY STAFF & DEPARTMENT CONTACT DETAILS

5.1 Staffing

The Pathology department team consists of the following:

- Laboratory Manager
- Consultant Pathologists
- Consultant Haematologists
- Consultant Microbiologist
- Consultant Clinical Biochemist
- Consultant Immunologist
- Heads of Department
- Medical Scientists
- Laboratory Aides
- Quality Manager
- Training Coordinator
- Laboratory Information System Scientist
- Support Services:
  - Secretarial
  - Household
  - Phlebotomy

The laboratory has been accredited as a training laboratory by the Joint Committee for Biomedical Sciences to provide the in-service training for student Medical Scientists.

5.2 Contact Details

Please note the times of receipt of telephone calls from external users (i.e. GPs, Reps etc.) are restricted in all departments except Blood Transfusion to between 10:00 – 11:00 and 15:00 – 16:30.

Position	Name	Direct *(From Within Hospital)*	Telephone *(From Outside Hospital)*
Consultant Staff			
Histopathologist	Dr Miriam Walsh		057-9358278
Haematologist	Dr Kanthi Perera		057-9358276
Haematologist	Dr Gerard Crotty		057-9358352
	All above consultants available on mobile via switch at MRH Tullamore		
Microbiologist	Dr Gergely Krizsan		089-2633335
Clinical Biochemist	Dr Graham Lee		01-8032423 0044 7902020833
Immunologist	Prof Conleth Feighery		087-9969041
Laboratory Staff – Management			
Laboratory Manager	Ms Frances Walsh	94548	044-9394548
Chief Scientist – Blood Transfusion	Ms Carol Cantwell	94868	044-9394868
Chief Scientist – Haematology	Ms Ciara Shanley	94333	044-9394333
Chief Scientist – Clinical Chemistry	Mr Paul Crowley	94871	044-9394871
Chief Scientist – Clinical Chemistry	Ms Martina Leonard	94871	044-9394871
Chief Scientist – Microbiology	Mr Ultan Campbell	94341	044-9394341

Position	Name	Direct *(From Within Hospital)*	Telephone *(From Outside Hospital)*
Chief Scientist – Immunology	Ms Norma Mullen	94339	044-9394339
Laboratory Staff – Other			
Quality Manager	Ms Jill Gillen	94260	044-9394260
ICT Project Lead	*TBD*		
Training Officer	Ms Sandra Dempsey	94329	044-9394329
Surveillance Scientist	Ms Jean Wellwood Ms Kathy Neylon	94336	044-9394336
Laboratory – General Enquiries			
Laboratory Office		94330/94327/94347	044-9394330 044-9394327
Sample Reception		94337	044-9394337
External Tests		94345	044-9394345
Clinical Chemistry		94328	044-9394328
Immunology		94339	044-9394339
Haematology		94333	044-9394333
Coagulation		94333	044-9394333
Blood Transfusion		94329	044-9394329
Microbiology		94332	044-9394332
On-call (Haematology/Blood Transfusion)		*51836	086-0081395
On-call (Clinical Chemistry)		*51835	086-0081394
On-call (Microbiology)		*51875	086-0319078
Laboratory Accounts		94340	044-9394340
Laboratory Fax		94342	044-9394342
Other Hospital Staff			
Haemovigilance Officer	Ms Aisling Sweeney	94313	044-9340221 Bleep 043
Infection Control	Ms Julie Cullen	94776	044-9340221 Bleep 077
SMO Public Health	Dr Gerard Meagher	95006	044-9395006
Other Useful Numbers			
RH Mullingar			044-9340221
Laboratory, MRH, Portlaoise		96283	
Blood Transfusion, MRH Portlaoise		94269	
Laboratory, MRH, Tullamore		58342	
Blood Transfusion, MRH Tullamore		58385	
Histology, MRH Tullamore		58338	
Irish Blood Transfusion Services (IBTS)		*51240	01-4322800
St. James' Hospital		*51074	01-4162059
St. Vincent's Hospital		*51080	01-2774390
Temple Street Hospital		*51049	01-8784200
National Virus Reference Lab (NVRL)		*51503	01-7161323
NVRL – Urgent Reports			01-7161240

6 LABORATORY REQUEST FORMS, SPECIMEN COLLECTION & RESULT REPORTING TIMES

This section outlines the information that is required to be documented on the laboratory request form and the specimen bottle or container, prior to the analysis of samples.

6.1 Pathology Policy on Request Form Completion & Specimen Labelling

The purpose of this policy is to effect uniformity of requirements across the various disciplines in line with ISO, INAB and HPRA standards. The policy ensures that:

- The information on both the request form and the corresponding clinical specimen are sufficient to unambiguously link the two together, thereby ensuring the correct results/blood products are always issued to the correct patient.
- The laboratory receives adequate information on the request form.
- The laboratory records accurate and complete patient and specimen identification for each request received.

It is the responsibility of the requestor/person taking the sample to ensure that the laboratory is provided with complete and accurate patient identification details on both the request form and specimen container.

6.2 Request Forms

There are a number of different forms. These are used for different pathology departments/tests as outlined below. It is important that the **correct form** is supplied for a particular test.

1. Blood Transfusion form (FORM-M/BTL/101): Pink form used for transfusion

A JONES & BROOKS EASISEAL SPECIMEN FORM. PATENT NO. 2221208 B

PRESS FIRMLY ON EACH END TO ENSURE A LEAKPROOF SPECIMEN CARRIER

JB-105439

Blood Transfusion Laboratory Request Form - Regional Hospital Mullingar

All Urgent Requests MUST be phoned 044 939 4329, Out of Hours *51836

FORM - M/BTL/101 Version 1. Active Date 01-09-2023

Attach iPMS addressograph label here

Surname: _____ Forename: _____

Gender: M ☐ F ☐ DOB: ___/___/_____ Hospital Number: _____ Former Surname: _____

Patient Address: _____

Ward: _____ Clinician: _____ Clinician Address: _____

Clinical Details/Diagnosis:	Reason for Transfusion:

TRANSFUSION HISTORY

Previous Transfusion: Yes ☐ No ☐
Any Reactions: Yes ☐ No ☐
Known Antibodies: Yes ☐ No ☐
Details: _____

SPECIAL REQUIREMENTS

CMV Negative ☐ Irradiated ☐ N/A ☐
State reason for requirements in Clinical Details Section

ANTENATAL HISTORY

Currently Pregnant: Yes ☐ No ☐

EDD: ___/___/_____ Parity: _____
Known Antibodies: Yes ☐ No ☐
Previous infant affected with HDFN: Yes ☐ No ☐
Anti-D given within the last 6 months: Yes ☐ No ☐
If yes, date given: ___/___/_____

TEST REQUESTS

- Group and Antibody Screen (Valid for 72hrs) ☐
- Red Cell Crossmatch Request ☐
- Neonatal Group / Cord Group ☐
- Direct Antiglobulin Test (DAT) ☐
- FMH Estimation (Kleihauer) ☐
- Anti-D/c Quantitation / Antibody Titration ☐
- Transfusion Reaction Investigation ☐

DATE/TIME REQUIRED: ___/___/_____ **AT:** ____:____

Sample Requirements - Whole Blood in EDTA required. Sample preferably labelled with BloodTrack PDA – handwritten samples acceptable. **NO** addressographs on samples

- Adults - EDTA Pink top 6mL tube
- Babies <4months of age - EDTA Red top 1.3mL tube
- Babies/Children ≥4months of age - EDTA Pink top 6mL tube with ≥2 mL sample if possible

BLOOD COMPONENT/PRODUCT REQUIREMENT

Product	Unit(s)	For patients under 16 years, order in mL
Red Cell Concentrate		
Platelets		
Plasma		
Fibrinogen (1g per vial)		
Albumin 5% (500 mL bottle)		
Albumin 20% (100 mL bottle)		

*Coagulation Factors: _____ Dose: _____
Request for coagulation factors should be discussed with the Haematology Team
Requests for patients with Haemophilia should be discussed with either St James Hospital/CHI at Crumlin

Requestor Details

Requestor's Name: _____

Contact №: _____ MCRN/NMBI: _____

Laboratory Use Only

Request Checked By: _____

Sample Accepted ☐ Sample Rejected ☐
Amendment Req'd ☐ Request Form Only ☐

Reason for Amendment/Rejection: _____

Contacted: _____ Date: __/__/__ Time: __:__

Blood Taken & Labelled By (Blood Track Label here or handwrite)

Collector's Name: _____

Contact №: _____ MCRN/NMBI: _____

Sample Collection Date: ___/___/_____ Time: _____:_____

Date & Time Received	Laboratory Number

2. Prophylactic Anti-D Order form (FORM-M/BTL/103): Blue/white form used for requesting prophylactic Anti-D from Blood Transfusion

PATHOLOGY REGIONAL HOSPITAL MULLINGAR
Longford Road, Mullingar, Co Westmeath

Blood Transfusion Laboratory Mullingar, Prophylactic Anti-D Ig Order Form

Print details or affix Patient Demographics Label here

Patient Name: _____ Chart Number: _____

Date of Birth: _____ Patient's Blood Group: _____

Ward: _____ Clinician: _____

*Note: Anti-D Ig is inappropriate for patients with a history of immune anti-D

Prophylactic Anti-D Ig Indication

Tick the box to the right of the appropriate indication

Clinical Indication with Gestation < 12 weeks

ERPC		Ectopic/Molar pregnancy	
Medical/Surgical termination		Vaginal bleeding associated with severe pain if approaching 12 weeks gestation	

Clinical Indication with Gestation ≥ 12 weeks

For pregnancies >12 weeks **check whether Fetal Rh D Screening** has been completed in the **current** pregnancy.
Prophylactic anti-D Ig is not required when the fetus is predicted as RhD negative.
Please send a kleihauer for gestations >20 weeks

Miscarriage		Abdominal trauma	
Termination of pregnancy		Other in-utero therapeutic intervention / surgery e.g. External cephalic version, amniocentesis, chorionic villus sampling, cordocentesis	
Ectopic pregnancy		Intrauterine death	
PV Bleed/Antepartum haemorrhage*#		# For recurrent PV bleeding, repeat Anti-D 1500 IU at 6-weekly intervals with FMH testing every 2 weeks. Note: RAADP is a standalone treatment so exclude this dose when calculating a 6 weekly interval.	

Clinical Indication with Gestation at 28 weeks

Please take a sample for group and antibody screen **prior** to the administration of prophylactic anti-D

Routine Antenatal Anti-D Prophylaxis (RAADP) *	

Following birth

Delivery of RhD Positive infant		Unable to obtain cord/peripheral blood sample from infant	

Completion of this section is MANDATORY

Requested By:
Name (PRINT): _____ Bleep/Phone No.: _____

MRCN/NMBI No.: _____ Date: _____ Time: _____

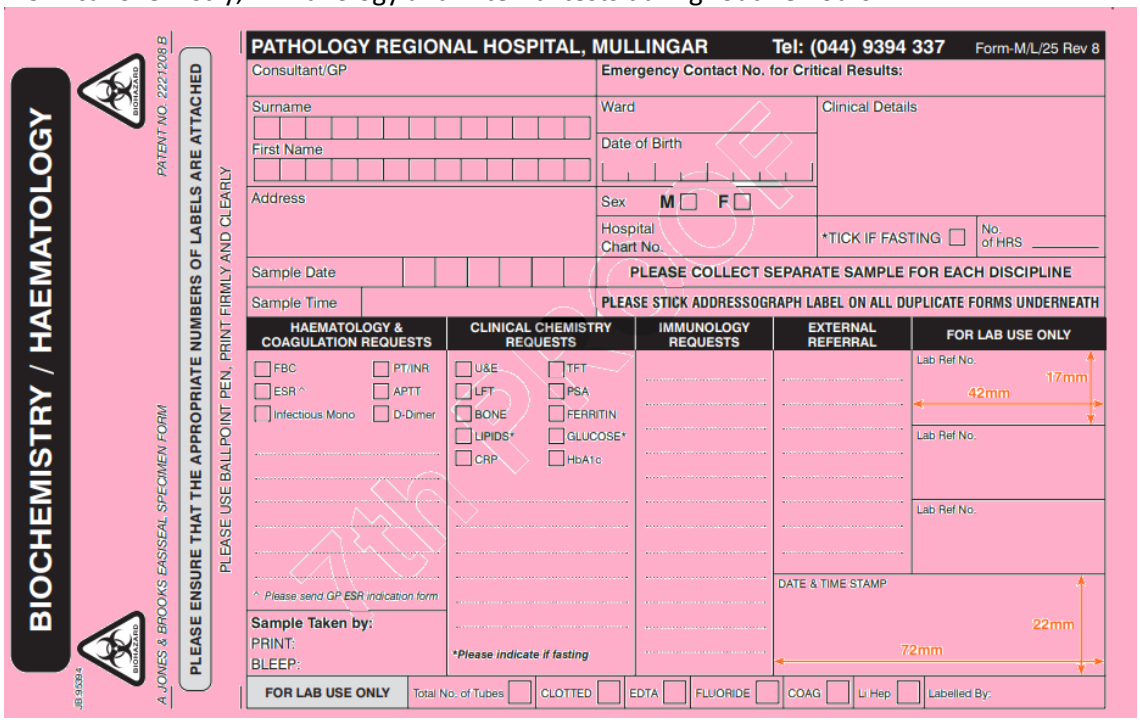
Date/Time required for:

Anti-D Ig will not be released until this completed form is received in the Blood Transfusion Laboratory

Lab Use: Date and time stamp here	Lab Accession Number: _____

Doc. No: FORM-M/BTL/103	**Doc Owner:** John Quigley	**Dept. & Location:** Blood Transfusion, RH, Mullingar	
Vers. No: 1	**Active Date:** 24/01/2023	**Doc Title:** Prophylactic Anti-D Ig Order Form	**No. Of Pg.:** 1 of 1

3. General Request form (FORM-M/L/25): 6-part pink form used for Haematology, Coagulation, Clinical Chemistry, Immunology and External tests during routine hours



BIOCHEMISTRY / HAEMATOLOGY

PATENT NO. 2221208 B

PLEASE ENSURE THAT THE APPROPRIATE NUMBERS OF LABELS ARE ATTACHED

PLEASE USE BALLPOINT PEN, PRINT FIRMLY AND CLEARLY

A JONES & BROOKS EASISEAL SPECIMEN FORM

PATHOLOGY REGIONAL HOSPITAL, MULLINGAR **Tel: (044) 9394 337** Form-M/L/25 Rev 8

Consultant/GP | Emergency Contact No. for Critical Results:

Surname | Ward | Clinical Details

First Name | Date of Birth

Address | Sex M ☐ F ☐

Hospital Chart No. | *TICK IF FASTING ☐ | No. of HRS

Sample Date | PLEASE COLLECT SEPARATE SAMPLE FOR EACH DISCIPLINE

Sample Time | PLEASE STICK ADDRESSOGRAPH LABEL ON ALL DUPLICATE FORMS UNDERNEATH

HAEMATOLOGY & COAGULATION REQUESTS	CLINICAL CHEMISTRY REQUESTS	IMMUNOLOGY REQUESTS	EXTERNAL REFERRAL	FOR LAB USE ONLY
☐ FBC ☐ PT/INR ☐ ESR ^ ☐ APTT ☐ Infectious Mono ☐ D-Dimer	☐ U&E ☐ TFT ☐ LFT ☐ PSA ☐ BONE ☐ FERRITIN ☐ LIPIDS* ☐ GLUCOSE* ☐ CRP ☐ HbA1c			Lab Ref No. 17mm 42mm Lab Ref No. Lab Ref No.

^ Please send GP ESR indication form

DATE & TIME STAMP 22mm 72mm

Sample Taken by:
PRINT:
BLEEP:

*Please indicate if fasting

FOR LAB USE ONLY | Total No. of Tubes ☐ | CLOTTED ☐ | EDTA ☐ | FLUORIDE ☐ | COAG ☐ | Li Hep ☐ | Labelled By:

4. Microbiology form (FORM-M/M/41): 4-part blue form used for Microbiology tests during both routine and on-call hours

HAVE YOU LABELLED THE SPECIMEN CORRECTLY?

PRESS FIRMLY ON EACH END TO ENSURE A LEAKPROOF SPECIMEN CARRIER

PATENT NO. 2221208 B

MICROBIOLOGY

Midland Regional Hospital Mullingar, Microbiology Request Form
Tel: (044) 9394332 Form-M/M/41 Rev D01

Consultant / GP | Medical Co. No. | Public ☐ | Private ☐ | GP Address:

Surname | Ward

Forename | Date of Birth | Clinical Details:

Address | Sex: M ☐ F ☐ | Hospital Chart No.

PLEASE STICK ADDRESSOGRAPH LABEL ON ALL DUPLICATE FORMS UNDERNEATH

Sample Date: | COMPLETE SEPARATE REQUEST FORM FOR EACH SAMPLE

Sample Time: | DATE AND TIME STAMP (for laboratory use only)

Specimen Source *(must specify specimen source)*

☐ Blood Culture	☐ Aspirate *(Specify Site)*	☐ Influenza	☐ Tip *(Specify Site)*
☐ CSF	☐ BAL	☐ Nasopharyngeal Aspirate	☐ Urethral Swab
☐ Fluid *(Specify Site)*	☐ Cervical Swab	☐ Nose Swab	☐ Vaginal Swab
☐ Stool *(Specify Test)*	☐ Chlamydia/Gonorrhoea *(Specify Site)*	☐ Penile Swab	☐ Vulval Swab
☐ Urine *(MSU)* for C&S	☐ Ear Swab	☐ Rectal Swab	☐ Viral *(Specify Site)*
☐ Urine *(CSU)* for C&S	☐ Eye Swab	☐ Scalp Swab	☐ Wound *(Specify Site)*
☐ Urine *(Suprapubic)* for C&S	☐ Fungal *(Specify Site)*	☐ Skin Swab	
	☐ Groin Swab	☐ Sputum	*Miscellaneous (Specify)*
	☐ Screening Swab *(Specify Site/test)*	☐ Throat Swab	

Specimen Comments:

Test Request: .....

Specify Site (if appropriate): .....

Sample Taken / Labelled by:
PRINT:
SIGN:
BLEEP:

LAB REF. NO.(S)

5. Haemochromatosis form (FORM-M/M/32): Single white page used for Haemochromatosis requests

Feidhmeannracht na Seirbhíse Sláinte
Health Service Executive

Regional Molecular Diagnostics Laboratory
Midlands Regional Hospital Mullingar

Hemochromatosis Molecular Genetic Testing

Sample requirements: One EDTA blood sample is required (4-6 mLs).

Indicate sample Date *and* Time taken: Date: ..... Time: .....am/pm

Specimen taken by: _____ Labelled by:_____ MCRN:_____

Patient Details:	**Referring Clinician:**
Name:	**Name:** .....
D.O.B:	**Address to which report will be sent:**
Gender:	.....
Address:	.....
.....	.....
.....	**Tel/Fax:** .....
Chart #	

Reason for Referral:

1. **Family History. Please tick:**

Yes ☐ **No** ☐ **Unknown** ☐

Specify relationship of current patient to the confirmed index case(s):

.....

2. **Clinical Details/Indications for Testing:**

Raised Transferrin Saturation	☐	_____%
Raised Serum Ferritin	☐	_____ ng/ml
Abnormal LFTs	☐	_____
Diabetes	☐	
Arthritis	☐	
Cardiomyopathy	☐	

Patient Consent:

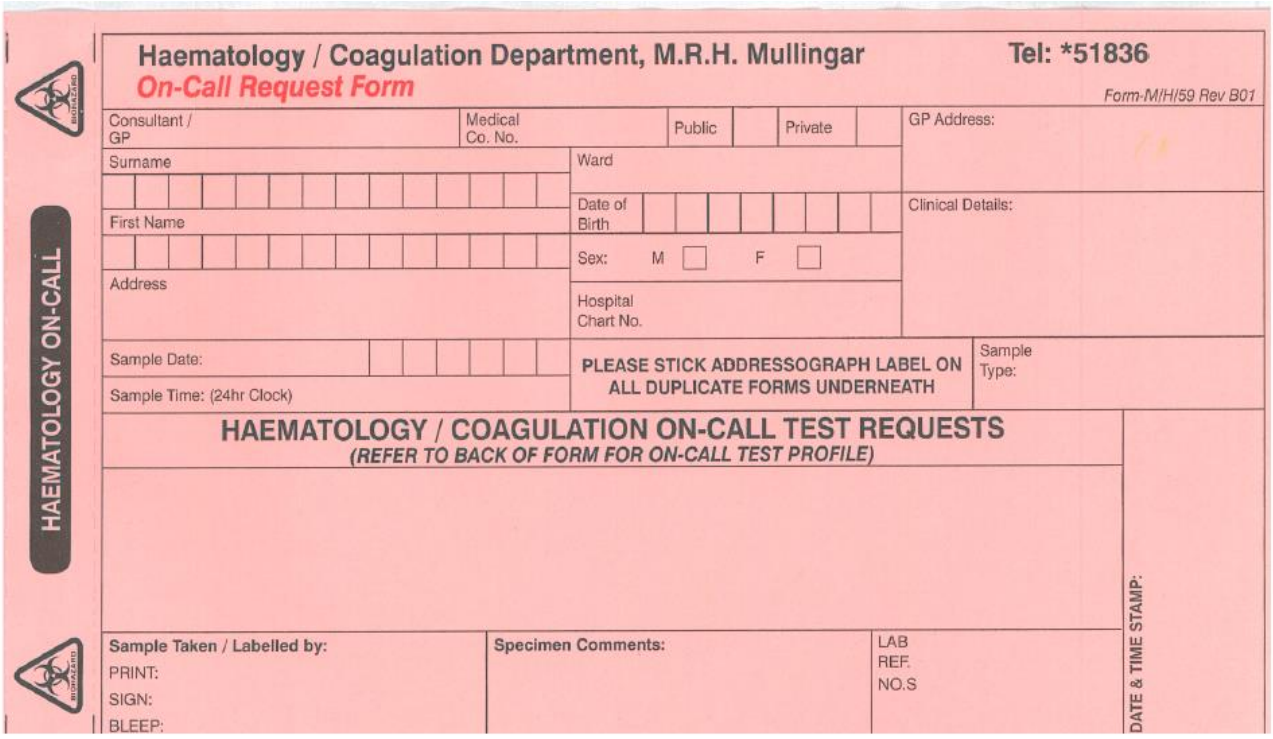
I fully understand the implications of the genetic test for Hereditary Haemochromatosis which have been explained to me by my doctor.

Signed: ..... **Date:** .....

Laboratory use only	*Date and Time Received:*

Doc. No: FORM-M/M/32	*Doc Owner: Colin Murtagh*	*Dept & Location: Molecular Laboratory MRHM*	
Rev. No: E01	*Active Date: 04/10/16*	*Doc Title: Haemochromatosis Gentic Testing Request Form*	*No. Of Pg: 1 of 1*

6. Haematology On-call form (FORM-M/H/59): 2-part pink form used for Haematology & Coagulation requests on-call



Haematology / Coagulation Department, M.R.H. Mullingar Tel: *51836
On-Call Request Form
Form-M/H/59 Rev B01

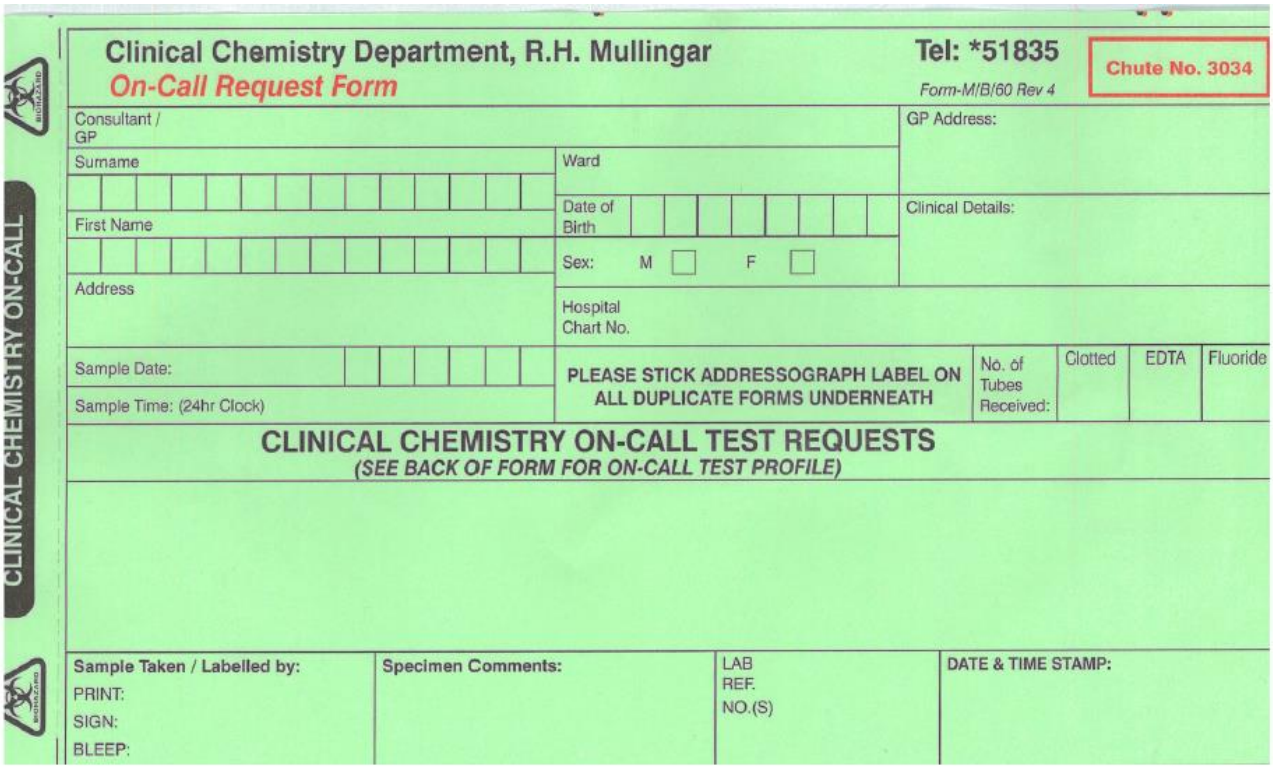
HAEMATOLOGY ON-CALL

Consultant / GP | Medical Co. No. | Public | Private | GP Address:
Surname | Ward
First Name | Date of Birth | Clinical Details:
Sex: M F
Address | Hospital Chart No.
Sample Date: | PLEASE STICK ADDRESSOGRAPH LABEL ON ALL DUPLICATE FORMS UNDERNEATH | Sample Type:
Sample Time: (24hr Clock)

HAEMATOLOGY / COAGULATION ON-CALL TEST REQUESTS
(REFER TO BACK OF FORM FOR ON-CALL TEST PROFILE)

Sample Taken / Labelled by:
PRINT:
SIGN:
BLEEP:
Specimen Comments:
LAB REF. NO.S
DATE & TIME STAMP:

7. Clinical Chemistry On-call form (FORM-M/B/60): 2-part green form used for Clinical Chemistry requests on-call



Clinical Chemistry Department, R.H. Mullingar Tel: *51835
On-Call Request Form
Form-M/B/60 Rev 4
Chute No. 3034

CLINICAL CHEMISTRY ON-CALL

Consultant / GP | GP Address:
Surname | Ward
First Name | Date of Birth | Clinical Details:
Sex: M F
Address | Hospital Chart No.
Sample Date: | PLEASE STICK ADDRESSOGRAPH LABEL ON ALL DUPLICATE FORMS UNDERNEATH | No. of Tubes Received: | Clotted | EDTA | Fluoride
Sample Time: (24hr Clock)

CLINICAL CHEMISTRY ON-CALL TEST REQUESTS
(SEE BACK OF FORM FOR ON-CALL TEST PROFILE)

Sample Taken / Labelled by:
PRINT:
SIGN:
BLEEP:
Specimen Comments:
LAB REF. NO.(S)
DATE & TIME STAMP:

8. Vitamin D Clinical Information form (FORM-M/CC/55): Single white page used for Vitamin D requests

PATHOLOGY REGIONAL HOSPITAL MULLINGAR
Longford Road, Mullingar, Co Westmeath Tel: 044 9394330

Vitamin D Clinical Information Form

https://www.hse.ie/eng/services/list/3/acutehospitals/hospitals/regional-hospital-mullingar/publications/

Please complete this form for all **Vitamin D** requests and enclose with each sample, to enable timely analysis. If this form is incomplete or not enclosed with the sample, normal analysis will not proceed. The sample will instead be retained for 5 days from the date of sample receipt and will be analysed only upon receipt of such details by the laboratory. During this time if there has been no such correspondence, samples will be discarded without analysis. Pink Lab request form also required.

Please affix patient label here or complete box below

Patient
Name:
Date of Birth:
Gender:

Requestor
Name:

* LAB USE ONLY Date and Time stamp:

Request Details

Has vitamin D been requested on this patient before? Yes / No (circle as applicable)
If Yes:
When was the last sample analysed? ____/___/20____
If <12 weeks ago and patient is on treatment, steady state vitamin D levels may not have been obtained therefore we suggest that you do not proceed with vitamin D analysis at this time
What was the result on the date of last analysis? _____ nmol/L

Please complete below:
What is the reason for this request (complete below as relevant);

- Metabolic Bone Disease? (Please specify) _____
- Monitoring response to vitamin D treatment? Yes / No (circle as appropriate)
- Low trauma/pathological fractures? Yes / No (circle as appropriate)
- Biochemical findings e.g. ↓Ca, ↑PTH? (Please specify): _____
- Other relevant clinical conditions that could be attributed to or lead to vitamin D deficiency? (Please specify)_____
- Signs or symptoms of possible vitamin D deficiency? Yes / No (circle as appropriate) (Please specify):_____

Doc No: FORM-M/CC/55	Doc Owner: Paul Crowley	Dept & Location: Pathology RH, Mullingar	
Rev. No: 4	Active Date: 31/01/2023	Doc Title: Vitamin D clinical information form	No. Of Pg: 1 of 1

9. Vitamin B12 and Folate demand management form (FORM-M/CC/58): Single white page used for Vitamin B12 and folate requests

PATHOLOGY REGIONAL HOSPITAL MULLINGAR
Longford Road, Mullingar, Co Westmeath Tel: 044 9394330

Vitamin/Folate B12 clinical indication form

https://www.hse.ie/eng/services/list/3/acutehospitals/hospitals/regional-hospital-mullingar/publications/

Please complete this form for all Vitamin B12/Folate requests and enclose with each sample, to enable timely analysis. If this form is incomplete or not enclosed with the sample, usual analysis will not proceed. The sample will instead be retained for 5 days from the date of sample receipt and will be analysed only upon receipt of this form by the laboratory. During this time if there has been no such correspondence, samples will be discarded without analysis. This form must accompany all requests for Vitamin B12/Folate testing. Lab request form also required. Please affix patient label here or complete box below

Please affix patient label here or complete box below

Patient demographics:
Name:
Gender:
Date of Birth:

Requestor's details
Name:

*Date and Time stamp LAB USE ONLY:
Request Details

Has Vitamin B12/Folate been requested on this patient before? Yes / No (circle as applicable) If Yes:
*When was the last sample analysed? ____/___/20_____
What is the reason for this request (complete below as relevant, giving specific details);

- High risk for nutritional B12/Folate deficiency? _____
- High risk for drug-related B12/Folate deficiency?_____
- GI disease/surgery or related features?_____
- Unexplained hematologic abnormalities?_____
- Unexplained neurologic abnormalities?
- Consultant Haematologist/Neurologist management? (Circle as relevant)
- Other supportive signs (e.g. glossitis, mouth ulceration)_____
- Pregnancy? Yes/No
- Dialysis patient? Yes/No

Doc. No: FORM-M/CC/58	Doc Owner: Paul Crowley	Dept & Location: Clinical chemistry RH, Mullingar	
Vers. No: 3	Active Date: 31/01/2023	Doc Title: Vitamin B12 demand management form	No. Of Pg: 1 of 1

10. Malaria Request form (FORM-M/H/77): Single white page used for Malaria requests

PATHOLOGY REGIONAL HOSPITAL MULLINGAR
Longford Road, Mullingar, Co Westmeath Tel: 044 9394330

MALARIA REQUEST FORM: This form should accompany a general request form.

Download from:
https://www.hse.ie/eng/services/list/3/acutehospitals/hospitals/regional-hospital-mullingar/publications/

1. Prior to requesting a malaria screen, it is important to establish that patient has been in a malaria-risk area.
2. Please fill out this form and inform the haematology laboratory at 044-9394333
3. Sample requirement: 1 EDTA sample (one sample can be used for FBC & Malaria screen.)
   - The sample should arrive in the Haematology Laboratory within two hours of venepuncture.
   - The sample is best taken during fever, but can be taken at any time.

Patient Name:

MRN : **Date of Birth:**

Very Important Information

Name of ward/medical centre/ hospital:

Requesting Doctors Name:

Bleep or phone or mobile phone number:

How can we contact you after hours if malaria screen is positive?
Out of hours contact phone number(MANDATORY):

Clinical Symptoms and Duration:

Travel History
What countries has the patient travelled to during the past year?

When did they return to Ireland?

Were anti-malarial/prophylaxis taken during travel? **Yes/ No**
If yes, what type?

Has malaria treatment commenced for this episode? **Yes/No**
If yes, what type?

Has the patient previously had malaria? **Yes/No**
If yes, what species?

Where and when was it diagnosed?

Date and time of receipt in laboratory:

Doc. No: FORM-M/H/77	***Doc Owner: Ciara Shanley***	***Dept & Location:*** *Pathology RH, Mullingar*	
Vers. No: 4	***Active Date: January 2023***	***Doc Title:* MALARIA REQUEST FORM**	***No. Of Pg:*** *1 of 1*

11. ESR Request form (FORM-M/H/82): Single white page used for ESR requests

PATHOLOGY REGIONAL HOSPITAL MULLINGAR
Longford Road, Mullingar, Co Westmeath Tel: 044 9394330

ESR

ESR clinical indication form. Download from
https://www.hse.ie/eng/services/list/3/acutehospitals/hospitals/regional-hospital-mullingar/publications/
(See also laboratory memorandum of MEMO-M/H/19)

Please complete this form for ALL ESR requests and enclose with each sample, to enable timely analysis. From 01/03/2020, if this form is incomplete or not enclosed with the sample, ESR analysis will NOT proceed. This form must accompany all requests for ESR testing. Lab request form also required. Please affix patient label here or complete box below

Please affix patient label here or complete box below
Patient demographics - Name: Gender: Date of Birth: Hospital Number:

Requestor's details
Name:
Source:

*Date and Time stamp LAB USE ONLY:
Request Details

Has ESR been requested on this patient before? Yes / No (circle as applicable) If Yes: *When was the last sample analysed? ____/___/20_____
What is the reason for this request (complete below as relevant, giving specific details):

- Giant cell arteritis / Temporal arteritis? _____
- Polymyalgia rheumatica? _____
- Prosthetic joint infection? _____
- Osteomyelitis_____
- Hodgkins risk assessment? _____
- Consultant Haematologist management? _____

Doc. No: ***FORM-M/H/82***	***Doc Owner: Ciara Shanley***	***Dept & Location: Haematology*** *Pathology RH, Mullingar*	
Vers. No: 3	***Active Date:*** ***January 2023***	***Doc Title: ESR clinical indication form***	***No. Of Pg:*** *1 of 1*

12. Troponin Request form (FORM-M/L/155): Single page white form used for Troponin requests

High Sensitivity Troponin (hs-cTnI) Request Form *Regional Hospital Mullingar*

Grúpa Ospidéal Oirthear na hÉireann — Ireland East HOSPITAL GROUP

Consultant Approved: Dr M Wilkinson, Dr G.R. Lee (Clinical Biochemistry), Dr I Khan (Cardiology) and Dr S Kuan (ED)

Hs-cTnI: Troponin (cTn) should be used to support the diagnosis of **Acute Coronary Syndromes** / **Myocardial Infarction** (ACS/MI) without persistent ST Elevation (NSTE-ACS / NSTE-MI) in patients with **chest pain** of **suspected cardiac** origin.
For patients with ST-ACS / STEMI, cTn testing should not delay immediate reperfusion.

Form-M/L/155 Vers.3 Effective from 01/02/202

1. Chest Pain? ☐ 2. Cardiac Chest Pain? ☐

3. Time in Hours since chest pain / ACS symptom onset, if known? (up to Sample Time) _____ Hrs

Details of Cardiac Chest Pain AND / OR other signs / symptoms supportive of ACS / AMI?

_____

_____

4. Ischaemic ECG changes? ☐ Details: _____

NOTE: **New high sensitivity Troponin I assay (hs-cTnI).** New units of reporting, now ng/L, previously ug/ml. There is a **1000 fold increase** in the reported result e.g. 0.04 ug/ml now equates to 40 ng/L (hs-cTnI) etc.

(i) A negative hs-cTnI ≤39 [Females]/≤53[Male] ng/L (≤99th percentile), early after symptom onset (e.g. <6h) may lack sensitivity for **Ruling Out MI.**

(ii) A very low Troponin (<3 ng/L) measured at least 3h after chest pain onset may also be used for **Rule out** of MI. Repeat at 3-6h however if clinical suspicion remains

Troponin may be raised acutely or chronically in cardiac and non-cardiac conditions, therefore:

(iii) A positive hs cTnI >39[F]/>53[M] ng/L requires **repeat** at 3-6h to help determine cause (e.g. Acute or Chronic).

(iv) A highly positive hs-cTnI (e.g. ≥150 mg/ml i.e. 5x99th percentile) does **NOT** usually require **repeat** to **Rule in MI.**

Surname:	Forename:		DOB:
Clinical Details:	Address:		Sex: M F
Requester:	Ward:		Chart No.
Sample Date:	Sample Time: ____:____	Sample Type: Red Top (Serum Gel)	Date & Time of Receipt:

13. BNP Request form (FORM-M/L/156): Single page white form used for BNP requests

N-terminal pro-brain natriuretic peptide (NT-proBNP) Request Form
Regional Hospital Mullingar

Grúpa Ospidéal Oirthear na hÉireann — Ireland East HOSPITAL GROUP

Consultant Approved: Dr M Wilkinson, Dr G.R. Lee (Clinical Biochemistry), Dr I Khan (Cardiology) and Dr S Kuan (ED)

NT-proBNP	N-Terminal pro Beta Natriuretic Peptide (NT-proBNP) is most useful to support the diagnosis of acute decompensated Heart Failure (HF) in patients presenting with **dyspnoea of uncertain cause**. NT-proBNP is an expensive test and should **NOT be ordered** IF: (1) there are no clinical signs & symptoms of HF, (2) Dyspnoea is consistent with other known aetiologies (e.g. COPD). It does not add significant diagnostic value where HF is obvious clinically.

Form-M/L/156 Vers.3 Effective from 01/02/2022

Please circle 1 OR 2 below as the indication for NT-proBNP testing. Provide any #other reason(s) as relevant

1. Obvious	2. Uncertainty	3. NO Evidence
Clinical diagnosis of HF	Suspected HF: NT-proBNP *has greatest diagnostic value here*	of HF
Consider need for NT-proBNP	Request NT-proBNP	Do Not Request NT-proBNP
Consider aetiologies* and Precipitating Causes *Think CHAMP: ACS, Hypertension, Arrhythmia, Mechanical, Pulmonary	NT-proBNP <400 ng/L make a diagnosis of new HF less likely. Note: Values <125 ng/L have greater certainty for rule out. Note: Age-related Rule In thresholds can be considered: ≥450 [<50y], ≥900 [50-75y], ≥1800 [>75y] pg/ml) in acute setting. Note: Many factors can ↓ (e.g. obesity, F<M if <55y, diuretics, ACEi etc.) +↑ (e.g. ACS, COPD, CKD) NT-proBNP levels.	Consider other causes of Dyspnoea if present

#OTHER REASON(S):

Surname:	Forename:		DOB:
Clinical Details:	Address:		Sex: M F
Requester:	Ward:		Chart No.
Sample Date:	Sample Time: ___:___	Sample Type: EDTA only	Date & Time of Receipt:

14. NT-proBNP Indication form (FORM-M/CC/68): Single page white form used for GP BNP

PATHOLOGY REGIONAL HOSPITAL MULLINGAR
Longford Road, Mullingar, Co Westmeath Tel: 044 9394330

NT-proBNP clinical indication and information form

(Dr Graham Lee, Consultant Clinical Biochemist, glee@mater.ie)

*Please see **Natriuretic Peptide (NP) testing interpretative notes (03/08/2022)** regarding interpretation of NT-proBNP available from:*
https://www.hse.ie/eng/services/list/3/acutehospitals/hospitals/regional-hospital-mullingar/publications/

Please complete this form for ALL NT-proBNP requests and enclose with each sample, to support timely analysis.

Please affix patient label here or complete box below: **Patient demographics –** **Name:** **Gender:** **Date of Birth:**

Please complete the details below

1. **Indication for testing?** Please circle Yes/No below as relevant:

Registration/First visit to Treatment programme:	Yes / No
Baseline NT-proBNP if existing HF (or AF, DM, COPD)?	Yes / No
Case finding, symptoms consistent with (new) heart failure?	Yes / No
Existing HF, cardiology specialist request	Yes / No
Deteriorating in symptoms consistent with HF?	Yes / No

2. **Existing disease?** Please circle Yes/No for the diseases below where known, otherwise circle Unknown

Type 2 diabetes?	Yes / No / Unknown
Pre diabetes (HbA1c: 42 – 47 mmol/mol)?	Yes / No / Unknown
Ischemic Heart disease?	Yes / No / Unknown
Atrial fibrillation?	Yes / No / Unknown
Hypertension?	Yes / No / Unknown
If known hypertension selected one of below:	
Stage 1 + target organ damage or QRISK ≥ 20%]?	Yes / No / Unknown
Stage 2 (≥160/100)]?	Yes / No / Unknown

3. BMI ≥30? Yes / No / Unknown

4. On ACEi, ARB, [1]ARNIs, Aldosterone or Beta (adrenergic) Receptor blockers? Yes[2] / No / Unknown
   [1]angiotensin receptor neprilysin inhibitor [2]Circle drug(s) as relevant

5. Other information to support your request?

Doc. No: FORM-M/CC/68	**Doc Owner:** Paul Crowley	**Dept & Location:** Clinical Chemistry RH, Mullingar	
Vers. No: 2	**Active Date:** 31/01/2023	**Doc Title:** NT-proBNP Indication form	**No. Of Pg:** 1 of 1

6.3 Completion of the Request Form

The following **essential** information must be documented in a legible manner on all request forms, including any back copies so that the identity of the patient is unequivocal:

1. Full name (First name & surname)
2. Date of Birth
3. Chart number
4. Test request (including anatomical site for Microbiology & Histology)
5. Ward/Location for destination of report
6. Signature of person who took sample *(Mandatory for Blood Transfusion)*
7. Date & time of sample collection *(Mandatory for Blood Transfusion)*

The following information is **desirable:**

8. Consultant or GP's name
9. Relevant clinical information appropriate to the tests requested e.g. history of administration of drugs, antenatal history etc. The minimum clinical information supplied must include gender and date of birth for interpretative purposes.

In the case of an unresponsive/unconscious patient, the following information should be supplied:

1. Unconscious Male/Female Adult
   Unconscious Male/Female child as relevant
2. Chart number

It is the responsibility of the medical officer to ensure that the request forms and specimens carry all of the above information.

Note: Most regularly used laboratory forms have more than one page. If using addressograph labels, they must be placed on all leaflets of the request form.

6.4 Clinical Details

The inclusion of brief clinical details including relevant medication and family history assists the laboratory in providing the most appropriate service for requesting doctors. Reference ranges quoted as age and gender specific where applicable. Relevant clinical details are of particular importance for allergy testing and blood film examination. Family history is especially relevant to genetic testing & interpretation of results.

All tests referred to the Microbiology department must include relevant clinical details and medications. Immune status, antimicrobial therapy in previous 72 hours and occupational or environmental risks are crucial to the processing of samples in Microbiology.
Clinical details should include the following:

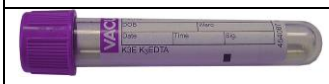
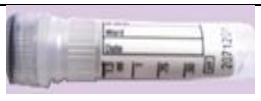
- Immune status
- Cystic fibrosis
- Pregnancy
- Drug therapy
- Burns
- Chemotherapy
- Prosthesis
- Post-surgery
- Radiation therapy
- Foreign travel

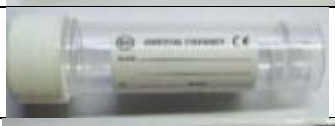
The range and type of investigations carried out are governed by this information. If it is absent or incomplete, possible pathogens may be missed or overlooked. It is the responsibility of the requesting doctor to convey clear and pertinent clinical details if present.

6.5 Specimen Types

6.5.1 Mullingar Sample Types

The Greiner Vacuette system for blood collection is used in RHM. Details of the type and volume of sample required for a particular assay are given in Section 17. The following blood bottle types are commonly used:

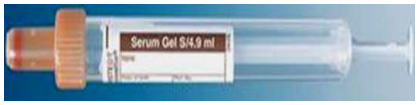
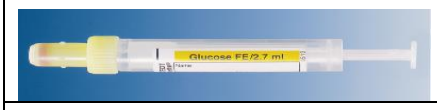
Specimen Bottle	Bottle Type & Information
Adult Bottles	
	**Red Vacuette – Product No. 455071** This tube contains a polymer gel and no anticoagulant. Fill to the mark (8.0mL). After blood collection, invert tube 5-10 times. This tube is suitable for **most Clinical Chemistry, Immunology and External tests including Troponin & NT-proBNP.**
	**Purple Vacuette – Product No. 454035** This tube contains EDTA anticoagulant. Fill to the mark (2.5mL). After blood collection, invert tube 8-10 times. This tube is suitable for **FBC, Reticulocytes, ESR, Blood Film, FMH Test, HbA1c, Ammonia, NT-proBNP, PTH**
	**Blue Vacuette – Product No. 454349** This tube contains trisodium citrate anticoagulant. Fill to the mark (3.0mL). Inadequately filled tubes CANNOT be processed. After blood collection, invert tube 4 times. This tube is suitable for **PT, INR, APTT, D-dimer and Fibrinogen.**
	**Grey Vacuette – Product No. 454085** This tube contains fluoride oxalate anticoagulant. Fill to the mark (2.0mL). After blood collection, invert tube 5-10 times. This tube is suitable for **Glucose, Lactate and Ethanol testing.**
	**Green Vacuette – Product No. 454084** This tube contains lithium heparin anticoagulant. Fill to the mark (4.0mL). After blood collection, invert tube 5-10 times. This tube is suitable for **Chromosome analysis.**
	**Pink Vacuette – Product No. 456093** This tube contains EDTA anticoagulant. Fill to the mark (6.0mL). After blood collection, invert tube 5-10 times. Babies/Children ≥4months of age: ≥2 mL if possible. This tube is suitable for **Group & Screen, Antibody screen, Crossmatching and DAT testing.**
Paediatric Bottles	
	**Pink Micro Tube – Product No. 41.1395.005** This tube contains EDTA anticoagulant. Fill to the mark (1.3mL). After blood collection, invert tube 5-10 times. This tube is suitable for **FBC, Reticulocytes, Group & DAT for babies <4 months (for group and screen/crossmatching for paeds >4 months see above), Ammonia and Meningococcal PCR. (Separate samples)**
	**Clear Serum Micro Tube – Product No. 41.1392.005** This tube contains no anticoagulant. Fill to the mark (1.3mL). After blood collection, invert tube 5-10 times. This tube is suitable for **most Clinical Chemistry, Immunology and External tests.**

Specimen Bottle	Bottle Type & Information
	**Yellow Micro Tube – Product No. 41.1394.005** This tube contains fluoride anticoagulant. Fill to the mark (1.3mL). After blood collection, invert tube 5-10 times. This tube is suitable for **Glucose and Lactate testing.**
	**Green Micro Tube – Product No. 41.1350.005** This tube contains citrate anticoagulant. Fill to the mark (1.3mL). Inadequately filled tubes CANNOT be processed. After blood collection, invert tube 5-10 times. This tube is suitable for **PT, INR, APTT and Fibrinogen.**
	**Orange Micro Tube – Product No. 41.1393.005** This tube contains lithium heparin anticoagulant. Fill to the mark (1.3mL). After blood collection, invert tube 5-10 times. This tube is suitable for **Chromosome analysis and Amino acids.**
Microbiology Specimens	
	**Urine Container** Fill the white tube from the Yellow container and label correctly. Send ONLY this sample to the lab. Minimum 50% fill required. Discard the Yellow urine container in appropriate biological waste bin. This container is suitable for **C&S, Pregnancy tests and Urinary Antigens.**
	**Fluid Container** This container contains no preservative. Do not overfill and ensure the cap is sealed correctly. This container is suitable for **sterile fluid (pleural, ascitic, joint) investigations and sputums.**
	**Faeces Container** This container is used for faeces/stool samples. Do not overfill. This container is suitable for **C&S, Ova and parasites, etc.**
	**White Cap Container** This container is suitable for **CSF.**
	**Black Charcoal Swab** This swab is suitable for **general C&S – wound, throat HVS etc.**
	**Orange Top Fine Tip Swab** Swab is intended for nasopharyngeal specimens and is characterised by a thin metal shaft and orange top.This swab is suitable for **Paranasal culture e.g. Pertussis screen.**
	**Pink Top Sterile Transport Swab** This swab is suitable for **Viral culture** (except Influenza/RSV)**.**
	**Cepheid UTM-RT Viral Collection kits** Nasopharyngeal swab only. This swab is used for screening for respiratory viruses including **Sars-Cov-2 RNA (Covid-19), Influenza, RSV** and also **Monkeypox**

Specimen Bottle	Bottle Type & Information
	**Yellow Top Cobas PCR Urine Packet - Male or Female** This swab is suitable for **Urine Chlamydia & Gonorrhoea screening** for male and female patients**.**
	**Yellow Top Cobas PCR Swab - Female** This swab is suitable for **Female Chlamydia & Gonorrhoea screening.** This swab is also used for rectal and pharyngeal specimens for CT/NG tests as well as neonatal ocular CT/NG tests.
	**Coban LQ Swab** This swab is suitable for screening for Carbapenemase Producing Enterobacteriaceae (CPE) and Group B Strep. The unit consists of a dual cotton tip swab with a red top.

6.5.2 Tullamore & Portlaoise Sample Types

The Sarstedt Monovette system for blood collection is used in MRH, Tullamore and MRH, Portlaoise. These samples are accepted by RHM for those tests analysed in Mullingar for Tullamore and Portlaoise patients. Details of the type and volume of sample required for a particular assay are given in Section 17. The following blood bottle types are commonly used:

Specimen Bottle	Bottle Type & Information
Adult Bottles	
	**Amber – Product No. 04.1935.001** This tube contains a polymer gel and no anticoagulant. Fill to the mark (4.9mL). After blood collection, invert tube 5-10 times. This tube is suitable for **most Clinical Chemistry and Immunology tests.**
	**Pink – Product No. 05.1073.001** This tube contains EDTA anticoagulant. Fill to the mark (2.7mL). After blood collection, invert tube 8-10 times. This tube is suitable for **HbA1c & Ammonia.**
	**Green – Product No. 05.1165.001** This tube contains trisodium citrate anticoagulant. Fill to the mark (3.0mL). Inadequately filled tubes CANNOT be processed. After blood collection, invert tube 4 times. This tube is suitable for **PT, INR, APTT, D-dimer and Fibrinogen.**
	**Yellow – Product No. 05.1073.001** This tube contains fluoride oxalate anticoagulant. Fill to the mark (2.7mL). After blood collection, invert tube 5-10 times. This tube is suitable for **Glucose, Lactate and Ethanol testing.**
	**Orange – Product No. 05.1553.001** This tube contains lithium heparin anticoagulant. Fill to the mark (4.0mL). After blood collection, invert tube 5-10 times. This tube is suitable for most routine **Clinical Chemistry and Immunology tests** for Renal Dialysis Patients and some Oncology patients.
	**Pink – Product No. 01.1605.006** This tube contains EDTA anticoagulant. Fill to the mark (7.5mL). After blood collection, invert tube 5-10 times. This tube is suitable for **Group & Antibody screen.**

Specimen Bottle	Bottle Type & Information
Paediatric Bottles	
	**Pink Paeds Tube – Product No. 06.1664.001** This tube contains EDTA anticoagulant. Fill to the mark (1.2mL). After blood collection, invert tube 5-10 times. This tube is suitable for paediatric **Ammonia.**
	**Clear Serum Paeds Tube – Product No. 06.1663.001** This tube contains no anticoagulant. Fill to the mark (1.2mL). After blood collection, invert tube 5-10 times. This tube is suitable for **most Clinical Chemistry and Immunology tests.**
	**Yellow Micro Tube – Product No. 06.1665.001** This tube contains fluoride anticoagulant. Fill to the mark (1.2mL). After blood collection, invert tube 5-10 times. This tube is suitable for **Glucose and Lactate testing.**

6.6 Specimen Collection

It is the responsibility of the person taking the sample to:

1. Ensure all appropriate sterile equipment is within date and all packaging is intact.
2. Explain procedure and rationale to patient, answering any questions.
3. Check patient identification, verbally confirming positive patient identification with the patient (where possible)
4. Ensure patient meets any special requirements e.g. fasting etc.
5. Take the sample into the appropriate specimen container for the tests required.
6. Dispose of all needles into sharps bin when finished sampling.
7. Dispose of all contaminated material into biohazard bin.
8. Label the specimen container fully as per Section 6.7 below.
9. Place in the bag attached to the form.
10. Ensure the form is properly completed.

For further information on blood sampling, please refer to 'National Clinical Policy and Procedural Guideline for Nurses and Midwives Undertaking Venepuncture in Adults' and 'National Clinical Policy and Procedural Guideline for Nurses and Midwives Undertaking Venepuncture in Children'. These are available from the HSE website www.hse.ie. Please note that any deviations or exclusions from, or additions to the documented collection procedure must be recorded on the request form by the sample collector.

See Section 6.12 for instructions for 24 hour urine collection.

6.7 Specimen Contamination

Blood culture bottles are easily contaminated. Always fill blood culture bottles first. Anticoagulants present in specimen bottles may cause problems if carried over from one type of container to another. Fill the blood bottles in the correct order as outlined below:

Order of Draw	Adult Colour	Paeds Colour
1. Blood Cultures	Blue & Purple tops	Silver top
2. Citrate	Blue top	Green top
3. Serum	Red top	Clear top
4. Lithium heparin	Green top	Orange top
5. EDTA	Purple or Pink top	Pink top
6. Fluoride	Grey top	Yellow top
7. Sodium citrate	Black top/ESR	Black top/ESR

6.8 Labelling the Specimen Container

The following unique identifiers **must** be documented in a legible manner on the specimen container so that the identity of the patient is unequivocal:

1. Full name (First name & surname)
2. Date of Birth
3. Chart number
4. Signature of person who took sample *(Mandatory for Blood Transfusion only)*

Addressograph labels are permitted on all laboratory samples **except Blood Transfusion samples** (see below). If using addressograph labels, please ensure that the label does not obscure the level of sample in the container. The label should not be wrapped around itself, hanging off the container as it makes it difficult to load samples on the various analysers. Blood Transfusion samples are preferentially labelled using the Blood Track system labels see Section 19.8.1. In the event that this not possible, please handwrite on the sample label.

The above requirements are for both the safety of the patients and for medico-legal protection of hospital staff.

6.9 Quality of Blood Specimens, Specimen Bottles or Request Forms (Excluding Blood Transfusion)

Laboratory personnel must inspect each blood specimen prior to testing for:

- Presence of mandatory identifiers
- Evidence of haemolysis
- Gross lipaemia
- Presence of clots (in specimens requesting full blood count and coagulation tests)

In such instances, a second sample may be requested or the test report will have a comment noting the presence of haemolysis, lipaemia or clots, as appropriate, see table below:

Issue	Action	Documentation
Specimen Issues		
Specimens unlabelled*	Sample is not processed	Report is returned to clinician stating the problem & requesting repeat sample.
Mandatory identifier absent (i.e. full name, DOB or chart number)*	Sample is not processed	Report is returned to clinician stating the problem & requesting repeat sample.
Request Form Issues		
No request form	Sample is not processed	Not applicable
Mandatory identifier absent (i.e. full name, DOB or chart number)*	Sample is not processed	Report is returned to clinician stating the problem & requesting repeat sample.
No test requested*	Sample is not processed	A comment will be applied to the final report stating 'No request on form'.
Specimen Quality Issues		
Evidence of haemolysis	The relevant pathology department will make a decision on whether or not the sample is suitable for testing. A second sample will be requested as appropriate.	Report is returned to clinician stating the problem & requesting repeat sample if required.
Gross lipaemia		
Presence of clots (in FBC or coagulation samples)		

Issue	Action	Documentation
Age of sample Miscellaneous quality issues	The pathology department will report results within a multi-test profile on analytes unaffected by specimen quality, while not reporting those affected in the profile.	
Sample leaking/soiled containers or forms	Sample is not processed	Report is returned to clinician stating the problem & requesting repeat sample.

* In the case of an emergency, where the clinician deems mislabelled samples unrepeatable, the requestor can present to the laboratory to correct the error. FORM-M/L/112 must also be completed accepting responsibility for same. Please see Section 19 for Blood Transfusion.

For urgent samples, the laboratory will contact the requestor and inform them of the reason for rejection.

6.10 Additional Testing Requests

If, on sending a specimen for testing and further testing is required, please contact the appropriate laboratory department to investigate the feasibility of using the initial specimen for analysis as age of specimen may impact on the validity of results. A request form should accompany all such requests but the lack of a request form should not impede the processing of an urgent result. In the event of analytical failure and where repeat testing is required, it may be necessary to request a fresh sample.
For further crossmatching of a Blood Transfusion sample, refer to Section 19.5.

6.11 Patient Preparation for Non-Blood Specimens

A current electronic version of Nursing PPPGs are available on a Hospital managed PPPG Shared Drive which is available on relevant desktops across the hospital.

6.12 Instruction for Completion of 24 Hour Urine Collection

Depending on the tests required, the 24 hour urine container may require a special preservative. If the container given has a sticker warning 'Caution – Contains Acid', then care must be taken when adding urine to it from the collection vessel. Do not urinate directly into these bottles. This container has a small amount of concentrated acid already added to it which is capable of causing a severe burn. **Do not empty the acid from the container. Keep out of the reach of children.** If acid comes in contact with the skin, rinse the area immediately with plenty of water. Refer to WI-M/L/1 'Instructions for Making a 24 Hour Urine Collection'. These instructions are distributed with the 24 hour urine containers. Approved containers are available from the laboratory. Please ensure that the container is clearly identified with the patient' name, DOB, chart number and date of collection.

1. Empty the bladder on rising (or a more convenient time) and **THROW AWAY** the sample. Only **AFTER** this sample has been passed is the collection started.
2. If the test is started whilst still in the hospital, the first sample should be discarded. Only AFTER this sample has been passed is the collection started.
3. Do not urinate directly in to container that contains acid – use cup provided and then pour slowly from cup to 24 hour container.
4. Collect all urine in the container provided on EVERY occasion that it is passed during the next 24 hours. Keep the container in the fridge is possible.
5. Empty your bladder on rising the next morning (or at the more convenient time chosen) and ADD this sample to the collection. This completes the 24 hour collection, which should be brought to the hospital the same morning.

6. Please ensure that the label on the container and the request form are fully completed and the cap is closed securely. **Finally, place the container in the Pathology Specimen bag for Urine and seal along the top.**

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. Please refer to PPG RMD022 – 24 Hour Urine Collection for Hospital Patients.

7 Health and Safety

All biological specimens should be considered as potentially hazardous and handled accordingly. However, special precautions are necessary for obtaining and handling specimens from patients infected (or thought to be infected) with high-risk pathogens. It is important to remember that carriers may be asymptomatic. Infection may be acquired by spillage of blood and other bodily fluids on to recently broken skin, accidental scratches, puncture wounds from needles, instruments or possibly by splashing into the eye, nostrils and lips of susceptible persons. Therefore, take care with all specimens for your own safety and that of others. **Please remember that it is the responsibility of the person who requests laboratory examination of the specimen to ensure that both the form and the container are correctly labelled to indicate a risk of infection.** Specimens that carry a risk of infectious disease should be clearly identified with red stickers.

High risk categories include:

- Known HIV, Hep B & C etc.
- Suspect E coli O157 etc.
- Jaundice
- Patient from high risk group
- Viral Haemorrhagic Fever (VHF) samples including Ebola testing
- Known Covid-19
- Suspected Monkeypox

Faecal or other potentially hazardous fluids/liquids that leak and soil containers or forms will be discarded without testing.

8 Delivery, Packing & Transport Requirements for all Diagnostic Specimens

It is the policy of the Pathology Department to treat all specimens as potentially infectious or high risk. Therefore, we advise taking universal precautions in the collection, packaging and the delivery of specimens being sent to the laboratory for analysis.

8.1 Specimen Delivery within the Hospital

- All samples must have the lid tightly secured and placed in the plastic bag attached to the form.
- The pneumatic tube system is used for sending samples to the laboratory throughout the day and night using chute numbers 9403 during routine hours and 9401 (Blood Transfusion/Haematology/ Microbiology) or 3034 (Clinical Chemistry) during on-call hours.
- **Blood cultures, CSF samples, Covid-19 samples and suspected VHF or Monkeypox samples cannot be sent via the chute. They must be hand-delivered directly to the Microbiology laboratory by porter.**
- **The CSF specimen for protein/glucose measurement (usually sample 2) should be hand-delivered directly to the Clinical Chemistry laboratory along with a Clinical Chemistry request form**
- **Blood cultures delivered between 5pm and 8am are now time stamped by the porter/attendant and placed in the red box on the Bench to your left as you come in to Microbiology**

- If the pneumatic tube system is not working, samples should be hand-delivered to the laboratory by hospital porters.

8.2 Packing of Diagnostic (Non-infectious) Specimens for Delivery to the Laboratory from Outside the Hospital

These specimens must be packed and transported in accordance with the European Agreement concerning International Carriage of Dangerous Goods by Road (UNADR).

1. Ensure the cap of the sample container is securely closed and placed in the sealed plastic bag attached to the request form.
2. Ensure lids in 24hour urine jars are tightly closed and containers are placed in Urine transport bags and sealed.
3. Place sample in a padded envelope labelled 'Diagnostic Specimens' or in place plastic transport containers for collection by taxi.

8.3 Packing of Diagnostic (Infectious) Specimens for Delivery to the Laboratory from Outside the Hospital

Specimens suspected or known to contain infectious pathogens should be packed and transported as follows:

1. Ensure the cap of the sample container is securely closed.
2. Wrap the container in tissue or cotton wool which will act as absorbent material in the event of any spillages.
3. Place the wrapped specimen inside the plastic container of UN approved Class 6.2 package type (available from the laboratory).
4. Place the container inside the cardboard box.
5. The box should contain a label 'Infectious Substance'.
6. Place the name, address and contact number of the destination laboratory on the outside of the box.

A licensed courier must be used for the transport of infectious specimens.

8.4 Specimen Delivery from Outside the Hospital

- It is advisable to refrigerate samples prior to collection by taxi/courier for delivery to the laboratory.
- If patients are delivering samples to the Laboratory, the GP must advise patients if there is a delay in delivery of samples, they must be refrigerated.
- Samples are delivered by GPs, patients, couriers and taxis to the laboratory reception area.
- Samples are delivered daily by taxi service from St Joseph's Hospital, Longford and from the GP surgeries in Longford.
- A taxi also leaves Athlone Hospital each day at 11am to facilitate Athlone GPs.
- There is a taxi service from GP surgeries in Coole, Castlepollard, Edgeworthstown, Ballymahon, Killucan, Kinnegad and Moate arriving in the Laboratory before 2pm.
- There is also a taxi between Tullamore and Portlaoise laboratories daily.
- Couriers and taxis are required to notify the laboratory of any spillage, accident or damage to specimens.
- Taxis are provided with transport boxes which are UN3373 compliant. The temperature of each box is checked on arrival in the laboratory.

9 External Quality Control Assessment Programme

The Pathology Department participates in relevant available third party EQA schemes. This includes schemes operated by:

- NEQAS – UK National External Quality Assurance Scheme
- IEQAS – Irish External Quality Assurance Scheme
- WEQAS – Welsh External Quality Assurance Scheme
- RIQAS – Randox International Quality Assurance Scheme
- EQUALIS – External Quality Assurance in Laboratory Medicine in Sweden
- LabQuality – Finland Quality Assurance Scheme

The laboratory is committed to participating in other QC schemes as they become available and are required to ensure comprehensive assessment of the test repertoire. Where third party EQA schemes are not available, inter-laboratory comparisons are used.

10 Reporting of Results

10.1 Frequency of Testing

- The frequencies stated in this handbook refer to normal working days.
- Where turnaround times (TAT) are stated, it refers to the time from when samples are received and stamped in sample reception until the time the result is issued from the laboratory so that it is available to the requestor.
- TATs do not take into account those cases where testing of samples need to be repeated for technical or quality control reasons.
- The times quoted are 'averages' and the laboratory at RHM will do their utmost to achieve them, circumstances permitting.
- Scheduled tests refer to assays which are batched when sufficient numbers are requested.

Urgent Tests

All samples are date and time stamped on receipt in the specimen reception. Urgent samples are then prioritised in the laboratory process. On authorisation, results are available on the Ward Enquiry system.

10.2 Result Reporting

It is the responsibility of the healthcare professional who requests a laboratory test to ensure that the result is reviewed and appropriate action taken.

Telephone Reports

Critical alert values have been drawn up in agreement with the laboratory management and consultants as well as the users of laboratory services. For in-patients, these results are telephoned/bleeped to the appropriate clinician. For out-patients, results are telephoned to OPD or a member of the Consultant team responsible for the patient. For GP patients, results are telephoned to the referring GP practice or nursing home as per *'National Clinical Care Pathology Programme – Communication of Critical Results for Patients in the Community'.*
https://www.hse.ie/eng/about/who/cspd/ncps/pathology/resources/

Staff phoning the result state that the result is 'critical' so the urgency of the phone call is communicated. Results are read back to ensure correct receipt of all information.

Classification of Critical Results Critical results are made according to the severity of potential underlying diagnoses, imminent risk to the patient and the urgency of intervention.
Category A results require communication within 2 hours. This classification indicates potential immediate danger to the patient, or a potentially life-threatening illness when urgent intervention is required.
Category B results require communication within 24 hours, and preferably on the same working day.
Category C results could have an immediate impact on a patient's management (either treatment or investigation), however action is likely to be taken on the next working day. Telephone communication of these results on the next working day was deemed satisfactory.

Clinicians have been offered the opportunity to provide a personal mobile number/email in the event that the primary method of contact is unsuccessful. A non-conformance will be raised when a critical results contact number is not answered and new contact details will be sought from the clinician for future patients.

With a category A result if the requester or patient cannot be contacted, the medical scientist will contact the laboratory Consultant to discuss the result. If the patient needs ambulance transport the National Emergency Operations Centre (NEOC) should be contacted on **0818308000.**

The critical alert values are found on LIST-M/L/48 'Critical Results for Phoning to Ward/Requestor' current revision. This is available to all service users upon request.

Ward Enquiry
Results, with the exception of Blood Transfusion, are available on Ward Enquiry. This system is password controlled and available to authorised personnel only. Please contact ICT Project Lead at 94220. Refer to Section 11.1 for instructions on using this system.

Blood Track Enquiry
This system can be used by clinical staff to check if blood is crossmatched for a patient. The number of red cell units crossmatched, plasma and platelet availability for a patient can be verified. Refer to Section 11.2 for instructions on using this system.

Heathlink
This is a Department of Health funded project which facilitates establishment of electronic links between GPs/Nursing Homes and the laboratory. This allows for timely, secure transfer of clinical data. Validated results are sent to Healthlink on a regular basis for GP access.

Printed Reports
Hardcopy reports are issued to the wards twice daily at 12.30pm and 5.30pm, Monday to Friday. Out of hours, Blood Transfusion printed reports are forwarded to wards regularly. Reports are also sent to GPs daily by external post or by courier to Tullamore and Portlaoise laboratories.

11 LABORATORY INFORMATION SYSTEMS

11.1 Ward Enquiry

Ward Enquiry is designed to enable staff on wards throughout the hospital to have access to laboratory results as soon as they have been validated. Ward Enquiry is refreshed every 25 seconds and staff have access to the previous 9 months of results on a patient. The ICT Project Lead in the laboratory will provide a password for use of Ward Enquiry on completion of training. Each user must be familiar with the HSE Information Technology Acceptable Usage Policy and must have read the User Training Guide for Ward Enquiry, found in the Ward Enquiry SOP folder on each computer. All signed training documents are kept in a folder in the laboratory.

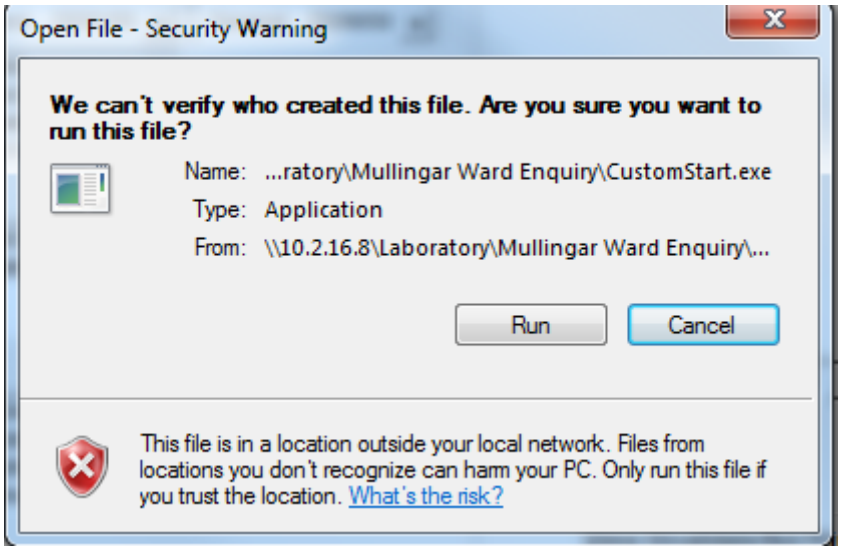
11.1.1 Logging In

1. Double-click on the Ward Enquiry Icon as shown in Figure 11.1 below.

Figure 11.1: Ward Enquiry Icon

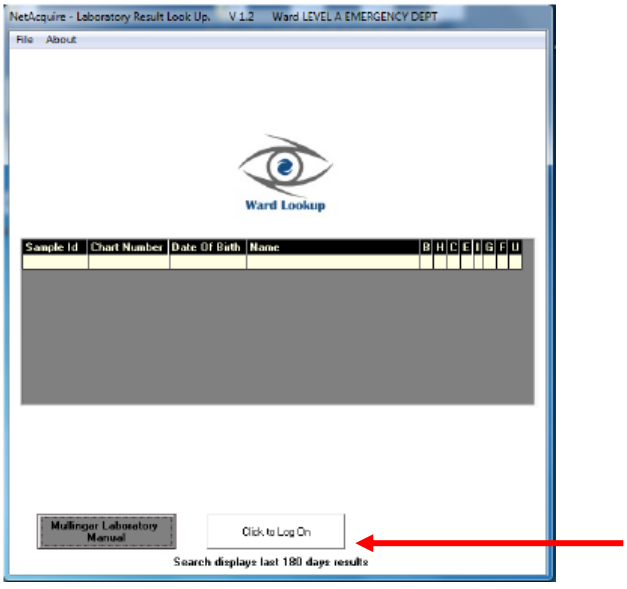
2. A Security warning will appear, please select "Run"

Figure 11.2: Security warning



3. This will activate the Lab Result Look-up screen, Figure 11.3. Click on the Click to Log On Button.

Figure 11.3: Lab Result Look-up Screen

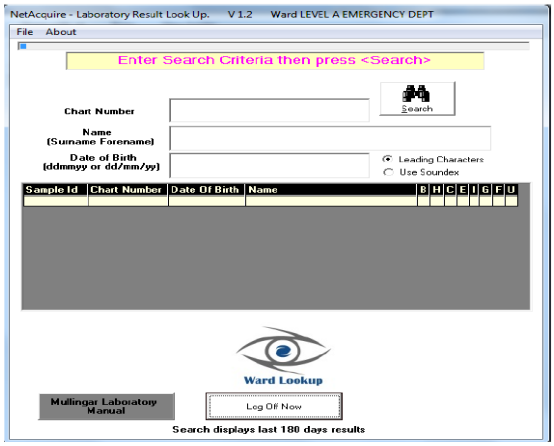


4. Enter your username as follows: First Name followed by Surname.
5. Enter your 6-10 digit password. This gives access to the search screen.

11.1.2 Searching for a Patient

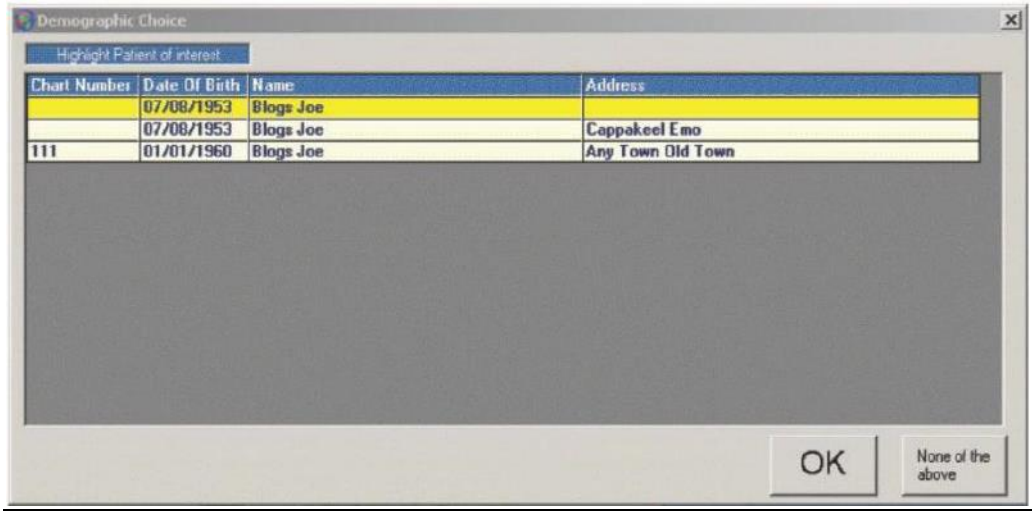
Search for a patient's results using chart number, name or date of birth using the Search screen shown in Figure 11.4.

Figure 11.4: Search Screen



1. Enter the patient's surname followed by first name and click search.
   OR
2. Enter the patient's date of birth as dd/mm/yy or ddmmyy and click search.
   OR
3. Enter the patient's chart number and click search.
4. The above searches will present you with a list of patient's to choose from as shown in Figure 11.5 below.

Figure 11.5: Demographic Choice Screen

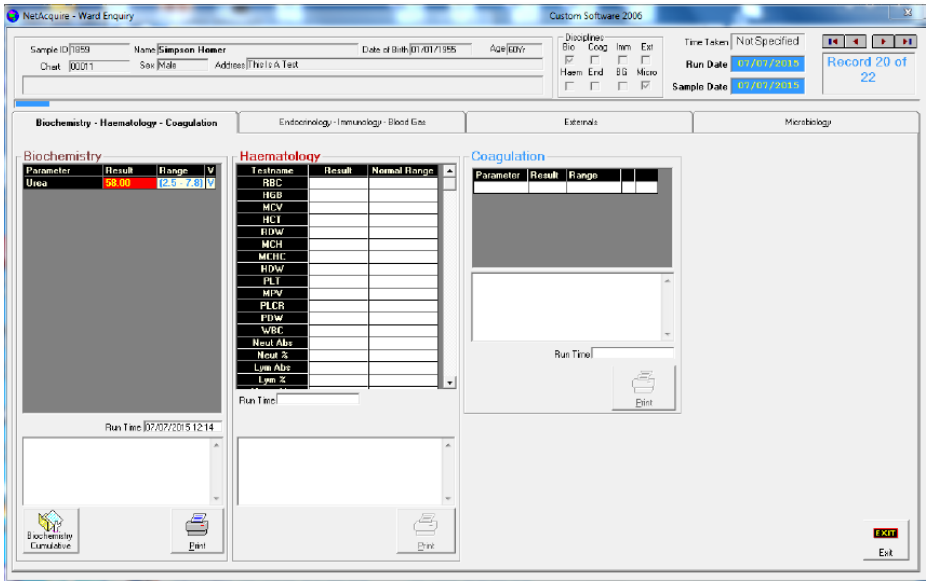


5. The patient with the most recent lab results is always displayed on the top of the list. Highlight the patient required and select OK to return the results.
6. If the patient required is not in the list, select 'None of the Above' to start again.
7. **If you cannot find patient results, check each of the search modes i.e. Name, DOB and Chart Number.**

11.1.3 Viewing Results

The View Result screen shown in Figure 11.6 below displays the results for the selected patient.

Figure 11.6: View Result Screen

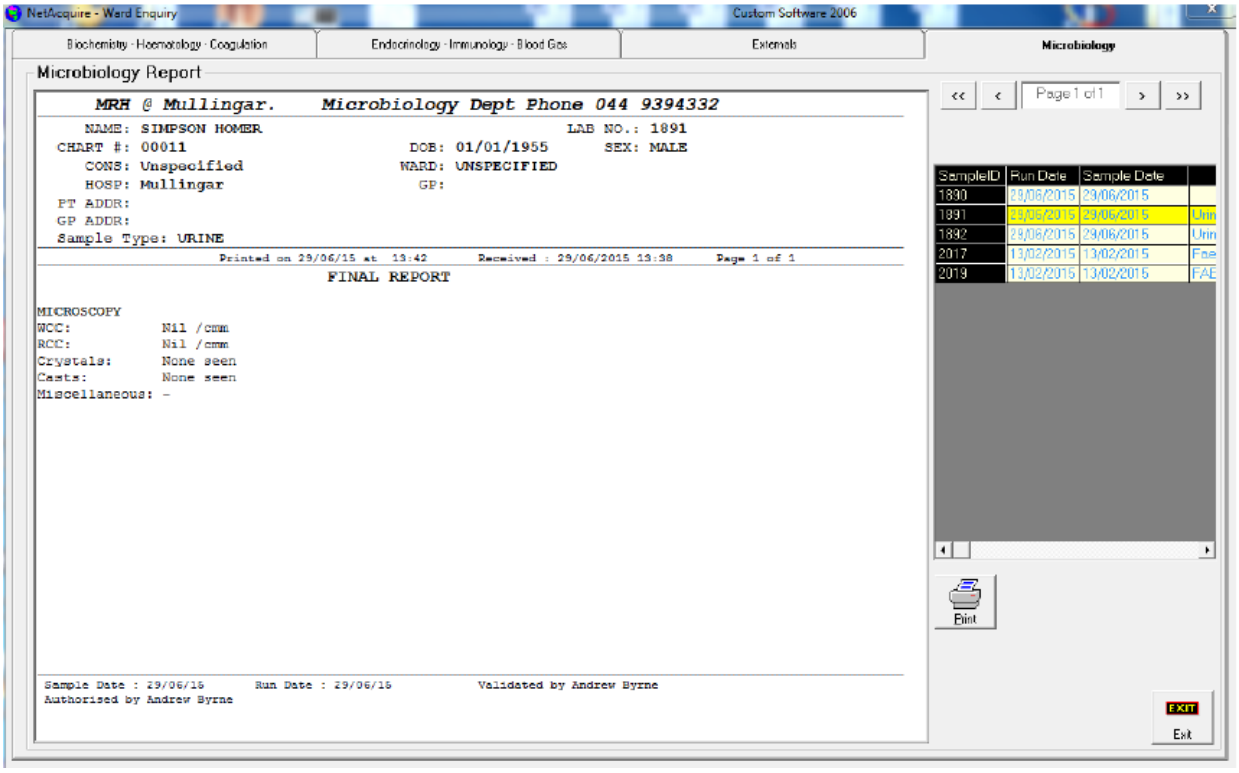


1. Run Date, Sample Date and Record Number are highlighted in the right-hand column.
2. The **arrow keys on the right-hand side** (beside sample date) allow movement through the records in increments of one.
3. The top right hand indicator check boxes inform you of the departments with results.
4. Clicking on the Tabs above the results moves between the departments.
5. The Print Icon allows printing of the result displayed on the screen.
6. Cumulative Icon allows viewing of cumulative results. Placing the cursor over the Sample ID and date displays the patient's address.
7. Cumulative results can be printed by clicking on the Print Icon.
8. Print out Endocrinology report to view the correct reference ranges for the hormone tests.

11.1.4 Viewing Microbiology Results

1. Search for patient results as per Section 11.1.2 above.
2. Highlight the patient required and select OK to return the results.
3. Click on the Microbiology tab. The most recent microbiology sample received and sample type for this patient is displayed in the right-hand column. If there are any previous samples on this patient, they will also be displayed.
4. Highlight the most recent sample date or if previous results are required, highlight the relevant sample date. Once the relevant sample date and the relevant sample type is highlighted, the results are displayed on the screen as per Figure 11.7 below.

Figure 11.7: Microbiology Result Screen



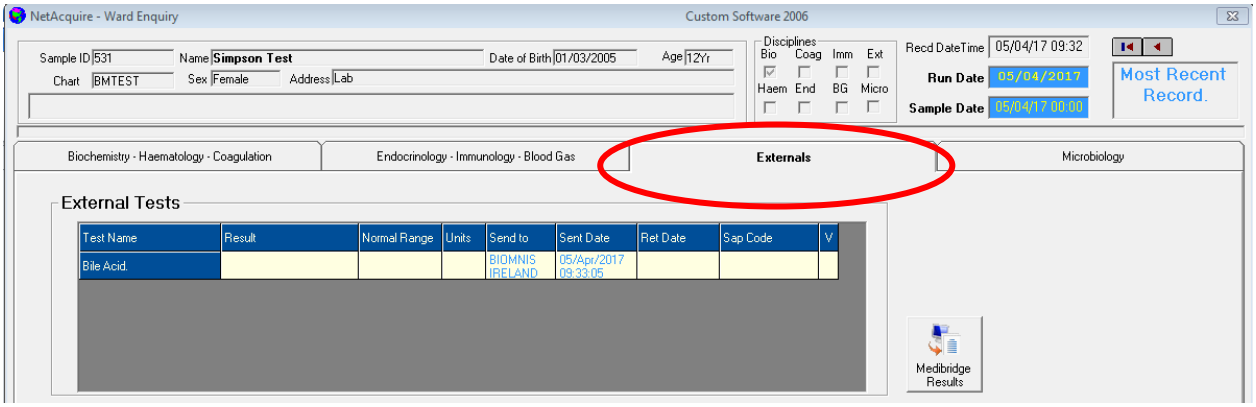
5. Check the patient details and then click on the print icon on the bottom right of the screen to print the Microbiology results.
6. To return to the main results screen, click on the Biochemistry-Haematology-Coagulation tab.
7. To search for another patient, click on the exit icon on the bottom right of the screen.

11.1.5 Viewing External Results in Ward Enquiry

Some results from the National Virus Reference Laboratory, St. James' and Eurofins Biomnis.

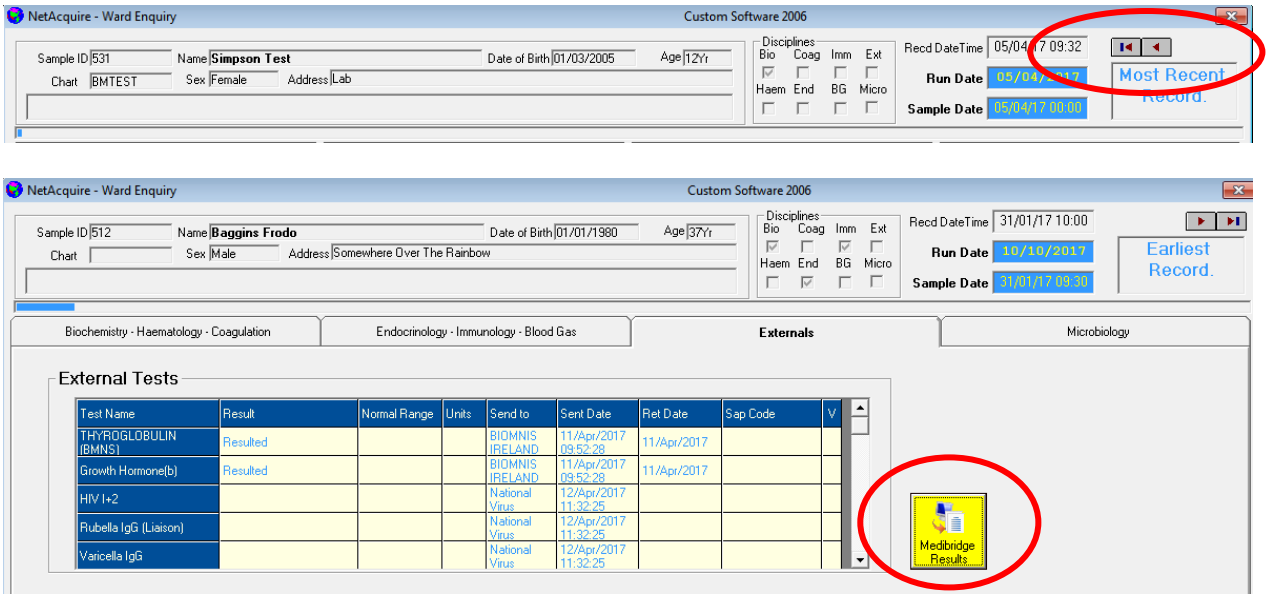
1. Search for patient as per Section 11.1.2
2. Select the correct patient from the list of patients returned and click OK.
3. The Results Overview Screen opens, select the 'Externals Tab' as per Figure 11.8 below.

Figure 11.8: Results Overview Screen



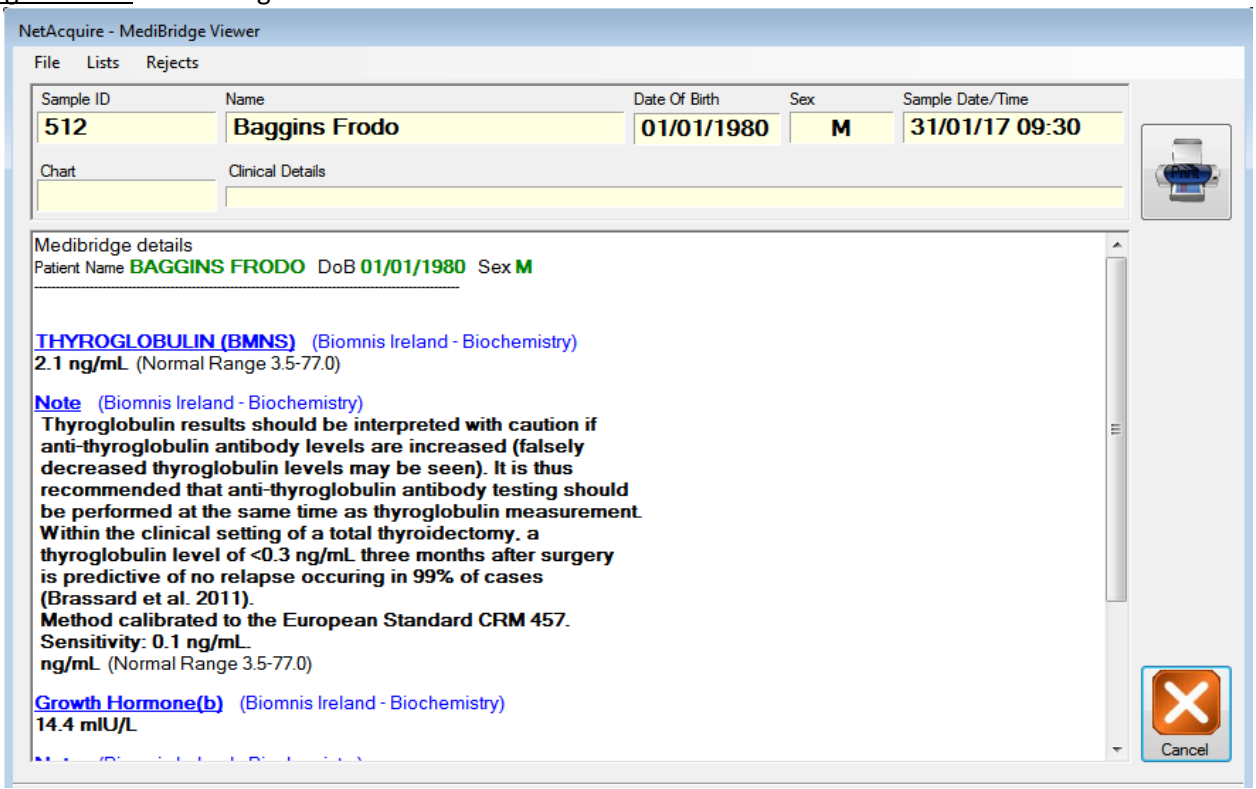
4. If results are available from the NVRL, St. James' and Eurofins Biomnis the 'Medibridge Results' button will be highlighted in yellow. You may need to scroll through previous lab encounters using the arrows on the right hand side of the screen to find the returned result as shown in Figure 11.9.

Figure 11.9: Arrows and Highlighted Medibridge Button



5. Click 'Medibridge Results'.
6. A new window opens displaying the NVRL results, see Figure 11.10 below. These results may be printed by selecting the print icon within the result viewer.

Figure 11.10: Medibridge Viewer



11.1.6 Printer Set-up

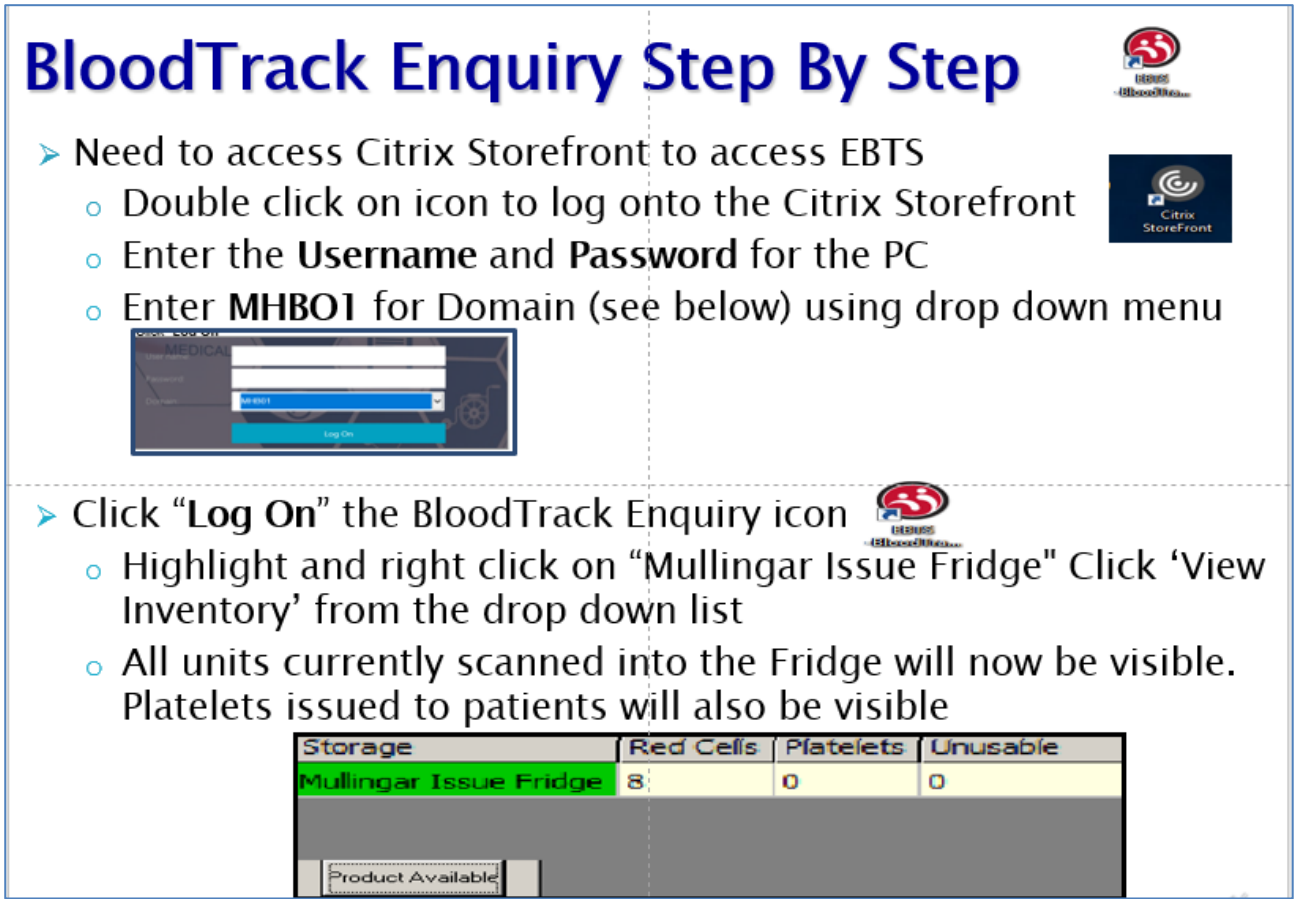
1. To set up a new printer or to reactivate a printer, right-click on the printer icon.
2. Input the password 'temo'. Click OK.
3. From the list of printers, select the name of the printer connected to the PC in use.
4. Highlight the name of this printer and click on Save.
5. Click Exit.

Notes

- **Print all results. Please do not transcribe results to paper.**
- User passwords expire every 90 days. The system will prompt for a new 6-10 digit password to be entered.
- Remember your password and don't give it to others.
- If you believe your password is compromised, contact ICT Project Lead for a new one (Ext 94220).
- Only validated results are available for viewing.
- An audit of all look-ups is maintained by the system.

11.2 BloodTrack Enquiry

This system allows viewing of crossmatched red cell units, plasma and platelets issued to a patient from ward PCs.



12 SERVICES AVAILABLE

12.1 Pathology Services

Service	Description
Haemovigilance	The Haemovigilance service is a Consultant-led service with a Haemovigilance Officer (HVO) based on site. The National Haemovigilance scheme is dedicated to the achievement of a national standard practice and quality of care for all patients before, during and following completion of transfusion. Further information can be obtained from the HVO at Ext 94313. See also Section 19.
Consultant Service	Two Consultant Haematologists are available for advice on Haematology & Blood Transfusion issues. The Blood Transfusion and Haematology departments offer a clinical service, both for diagnosis and patient management advice. There is also a medical Consultant available in Histopathology, Clinical Microbiology, Immunology and Clinical Chemistry. See Section 5.2 for contact details.
Phlebotomy	A phlebotomy service is available for in-patients and out-patients. The phlebotomists visit the wards Monday to Friday during routine hours. There is also a phlebotomy session 9am-2pm at weekends. NCHDs are responsible for taking specimens at all other times. The phlebotomy service is under the control of the Director of Nursing.
Warfarin Clinic	An outpatient Warfarin clinic is available. This clinic operates on Tuesdays, Thursdays and Fridays between 9.30am and 12pm and on Wednesdays between 12.30pm and 3pm. Contact phlebotomy for details.
Point of Care Support	A Point of Care Coordinator has been appointed to support Point of Care (POC) instruments in the hospital, including Blood Gas analysers and rapid Covid-19 testing analysers.
Autopsies	Please inform Nursing Administration, who will contact the Coroner (if required) and Pathologist on-call.
Slides for Presentations, etc.	The Pathologist needs a minimum of 2 days' notice, preferably one week, as the sections must first be sent back from Tullamore for photography.
Complaints Handling Procedure	The Laboratory documents all perceived or real grievances from clinicians, patients or other related parties and investigates theses as formal complaints following the laboratory complaint procedure. Refer to QP-M/L/8 'Quality Improvement Processes (Including Non-conformances, Complaints, Preventative Actions and Improvement Ideas) current revision. If a complaint cannot be resolved at a local level, the complainant is advised of their right to an independent review by the Hospital Complaints Officer and if not resolved at that stage, an independent review by the Ombudsman.
Advisory Services	The Laboratory Consultants and Senior Scientific staff provide an extensive advisory service to all users of the service. Senior Medical Scientific staff are authorised to give advice on logistic and scientific information such as the user of the laboratory service and interpretation of laboratory results.

12.2 Hospital & Regional Meetings

The Pathology department has representatives on a number of Hospital and Regional committees. These include Hospital Clinical Governance meeting, Hospital Operations meeting, Hospital Transfusion Committee, Regional Transfusion Committee, Medical Devices Committee and National LIS Committee.

Feedback is given to the Nursing staff from Transfusion Committees by the HVO at CNM meetings when relevant. Feedback from all other committees is given to laboratory staff at bi-monthly pathology management meetings.

12.3 Laboratory Supplies

- The Pathology Department supplies blood bottles, urine & stool containers and request forms to all users of the service.
- For internal hospital users, supplies can be obtained by contacting Specimen Reception at 044-9394337 9am – 5.30pm, Monday to Friday.
- For external users, FORM-M/L/153 'Supplies Requisition for GPs/Nursing Homes' is submitted directly to Cruinn Diagnostics

12.4 Storage of Examined Specimens

Examined specimens are stored for archive and look-back purposes as per Royal College of Pathologists 'Retention of Records & Specimens' 5th edition, 2015 and NPAAC 'Requirements for the Retention of Laboratory Records and Diagnostic Material' 9th edition, 2022.

Specimen Description	Storage Location	Minimum Retention Time	Responsibility
Primary Transfusion and Antenatal Samples	Reagent Fridge Cold Room	7 days	Chief Medical Scientist Blood Transfusion
Plasma for titration	Blood Transfusion Sample Freezer	For current pregnancy	Chief Medical Scientist Blood Transfusion
Serum	Clinical Chemistry / Immunology Fridges	3-10 days (storage permitting)	Chief Medical Scientist Relevant Departments
Whole Blood	Haematology	3-7 days (storage permitting)	Chief Medical Scientist Haematology
Microbiology Samples	Microbiology	7 days	Chief Medical Scientist Microbiology

13 Laboratory On-call Protocol

This service is for genuine medical emergencies only, where the results are likely to influence immediate management of the patient.

- On-call service is provided Monday – Friday from 8pm to 8am and on Saturdays, Sundays and Bank Holidays.
- The emergency on-call service is provided by three medical scientists. One is responsible for Haematology and Blood Transfusion, one is responsible for Clinical Chemistry and the other is responsible for Microbiology.
- Calls after midnight should be curtailed as much as possible.
- On-call staff must be contacted prior to sending the sample to the Laboratory particularly post-midnight.
- To contact scientific staff, please phone:

Blood Transfusion/Haematology	Clinical Chemistry	Microbiology
Mobile: 086 0081395	**Mobile:** 086 0081394	**Mobile:** 086 0319078
Speed Dial: *51836	**Speed Dial:** *51835	**Speed Dial:** *51875

- The request form accompanying the emergency sample must be fully completed as per Section 6.3. Refer to Section 6.2 for which forms to complete on-call.

- ***Tests will not be reported unless name, DOB & chart number are given.***
- Results of tests performed during emergency service hours are returned to the location stated on the request form via the pneumatic tube system. If no location is provided, results will be returned to ED.

13.1 Tests Available On-call

To request tests other than those listed below, the Consultant in charge of the patient must contact the Medical Scientist directly.

Department	Tests Available
Haematology	○ FBC ○ ESR ○ PT, INR, APTT *(To monitor anticoagulant therapy. Coagulation screen should only be requested if clinical findings or history indicate a coagulation defect)* ○ D-dimer *(Covid positive patients, suspected cases of DIC and to rule out DVT or PE)* ○ Fibrinogen *(e.g. PPH, severe sepsis, massive haemorrhage, new leukaemias)* ○ Malaria Screen ○ Sickle Cell Screen *(for pre-ops only)*
Blood Transfusion	○ Group & Screen ○ Group & Crossmatch *(Emergencies only, not elective surgery)* ○ Neonatal Group & Direct Antiglobulin Test – (*Urgent e.g. maternal antibody, jaundiced baby, neonatal anaemia)* ○ Antibody Identification ○ Packing of blood for transport to another location ○ Issuing of Platelets/Blood Products
Clinical Chemistry	○ U&E ○ Creatinine ○ Glucose ○ Calcium/Albumin ○ CRP ○ Amylase ○ Bilirubin on neonates ○ Blood Alcohol ○ Salicylate ○ Paracetamol ○ Magnesium ○ LFTs ○ Lactate ○ Urinary Na, K, Amylase ○ Uric acid *(PET only)* ○ BNP ○ Troponin ○ Urine PCR *(In pregnancy at weekends/Bank holidays until 2pm only)* ○ CK ○ Phosphorous

Department	Tests Available
Microbiology	○ Urine for Microscopy and C&S in paediatric cases – under 3 years old is routinely processed ○ Urine for Microscopy and C&S on 3-16 year olds by request by Hospital Consultant Paediatrician ○ Positive Blood Culture ○ CSF Examination ○ Pregnancy Test ○ Urgent Influenza/RSV ○ CPE ○ Group B Streptococcus ○ Urgent SARS-Cov-2 (Covid-19)

14 CLINICAL CHEMISTRY

The Clinical Chemistry department uses biochemical knowledge and techniques to understand human health and to assist in the detection, diagnosis and treatment of disease. The department provides a comprehensive analytical service for indices of renal function, liver function, carbohydrate and lipid metabolism and for various enzymes, therapeutic drugs and many other chemical and biochemical compounds. This service is provided to RHM and all GPs and nursing homes in the Longford and Westmeath area.

The department also uses immunoassay techniques to assist in the diagnosis and monitoring of disorders of the endocrine system. A wide portfolio of hormone assays is available as an aid to investigating diseases such as thyroid, reproductive system disorders, anaemia, vitamin deficiencies and diabetes. This is provided as a regional service to RHM, MRH, Tullamore, MRH Portlaoise and all GPs in the Longford/Westmeath/ Laois/Offaly area and nursing homes in the midlands region.

14.1 Contact Details for Key Members of Staff

Title	Name	Telephone Number	Email
Chief Medical Scientists	Mr Paul Crowley	044-9394871	Paul.crowley@hse.ie
	Ms Martina Leonard	044-9394871	Martina.leonard@hse.ie
Senior Medical Scientists	Mr Conor Tubman	044-9394328	Conor.tubman@hse.ie
	Ms Grainne Keegan	044-9394328	Grainne.keegan@hse.ie
	Ms Emer Gordon	044-9394328	Emer.gordon@hse.ie
Consultant Clinical Biochemist	Dr Graham Lee	Contactable on mobile 0044 7902020833 via RHM 044-9340221 Or via switch at the Mater 01-8032423	glee@mater.ie

14.2 Test Profiles

The following table describes the tests analysed within the profiles stated. Only the profile names stated below are to be used. Non-specific and vague profiles e.g. 'bioprofile' or 'toxicology' may result in missed analyses. Please carefully specify the tests needed. See also Section 14.6 for guidelines on endocrinology testing.

Profile Name	Assays Included in Profile
U&E or Renal	Urea, Creatinine, Sodium, Potassium, Chloride
CE (Cardiac Enzymes)	CK, AST
LFT or Liver Function	ALP, ALT, GGT, Total Bilirubin
Bone	Ca, PO_4, ALP, Albumin
Lipids	Cholesterol, Triglyceride, HDL, LDL
PET	U&E, LFT, Uric Acid
TFT or Thyroid Function	Free T4, TSH
Fertility Profile (Menopausal)	FSH, LH, Oestradiol
Fertility Profile (Pre-menopausal)	FSH, LH, Day 21 Progesterone

14.3 Unexpected Results

Artefactual results may arise from difficulties or errors in, for example, sample collection, choice of specimen bottle, specimen transport or specimen storage. Artefactual results will also occur when samples are drawn from a site proximal to an infusion, when there has been prolonged venous stasis during

collection or as a result of difficult or traumatic sample collection. It is important that the Laboratory is informed as soon as possible if results appear to be inconsistent with the patient's condition or at variance with previous results.

14.4 Turnaround Times

Samples labelled urgent, samples from ICU, ED, SCBU, AMAU, RED or EPU or samples marked as 'oncology' are given priority. The following table indicates TAT for such urgent samples:

Test	Turnaround Time
U&E	1 hour
Glucose	1 hour
Calcium	1 hour
Amylase	1 hour
Salicylate	1 hour
Paracetamol	1 hour
Alcohol	1 hour
ThCG	2 hours
HSTNI	1.5 hours
NT ProBNP	3 hours

All non-urgent ward tests have a same day turnaround time. All non-urgent GP and OPD biochemical tests have a 24 hour turnaround time unless they arrive in the laboratory after 4pm on a Friday. Samples received in the laboratory after 4pm on a Friday will be reported as soon as possible.
Endocrine tests have a turnaround time of 3 working days.

Section 17 lists the tests available, type of sample required and the approximate frequency of testing for Clinical Chemistry/Immunology/Haematology/Coagulation testing.

14.5 Guidelines for Clinical Chemistry Testing

Guidelines are only one type of information that healthcare professionals use when making decisions about patient care. It is assumed that these guidelines will be used by healthcare professionals who will also bring to bear their clinical knowledge and judgement in making decisions about caring for individual patients. It is not always appropriate to apply either specific recommendations or general messages in this manual to each individual or in every circumstance. The availability of resources may also influence decisions about patient care, including the adoption of recommendations.

14.5.1 Thyroid Function

Sample Required: 8 mL Serum

Possible Interpretative Difficulties

Please give the laboratory full clinical details when requesting TFTs, in particular, information as to whether the patient is pregnant, or on antithyroid treatment, amiodarone etc. This will ensure that the most appropriate tests are performed, the correct comment appears on the report and the results are not delayed because of unnecessary tests. See table below for drugs that interfere with TFT results:

Drug	Interference
Glucocorticoids	In large doses, this can lower Free T3 and inhibit TSH secretion
Propranolol	Sometimes used to treat manifestations of thyrotoxicosis and has an inhibitory effect in T4 and T3 conversion. Propranolol when given to thyroid patients can cause an elevation in TSH as a result of the impaired T4 to T3 conversion.

Drug	Interference
Iodine	Can cause both hypo- and hyper-thyroidism
Amiodarone	This can induce the development of hypo- or hyperthyroidism in 14-18% of patients with normal thyroid function or pre-existing abnormalities.
Phenytoin Carbamazepine Furosemide/Fursemide	These drugs may competitively inhibit thyroid hormone binding to serum proteins in the sample and acutely increase free T4 resulting in a serum total T4 values through a feedback mechanism.
Heparin IV	IV heparin through in vitro stimulation of lipoprotein can liberate free fatty acids which inhibit T4 binding to serum proteins and falsely elevate free T4.
Biotin	Can falsely elevate FT4 and FT3 levels.

Guideline 1

Free T3 should only be measured if:

1. Patient has a normal Free T4 with a TSH <0.10 mIU/L
2. There is a stated clinical suspicion of T3 toxicosis
3. Requested by hospital Consultant

However FT3 will be measured if requested.

Guideline 2

Investigation of sub-clinical hypothyroidism:

- Raised TSH (5.3-10.0 mIU/L): Check TPO antibodies (See Immunology Section 15); verify family history of thyroid disease and presence of goitre.
- TSH still raised: If the TPO antibody is positive and TSH >10 mIU/L (or 5.3-10.0 mIU/L with the presence of hypothyroid symptoms), consider commencing thyroid replacement therapy.

Subclinical hypothyroidism is a relatively common disorder that occurs in asymptomatic patients. It is characterised by the finding of a slight to moderate increase in serum TSH with normal free T4 concentrations. TSH is not raised to levels of diagnostic hypothyroidism and levels return to normal during the recovery phase.

14.5.2 Haematinics

Sample Required: 8 mL Serum

For GP requests please include a clinical information form (FORM-M/CC/58) with the request form and sample.

Serum Ferritin

Purpose of the test:

- Screens for iron deficiency
- Measures iron storage
- Distinguishes between iron deficiency and inflammation

*Interpretation of '**High**' result:*

- Acute or chronic infection
- Chronic haemolytic anaemia
- Chronic kidney disease
- Hodgkin's disease
- Iron overload
- Leukaemia
- Acute or chronic liver disease

*Interpretation of '**Low**' result:*

- Iron deficiency

Other factors that may affect test results:

- A recent blood transfusion can increase ferritin levels
- If the tourniquet is applied on the arm too long (over 1 minute)

It is not advised to re-check ferritin subsequent to treatment, rather recheck FBC.
Transferrin saturation is a second line test measured only after confirming a high ferritin.

Serum Folate and Vitamin B12

Purpose of the test:

- Helps to confirm the diagnosis of megaloblastic anaemia
- Helps to distinguish between folic acid and vitamin B12 deficiency
- Assesses the amount of folic acid stored in pregnancy

Patient Preparation:
It is recommended that the patient fast for 12 hours prior to the sample being taken.

*Interpretation of '**High**' result (rare event):*

- Leukaemia
- Acute or chronic liver disease

*Interpretation of '**Low**' result:*

- Inadequate ingestion of folic acid
- Low levels of intrinsic factor antibody necessary for vitamin B12 absorption in pernicious anaemia
- Hyperthyroidism
- Use of metformin in type 2 diabetes and PCOS

Other factors that may affect test results:

- Phenytoin
- Pyrimethamine
- Alcohol
- Failure to fast overnight
- If the tourniquet is applied on the arm too long

Guideline 3

Please note that samples for vitamin B12 and folate must not be more than two days old when received in the lab to avoid loss of vitamins in the sample.

Guideline 4

It is recommended that an FBC be taken prior to assessing the vitamin status of the patient. It not advised to check the vitamin B12 level for several weeks after an IM injection.

Folate Deficiency	Vitamin B12 Deficiency
Anaemia (macrocytic)	Anaemia (macrocytic)
Raised MCV (usually)	Raised MCV (usually)
Megaloblastics in bone marrow	Megaloblastics in bone marrow
Neuropathy (very rarely)	Neuropathy (sometimes)
Serum folate decreased	Serum folate normal

Folate Deficiency	Vitamin B12 Deficiency
Anaemia responds to folic acid Anaemia shows no response to Vitamin B12	Anaemia responds to folic acid and vitamin B12 Neuropathy responds to Vitamin B12

The following guideline must be used when requesting a haematinic profile:
FBC and red cell indices should be checked prior to requesting haematinics. With the following exceptions:

1. Characteristic pallor
2. Known coeliac
3. Vegan
4. Alcoholic
5. Patients with neurological symptoms
6. Previous gastric or bowel problems
7. Findings of malabsorption
8. Extensive inflammatory bowel disease
9. In the case of ferritin, signs & symptoms of haemochromatosis or family history of same

Appropriate red cell indices for haematinic requesting would include:

1. Low Hb, normal MCV and high RDW
2. Low Hb, low MCV and low MCH
3. Low Hb with high MCV

It is imperative that full clinical details are written on the request form. Feel free to discuss any circumstance where you feel it necessary to request haematinics outside of this guideline.

Vitamin B12 and folate levels should not be repeated within a 3-month interval. Ferritin levels should not be repeated within 6 weeks of last testing.

We appreciate that it is convenience that results in the ordering of a haematinic profile at the same time as the FBC is requested. However examination of test reports during audit has shown that the vast majority of requests have a normal FBC report with no requirement for a haematinic profile.

This is cost saving exercise but it is also best practice. Without your participation, the service will continue to be inappropriately used and future improvements in the service will be made a lot more difficult.

14.5.3 Hormone Profile

Sample Required: 8 mL Serum

Guideline 5

The Clinical Chemistry department has sought guidance from Dr Gannon, Consultant Obs/Gynae on the official policy of requesting serum ThCG. He has advised that serum ThCG should only be requested for the purpose of monitoring pregnancy and that urine HCG is still the tool for diagnosing pregnancy.

Selection of Hormone Tests for Common Clinical Problems:

Guideline 5: Female Infertility with Regular Cycles

Request: Luteal phase progesterone

The progesterone peak, which occurs between days 18 and 24, gives an indication of ovulation. This is sometimes called 'Day 21 progesterone' but in fact the progesterone peak occurs about 7 days before the

onset of menses. Therefore progesterone should be measured on day 24 for a 31 day cycle or day 18 for a 25 day cycle.

Guideline 7: Amenorrhoea/Oligomenorrhoea

Request: LH, FSH and Prolactin

The sample should be taken in the early follicular phase (Day 1-7).

Polycystic Ovarian Syndrome (PCOS)

Request: LH & FSH

In PCOS, the LH is sometimes raised relative to normal or low normal FSH. The LH is also raised at mid-cycle peak; therefore if LMP is unknown, a raised LH should be checked two weeks from the date of the first specimen. Interpretation should be made in conjunction with the clinical presentation.

Guideline 8: Galactorrhoea

Request: Prolactin

Thyroid function should also be requested as hypothyroidism is occasionally a cause of hyperprolactinaemia. Macroprolactin will be measured in samples with a value of >700 mIU/L.

Guideline 9: Assessment of Menopausal Status

Request: FSH, LH & Oestradiol

Due to the highly unpredictable nature of the perimenopausal era, endocrine investigations are not recommended as they only offer a snapshot interpretation. FSH is the more sensitive indicator of declining ovarian function. The menopause can only be identified with certainty at least one year after the event.
Please state if the patient is on HRT or taking oral contraceptives.

Guideline 10: Male Infertility

Request: LH, FSH, Prolactin, Ferritin & Testosterone (male only, female sent out externally).

Guideline 11: Monitoring Hormone Replacement Therapy

Patients with implants: Request oestradiol

This should be measured 2 weeks prior to insertion of a new implant to ensure that levels are not high as there is risk of tolerance to the dose.

Patients on oral HRT: Hormone measurements are difficult to interpret in patients receiving oral oestrogen and routine measurement of FSH or oestradiol is not indicated. However, if symptoms persist at the maximum recommended dose then measurement of FSH and oestradiol may identify possible GI tract absorption problems.

Relevant clinical details, especially the date of the last menstrual cycle, are crucial to deriving maximum benefit from such protocols.

14.5.4 Cortisol

Sample Required: 8 mL Serum

Guideline 12

Random cortisol samples will no longer be analysed except in acutely ill patients with suspected adrenal insufficiency. A midnight or 9am sample is recommended initially to check the circadian rhythm. If adrenal insufficiency or Cushings Syndrome is suspected, seek specialist advice.

Dexamethasone Overnight Suppression Test

This is to diagnose Cushing's syndrome/disease. Investigation of Cushing's syndrome is only recommended if there is a high degree of clinical suspicion. The overnight suppression test is a convenient screening test for outpatient and GP patients.

1. 1mg dexamethasone is given orally at 11pm.
2. A blood sample is taken a 9am for cortisol measurement.

False positive results may be caused by:

- Depressive illness
- Alcoholism & obesity
- Drugs – Phenytoin, Phenobarbitone, Carbamazepine & Rifampicin
- Oestrogen containing drugs
- Stress

Comment:
Cortisol <50 nmol/L is consistent with a normal response Post-Dexamethasone. Note false positives (failure to suppress e.g. OCCP, HRT, pregnancy) and False negatives (CRD, liver failure). For clinical advice, contact Dr Graham Lee, Consultant Clinical Biochemist, glee@mater.ie.

Synacthen Test
This is a screening test for adrenal insufficiency. Preferably the test should start at 9am. Please labels bottles with specific times.

1. At 9am, take blood samples for Cortisol (serum sample) and ACTH (EDTA on ice). ACTH must be sent to the lab immediately for separation and freezing.
2. Inject 250 µg of Synacthen IM ideally (or IV).
3. Take another blood sample at 30 minutes for cortisol.

Comment:
A normal response is indicated by Post-Synacthen Cortisol >460 nmol/L. Where uncertainty exists, consider repeat SST with cortisol at 30 & 60 mins Post-Synacthen. For clinical advice, contact Dr Graham Lee, Consultant Clinical Biochemist, glee@mater.ie.

14.5.5 PSA

Sample Required: 8 mL Serum

Guideline 13

- Elevated levels are found in benign prostatic hypertrophy (BPH) and prostatitis. Therefore repeat after one month if there is any evidence of infection.
- Elevated levels are also found in primary and metastatic prostatic carcinoma.
- PSA should fall with a half-life of 2.2 days after radical prostatectomy and when treatment fully suppresses prostate activity.
- BPH: Please state in clinical details when treated with finasteride as this blocks the conversion of testosterone to di-hydroxytestosterone and halves the PSA levels.
- UTIs, insertion of catheters and digital rectal examination may result in a transient increase in PSA levels.

As per MEMO-M/CC/53, PSA referral thresholds have been updated based on the National Cancer Control Programme (NCCP) PSA test harmonisation outcomes report, refer to Section 21.2.1 for ranges.

14.5.6 Testosterone

Sample Required: 8 mL Serum

Guideline 14

Purpose of the test is to investigate:

- Delayed or precocious puberty
- Decreased sex drive
- Erectile dysfunction
- Infertility
- Testicular tumours
- Hypothalamus or pituitary disorders

*What a **high** result may indicate:*

- Testicular tumours
- Adrenal tumours that are producing testosterone
- Use of anabolic steroids
- Early puberty of unknown cause in boys
- Hyperthyroidism
- Congenital adrenal hyperplasia

*What a **low** result may indicate:*

- Hypothalamic or pituitary disease
- Genetic diseases such as Kleinfelter's, Kallman's or Prader-Willi Syndrome
- Testicular failure and infertility as in myotonic dystrophy
- Impaired testosterone production because of acquired damage to the testes

It should also be noted that alcohol and liver disease in males can decrease testosterone levels. Drugs such as androgens and steroids can decrease testosterone levels also. Prostatic cancer responds to androgens, therefore many men with advanced prostate cancer receive drugs that lower testosterone levels. In addition, drugs such as anticonvulsants, barbiturates and clomiphene can cause testosterone levels to rise.

If the male testosterone result is between 3.0-8.0 nmol/L, the sample will be sent out for SHBG. An androgen free index can be calculated, as per MEMO-M/CC/131.

14.5.7 Digoxin

Sample Required: 8 mL Serum

Guideline 15

Oral administration: Peak concentration following oral therapy usually reached in 60-90 minutes after administration of dose.

Toxic Effects:

- Cardiac: atrial fibrillation
- Gastrointestinal: anorexia, nausea, diarrhoea
- Neurological: headache, fatigue, colour vision

14.5.8 HbA1c

Sample Required: 2.5 mL EDTA

Guideline 16

HbA1c is a measure of the average plasma glucose over the preceding 8-12 weeks. At present, it is not used as a diagnostic test for diabetes but this may change in the future.

HbA1c measurement intervals should not be less than 3-monthly except in gestational diabetes. HbA1c is IFCC aligned in RHM.

Comment:
On occasion a haemoglobin variant may be detected during HbA1c analysis. These samples are not referred for further analysis. The following comment will be added to these reports: 'Haemoglobin variant detected, interpret HbA1C result with caution. Do not use this result for diagnosis or to assess concordance with glycaemic targets'

14.5.9 Vitamin D

Sample Required: 8 mL Serum

For GP requests please include a clinical information form (FORM-M/CC/55) with the request form and sample.

Guideline 18

Although not always required, measurement of serum parathyroid hormone (PTH) level may help establish the diagnosis of vitamin D insufficiency. PTH levels are often elevated in patients with vitamin D insufficiency, indicating secondary hyperparathyroidism.

Screening for vitamin D deficiency is recommended only in those individuals who are at high risk, including the following:

- Patients with osteoporosis
- Patients with malabsorption syndrome
- Black and Hispanic individuals
- Obese persons (Body mass index > 30kg/m^2)
- Patients with disorders that affect the metabolism of vitamin D and phosphorous (e.g. chronic kidney disease)

14.5.10 Parathyroid Hormone (PTH)

Sample Required: 2.5 ml EDTA

Guideline 18

Please note exceptionally high level of biotin may cause interference in the PTH method. These may be found in nutritional supplements such as those promoted for skin, hair and nail health and in end-stage renal disease patients taking multiple daily courses of biotin supplementation. This may impact in giving falsely low PTH results. All PTH results should be interpreted with a serum Calcium value in the context of patient clinical status. The patient should be assessed with other markers such as Phosphorous, Magnesium and Alkaline Phosphatase.

14.5.11 Paracetamol

Sample Required: 8 mL Serum

Possible Interpretative Difficulties

N-acetyl-p-benzoquinone imine (metabolite of paracetamol) may generate erroneously low results for Creatinine, HDL and Uric Acid depending on the level of paracetamol.

Guideline 19: Paracetamol overdose: Guidance on treatment with intravenous acetylcysteine

The Irish Medicines Board (IMB) has approved new simplified guidance on the treatment of paracetamol overdose with intravenous acetylcysteine (Parvolex). The simplified guidance is aligned with the findings of

a review undertaken by the Commission on Human Medicines (CHM – UK) and includes an updated treatment nomogram.

A summary of the updated guidance for healthcare professionals is as follows:
The previous treatment nomogram has been amended to a single treatment line (previously high risk line) so all patients with a plasma paracetamol level of 100mg/litre at 4 hours are recommended to have treatment (Figure 14.1 below). Regardless of risk factors for hepatoxicity, all patients with a timed plasma paracetamol level on or above a single treatment line joining points of 100 mg/L at 4 hours and 15 mg/L at 15 hours after ingestion should receive acetylcysteine (Parvolex) based on this new treatment nomogram.
This new nomogram (Figure 14.1) will thus be a single line joining the points of 100mg/L at 4 hours and 15mg/L at 15 hours after ingestion of paracetamol on or above which all patients should receive treatment with acetylcysteine. Where there is doubt over the timing of paracetamol ingestion including when ingestion has occurred over a period of one hour or more (i.e. staggered overdose), acetylcysteine should be given without delay (that is, the nomogram should not be used). To minimise the risk of anaphylactoid reactions, initial loading dose infusion should be increased from 15 minutes to 60 minutes. To minimise the risk of administration errors, a clear comprehensive weight-based dosage table will be included in the product information for both adults and children. Hypersensitivity has been removed as a contraindication to the administration of acetylcysteine.

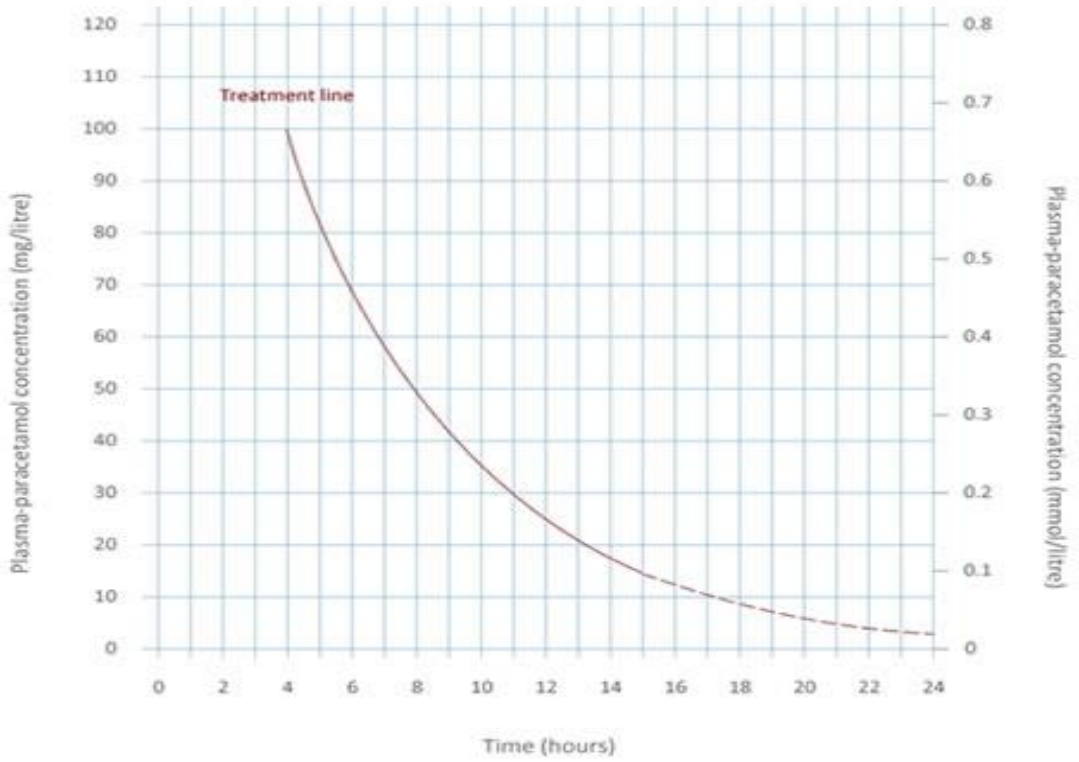
Background
Acetylcysteine (Parvolex) is licensed for the treatment of paracetamol poisoning. Its mode of action is to reduce the hepatic toxicity of NAPQI (n-acetyl-p-benzo-quinoneimine) which is the highly reactive intermediate metabolite produced following ingestion of a high dose of paracetamol. Acetylcysteine acts as a precursor for the synthesis of glutathione and, therefore, maintains cellular glutathione at a level sufficient to inactivate NAPQI.
Paracetamol overdose can result in liver damage which may be fatal. Intravenous acetylcysteine is the antidote to treat paracetamol overdose and is highly efficacious in preventing liver damage if administered within 8 hours of the overdose. After this time efficacy of acetylcysteine declines progressively.
New simplified guidance on the treatment of acute paracetamol overdose with acetylcysteine has been released following an evidence-based review by the Commission on Human Medicines (CHM – UK). The IMB has also assessed the proposed changes to the product information and following discussion with its advisory committee for human medicines (ACHM), has approved the changes to the Parvolex product information.
It is now recommended that treatment of paracetamol poisoning is simplified and a number of changes to the SmPC for acetylcysteine are proposed.

Previously healthcare professionals treating patients for paracetamol overdose were advised to assess for risk factors of hepatotoxicity (i.e. poor nutritional intake, chronic alcohol consumption, concomitant medications etc.). This assessment of risk factors resulted in two separate lines on the treatment nomogram-one for patients with risk factors and one for those without risk factors. The previous treatment nomogram has been amended to a single treatment line (previously high risk line) so all patients with a plasma paracetamol level of 100mg/litre at 4 hours are recommended to have treatment (Figure 14.1).

In the past there have been a number of reports of administration errors with intravenous acetylcysteine, some of which have the potential to result in significant harm. A contributing factor to these errors was the dosing regimen for acetylcysteine. One important recommendation is the introduction of weight-based dosage tables for adults and children. This will remove the need to calculate the dose. Since the majority of common dose-related adverse reactions occur within the first hour of the initial acetylcysteine infusion, enough evidence is available to support extending the time of initial infusion from 15 minutes to 60 minutes in order to reduce the incidence of adverse reactions. There are now no specific contraindications

to acetylcysteine including known hypersensitivity to any of the ingredients in the product. Even if patients have had a previous reaction to acetylcysteine, the benefits of treating a paracetamol overdose outweigh the risks and acetylcysteine should be given. Healthcare professionals treating patients with paracetamol toxicity should consult with the relevant clinical experts, as necessary.

Figure 14.1: Normogram for Paracetamol Poisoning



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15 IMMUNOLOGY

The Immunology department investigates the body's immune response to disease e.g. specialised protein investigation, serum protein electrophoresis, coeliac disease, allergy testing and autoimmune disease investigations. The Immunology department provides a regional service to RH Mullingar, MRH Tullamore and Portlaoise and all GPs and nursing homes in the Longford/Westmeath/Laois/Offaly area. For SPE, Protein and Albumin are processed by the referring laboratory i.e. MRH Tullamore or MRH Portlaoise. The results are included in the Immunology report for interpretation of the SPE results. The reference ranges for these tests should be taken from the relevant Chemistry report.

15.1 Contact Details for Key Members of Staff

Title	Name	Telephone Number	Email
Chief Medical Scientist	Ms Norma Mullen	044-9394339	norma.mullen@hse.ie
Senior Medical Scientist	Ms Martina Collins	044-9394339	martinam.collins@hse.ie
Clinical Advisory Service	Prof Conleth Feighery	087-9969041	confeighery@tcd.ie
	Dr Kanthi Perera (Electrophoresis)	057-9358276 Contactable on mobile via MRH Tullamore 057-9321501	Meegahage.perera@hse.ie
	Dr Gerard Crotty (Electrophoresis)	057-9358352 Contactable on mobile via MRH Tullamore 057-9321501	Gerard.crotty@hse.ie

15.2 Allergy Testing

Allergic disorders usually have a very clear cut manner of presentation. The aeroallergens typically result in conjunctivitis and rhinitis. Food allergy can affect many different organ systems and may result in symptoms affecting a combination of the oral cavity, airways, lungs, gastrointestinal tract, skin and cardiovascular system. Food allergy is quite rare, affecting approximately 2% of the adult UK population and only 6–8 % of children have a proven food allergy[1]. Skin symptoms typically result in hives or wheals. In the case of food allergy, a rapid reaction with typical symptoms is most common. Suspecting allergy as the cause of a diverse range of symptoms can lead to excessive investigations and over-diagnosis. This is particularly the case with atypical symptoms such as fatigue, constipation etc. which are very unlikely to be caused by allergy. Failure to recognise symptoms as unlikely to be caused by allergy can result in unnecessary and costly investigations, medications, and referrals[2].

Allergic reactions are initiated by binding of the patient's Immunoglobulin E (IgE) to the specific allergen which leads to rapid onset of symptoms. The majority of these IgE mediated reactions occur within 30 minutes of exposure to the allergen and many occur even more rapidly than this. Allergic reactions are caused by organic substances (proteins) and only proteins can cause true allergic reactions.

The most important part of the initial assessment of a patient, suspected of having allergic disease, is a thorough clinical history. From the history alone, the likely allergen(s) can often be identified and should help determine whether the mechanism of the reaction is likely to be IgE-mediated or non-IgE-mediated. Please refer to NICE guidelines below on how to perform an allergy focused patient history, which will likely identify which allergen, if any, is causing the patient's problem.

IgE levels can show marked variation between healthy individuals, and may increase several hundred or thousand-fold in response to certain stimuli. However, some individuals who don't have clinical allergy may have IgE levels in the hundreds or even thousands. Levels of several thousand can be seen in patients with eczema and/or asthma, even in the absence of clinical allergy, and high levels can persist even when the initial condition has been outgrown. Therefore a raised total IgE can be seen even when there are no symptoms of allergy present.

The interpretation of specific IgE results depends on a number of factors and should always be interpreted in light of the clinical presentation. Thus, the panel of available tests can only be correctly chosen in the laboratory when the history is made available. It is also important to remember that a raised specific IgE reveals "sensitisation" and is not confirmatory evidence that an allergen is causing a clinical disorder.

The NICE guidelines state that clinicians should only think about testing by skin prick testing or specific IgE tests when you have a patient with a history of an IgE mediated reaction. Skin prick testing is more sensitive and specific than specific IgE tests – but is essentially providing similar information to the blood test. If it is available, it is also speedier and less expensive!

Challenge is the ultimate investigation in food and drug allergy investigations. Clearly this is only available in clinical centres, but is necessary if possibly lifelong decisions are to be taken about allergen avoidance. The optimal use of resources for the diagnosis of allergy depends upon an appropriate partnership between requesting clinicians and the Immunology Dept. It is impossible to know which tests to perform when 'allergy screen', 'RAST' or 'allergy testing please' are the only pieces of information on the request form. Likewise, an extensive list of allergen tests, not based on an accurate allergy focused history is not ideal.

Specific IgE testing is only carried out on patient samples when accompanied by a relevant clinical history. If this is not given, only total IgE will be measured, with a comment requesting the clinician to contact Immunology if specific allergen tests are required. The sample will be stored for 7 days to allow for this further testing.

See below for allergens associated with particular conditions. If allergens outside these lists are requested, tests will only be performed if other relevant clinical details are included.
Perennial allergic rhinitis panel: total IgE, house dust mite, mixed moulds, cat and dog dander.
Asthma panel: total IgE, house dust mite, mixed moulds, cat and dog dander.
Seasonal allergic rhinitis panel: total IgE, mixed grass, mixed trees
Eczema panel: total IgE, house dust mite, milk, egg white
Food allergy panel: total IgE, wheat, soya bean, milk, egg white, cod, peanut

95% predicative values for paediatrics have been published (by Phadia) as follows:

Allergen	Eggs	Milk	Peanut	Fish (Cod)
Predicative Value	6 kU/L	32 kU/L	15 kU/L	20kU/L

Values greater than or equal to these levels should be taken as conclusive of allergy.

The following are the allergen panels available:

Panel	**Allergens Included**
Food	Egg White, Milk, Fish, Peanut, Wheat, Soya Bean

Panel	Allergens Included
Nut	Peanut*, Hazelnut, Brazil Nut, Almond, Coconut
Seafood	Fish (Cod), Shrimp, Blue Mussel, Tuna, Salmon
Fruit	Orange, Apple, Banana, Peach
Individual Foods	Egg White, Milk, Fish cod, Peanut, Wheat, Soya Bean, Hazelnut, Brazil Nut, Almond, Coconut, Walnut, Cashew, Pecan, Pistachio, Shrimp, Blue Mussel, Tuna, Salmon, Sesame, Tomato, Kiwi
Animal Danders	Cat, Dog, Horse, Cow
Individual Danders	Cat, Dog, Horse, Cow
Moulds	Penicillium notatum, Cladosporium herbarum, Aspergillus fumigates, Alternaria alternata
Individual Moulds	Penicillium notatum, Cladosporium herbarum, Aspergillus fumigates, Alternaria alternata
Grasses	Timothy, Cultivated Rye, Sweet Vernal Grass, Rye, Velvet grasses
Tree Pollen	Box-elder, Hazel, London Plane, Oak, Silver Birch
House Dust Mite	D. Pternonyssinus
Penicillin V	
Penicillin G	
Latex	

*For GPs, component testing (Ara h 2) for peanut positive results will only be carried out on results 3.0-5.0 kUA/L. Results <3.0 kUA/L suggest low level sensitisation to peanut, but if there is a clinical history suggesting peanut allergy, please contact Immunology and further testing may then be performed. Results >5.0 kUA/L suggests strong sensitisation to peanut; thus peanuts should be avoided if there is a clinical history suggesting peanut allergy, and referral to an allergist is recommended. Ara h 2 testing will be carried out on all peanut positive results requested by Paediatric Consultants.

For all positive specific IgE results, please interpret in context of the clinical history.

High total IgE levels can result in low level positivity (up to 3.5 kUA/L) in specific IgE tests. This is particularly the case when the total IgE is more than 1000 kU/L. Please interpret in context of the clinical history.

The food allergen panel is particularly of use in children <3 years, while the inhalant panel is principally of value in children >3 years.

Useful Websites for Allergy Information *(Both for Clinician and Patient)*

- Irish Food Allergy Network – www.ifan.ie
- Allergy Education – www.allergyeducation.co.uk

Guidelines for Allergy Testing

The NICE guideline recommends that allergy diagnosis should be based on a combination of good history and appropriate testing. The following questions can form the basis of a patient history and indicate whether you are dealing with a case of suspected food allergy and, if so, whether the reaction is likely to be IgE-mediated or not. These are an example of how to take an allergy history (taken from www.allergyeducation.co.uk):

1. Is there a personal or family history of allergic problems?
    - E.g. eczema, asthma, hay fever or food allergy.
    - If a family history of allergy exists, it is more likely the underlying symptoms may be allergic

2. Is there a personal history of eczema? What was the age of onset and level of severity?
    - There is a close association between how early eczema begins in life, how severe it is and the likelihood of IgE-mediated allergy.
3. What was the age/situation of onset?
    - Most food allergy develops early in infancy.
    - Consider when symptoms start in relation to a change in diet e.g. move to cow's milk from formula.
4. What food(s) are causing concern?
    - The majority of IgE reactions are caused by cow's milk, eggs, peanuts, tree nuts, fish, shellfish, soya, wheat, kiwi and sesame.
    - Non-IgE reactions are more likely linked to milk and less so with egg.
5. What symptoms are triggered?
    - In IgE-mediated allergy look for cutaneous symptoms such as urticaria, angiodema and itchiness, GI symptoms such as oral pruritus, vomiting or diarrhoea.
    - Involvement of the respiratory system and less commonly the cardiovascular system indicates anaphylaxis.
    - In non-IgE-mediated reactions look for persistent symptoms involving mainly the skin and GI system such as eczema, gastro-oesophageal reflux, loose stools, pallor and tiredness, faltering growth plus one or more GI symptom especially those symptoms that do not respond to first-line treatment.
6. What is the time between exposure and the onset of symptoms?
    - IgE-mediated reactions are more acute in onset and rapidly progressive
    - Non-IgE-mediated reactions are more likely to cause chronic symptoms
7. What quantity of food is needed to trigger a reaction?
    - With IgE-mediated reactions, very small amounts of exposure can be enough to trigger a reaction.
    - With non-IgE-mediated reactions, larger quantities may be needed.

Following the clinical history and physical examination, if you suspect:

- Non-IgE-mediated allergy, consider consulting a dietician with the appropriate competencies.
- IgE-mediated allergy, consider conducting a diagnostic test such as a Specific IgE blood test.

Just eight food allergens are responsible for 90% of allergic reactions:

Figure 15.1: Eight Most Common Food Allergens

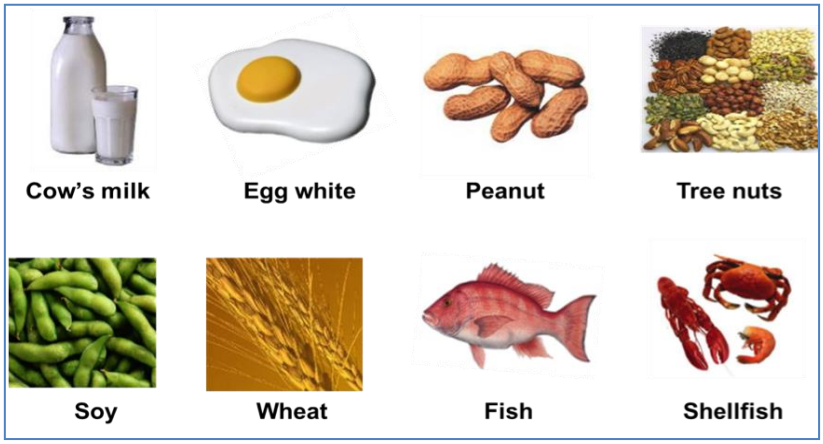

Image from http://www.slu.edu/blogs/healthinsitiutestl/files/2014/08/Causes-of-food-allergies.png

15.3 Guidelines for Testing for TPO Antibodies

Thyroid peroxidise (TPO) is an enzyme involved in thyroid hormone synthesis. TPO antibodies can be seen in patients with both hypo- and hyperthyroidism and they are surprisingly common in patients without any thyroid disease (10-15%). Therefore, detection and quantification of these antibodies is of limited value in investigating patients with suspected autoimmune thyroid disease. Anti-TPO antibodies activate complement and are thought to be significantly involved in thyroid dysfunction and the pathogenesis of hypothyroidism.

Appropriate reasons for measuring TPO antibodies:

- Hypothyroidism – low T4 with high TSH
- Thyrotoxicosis – high T4 with undetectable TSH
- Newly diagnosed patients with goitre, regardless of TFT
- As part of the work-up of patients with thyroid cancer (*Ann Clin Biochem* 2003; 40: 435)
- Pregnant women with newly diagnosed thyroid hormone derangement

Measurement of TPO antibodies is not indicated:

- If the TFTs are normal and the patient does not have goitre
- Without knowledge of the TFTs
- If measured before and there has not been any marked change in symptoms
- In patients on thyroxine replacement

Interpretation

- The expected values in a normal population are <25 IU/mL; however 10-15% of the normal population may test positive for these antibodies.
- Antibodies are found in 95% of patients with Hashimoto's thyroiditis and 60-80% of patients with Grave's disease.
- If detected during pregnancy, it may indicate a risk of post-partum thyroiditis.
- May be found in patients with other autoimmune diseases including pernicious anaemia, Addison's disease and Sjögren's syndrome and may predict future autoimmune hypothyroidism.
- If detected in asymptomatic individuals may be predictive of future hypothyroidism.

15.4 Serum Protein Electrophoresis/Urine Protein Electrophoresis

- SPE will not be carried out on patients that have had SPE done within the previous four weeks unless specifically arranged with the Immunology department.
- Requests for Immunoglobulins will have SPE carried out if the results are outside the normal reference range. (Note: This will not apply if there has been an SPE done on the same patient within the previous three months that did not show abnormal bands.)
- An immunofixation result on a report can be as a result of investigations by immunofixation and/or immunotyping
- Bands identified by immunofixation and/or immunotyping will be quantified and reported as paraproteins (1-4, depending on number of bands found)

15.5 Notes for Immunology Tests

- Positive anti-mitochondrial antibody samples will be forwarded for pyruvate dehydrogenase (PDH/PBC) analysis if not done previously.
- Endomysial antibodies (EMA) will not be repeated on patients with previous positive tTG & EMA /known coeliac patients – only tTG analysis will be done to monitor dietary compliance.
- EMA testing is only carried out on tTG results of >7.0 U/mL. IgA Endomysial antibodies are the default test. IgG Endomysial antibodies will be processed where in cases of IgA deficiency.

- ANA will not be repeated if done within the previous 6 months.
- As the substrate used for autoantibody testing includes Anti-Nuclear Antibodies, Anti-Smooth Muscle Antibodies, Anti-Mitochondrial Antibodies, Anti-Liver Kidney Microsomal Antibodies and Gastric Parietal Cell Antibodies, all five of these results will be reported on all requests for autoantibodies or any combination of the individual antibodies above.
- All adults are screened at titre 1:80 for the above antibodies while paediatrics (<18 years) are screened at titre 1:20.
- A low titre (1:80) Antinuclear Antibody (ANA) in adults can often be associated with increased age, infection, malignancy, therapy with certain drugs and a range of inflammatory disorders. A low titre (1:80) Antinuclear Antibody (ANA) is considered to be clinically relevant in the paediatric population. A high titre (1:160 or >1:160) Antinuclear Antibody (ANA) is considered to be clinically relevant in the adult population and is more likely to be associated with a connective tissue disease.
- DNA antibody testing is only carried out if the ANA is positive.
- GP ENA requests will be only be tested (in an external lab) on ANA positive adult patients with titre of 1:160, and on paediatric patients with titre of 1:80, (if not done within the previous 12 months). All ENA requests from hospital consultants will be referred for testing.
- TPO (Thyroid peroxidase) analysis will not be repeated if done in the previous 12 months.
- Alpha-1 Antitrypsin results <1.0 g/l will automatically be referred to the Alpha-1 Foundation for phenotyping (unless already sent in past). This is in keeping with national guidelines https://www.hse.ie/eng/about/who/cspd/ncps/pathology/resources/lab-testing-for-alpha-1-antitrypsn-antibodies.pdf Early diagnosis of Alpha-1 Antitrypsin deficiency can present the healthcare professional and the affected individual with a unique opportunity for early medical intervention, specific treatments, and lifestyle modification (e.g. smoking cessation), leading to the prevention or postponement of lung disease. Additionally, patient advice, information and support services are provided by Alpha-1 Foundation Ireland (see www.alpha1.ie for details).

15.6 Turnaround Times for Immunology Testing

Analytes	TAT (Working Days)	Frequency of Testing
IgG	2	Daily
IgA	2	Daily
IgM	2	Daily
Complement C3	2	Daily
Complement C4	2	Daily
Alpha-1 Antitrypsin	2	Daily
Ceruloplasmin	2	Daily
Haptoglobin	2	Daily
B2-Microglobulin	2	Daily
Urinary Electrophoresis	9	Weekly
Serum Electrophoresis	3	Daily
Immunofixation	3	Daily
Anti-Nuclear Antibodies	3	Daily
Smooth Muscle Antibodies	3	Daily
Gastric Parietal Cell Antibodies	3	Daily
Mitochondrial Antibodies	3	Daily
DNA Antibodies	3	Daily
LKM Antibodies	3	Daily

Analytes	TAT (Working Days)	Frequency of Testing
Tissue Transglutaminase (tTG)	7	Weekly
IgA Endomysial Antibodies (EMA)	5	Weekly
Total IgE	10	Weekly
Specific IgE	10	Weekly
Thyroid peroxidase (TPO)	9	Weekly

The TAT for these tests is for when the result is not abnormal. The TAT will increase if further testing/investigations are indicated.

16 HAEMATOLOGY

The Haematology department performs a wide range of tests including coagulation studies. This department provides a service to RH Mullingar and all GPs and nursing homes in the Longford/Westmeath area.

16.1 Contact Details for Key Members of Staff

Title	Name	Telephone Number	Email
Chief Medical Scientist	Ms Ciara Shanley	044-9394333	ciara.shanley@hse.ie
Senior Medical Scientist	Laura Fitzpatrick Karen Blighe	044-9394333	laura.fitzpatrick1@hse.ie karen.blighe@hse.ie
Consultant Haematologists	Dr Kanthi Perera	057-9358276 Contactable on mobile via MRH Tullamore 057-9321501	Meegahage.perera@hse.ie
	Dr Gerard Crotty	057-9358352 Contactable on mobile via MRH Tullamore 057-9321501	Gerard.crotty@hse.ie

16.2 Turnaround Times for Haematology Testing

Samples labelled urgent, samples from ICU, ED, RED, SCBU, AMAU or EPU or samples marked as 'oncology' are given priority. The following table indicates TAT for Haematology samples:

	Test	Turnaround Time
Urgent	FBC	1 hour
	Coagulation Tests	1 hour
	ESR	2 hours
	Sickle Cell Screen*	1 hour
	Malaria Screen*	1 hour
	Infectious mononucleosis	1 hour
	Blood Films	1 hour
Non-urgent (Ward)	FBC	Same day
	ESR	Same day
	Coagulation Tests	Same day
Non-urgent (GP & OPD)	FBC	24 hours
	ESR	24 hours
	Coagulation Tests	24 hours
Non-urgent	Infectious mononucleosis	48 hours
	Blood Films	3 working days

*The TAT for Sickle screen and Malaria screen is for when the result is not abnormal. The TAT will increase if further testing/investigations are indicated. Positive Sickle screen may be referred to external laboratory for full Haemoglobinopathy screen. Positive Malaria will be referred to Hospital for Tropical Diseases, London for confirmation of species.

16.3 Guidelines for Use of D-Dimers (DVT or PE)

A negative D-Dimer assay is only of use in patients with low pre-test probability of DVT or pulmonary embolism. A negative result means that no further diagnostic testing is required. While the D-Dimer test

should only be requested if there is some suspicion of venous thromboembolism, if the test does not exclude venous thromboembolism, there is a need for further clinical investigations and confirmatory tests.

The combination of a negative D-Dimer AND a low pre-test probability of DVT means that there is only a 0.4% chance of DVT over the next three months. Kearon et al reported a negative predictive value of 99.6 % during a three month follow up. This means that one could be 99.6 % sure that no DVT would occur during 3 month follow-up.

Similarly for suspected pulmonary embolism, a negative D-Dimer combined with a low pre-test probability yields a negative predictive value of 99.5% during a three month follow up.

17 SAMPLE REQUIREMENTS FOR DIAGNOSTIC TESTS

This section outlines the tests that are available in the different Pathology departments. They will be described under the following disciplines:

- Haematology (H)
- Clinical Chemistry (CC)
- Immunology (I)
- External (X) – tests sent to referral laboratories

Each test will be described under the following headings:

- Test name
- Department where analysis takes place
- Specimen type/volume/colour code. Note: containers and colour code are as per adult bottles. For paediatric equivalent, please see Section 6.5.
- Specimen requirements and comments
- Frequency of testing
- Test Methodology and platform/instrument on which it is measured – *Please note this information is only provided for tests performed in-house. For referral tests, please contact the referral lab.*

Where turnaround time is described, it is defined as the time from specimen receipt in the Pathology department to the time results are available.

Tests performed within the Pathology Laboratory, RHM and currently accredited by INAB to ISO 15189 are available on:
https://www.inab.ie/Directory-of-Accredited-Bodies/Laboratory-Accreditation/Medical-Testing/

Please note that as of April 2017, the Pathology Laboratory operates a flexible scope of accreditation. This allows the laboratory to make defined changes to our accreditation scope without first receiving approval from INAB. These tests can be marked as accredited prior to our next inspection. INAB then retrospectively assesses any changes during the next assessment. The scope available on the website will be updated on an annual basis. A list will be kept in the laboratory detailing any changes since the previous inspection. An up to date version of this list is also publically available at:
https://www.hse.ie/eng/services/list/3/acutehospitals/hospitals/regional-hospital-mullingar/publications/

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
17-Hydroxyprogesterone	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		
17-Hydroxysteroids	X	Urine	24 hour	**Plain**	**Yellow**	External – 10 days		
5-HIAA	X	Urine	24 hour	**Strong Acid**	**Green top**	External – 10 days		Advise patient of handling precautions. Contact lab for acidified container
Acetaminophen (Paracetamol)	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Colorimetric: acyl amidohydrolase	Take sample 4 hours post overdose. State time on form
Acetyl Choline	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
ACTH	X	Blood	2.5 mL	**EDTA**	**Purple top**	External – Scheduled		Send to lab immediately for freezing
Adenovirus	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Clinical details vital
Adrenal Antibodies	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Albumin	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Colourimetric (BCG)	
Alcohol (Ethanol)	CC	Blood	2 mL	**Na Fluoride Gel tube**	**Grey top Red top**	Daily	Siemens Atellica CH Enzymatic	Not for medico-legal purposes
Aldolase	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Aldosterone	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – 14 days		Take 2 samples, resting & ambulatory. Send to lab immediately for freezing

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Alkaline phosphatase	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH IFCC Standardization	Higher in children & pregnancy
Alkaline phosphatase isoenzymes	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Consultant request only
Alpha fetoprotein	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Tumour marker associated with liver and testes, give clinical details
Alpha-1 Antitrypsin	I	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica NEPH 630 Nephelometry	Low results will be reflexed to the Alpha-1 Foundation for phenotyping
Alpha-1 Antitrypsin DNA	X	Blood	3 x 2.5 mL	**EDTA**	**Purple top**	External – 14 days		
ALT	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Modified IFCC	
Amikacin	X	Blood	8 mL	**Gel tube**	**Red top**	External		Pre and post dose levels
Amino acids – Adult	X	Blood	4 mL	**Li Heparin**	**Green top**	External – 10 days		Send to lab immediately for freezing
Amino acids – Paeds	X	Blood	1.3 mL	**Li Heparin**	**Orange top**	External – 10 days		
Amino acids	X	Urine	30 mL	**Plain**	**Yellow**	External – 10 days		
Ammonia – Adult	CC	Blood	2.5 mL	**EDTA**	**Purple top**	Arrange with lab	Siemens Atellica CH Enzymatic	Higher in smokers. Send to lab immediately
Ammonia – Paeds	CC	Blood	1.3 mL	**EDTA**	**Pink top**	Daily		Send to lab immediately
Amylase	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Ethylidene Blocked-pNPG7	
	CC	Urine	24 hour	**Plain**	**Yellow**	Daily		Values may remain elevated in urine post-acute pancreatic attack
ANCA	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Androgen profile	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		SHBG & Testosterone only
Androstenedione	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Angiotensin Converting Enzyme	X	Blood	8 mL	**Gel tube**	**Red top**	External – 7 days		
Anti-cardiolipin antibodies	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Anti-DNA antibodies (DNA Abs)	I	Blood	8 mL	**Gel tube**	**Red top**	Daily	Quantalyser IIF	Marker for SLE, only assayed if ANA is positive
Anti-LKM antibodies	I	Blood	8 ml	**Gel tube**	**Red top**	Daily	Quantalyser IIF	
Anti-nuclear antibodies (ANA/ antinuclear Abs)	I	Blood	8 mL	**Gel tube**	**Red top**	Daily	Quantalyser IIF	Indications: SLE, RA, mixed connective tissue disease, Raynaud's, CREST
Anti-streptolysin titre (ASOT)	M	Blood	8 mL	**Gel tube**	**Red top**	10 days	Siemens Atellica NEPH 630 Nephelometry	
Anti-TSH receptor antibodies	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Aspergillus antibodies	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
AST	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Modified IFCC	
B2-microglobulin	I	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica NEPH 630 Nephelometry	Useful in paraproteinaemia as an index of the extent of disease

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Bile Acids/Bile Salts	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		
Bilirubin – Direct	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica Vanadate oxidation	Only assayed if Total Bilirubin >28 µmol/L
Bilirubin – Total	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Vanadate oxidation	
Blood Film	H	Blood	2.5ml	**EDTA**	**Purple top**	Daily		Fresh sample, less than 8 hours old.
Blood Gas (Specified hospital wards)	POC	Blood	2 mL	**Hep Syringe**		Daily		Mix well to prevent clots. Expel air bubbles from syringe.
NT pro BNP	CC	Blood	2.5 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Direct chemiluminescent technology	
Borrellia (Lyme disease)	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Clinical details important
Bromide	X	Blood	8 mL	**Gel tube**	**Red top**	External – 2-3 weeks		
Brucella agglutination (BAT)	X	Blood	8 mL	**Gel tube**	**Red top**	External – 7 days		
Calcium	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Arsenazo - Colorimetric	Avoid venous stasis – no tourniquet
	CC	Urine	24 hour	**Acid**	**Green top**	Daily		Advise patient of handling precautions. Contact lab for acidified container
CA 125	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Used for monitoring response to treatment in ovarian cancer, give clinical details

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
CA 15.3	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Tumour marker associated with breast, give clinical details
CA 19.9	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Tumour marker associated with pancreas & stomach, give clinical details
Calcitonin	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Send to lab immediately for freezing
Cannabis	X	Urine	30 mL	**Plain**	**Yellow**	External – 10 days		Within guardian consent required if patient <16 years
Carbamazepine	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH PETINIA	Steady state 2-6 days. Take trough sample
Carboxyhaemoglobin	POC	Blood	2 mL	**Hep Syringe**		Daily		On blood gas analysers in hospital
Carnitine (Child)	X	Blood	1.3 mL	**Li Heparin**	**Orange top**	External – 2-3 weeks		
Carotene	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Protect from light
Catecholamine	X	Blood	4 mL	**Li Heparin**	**Green top**	External – 10 days		Send to lab immediately for freezing
	X	Urine	24 hour	**Strong Acid**	**Green top**	External – 10 days		Advise patient of handling precautions. Contact lab for acidified container
CD4, CD8+ A158+	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – Weekly		Fresh sample by lunchtime with FBC
CD59, CD16	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – Weekly		Fresh sample by lunchtime with FBC

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
CEA	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Tumour marker associated with liver, lung, breast & pancreas, give clinical details
Ceruloplasmin	I	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica NEPH 630 Nephelometry	
Cholesterol	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica Colourimetric	Check 3-6 months if on treatment
Chlamydia	M	Urine	30 mL	**Plain**	**Yellow**	Weekly	Cobas 4800 Realtime PCR	
	M	Swab				Weekly	Cobas 4800 Realtime PCR	See Microbiology, Section 18
Chlamydia Psittaci	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		
Chromosome Analysis (Adult)	X	Blood	4 mL	**Li Heparin**	**Green top**	External – 3 weeks		Fill out appropriate form. Consent form signed by patient & clinician must accompany request. Form available at www.genetics.ie or from laboratory
Chromosome Analysis (Paeds)	X	Blood	1.3 mL	**Li Heparin**	**Orange top**	External – 3 weeks		Fill out appropriate form.
Chromogranin A	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
CK	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Enzymatic	Elevated by haemolysis, IM injection, exercise, surgery
Clozapine (Clozaril)	X	Blood	2.5 mL	**EDTA**	**Purple top**	External – 14 days		Send to lab immediately for freezing

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Coag Screen (PT/APTT)	H	Blood	4 mL	Na Citrate	Blue top	Daily	STAGO STAR Chronometry	Fill to mark, send to lab within 4 hours of Phlebotomy (2 hours for patients on unfractionated heparin)
Cold Agglutinins	X	Blood	1 X 6ml 1 X 8ml	EDTA Gel tube	Pink top Red top	External - 7 days		Send to lab immediately for separation at 37°C
Complement C3/C4	I	Blood	8 mL	Gel tube	Red top	Daily	Siemens Atellica NEPH 630 Nephelometry	
Copper	X	Blood	8 mL	Gel tube	Red top	External – 10 days		
Cortisol	X	Urine	24 hour	Plain	Yellow	External – 10 days		
Cortisol	CC	Blood	8 mL	Gel tube	Red top	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	State times clearly on sample bottles
C-reactive Protein (CRP)	CC	Blood	8 mL	Gel tube	Red top	Daily	Siemens Atellica IM Immunoturbimetric	
Creatinine	CC	Blood	8 mL	Gel tube	Red top	Daily	Siemens Atellica CH Kinetic colour (Jaffe) or Enzymatic	
	CC	Urine	24 hour	Plain	Yellow	Daily	Siemens Atellica CH Enzymatic	Refrigerate
Creatinine Clearance	CC	Blood & Urine	As above	As above	As above	Daily		Take blood sample during urine collection
Cryoglobulins	X	Blood	8 mL	Gel tube	Red top	External – 10 days		Special requirements for taking sample, contact Specimen Reception in advance

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Cyclosporin	X	Blood	2.5 mL	**EDTA**	**Purple top**	External		
Cysteine	X	Blood	4 mL	**Li Heparin**	**Green top**	External – 7 days		Send to lab immediately
	X	Urine	30 mL	**Plain**	**Yellow**	External – 7 days		Send to lab immediately
Cystic Fibrosis	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – 3 weeks		
Cytomegalovirus (CMV)	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Dexamethasome test *(Cortisol)*	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	Baseline sample taken at midnight. Post dex sample at 8am
D-dimer	H	Blood	4 mL	**Na Citrate**	**Blue top**	Daily	STAGO STAR Photometry	Suspected cases of DIC, covid and to out rule DVT or PE. The D-Dimer test should be carried out within eight hours of the blood being phlebotomised.
DHEAS	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Dibucaine Number	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		
Digoxin	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM immunoturbidimetric	Steady state at 6 days. Take sample 6-8 hours post oral dose.
Diptheria Antibodies	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Drugs of Abuse Screen	X	**Not** for medico-legal purposes						
- Barbiturates	X	Blood	8 mL	**Gel tube**	**Red top**	External <7 days		
	X	Urine	30 mL	**Plain**	**Yellow**	External <7 days		
- Benzodiazepines	X	Blood	8 mL	**Gel tube**	**Red top**	External <7 days		
	X	Urine	30 mL	**Plain**	**Yellow**	External <7 days		
-Cannabis	X	Urine	30 mL	**Plain**	**Yellow**	External <7 days		Written guardian consent if patient <16 years for screen purposes
- Ecstasy	X	Urine	30 mL	**Plain**	**Yellow**	External <7 days		
- MAOI's	X	Urine	30 mL	**Plain**	**Yellow**	External <7 days		
- Phenothiazines	X	Urine	30 mL	**Plain**	**Yellow**	External <7 days		
- Tricyclics	X	Blood	8 mL	**Gel tube**	**Red top**	External <7 days		
	X	Urine	30 mL	**Plain**	**Yellow**	External <7 days		
Echinococcus serology	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		
Electrophoresis								
- Serum Protein (SPE)	I	Blood	8 mL	**Gel tube**	**Red top**	Daily	Sebia Capillarys 3 Octa CZE	Clinical details vital. Send urine also as a percentage of myeloma patients have bands only in urine

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
- Urine Protein (UPE)	I	Urine	30 mL	**Plain**	**Yellow**	Weekly	Sebia Hydrasys Gel Electophoresis	
	I	Urine	24 hour	**Plain**	**Yellow**	Weekly		
Endomysial antibodies (EMA)	I	Blood	8 mL	**Gel tube**	**Red top**	Weekly	Quantalyser IIF	Only performed on positive or borderline tTG (Not done on known Coeliac patients)
Entamoeba Antibodies	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		
Epstein Barr Virus	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Erythropoietin	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
ESR	H	Blood	2.5 mL	**EDTA**	**Purple top**	Daily	Vesmatic Cube/ Alifax Roller Sedimentation rate	Used for hospital patients & GPs sending ESRs to lab. The ESR test should be carried out within four hours of the blood being phlebotomised.
ESR (POCT)	H	Blood	2.5 mL	**Na Citrate**	**Black top**	Daily	Manual Sedimentation rate	Fill to mark. Used for GPs, not suitable for sending to lab
Ethosuximide	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Extractable Nuclear Antigen	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Farmer's Lung Antibodies	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
FBC	H	Blood	2.5 mL	**EDTA**	**Purple top**	Daily	ADVIA 2120i Light scatter analysis, Flow Cytometry, Peroxidase staining, Colourimetric	Send two EDTA samples if HbA1c is also required
Ferritin	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	
Fibrinogen	H	Blood	4 mL	**Na Citrate**	**Blue top**	Daily	STAGO STAR Chronometry	Only as part of a DIC investigation. The Fibrinogen test should be carried out within eight hours of the blood being phlebotomised.
Flecanide	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		Send to lab immediately for freezing. Clinical details required.
Folate	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	
Fragile X – Adult	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External < 6 months		Consent form signed by patient & clinician to accompany request
Fragile X – Paeds	X	Blood	2 x 1.3 mL	**EDTA**	**Pink top**	External < 6 months		
Free Fatty Acids	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		
FSH	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	Indicates ovarian failure, confirmation of menopause
FTA Absorption	X	Blood	8 mL	**Gel tube**	**Red top**	External – 7 days		

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
G6PD	X	Blood	2.5 mL	**EDTA**	**Purple top**	External – 7 days		Doctor must phone Haematology SHO in St James' Hospital
Gastric Parietal Cell Abs (GPC/Parietal Abs)	I	Blood	8 ml	**Gel tube**	**Red top**	Daily	Quantalyser IIF	Indications: Pernicious anaemia
Gastrin	X	Blood	8 mL	**Gel tube**	**Red top**	External – Scheduled		Send to lab immediately for freezing
Gentamicin	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH PETINIA	Trough sample
GGT	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Modified IFCC	
Glomerular Basement Membrane Antibodies	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Glucose	CC	Blood	2 mL	**Na Fluoride**	**Grey**	Daily	Siemens Atellica CH Hexokinase	May be analysed on gel sample if <1 hour old, state time of sampling
Glutamase	X	Blood	4 mL	**Li Heparin**	**Green top**	External – 10 days		
Glutarate	X	Urine	30 mL	**Plain**	**Yellow**	External – 7 days		Send to lab immediately for freezing
Growth Hormone	X	Blood	8 mL	**Gel tube**	**Red top**	External		Send to lab immediately for freezing
Haemoglobin A1c (HbA1c)	CC	Blood	2.5 mL	**EDTA**	**Purple top**	Daily	Menarini HA-8180 HPLC	
Haemoglobin Electrophoresis	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – 10 days		
Hamm Test (PNH)	X	Blood	2.5 mL	**EDTA**	**Purple top**	External – 10 days		

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Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Haptoglobin	I	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica NEPH 630 Nephelometry	
HDL Cholesterol	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Elimination/catalase	
Hepatitis B PCR	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – 10 days		Send to lab immediately for freezing
Hepatitis C PCR	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – 10 days		Send to lab immediately for freezing
Hepatitis Screen	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Clinical details important: exposure risk, needle stick etc.
HIV	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Patient consent required. For needle stick injury, contact Occupational Health
T-hCG	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	To monitor pregnancy. Give clinical details
β-hCG	X	Blood	8 mL	**Gel tube**	**Red top**	External – 7 days		Tumour marker associated with testicular cancer. Give clinical details
HLA B27	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – 10 days		Do not take over weekend, must be analysed within 24 hours
HLA-H (Haemochromatosis)	M	Blood	2.5 mL	**EDTA**	**Purple top**	Batched	Cobas 4800 PCR	Refer to guidelines, Section 18.2.23
HLA Tissue Typing	X	Blood	8 mL	**Gel tube**	**Red top**	External > 14 days		Send within 24 hours. Separate & store at 2-8° for no longer than 48 hours. Freeze at -50 to -80°.

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Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Homocysteine	X	Blood	2.5 mL	**EDTA**	**Purple top**	External – 7 days		Send to lab immediately for freezing
	X	Urine	30 mL	**Plain**	**Yellow**	External – 10 days		
H. pylori	M	Stool		**Plain**	**Blue Cap**	Daily	Manual Immunochromatography	May indicate recent or past infection. Negative= unlikely to be H. pylori
Huntington's Chorea	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External > 14 days		
Hydroxyproline	X	Urine	24 hour	**Plain**	**Yellow**	External – 10 days		
Infectious Mononucleosis Screen	H	Blood	2.5 mL	**EDTA**	**Purple top**	Daily	Manual Immunoassay	Indications: Lymphadenopathy
Immunoglobulins - IgA, IgG, IgM	I	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica NEPH 630 Nephelometry	
- IgE (Total & Specific)	I	Blood	8 mL	**Gel tube**	**Red top**	Weekly	Phadia 250 Chemilumenescence	See guidelines for requesting allergens
INR (PT)	H	Blood	4 mL	**Na Citrate**	**Blue top**	Daily	STAGO STAR Chronometry	Fill to mark. Analysis can be delayed for up to 2 days (warfarin patients only), store at 4°.
Insulin	X	Blood	8 mL	**Gel tube**	**Red top**	External – Scheduled		Send to lab immediately for freezing
Insulin Growth Factor 1	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		Send to lab immediately for freezing
Ionised Calcium	POC	Blood	2 mL	**Hep Syringe**		Daily		On blood gas analysers in hospital

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Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Iron	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Ferrozine	Fasting preferred. Indications: Iron overdose, Haemochromatosis. Not for iron deficiency
Islet Cell Antibodies	X	Blood	8 mL	**Gel tube**	**Red top**	External > 14 days		
Jo1 Antibodies	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Lactate	CC	Blood	2 mL	**Na Fluoride**	**Grey**	Daily	Siemens Atellica CH Oxidation colour	Send to lab immediately. State sample time
Lamotrigine (Lamictal)	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
LATS	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
LDH	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Lactate / NAD	Haemolysis interferes with test
LDL Cholesterol	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica Elimination/catalase	
Lead	X	Blood	2.5 mL	**EDTA**	**Purple top**	External – 2-3 weeks		
Legionella	X	Blood	2.5 mL	**EDTA**	**Purple top**	External – 10 days		
Leptospirosis	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Incubation period 4-19 days
Leucocyte Enzyme	X	Blood	2.5 mL	**EDTA**	**Purple top**	External > 14 days		
Levetiracetam (Keppra)	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		

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Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
LH	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	See guidelines Section 14.6.3
Lipase	X	Blood	8 mL	**Gel tube**	**Red top**	External > 14 days		
Lipid Profile	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily		See Cholesterol, Triglyceride, HDL & LDL. State Fasting/Random
Lithium	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Colorimetric endpoint	Steady state 3-7 days. Take sample 12 hours post dose
Magnesium	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Xylidyl Blue	
Malaria Screen	H	Blood	2.5 mL	**EDTA**	**Purple top**	Daily	Manual Immunochromatographic Morphological	Sample as fresh as possible. A malaria request form must be submitted with general request form and the Haematology Lab phoned prior to sending malaria screen.
Meningococcal PCR	X	Blood	2.5 mL	**EDTA**	**Purple top**	External < 7 days		To confirm meningococcal disease in hospitalised patients
Mercury	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – 2-3 weeks		Contact Laboratory 94345
Metabolic Screen – Adult	X	Blood	4 mL	**Li Heparin**	**Green top**	External – 10 days		
Metabolic Screen – Paeds	X	Blood	1.3 mL	**Li Heparin**	**Orange top**	External – 10 days		
Mitochondrial antibodies (AMA/ Mitochondrial Abs)	I	Blood	8 mL	**Gel tube**	**Red top**	Daily	Quantalyser IIF	Indications: 1° Biliary Cirrhosis

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Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Mucopolysaccharide	X	Urine	30 mL	**Plain**	**Yellow**	External > 14 days		
Mycoplasma	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Neutrophil Antibodies	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Oligoclonal Banding	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		For investigation of Multiple Sclerosis. Both Serum and CSF required.
	X	CSF	300 µL	**Plain**	**White Cap**			
Oestradiol	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	
Oestrogen Receptors	X	Blood	8 mL	**Gel tube**	**Red top**	External > 14 days		
Organic Acids	X	Urine	30 mL	**Plain**	**Yellow**	External – 7 days		Send to lab immediately for freezing
Osmolality	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	OsmoPro Freezing point depression	
	CC	Urine	30 mL	**Plain**	**Yellow**	Daily	OsmoPro Freezing point depression	
Oxalate	X	Urine	24 hour	**Acid**	**Green top**	External – 10 days		Indications: Renal calculi
Parvovirus B19	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		
Paternity Testing	X							Doctor or patient to contact Prof Alan Dobson, Tel: 021-4902743 or 021-4901946
Pertussis Antibodies	X	Blood	8 mL	**Gel tube**	**Red top**	External > 14 days		

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Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Phenobarbitone	CC	Blood	8 mL	Gel tube	Red top	Daily	Siemens Atellica CH PETINIA	Steady state adult 10-25 days, child 8-15 days. Take trough sample
Phenylalanine	X	Blood	4 mL	Li Heparin	Green top	External – 7 days		
Phenytoin	CC	Blood	8 mL	Gel tube	Red top	Daily	Siemens Atellica CH PETINIA	Take trough sample
Philadelphia Chromosome	X	Bone Marrow	1 mL	Li Heparin	Green top	External – 3 weeks		Send to lab immediately
Phosphorous	CC	Blood	8 mL	Gel tube	Red top	Daily	Siemens Atellica CH Phosphomolybdate	Aged sample unsuitable
Platelet Antibodies	X	Blood	8 mL	Gel tube	Red top	External – 10 days		Not done for ITP
Platelet Associated IgG	X	Blood	4 x 2.5 mL	EDTA	Purple top	External – 14 days		Store at room temperature
Platelet Count	H	Blood	2.5 mL	EDTA	Purple top	Daily	ADVIA 2120i Light scatter analysis, Flow Cytometry	
Pneumococcus Antibodies	X	Blood	8 mL	Gel tube	Red top	External – 10 days		
Pneumococcus PCR	X	CSF	500 µL	Plain	White Cap	External < 7 days		
Porphyrin Screen	X	Blood	3 x 2.5 mL	EDTA	Purple top	External – 14 days		One sample type required. Protect **all** samples from light. Stool and urine samples to be refrigerated.
	X	Blood	2 x 4 mL	Li Heparin	Green top	External – 14 days		
	X	Urine	30 mL	Plain	Yellow	External – 14 days		

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Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
	X	Urine	24 hour	**Plain**	**Yellow**	External – 14 days		
	X	Stool	10 g	**Plain**	**Blue Cap**	External – 14 days		
Potassium	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Indirect IMT	Aged/haemolysed samples unsuitable. Do not force blood through needle into tube. Do not pour blood from EDTA bottle into gel tube. Do not take blood from drip arm.
Primidone	X	Blood	8 mL	**Gel tube**	**Red top**	External – 7 days		Send to lab immediately for freezing. Take sample immediately prior to next dose.
Progesterone	X	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	Indication: Confirmation of ovulation See guidelines Section 14.6.3
Prolactin	X	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	Indications: pituitary tumour. May be elevated after epileptic fit or stress. See guidelines Section 14.6.3
Proline	X	Blood	4 mL	**Li Heparin**	**Green top**	External – 14 days		
Protein	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Biuret	
	CC	Urine	24 hour	**Plain**	**Yellow**	Daily	Siemens Atellica CH Dye binding	Refrigerate
PSA	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	Do not request if patient has acute renal retention, post TURP, post needle biopsy or cystoscopy as PSA may be falsely elevated

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Psitticosis Antibodies	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		(Farmer's Lung)
PT (INR)	H	Blood	4 mL	**Na Citrate**	**Blue top**	Daily	STAGO STAR Chronometry	Fill to mark. Analysis can be delayed for up to 2 days (warfarin patients only), store at 4°.
PTH	CC	Blood	2.5 mL	**EDTA**	**Purple top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	
Pyruvate	X	Blood						Contact Biochemistry, Crumlin for sample requirements
Renin	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – 14 days		Take two sample, supine & upright
Reticulocyte Count	H	Blood	2.5 mL	**EDTA**	**Purple top**	Daily	ADVIA 2120i Light scatter analysis, Flow Cytometry	
Rheumatoid Factor	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Immunoturbimetric	
Rickettsioses	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		
Rubella	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Salicylate	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Colourimetric	
Schilling Test	X	Urine						Collected post radioactive dose. Dr must contact Department of Nuclear Medicine, St. Vincent's
SHBG	X	Blood	8 mL	**Gel tube**	**Red top**	External – Scheduled		

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Sickle Cell Screen	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – 14 days		
Sickle Cell Screen	H	Blood	2.5 mL	**EDTA**	**Purple top**	Daily	Manual Solubility	If urgently required only
Smooth muscle antibodies (ASMA/ Smooth muscle Abs)	I	Blood	8 mL	**Gel tube**	**Red top**	Daily	Quantalyser IIF	Indications: Active chronic hepatitis
Sodium	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Indirect IMT	Aged samples unsuitable. Do not force blood through needle into tube. Do not pour blood from other bottles into gel tube. Do not take blood from drip arm.
	CC	Urine	24 hour	**Plain**	**Yellow**	Daily		Refrigerate
	CC	Urine	30 mL	**Plain**	**Yellow**	Daily		Refrigerate
Somatomedin	X	Blood	8 mL	**Gel tube**	**Red top**	External > 14 days		
Sputum – Malignant Cells	X	Sputum	30 mL	**Plain**	**Yellow**	External – 7 days		Mouth should be rinsed with water beforehand. Salivary samples are of no value & will be discarded without testing.
Synacthen Test *(Cortisol)*	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	Samples taken at 0 and 30 minutes post synacthen injection for Cortisol
Syphilis	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
T cell	X	Blood	2.5 mL	**EDTA**	**Purple top**	External – 10 days		

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Testosterone – Male	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica Chemiluminescent Immunoassay	
Testosterone – Female (inc M-F & F-M)	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Theophylline	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM PETINIA	Trough sample for immediate release preparations. Modified-release oral theophylline: 4-6 hours after dose.
Therapeutic Drug Monitoring	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily		See individual drugs: Phenytoin, Phenobarbitone, Carbamazepine, Theophylline, Digoxin, Gentamicin, Vancomycin, Lithium, Digoxin
Thyroxine – Free (FT4)	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	May be slightly elevated in non-thyroidal illness
Tissue Polypeptide Specific Antigen (TPS)	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		
Tissue Transglutaminase (tTG/ IgA tTG Abs)	I	Blood	8 mL	**Gel tube**	**Red top**	Weekly	Phadia 250 Chemilumenescence	Marker for Coeliac Disease – if positive, reflexed for EMA
Tobramycin	X	Blood	8 mL	**Gel tube**	**Red top**	External < 7 days		
TORCH	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Toxicology Screen	X							See Drugs of Abuse

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Toxoplasma	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
TPHA	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Trace Metals	X	Urine	30 mL	**Plain**	**Yellow**	External – 2-3 weeks		
	X	Blood				External – 2-3 weeks		Contact lab for special bottle
Transferrin	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Immunoturbimetric	
Transferrin Saturation	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily		Calculated from Iron and Transferrin
Triglyceride	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH GPO	Raised levels/lipaemia can interfere with HDL/LDL cholesterol assays
Troponin I (High Sensitive/HSTnI)	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	Only available to hospital patients
Thrombophilia Screen – Adult	X	Blood	6 x 4 mL	**Na Citrate**	**Blue top**	External – 10 days		All 9 samples required. To be organised with phlebotomy, fresh samples to arrive in lab by 9am.
	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – 10 days		
	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Thrombophilia Screen – Paeds	X	Blood	2 x 1.3 mL	**Na Citrate**	**Green top**	External – 10 days		All 4 samples required. Fresh samples to arrive in lab by 9am.
	X	Blood	1 x 1.3 mL	**EDTA**	**Pink top**	External – 10 days		
	X	Blood	1 x 1.3 mL	**Serum**	**Clear top**	External – 10 days		

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Triiodothronine – Free (FT3)	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	Not routinely analysed on patients on treatment
TPO	I	Blood	8 mL	**Gel tube**	**Red top**	Weekly	Phadia 250 Enzyme link Immunoassay	See guidelines, Section 15.4
Trypsin	X	Stool		**Plain**	**Blue Cap**	External – Scheduled		Fresh sample required
TSH	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	
Tumour Markers	X							
- AFP	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Tumour marker associated with liver and testes, give clinical details
- βhCG	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Tumour marker associated with testicular cancer, give clinical details
- CA 125	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Used for monitoring response to treatment in ovarian cancer, give clinical details
- CA 15.3	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Tumour marker associated with breast cancer, give clinical details
- CA 19.9	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Tumour marker related to pancreas & stomach, give clinical details
- CEA	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		Tumour marker associated with liver, lung & breast, give clinical details
- PSA	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	Do not request if patient has acute renal retention, post TURP, post needle biopsy or cystoscopy as PSA may be falsely elevated

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Uric acid	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Uricase/Peroxidase	Affected by dietary factors
Urea	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH Urease with GLDH	
Urinary albumin	CC	Urine	30 mL	**Plain**	**Yellow**	Daily	Siemens Atellica CH Immunoturbimetric	Useful in monitoring diabetic patients. Morning sample preferred.
	CC	Urine	24 hour	**Plain**	**Yellow**	Daily		
Urinary uric acid	X	Urine	24 hour	**Plain**	**Yellow**	External – 10 days		
Urinary urea	X	Urine	24 hour	**Plain**	**Yellow**	External – 14 days		Refrigerate.
Valporate (Epilim)	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH PETINIA	Steady state 2-3 days. Take trough samples
Vancomycin	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica CH PETINIA	Trough sample.
Varicella	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		
VDRL/TPHA	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		
Vigabatrin (Sabril)	X	Blood	8 mL	**Gel tube**	**Red top**	External – 14 days		
VIP	X	Blood	4 mL	**Li Heparin**	**Green top**	External > 14 days		
Viral Load	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – 10 days		Fresh sample required
Viscosity	X	Blood	2 x 2.5 mL	**EDTA**	**Purple top**	External – 10 days		Store at room temperature

Refer to the INAB website www.inab.ie for the current list of accredited tests on the scope of accreditation 195MT								
Test	**Dept.**	**Sample**	**Volume**	**Container**	**Colour Code**	**Frequency**	**Instrument & Methodology**	**Comment**
Vitamin A	X	Blood	8 mL	**Gel tube**	**Red top**	External > 14 days		Protect from light
Vitamin B12	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	
Vitamin D	CC	Blood	8 mL	**Gel tube**	**Red top**	Daily	Siemens Atellica IM Chemiluminescent Immunoassay	
Vitamin E	X	Blood	8 mL	**Gel tube**	**Red top**	External > 14 days		
Vitamin K	X	Blood	8 mL	**Gel tube**	**Red top**	External > 14 days		Protect from light
VMA	X	Urine	24 hour	**Strong Acid**	**Green top**	External – 10 days		Advise patient of handling precautions. Contact lab for acidified container
Von Willebrand's Factor	X	Blood	6 x 4 mL	**Na Citrate**	**Blue top**	External – 10 days		
Widal (Salmonellosis)	X	Blood	8 mL	**Gel tube**	**Red top**	External – 10 days		
Yersina	X	Blood	8 mL	**Gel tube**	**Red top**	External > 14 days		

For a list of Non-Accredited Tests at Pathology, Regional Hospital Mullingar, reference LIST-M/L/62, which is available to view on:
https://www.hse.ie/eng/services/list/3/acutehospitals/hospitals/regional-hospital-mullingar/our-services/

18 MICROBIOLOGY

The Microbiology department provides a wide range of testing to RH Mullingar and all GPs and nursing homes in the Longford/Westmeath area. This department also provides regional services for Chlamydia and Mycology to MRH Tullamore, MRH Portlaoise and GPs in Laois and Offaly. A clinical service is offered for both diagnosis and patient management advice, see contact details below. Please contact the Consultant Microbiologist for advice on antibiotic results. Please refer to RHM guidelines for the use of antibiotics available on the Shared Drive.

18.1 Contact Details for Key Members of Staff

Title	Name	Telephone Number	Email
Chief Medical Scientist	Mr Ultan Campbell	044-9394341	ultan.campbell@hse.ie
Senior Medical Scientists	Mr Mark McKeon	044-9394332	mark.mckeon@hse.ie
	Mr Colin Murtagh		colin.murtagh@hse.ie
	Ms Roisin Lynch		roisin.lynch5@hse.ie
Consultant Microbiologists	Dr Gergely Krizsan	00 353 892 633 335 (Irish) 00 36 30 821 108 (Hungarian)	gergely.krizsan@gmail.com
	Dr Zsuzsanna Berek	00 353 851 443 345 (Irish) 00 36 30 290 5294 (Hungarian) 00 20 122 842 8031 (Egyptian)	zsuzsayy49@gmail.com

18.2 Tests

Note: For all microbiology tests, a negative result does not exclude infection

18.2.1 CSF (Cerebrospinal Fluid)

Sample Required:
Three samples (>1 mL each) are taken into three universal containers included in CSF pack, and labelled as 1, 2 and 3. The CSF specimen for protein/glucose measurement (usually sample 2) should be hand-delivered directly to the Clinical Chemistry laboratory along with a Clinical Chemistry request form

Where Xanthochromia is specifically required, a separate CSF sample with a minimum of 1 mL volume must be tapped directly into a light-protected container. These are available upon request from the laboratory. This should be accompanied by a blood glucose sample. If oligoclonal banding investigation is required, a clotted blood sample must accompany the CSF sample.

CSF samples must not be placed in the fridge or sent through the pneumatic chute system.

Turnaround Times: Processed on receipt

Report	TAT
Microscopy Report	<2 hours
Final negative culture	48 hours
Final positive culture	48-72 hours

Note: Minimum CSF volumes required for additional testing:

Test	Minimum Volume
Xanthochromia	1 mL

Test	Minimum Volume
Viral PCR	0.5 mL
TB AFB & Culture	0.25 mL
TB PCR	0.25 mL
Meningococcal PCR	0.25 mL
Cryptococcal antigen	0.5 mL

Reference Ranges:

Leucocytes	Neonates	Less 28 days	0-30 cells x 10^6/L
	Infants	1 to 12 months	0-15 cells x 10^6/L
	Children/Adults	1 year +	0-5 cells x 106/L
Erythrocytes	No RBCs should be present in normal CSF		

From: UK Standards for Microbiology Investigations 'Investigation of Cerebrospinal Fluid' Issue 6. 2017

Note: All CSF samples requesting bacterial and/or viral screening will now be processed 24/7 in-house using the FilmArray ME panel. This panel is capable of detecting 14 of the main bacterial, viral and fungal pathogens associated with meningitis/encephalitis.

18.2.2 Blood Cultures

Samples Required:

Patient	Sample Bottles
Adult	Aerobic Bottle (Blue)
	Anaerobic Bottle (Purple)
	Fungal Bottle (Green)
Paeds	Paediatric Bottle (Pink)

- Do not cover the bottle's barcode label as this is scanned as part of the analytical process.
- Specimens must be sent to the laboratory immediately for incubation at 37°C.
- Do not send through the pneumatic chute system.
- Blood cultures received between 20.00 and 08.00 should be time stamped and placed in the red box on the bench
- Blood cultures are incubated for 5 days.
- Please indicate if Infective Endocarditis (IE), fungal infection or Brucella is suspected as incubation is extended for these cases.

Turnaround Times: Blood Cultures are monitored continuously and processed 24 hours a day.

Positive Results:

During the routine day positive blood cultures are phoned to the clinical teams within 2 hours of flagging positive. After 20:00 Monday to Friday and 14:00 Saturdays, Sundays and BH Mondays positive blood cultures are phoned to the clinical teams before 11:30 the following day. A written interim report is then issued. Direct susceptibility testing will be available on organisms isolated for clinical guidance within 24 hours. Standardised susceptibility testing results and final report will be issued within 24-48 hours.

Negative Results:

Negative reports are issued after 5 days incubation (10 days if Infective Endocarditis, fungal infection or Brucella is suspected).

18.2.3 Urine – Culture & Sensitivity

Samples Required: All urines (e.g. Midstream CSU's etc) must be received in the thin white capped sterile tube. The white-cap tube must be filled under vacuum from the yellow-cap vacutte universal container. Please only submit the white-cap tube to the laboratory with a minimum volume of 2mLs contained therin.

Turnaround Times:

	Report	TAT
Urgent	Microscopy Report	2 hours
	Negative culture	24 hours
	Positive culture	48-72 hours
Routine	Microscopy Report	Same day
	Negative culture	48 hours
	Positive culture	48-72 hours

Notes:

- Urine dipstick for glucose, protein etc. is not routinely performed on urines in the laboratory.
- It is unnecessary to routinely send urines to the laboratory on all patient's attending Out-Patients clinic except for the following patients:
    - Diabetic patients
    - Patients with known renal disease
    - Patients with acute symptoms suggesting urinary tract infections e.g. urgency, frequency, dysuria, haematuria, fever.

18.2.4 Urine Pregnancy Test

Sample Required: Collect early morning urine directly into a 60 mL sterile urine container. Do not transfer from another container. Do not use boric acid container.

Turnaround Times:

Report	TAT
Urgent samples	1 hour
Routine samples	Same day

18.2.5 Urine – TB Culture

Sample Required: Three consecutive early morning urines
This test must be arranged with St James' Hospital TB lab in advance.

18.2.6 Urine – Chlamydia & Gonorrhoea

Sample Required: CT/NG PCR Urine collection kits available from Microbiology. External users should contact Cruinn Diagnostics for supplies.

Turnaround Times: 5 days.

Note: A negative PCR molecular test for Chlamydia trachomatis or Neisseria gonorrhoeae does not preclude the presence of the target pathogen. Clinical discretion is advised when reviewing results from these tests.

18.2.7 Sputum – AFB

Sample Required: Use plain 60 mL sterile container. Send three consecutive purulent specimens.
Do not wash teeth or use oral hygiene products before collection.
Salivary/mucoid samples are of no value and will be discarded without testing.
C&S and AFB require separate samples for each. Single samples will be processed for routine C&S only.

Turnaround Times: Samples are referred to the Irish Mycobacteria Reference Laboratory (IMRL), St James's Hospital. This laboratory operates a specimen acceptance policy with regards to repeat submission of samples, available from IMRL.

Report	TAT
Microscopy	2 days
Negative culture	8 weeks
Positive culture	Refer to IMRL for detailed breakdown

18.2.8 Swab – Chlamydia & Gonorrhoea

Sample Required: Female collection kits are available from Microbiology. External users should contact Cruinn Diagnostics for supplies.
Turnaround Times: 5 days.

Note: A negative PCR molecular test for Chlamydia trachomatis or Neisseria gonorrhoeae does not preclude the presence of the target pathogen. Clinical discretion is advised when reviewing results from these tests.

18.2.9 Sputum – Culture & Sensitivity

Sample Required: Use plain 60 mL sterile container.
Salivary/mucoid samples are of no value and will be discarded without testing.
C&S and AFB require separate samples for each.
Repeat samples will not be processed within a 5 day period.

Note: These samples are not routinely cultured for Legionella. Urine samples from ICU patients routinely screened for Legionella/Pneumococcal antigen on request by ICU consultants. For all other requests, please contact the consultant microbiologist through the hospital switchboard

Turnaround Times:

Report	TAT
Negative culture	24 hours
Positive culture	48-72 hours

18.2.10 Swabs – Culture & Sensitivity

Sample Required: Use transport swabs. Please indicate type e.g., vaginal, throat etc.
If wound swab, indicate site and also if skin lesion or deep-seated.

Turnaround Time: Final report 48-72 hours.

18.2.11 Swabs – Pernasal

Sample Required: Use ENT swabs (orange), clearly label.

Turnaround Time: Pernasal swabs now referred to Microbiology Dept. OLCHC, Crumlin for molecular screening

18.2.12 Swab – Carbapenemase Producing Enterobacteriaceae (CPE)

Sample Required: Please refer to infection control guidelines for specific testing requirements, available on the hospital Shared Drive. Samples must reach Microbiology by 6pm Monday-Friday and 12pm Saturday, Sunday and Bank Holidays.

Turnaround Time: 2 hours.

Note: A negative PCR molecular test for Carbapenemase-Producing Enterobacteriaceae (CPE) does not preclude the presence of the target pathogen. Clinical discretion is advised when reviewing results from these tests.

18.2.13 Swab – Influenza & RSV

Sample Required: Nasopharyngeal Collection kits specific for this test (available from the laboratory) are required. Samples are processed 24/7.

Turnaround Time: 2 hours.

Notes:

- A negative PCR molecular test for Influenza or RSV does not preclude the presence of the target pathogen. Clinical discretion is advised when reviewing results from these tests.
- FilmArray respiratory panel is available is available and capable of detecting 19 viral and 4 bacterial pathogens. **Such requests are accepted from ICU and Paediatric consultants. All other requests must be authorised by the consultant microbiologist via the hospital switchboard.** Turnaround time -1 hour.

18.2.14 Swab – Rapid Group B Streptococcus

Sample Required: Coban LQ Swab consisting of a dual cotton tip swab with a red top. Testing provided only to patients who meet specific criteria as set up by the Obstetric team.

Turnaround Time: 2 hours.

18.2.15 Swab – SARS-Cov-2 (Covid-19)

Sample Required: Nasopharyngeal Collection kits specific for this test (available from the laboratory) are required.

Turnaround Time: 1.5 hours.

Note: A negative PCR molecular test for SARS-Cov-2 does not preclude the presence of the target pathogen. Clinical discretion is advised when reviewing results from these tests.

18.2.16 Stool – Molecular analysis

Sample Required: Use blue-capped faeces container, 5-10g sample. Do not fill container.

Notes:

- Stool samples are routinely screened for Salmonella, Shigella, Verotoxigenic E. Coli and Campylobacter by PCR analysis.

- All samples will be screened for Cryptosporidium and Giardia regardless of request for ova & parasites.
- Patients less than 4 years old are screened for Rotavirus and Adenovirus also.
- Clinical details are essential e.g. if the patient has recently been abroad or in contact with a diagnosed case of enteritis, etc.
- Screening for Vibrio and Yersinia performed by culture. Please provide clinical details and indicate any recent foreign travel including countries visited.
- Request for enteric screen does not include C. difficile toxin. This must be requested separately when clinically indicated.
- Routine enteric screen is not performed on formed stool samples.

Turnaround Time: Final report within 24 hours.

18.2.17 Stool – C. difficile Toxin

Sample Required: Use blue-capped faeces container, 5-10g sample. Do not fill container.
C. difficile toxin is only performed on patients with diarrhoea.
If C. difficile is negative and diarrhoea persists, it may be appropriate to request more extensive culture.
There is no value in repeat tests for C. difficile on patients for whom there is a previous positive result.

Turnaround Time: C. difficile toxin testing is performed daily for samples received in the lab up to 12 noon.

18.2.18 Stool – Norovirus (Winter Vomiting Bug)

Sample Required: Use blue-capped faeces container, 5-10g sample. Do not fill container. Samples are tested after clearance by Consultant Microbiologist and/or Infection Control. Samples must reach Microbiology by 6pm Monday-Friday and 12pm Saturday, Sunday and Bank Holidays.

Turnaround Time: 2 hours.

Note: A negative PCR molecular test for Norovirus does not preclude the presence of the target pathogen. Clinical discretion is advised when reviewing results from these tests.

18.2.19 Stool – Ova & Parasites (O&P)

Sample Required: Use blue-capped faeces container, 5-10g sample. Do not fill container.
Positive findings are rare. This methodology is very demanding on scientist's time and should only be requested where there are clear clinical indications. Clinical details and travel history must be indicated on request form. If in doubt, contact the Microbiology laboratory.
Sudden onset of diarrhoea is not an indication for screening for O&P except in the following circumstances:

- When foreign travel has occurred to specific regions e.g. Africa, Asia or Central/South America
- In patients from areas where enteric parasites are endemic
- Other indications of possible parasite infestation e.g. Eosinophilia

18.2.20 Stool – Rotavirus/Adenovirus

Sample Required: Use blue-capped faeces container, 5-10g sample. Do not fill container.
Routinely tested on children aged 3 and under.

Turnaround Time: 24 hours.

18.2.21 Stool – Helicobacter pylori Antigen

Sample Required: Use blue-capped faeces container, 5-10g sample. Do not fill container.

Turnaround Time: 24 hours.

18.2.22 Semen Analysis

Sample Required: Contact the Microbiology laboratory for instructions. Sample must be received in laboratory before 3pm for processing.
Turnaround Time: 24 hours.

18.2.23 Haemochromatosis Genetic Testing (HFE)

Sample Required: 2.5 mL EDTA
Reference Ranges: Normal/Heterozygous/Homozygous
(See each individual report for interpretative comments)

Hereditary Haemochromatosis is associated in most patients with mutations of HFE gene, C282Y and H63D.

Only samples which demonstrate the following criteria will be considered for HFE testing:

- Fasting transferrin saturation levels ≥45%
- Positive spouse or first degree relative

These criteria are in keeping with accepted guidelines which were published in 2006 by the National Centre for Medical Genetics, Our Lady's Children's Hospital, Crumlin.

All test requests for Haemochromatosis testing should include an EDTA sample for HFE genotyping and a FASTING serum sample for the transferrin saturation test. These must be submitted along with the appropriate request form (FORM-M/M/32) which incorporates patient consent. See Section 6.2 for request form information.

A fasting serum sample is required for % transferrin to exclude a false high result.

Special requests for HFE testing based on high serum ferritin with a normal transferrin saturation level may be discussed with Dr Perera, Consultant Haematologist for further consideration. Information regarding such correspondence must be included in the clinical details when requesting the Haemochromatosis test.

18.2.24 Virology Screen

Serology is the principle diagnostic technique in virology. Please specify viral screen required or contact the Consultant Microbiologist. All virology testing in performed at the National Virus Reference Laboratory in Dublin. Please refer to https://nvrl.ucd.ie/usermanual for virology queries.

18.2.25 TB Quantiferon

Routed via the microbiology laboratory and performed externally Monday to Thursday only. Specific requirements and request form. Contact the microbiology laboratory for further information if required.

18.2.26 Tissue/Biopsy – Culture

Samples should be sent neat in a sterile container without any additives. Send separate samples for each test required, accompanied by the appropriate test request form.
N.B. Do not sent samples wrapped in gauze or other material.

19 BLOOD TRANSFUSION & HAEMOVIGILANCE

The Blood Transfusion Department provides a routine and emergency blood transfusion service to RH Mullingar and an antenatal blood group and antibody screening service to antenatal clinics in the Longford/Westmeath area. This department also provides regional antenatal testing services to MRH Tullamore and MRH Portlaoise. Clinical, technical and haemovigilance advisory services are also provided.

19.1 Contact Details for Key Members of Staff

Title	Name	Telephone Number	Email
Chief Medical Scientist	Ms Carol Cantwell	044-9394868	carolb.cantwell@hse.ie
Senior Medical Scientists	Mr Eunan Connolly	044-9394329	eunan.connolly@hse.ie
	Mr John Quigley	044-9394364	john.quigley1@hse.ie
Haemovigilance Officer	Ms Aisling Sweeney	044-9394313 Bleep 043	aisling.sweeney@hse.ie
Consultant Haematologists	Dr Kanthi Perera	057-9358276 Contactable on mobile via MRH Tullamore 057-9321501	meegahage.perera@hse.ie
	Dr Gerard Crotty	057-9358352 Contactable on mobile via MRH Tullamore 057-9321501	gerard.crotty@hse.ie

19.2 Blood Transfusion Tests

Test/Profile	Specimen Type	Adult Sample Requirement	Special Requirements	Turnaround Time
Group & Screen	Blood	EDTA – 6 mL**	None	Routine -1 Day Urgent - 90 minutes
Crossmatch	Blood	EDTA – 6 mL**	None	See Section 19.4
Direct Antiglobulin Test	Blood	EDTA – 6 mL**	None	1 Day
Neonatal Group & DAT	Blood	EDTA – 6 mL**	Cord Sample	1 Day
Antenatal Group & Screen	Blood	EDTA – 6 mL	None	5 Days
Kleihauer Test	Blood	EDTA – 6 mL or EDTA – 2.5ml	Specimen should be taken 30-45 minutes post sensitising event / delivery.	3 Days
Antenatal antibody titration	Blood	EDTA – 6 mL x 2	None	10 Days
Anti D Quantitation*	Blood	EDTA – 6 mL	None	14 Days
Anti c Quantitation*	Blood	EDTA – 6 mL	None	14 Days
Fetal *RHD* Screen*	Blood	EDTA – 6 mL	Never refrigerated. Samples collected on Tuesdays. Patient consent required.	14 days from receipt in UK

Test/Profile	Specimen Type	Adult Sample Requirement	Special Requirements	Turnaround Time
Transfusion Reaction Investigation	As advised by Consultant Haematologist and/or team	As advised by the Consultant Haematologist and/or team	Transfusion reaction investigation is only performed upon consultation with the Consultant Haematologist and/or team	Dependent upon the type of reaction

* Tests referred externally, not covered under RH Mullingar's scope of accreditation.

** Sample requirements for Paediatric patients:

- Babies <4months of age: EDTA Red top 1.3mL tube
- Babies/Children ≥4months of age: EDTA Pink top 6mL tube with sample ≥2 mL if possible.

Turnaround times given above refer to routine working days. However, in the event of rare multiple antibodies, the TAT for group and screen or group and crossmatch may exceed 1 day depending on antibody specificity.

19.3 Requests for blood components/products

Request	Specimen Type	Sample Requirement	Comments	Turnaround Time
Group and full serological crossmatch	Blood	EDTA – 6 mL**	Valid sample must be taken within 72 hours of transfusion	Routine - 1 Day Urgent* (non-bleeding) - 90 minutes* Urgent (patient bleeding) - 60 minutes*
Add-on crossmatch with a valid sample in laboratory and a negative antibody screen	Blood	N/A	Send additional test request form (sample valid for 72 hours)	45 minutes*
Add-on crossmatch with a valid sample in laboratory and patient meets the requirements for electronic issue	N/A	N/A	Send additional test request form (sample valid for 72 hours from collection)	15 minutes
Emergency uncrossmatched O RhD Negative red cells for adult patient	Blood	Uncrossmatched O RhD Negative red cells can be requested before a sample is taken but a 6mL EDTA blood sample should be taken before transfusion if possible	2 units of O RhD Negative red cells are stored in the blood transfusion laboratory issue fridge for immediate use	Immediately

Request	Specimen Type	Sample Requirement	Comments	Turnaround Time
Emergency uncrossmatched O RhD Negative red cells for neonatal patient	Blood	Uncrossmatched O RhD Negative red cells can be requested before a sample is taken. A 1.3mL EDTA blood sample for babies <4 months and a 6mL EDTA container containing at least 2mL for babies/children > 4 months should be taken before transfusion if possible	1 units of O RhD Negative red cells suitable for neonatal use is stored in the blood transfusion laboratory issue fridge for immediate use	Immediately
Group specific/ Group O RhD matched uncrossmatched blood	Blood	EDTA – 6 mL	Valid sample must be taken within 72 hours of transfusion (historic group or confirmatory sample required for group specific)	15-45 minutes
Plasma (Frozen)	Blood	EDTA – 6 mL		40 minutes
Platelets	Blood	EDTA – 6 mL	Platelets are not stored on site	2-3 hours for transport from IBTS*
Anti-D Immunoglobulin (Ig)	Blood	EDTA – 6 mL	Valid sample must be taken within 72 hours of administration for inpatients (1 week for RAADP clinic)	5 minutes if valid blood group available
Albumin – 5%	None	None		5 minutes
Albumin – 20%	None	None		5 minutes
Fibrinogen e.g. Riastap	None	None	A coagulation sample requesting a Fibrinogen level should be taken prior to requesting Fibrinogen concentrate.	5 minutes
Prothrombin Complex Concentrate (PCC) (Octaplex)	None	None	Discuss with Consultant Haematologist via Tullamore switch	5 minutes
Factor VIII e.g. Elocta	None	None	Discuss with Comprehensive Care Centre (CCC) in St James or CHI at Crumlin	5 minutes

Request	Specimen Type	Sample Requirement	Comments	Turnaround Time
Factor IX e.g. Aprolix	None	None	Discuss with CCC in St James or CHI at Crumlin	5 minutes
Activated Factor VII e.g. Novoseven	None	None	Discuss with Consultant Haematologist via Tullamore switch	5 minutes
Factor VIII & vWF e.g. Wilate	None	None	Discuss with CCC in St James or CHI at Crumlin	5 minutes

* Red cell or platelet units that have additional special requirements such as antigen negative, irradiated, HPA1a- will take additional time as they need to specially ordered from the Irish Blood Transfusion Services

** Sample requirements for Paediatric patients:
- Babies <4months of age: EDTA Red top bottle, 1.3mL
- Babies/Children ≥4months of age: EDTA Pink top 6mL tube with sample ≥2 mL if possible.

CCC = Comprehensive Care Centre (formerly National Coagulation Centre)
CHI = Children's Hospital Ireland

19.4 Blood Transfusion Requests

Refer to Section 6.2 for Blood Transfusion request form (FORM-M/BTL/101)

19.4.1 Routine requests

- For elective transfusion requests, the pre-transfusion sample must be received for testing during core hours (9am-4pm) the day before surgery/anticipated transfusion to ensure requirements are met. Samples that arrive after this time will not be processed until the following morning. Elective pre-op samples are not processed at the weekends.
- If red cells are required for a specific time or date, this should be stated on the request form.
- To ensure optimal stock management, the laboratory staff will restock crossmatched units of red cells into general stock after 24 hours. If the availability of crossmatched red cells is required for longer than 24 hours, it must be specifically requested.
- **Optimal timing of transfusion**: Routine blood transfusions should only be performed during the routine day as there are more nursing and medical staff on duty and the patient is more alert and easier to observe.
- The RhD Negative post-delivery cord bundle will be tested within the hours of 8am-8pm Monday to Friday and 9am-2pm at weekends and Bank Holidays,
- Cord Bloods will be processed 24 hours/day, 7 days/week where the mother has clinically significant antibodies. Please note out-of-hours, the medical scientist on-call must be informed.

19.4.2 Urgent requests

During routine hours, please telephone urgent requests directly to Blood Transfusion on extension 94329 to ensure priority processing and to ensure Group and Screen results are available for patients going to theatre.

Out-of-hours, the medical scientist on-call for Haematology and Blood Transfusion **must** be contacted for all Blood Transfusion specimens required out of hours. The medical scientist can be contacted directly using speed-dial *51836.

19.4.3 Completion of the request form

The Blood Transfusion request forms (See Section 6.2) are used to request:

- Group and Antibody Screen
- Red Cell Crossmatch
- Neonatal/ Cord Group
- Direct Antiglobulin Test
- FMH estimation (Kleihauer test)
- Quantitation of antibodies for antenatal patients
- Transfusion Reaction Investigation
- Plasma, Platelets or Fibrinogen
- Coagulation Factors and other laboratory based products
- Anti-D immunoglobulin (specific request form)

- A specific external request form is used to request a Fetal RhD Screen.
- A current addressograph label is preferred on the request form. (Do not use Blood Track label for completion of demographics on the patient's request form). Ensure the details are accurate by verifying patient details with the patient/carer where appropriate.
- In the absence of an addressograph label, the patient details are to be recorded in legible hand-writing. Printing of patient details is advised.
- All sections of the request form should be completed in full. If information is not available, indicate this on the form.
- The provision of clinical details, transfusion history and known antibody status on the request form enhances the safety of transfusion for your patient.
- When completing the request form for elective surgical procedures, refer to the MBOS for guidance (available on the hospital shared file and RHM APP(Meg e-Guides).
- The doctor is responsible for ordering the correct blood component/product taking into account special requirements e.g. CMV negative and/or irradiated blood components, (available on the hospital shared file and RHM APP (Meg e-Guides).
- The request form is completed by both:
  - The individual completing the form (who requested the test)
  - The person who collected the blood transfusion sample (Note: If BloodTrack is used for the pre-transfusion sample, the PDA label with the Electronic Signature can be on the request form instead of the handwritten signature).
  - The requester and the person collecting the blood sample can be the same person but both sections on the request form need to be completed in full.
- Date of completion of the request form, date and time sample was collected, MCRN/NMBI where appropriate and bleep numbers should also be included. When BloodTrack is used to label the pre-transfusion sample the date, time and electronic signature of the sampler are automatically included.

19.4.4 Add-on requests / Phone requests

When a valid sample is available in the Blood Transfusion Laboratory. A request for additional blood products or components are made by completing a Blood Transfusion Request form (See Section 6.2). The following information is required:

a) Patient's full name
b) DOB
c) Chart number
d) Ward
e) Consultant
f) Clinical details and reason for request
g) Number of units/mL or product required

h) Special requirements e.g. irradiated components, CMV negative (Refer to Section 19.10)
i) Date/Time product/component is required
j) Requestor's name
k) Note there is no requirement to complete the blood taken & labelled by section as no sample will be sent with this add on request

In an urgent situation e.g. massive haemorrhage, a telephone request to the Blood Transfusion Laboratory will be permitted initially with the written request to be sent as soon as possible. There will not be a delay in providing blood.

19.5 Sample collection and labelling

A correctly labelled sample is critical to ensure safety in Blood Transfusion. Collection of the pre-transfusion sample using EBTS BloodTrack PDA and printer is preferable to handwriting of the sample label but both systems are accepted by the Blood transfusion Laboratory once sample labelling requirements are met.
When taking a sample;

1. The patient is requested to state his/her name and DOB which is verified with the patient's identity (ID) bracelet and request Blood Transfusion request form
2. If the patient is not wearing a hospital ID bracelet (in-patients only), blood must not be taken until one is applied. If at any stage an ID bracelet is removed e.g. for cannulation, then it is the responsibility of the person who removed it to re-apply a new ID bracelet immediately.
3. It is recommended, where possible, to take the sample from an alternative limb to the one where fluids are infusing. Where the sample must be taken from the same limb, stopping the infusion before taking the sample and choosing a vein distal to the infusion is recommended (NHO, 2002).
4. Use disposable gloves.
5. Apply tourniquet and withdraw sample. The Vacutainer system is used for sampling adults in RHM.
6. After blood collection, invert tube 5-10 times.
7. Addressograph labels are **never** permitted on the sample tube. If EBTS is not used for labelling of the pre-transfusion sample, the sample tube must be handwritten immediately after sampling at the patient's bedside **Samples must never be pre-labelled.**
8. Mandatory information on the sample label:
    a. Patient's Forename and Surname
    b. DOB
    c. Chart number (or address for GP patients)
    d. Signature of sample taker
    e. Date & time sample was taken
9. It is laboratory policy to only accept samples that meet the required criteria. If these criteria are not met, the Blood Transfusion department will request a new sample and the original sample will be discarded.

19.5.1 Sample Rejections

Samples must be rejected in the following situations:

- Unlabelled samples
- Addressograph label on sample (even if BloodTrack Label is present)
- Core patient identifiers (Name/DOB/chart number) are missing, incorrect, do not match on sample or form

19.6 Factors affecting test results/interpretation

Patient and collection conditions can affect blood transfusion results/interpretation. Occasionally repeat samples may be requested when the plasma is found to be significantly haemolysed (as a result of difficult or traumatic sample collection) or lipaemia.

19.7 Confirmatory Sample rule

There is a **second sample for confirmatory group** policy in place in the hospital for the transfusion of red cells. If a patient does not have a historical group in the laboratory information system then a second pre-transfusion sample should be taken from the patient from a separate blood draw. This is to prevent an incompatible transfusion due to a wrong blood in tube error.

A specific confirmatory sample pack will be sent to the clinical area by Blood Transfusion scientist, for the sample collection if the primary sample has been taken within the last 12 hours. If greater than 12hrs a sample can be sent form the clinical area with the Blood transfusion laboratory request form (FORM-M/BT/215) stating in the clinical details/diagnosis section the sample is a confirmatory sample.

In the event of an emergency (e.g. a bleeding patient) where collection of a confirmatory sample is not possible due to the urgency of transfusion, inform the Medical Scientist when requesting the crossmatch that you will not be able to collect a confirmatory sample until after the transfusion is required. Blood will be provided without delay. Issue of compatible units will not be delayed due to the requirement of a confirmatory sample. Group O, RhD matched Red Cells will be issued until the confirmatory sample is received. The confirmatory sample can be collected at a later time when other blood samples are being collected.

19.8 Access to Haemovigilance Documents and Citrix for EBTS

The Haemovigilance PPPGs is available on the hospital managed PPPG Shared Drive 

which is available on relevant desktops across the hospital.

A summary of the PPPGs are also available on the RHM App (MEG e-Guides).

To access the APP download MEG eGuides from Playstore (Android) or App Stores (iPhone).

Then select;

- Regional Hospital Mullingar
- Log on with User name: **rhm** Password: **pass**

Use Citrix Storefront to access the EBTS to check if Blood is available in the Blood issue fridge in Blood Transfusion Laboratory.

To access the EBTS follow below:

- Double click on the Citrix icon to log onto the Citrix Storefront on the desktop
- Enter the Username and Password for the PC
- Enter MHBO1 for Domain using drop down menu
- Click “Log On” the BloodTrack Enquiry icon
- Highlight and right click on “Mullingar Issue Fridge" Click ‘View Inventory’ from the drop down list
- All red cell and plasma units currently scanned into the fridge will now be visible. Platelets issued to patients will also be visible

19.9 Maximum Blood Ordering Schedule and Blood Stock Management

The **Maximum Blood Ordering Schedule (**MBOS) is currently available for

A. Surgical
B. Obstetrics and Gynaecology

Current versions of the MBOS are available on the hospital managed PPPG Shared Drive which is available on relevant desktops across the hospital. The MBOS are available on the RHM App (MEG e-Guides). Where your requirements for a specified **elective** procedure differs from the agreed schedule, please indicate your reason clearly on the Blood Transfusion Request Form.

Single unit transfusions in the non-bleeding patient followed by reassessment of the patients clinically with a post transfusion FBC is advised to determine if further transfusion is required. For "Triggers for RCC transfusion guideline at RHM" please refer to "HVGL-M/HV/6 'Administration of Blood Component and Products' on the shared drive or refer to the RCC transfusion section on the RHM APP (MEG e-Guide).

19.10 Special requirements

Refer to Haemovigilance Guideline HVGL-M/HV/11 'Guideline for the Use of Cytomegalovirus (CMV) Negative and Irradiated Blood Components' for detailed information. This is available in all clinical areas on the shared drive or refer to the RCC transfusion section on the RHM APP (MEG e-Guide).

19.11 Patient consent and patient information leaflet

Verbal consent is required for blood transfusion with the exception of emergency situations. The attending doctor must record gaining consent in the patient's Healthcare records.

- To assist in informed consent, a Blood Transfusion Information Leaflet should be provided to the patient before commencing their transfusion. If the patient is unable to receive the leaflet (e.g. unconscious) then they should be informed by their clinician that they received a transfusion when/if they recover.
- Tick boxes should be completed on the front of the Blood Component/Product Transfusion & Prescription Record Sheet (BTPRS) for documenting the gaining of patient's verbal consent and the provision of the Patient Information Leaflet.
- If the patient is unable to understand the leaflet e.g. child or language barrier then the information should be related to them in a language they understand. The assistance of an interpreter to translate the information leaflets can be requested where the patient is unable to understand the leaflet (i.e. language). Alternatively you can download translations of the patient information leaflet from:
  https://www.hse.ie/eng/services/publications/hospitals/blood-transfusion-leaflets.html

19.12 Prescription

Refer to Haemovigilance PPPGs: HVGL-M/HV/8 'The Completion and Use of the Blood Component/Product Transfusion & Prescription Record Sheet' and HVGL-M/HV/6 'Administration of Blood Component and Products' available on the Shared Drive for detailed information.

- Red cells, Plasma, Platelets, Albumin and Factor Concentrates are prescribed by a Doctor on the Blood Component/Product Transfusion & Prescription Record Sheet (BTPRS).
- Anti-D Ig is prescribed on the Drug Prescription Record Sheet.
- Each unit is to be prescribed individually on a unit by unit basis (use mL for Paeds) and each row applies to a single unit. The only exception to this is in a massive transfusion, see reverse of BTPRS where the prescription of multiple units together in an emergency is permitted.
- A transfusion prescription is valid for 2 days.
- A medical practitioner can cancel transfusion prescriptions by drawing a single line through the prescription. The doctor is required to record their signature and the date cancelled. The prescription must include the following:
  - Date of transfusion
  - Component/Product type (state actual volume for paediatrics)
  - Special requirements if required e.g. CMV Negative or Irradiated
  - Rate of transfusion of component/product
  - Pre-transfusion haematology/coagulation result
  - Reason for transfusion
  - If any specific drugs are to be administered pre, post or with the transfusion. These should be prescribed on the Drug Prescription Record Sheet. Complete tick box on BTPRS if transfusion related medication is required.

- Doctor's signature, printed name and MCRN

19.13 Transport of Blood product

Please refer to HVSOP-M/HV/15 "The transportation of blood components/products and the temporary storage of RCC's" for the full guideline on transport of blood components and products.

Plastic Disposable Ziplock Bags are used for collection of laboratory based blood/ blood products. The Ziplock bags are for single use only and are used for the internal transport of Red Cell Concentrates (RCCs), Plasma, Platelets, and other blood products issued by the transfusion laboratory at the RHM which are for immediate use. These bags can accommodate 2 units of RCCs or Plasma but a separate bag is required if collecting a combination of components/products.

The transport box (MT8 blood transport box) is validated for the internal temporary storage of red cells (≤ 6 hours) at RHM e.g. where RCCs are required on standby or in an emergency situations that require transport of blood from RHM to another hospital. In the case of an emergency, the emergency SAGM neonatal unit (O RhD negative Red Cells) may be packed for transport in the MT8 blood transport box. The MS on duty must be contacted when the MT8 blood transport box is required.

Paedipacks are not suitable for transport/ temporary storage in the MT8 blood transport box.

NOTE: Ziplock bags may be used on rare occasions for the transport of a paedipack with a baby to an external hospital where the paedipack is meant for immediate use. Paedipacks packed in a Ziplock bag must be transfused within 4 hours of removal from the fridge.

Ziplock bags can also be used for external transport of Platelets with a patient intended for immediate use. Packing of the Platelets in a Ziplock bag should only happen where it is not possible to commence the Platelet transfusion prior to departure from RHM.

19.14 Administration of Blood products and components

For detailed guidance on the administration of blood products and components please refer to HVGL-M/HV/6 "The administration of blood components and products", available through the hospital shared drive. The RHM App (MEG e-Guides) also has quickstep guide for the administration of RCC, Plasma and Platelets and Albumin

General administration advice

- The procedure is explained to the patient.
- All equipment required for transfusion must be brought to the bedside prior to checking of the unit.
- A blood administration set (with an integral 170-200 micron filter) is used for administration of RCCs, Platelets and Plasma.
- Disposable gloves must be worn to prime the unit and connect it to the patient.
- The blood administration set is primed with the blood component/product using an Aseptic Non Touch Technique (ANTT) and is attached to the patient's IV access.
- Infusion solutions or drugs must never be added to any blood component as they may result in haemolysis or clotting.
- Transfusion can take place through one lumen of a multi lumen central catheter while the other lumens are in use except for an infusion of Anti-thymocyte Globulin (ATG).
- Blood Components should not be transfused while an infusion ATG is in progress.
- If RCCs, Platelets or Plasma are stopped for any reason while in progress, they should be discarded after 30 minutes (e.g. IV cannula tissues then it must be re-sited within thirty

minutes). A sterile cap must be applied to administration set while disconnected from the patient's IV access.

19.15 Massive transfusion

The management of massive haemorrhage document HVGL-M/HV/14 "A guideline for the use of Blood components & blood products in the management of a massive haemorrhage" is available on the hospital-shared file. In addition on both the shared file and the RHM App (MEG e-Guides) "Management of Massive haemorrhage in Adults > 50Kg and "Management of Massive Haemorrhage in Children < 50kg (excluding neonatal haemorrhage)" charts are available.
In the Emergency Department during a massive haemorrhage, the Massive Transfusion Protocol (MTP) can be activated.

Important points to follow during a Massive Haemorrhage

- Inform BT staff –communication is vital.
- Take BT samples as soon as possible if a valid sample is not already in the Blood Transfusion Laboratory.
- Emergency O RhD Negative Blood is always available in the BT laboratory. In the blood issue fridge two O RhD Negative units are available and one Paediatric O RhD Negative for a children <1yr old. Make sure to inform the scientist when an Emergency O RhD Negative is removed from the fridge.
- Unidentified/unconscious patients require 2 minimum identifiers
    - Gender of the patient i.e. unconscious adult male/female
    - Chart number
    - Signature of sample taker
- A new sample should be collected with the patient's details as they become available and the patient is stabilised.
- When transferring the patient to another hospital and RCC need to be 'packed' for transfer – inform lab staff ASAP as 15 minutes notice required.
- All blood products and components must be prescribed by the Doctor, go to page 6 of the "Blood component product transfusion and prescription record form (BTPRS)" the massive /emergency transfusion record sheet.
- Use BloodTrack when administrating blood (one-person check); with the exception of emergency ORhD Negatives and batch products, which require a two-person check e.g Fibrinogen, PCC, factor concentrates.
- Document the massive haemorrhage in both the Doctors Notes and the Nursing Notes.
- Return any unused products to Blood Transfusion Laboratory.
- 100% traceability is required even in an emergency situation. BloodTrack fates the unit in real time, for manually checked units the traceably label must be completed as per Section 19.16 then returned to the blood transfusion lab.
- Keep the Blood transfusion laboratory informed if the haemorrhage is continuing or has ended.

19.16 Traceability

EU Directive 2002/98/EC requires 100% traceability and fating of each blood product transfused. Fating is automatic when Electronic BloodTrack System (EBTS) is used for checking and administration of RCCs, Platelets and Plasma. Manual fating of other blood products and uncrossmatched RCCs is required as EBTS cannot be used so follow steps 1-6 for traceability below. On commencement of each blood product transfusion where BloodTrack has not been used, the traceability label (purple section) attached to the compatibility label on the product must be:

1. Detached from the unit
2. Dated

3. Timed (24 hour)
4. Signed
5. Name printed
6. Returned to the Blood Transfusion laboratory, RH Mullingar. (Red envelope provided)

19.17 Transfusion reactions and events

All suspected or confirmed transfusion reactions and events should be managed immediately. A transfusion reaction can be acute (within 24 hours) or delayed (between 24 hours and 28 days of a transfusion). When the Nurse/Midwife monitoring the patient suspects a transfusion reaction, the Doctor must contact the Haematology team in MRH-Tullamore without delay, contact the TSO and advise the Blood transfusion Laboratory of test required after contacting the Haematology Team.
Follow the "prompt guide for the management of adverse transfusion reactions "to assist in managing the transfusion reaction this will also assist you when discussing the reaction with the Haematology team. The prompt has four sections

- User guide
- Table 1 – Symptoms
- Table 2- Indications for management
- Table 3 -Indications for the investigation per type of transfusion reaction

You will find these documents In the shared file access HVGL-M/HV/5 "Management of Adverse Transfusion Reactions and Events " or go to the RHM App (MEG e-Guides) by tapping "Lab/Blood" then tap "Transfusion reactions and Events section", then tap the "prompt guide".
Suspected transfusion reaction due to:

- Bacterial contamination of the blood component/product
- Viral, parasitic or other post-transfusion infection
- Transfusion Related Acute Lung Injury (TRALI)

May require a Rapid alert to the Irish Blood Transfusion Service is necessary. The decision to initiate a rapid alert notification should be taken following review with the consultant haematologist and/or the patient's primary clinician. The Medical Scientist and TSO should be informed if there is any suspicion of the above.

19.18 Blood products and components available at RH-Mullingar

19.18.1 Red cell concentrate (RCC)

To increase oxygen carrying capacity in order to improve tissue oxygen delivery.
Indications refer to "Triggers for red cell (RCC) transfusion at Regional Hospital Mullingar refer to the RCC transfusion section on the RHM APP (MEG e-Guide). For the full guideline on the administration of RCC including triggers refer to HVGL-M/HV/6 "The administration of blood Components and products"

19.18.2 Plasma

To replace clotting factors where there is evidence of critical deficiencies.
The correction of coagulation disorders where treatment is needed and no other specific therapy is available e.g.

- Haemostatic failure associated with major blood loss
- Acute Disseminated Intravascular Coagulation (DIC)
- Replacement of single factor plasma deficiencies where no licensed virally-inactivated or recombinant single factor concentrate is available e.g. Factor V deficiency
- Liver disease in the presence of haemorrhage or prior to an elective procedure. Haematology advice is recommended as Prothrombin Complex Concentrate (Octaplex) may be more effective.

- Emergency warfarin reversal where Prothrombin Complex Concentrate (Octaplex) is contraindicated
- The treatment of choice in Thrombotic Thrombocytopaenia Purpura (TTP) in conjunction with plasma exchange

For the full guideline on the administration of plasma, refer to HVGL-M/HV/6 "The administration of blood Components and products" or refer to the "Plasma " section on the RHM APP (MEG e-Guide).

19.18.3 Platelets

Used in the treatment of;

- Thrombocytopenic bleeding associated with bone marrow failure caused by disease, cytotoxic therapy or irradiation. The advice of a Consultant Haematologist should be sought. (For Paediatric patients receiving shared care with CHI at Crumlin refer to Shared Care manual).
- Prophylactic threshold of $10x10^9$/L or $20x10^9$/L in the presence of sepsis
- Active bleeding or DIC (threshold of $50x10^9$/L). Anticipate platelet count <50 x 10^9/L after replacement of 2 times the patient's blood volume). In Multiple CNS trauma or abnormal platelet function a target platelet count of >100 $x10^9$/L may be desirable (BSH 2016)
- Note: patients with Thrombotic Thrombocytopenia Purpura (TTP), Heparin-Induced Thrombocytopenia (HIT) or Autoimmune Thrombocytopenia should not be transfused with platelets except for major haemorrhage.
- Management of Surgical Patients on Clopidigrel (Plavix)/Aspirin/GP IIb/IIIa Inhibitors

For further information refer to HVGL-M/HV/6 "The administration of blood components and products"
For the full guideline on the administration of platelets, refer to HVGL-M/HV/6 "The administration of blood components and products" or refer to the "Platelet" section on the RHM APP (MEG e-Guide).

19.18.4 Albumin

There are no absolute indications for the use of Human Albumin Solution
For further information, refer to HVGL-M/HV/6 "The administration of blood components and products" or refer to the "Albumin" section on the RHM APP (MEG e-Guide).

19.18.5 Factor concentrates

Fibrinogen, Elocta, Aprolix, Prothrombin complex concentrate (PCC), Novaseven and Wilate are available in the BT Transfusion Laboratory.
Refer to HVGL-M/HV/7 "The use of factor concentrates" which is available in all clinical areas on the shared drive or refer to the "Factor concentrate" section on the RHM APP (MEG e-Guide) for the quickstep guide to administer Alproxlix, Elocta, Fibrrinogen and PCC.

19.19 Anti-D Immunoglobulin and Kleihauer Testing

Refer also to Haemovigilance PPPG: HVGL-M/HV/13 'Guideline for the Administration of Anti Immunoglobulin & Kleihauer Testing' and CHART-M/HV/2 'Guide for Anti-D administration to RhD negative women in pregnancy' current versions. Anti-D immunoglobulin is administered to RhD negative non-sensitised mothers to prevent Haemolytic Disease of the Newborn. Fetal RhD screening is offered to RhD negative pregnant women at 11^{+2} weeks gestation and less than 26/40 confirmed by scan. Patients with **immune anti-D or G antibodies are not eligible for this test.**

Anti-D Ig is only indicated where:

- the Fetal RhD screen has indicated a RhD positive fetus
- the Fetal RhD screen is inconclusive/unknown

The Fetal RhD screen relates to the current pregnancy and EDD must be checked on the official report.

19.19.1 Targeted Routine Antenatal Anti-D Prophylaxis (tRAADP)

This is the routine administration of 1500 IU Anti-D immunoglobulin to non-sensitised RhD negative women at 28/40 gestation where the Fetal RhD screen has indicated a RhD positive fetus or the Fetal RhD screen is inconclusive/unknown. The rationale behind tRAADP is to protect against sensitisation caused by 'silent' Fetal Maternal Haemorrhage and thus prevent complications and potential morbidity in subsequent pregnancies.

19.19.2 Potentially Sensitising Events

Anti-D Immunoglobulin should be administered in pregnancy to RhD negative non-sensitised women where the Fetal RhD screen has indicated a RhD positive fetus or the Fetal RhD screen is inconclusive/unknown in the following circumstances:

Prior to 12 Weeks Gestation:

- Any medical/surgical methods to evacuate the products of conception (Includes TOP after 7/40 gestation)
- Diagnosis of ectopic pregnancy
- Molar pregnancy
- Patients with heavy or repeated bleeding associated with abdominal pain particularly if approaching 12 weeks gestation

After 12 Weeks Gestation:

- Antenatal patients who are bleeding and are not sensitised
- Miscarriage including threatened miscarriage
- Missed miscarriage that requires ERPC
- Medical/surgical evacuation of the products of conception including Termination of Pregnancy (TOP)
- Ectopic pregnancies
- Hydatidiform mole
- External Cephalic Version
- Abdominal trauma (Kleihauer test recommended after 20 weeks gestation)
- Amniocentesis/Cordocentesis/Chorionic villus sampling
- Other in-utero therapeutic intervention/surgery
- Intrauterine death - note the diagnosis of IUD is the sensitising event rather than delivery and therefore anti-D Ig should be administered within 72 h of diagnosis

19.19.3 Post-natal:

All babies of RhD negative mothers have their blood group (cord bloods) confirmed post-delivery and anti-D Ig is indicated where the baby is RhD positive regardless of the Fetal RhD screen result. This should be given within 72 hours of delivery regardless of recent administration of Anti-D Ig antenatally and irrespective of tRAADP.

Anti-D is **not** indicated in the following situations:

- Women with threatened miscarriage with a viable fetus where bleeding completely stops before 12 weeks gestation.
- Uncomplicated miscarriage prior to 12 weeks gestation, as long as medical or surgical methods have not been used to evacuate the products of conception (Clinical Practice Guideline, 2012)
- where the Fetal RhD screen has indicated a RhD negative fetus unless it was not possible to obtain a cord / baby peripheral sample e.g. stillborn infant, then the mother should be issued anti-D Ig regardless of the fetal RHD screen result if performed and a kleihauer performed.

19.19.4 Anti-D Immunoglobulin

Prescription: The doctor interprets the results of the official laboratory report and when Anti-D immunoglobulin (Ig) is required, it must be indicated in the patient's medical records. An informed verbal consent is obtained from the patient and an information leaflet is provided. Anti-D Ig is prescribed by a doctor in the blood & blood product section of the Drug Prescription Record Sheet. Anti-D Ig is ordered from the BT Laboratory by completing FORM-M/BTL/103 'Prophylactic Anti-D Order Form' and sending it to the BT Laboratory.

Dosage:

- Anti-D Ig (Rhophylac) is presented in a prefilled syringe which contains 1500 IU of human anti-D Ig in 2 mL. This standard dose is administered to antenatal and postnatal women as indicated.
- Anti-D Ig is administered within 72 hours of the potentially sensitising event. The deltoid muscle is the preferred site to optimise absorption but it can be given in the gluteus muscle if required. Rhophylac anti-D Ig can be administered IV by doctors, refer to Haemovigilance PPPG: HVGL-M/HV/13 'Guideline for the Administration of Anti-D Immunoglobulin & Kleihauer Testing' current revision.
- Anti-D prophylaxis should be given at 6-weekly intervals as per indications if bleeding is recurrent. If an additional sensitising event occurs in the setting of recurrent antenatal bleeding, this should be treated as a separate event and anti-D Ig should be administered. For recurrent bleeding after 20 weeks gestation, FMH estimation performed at 2-weekly intervals and additional anti-D administered if required.

Contraindications:

- Known or suspected allergic response to anti-D or to blood components or products
- Incomplete documentation or laboratory reports
- The intramuscular injection route is contraindicated in persons with severe thrombocytopenia or other disorders of haemostasis. In these situations, it is administered IV.

Interactions: Active immunisation with live virus vaccines e.g. measles, mumps, rubella or varicella should be postponed until 3 months after the last administration of anti-D immunoglobulin, as the efficacy of the vaccine may be impaired.

19.19.5 Kleihauer Testing

The Kleihauer blood test detects fetal cells in the maternal circulation. **Fetal Maternal Haemorrhage (FMH) estimation is not indicated if pre-formed immune anti-D is present in the mother's plasma as prophylaxis is not appropriate.** Refer to Haemovigilance PPPG: HVGL-M/HV/13 'Guideline for the Administration of Anti-D Immunoglobulin & Kleihauer Testing' current version.

Indications for FMH estimation in RhD negative non-sensitised patients where the Fetal RhD screen has indicated a RhD positive fetus or the Fetal RhD screen is inconclusive/unknown:

- Ante Partum Haemorrhage (APH) after 20/40 weeks gestation
- Following significant abdominal trauma after 20/40 gestation
- All RhD negative non-sensitised women post-delivery where the baby is Rh D Positive
- Cordocentesis
- External Cephalic version
- Following Intra Uterine Death and still births (Note: indicated for both RhD Positive and RhD Negative women)
- In cases where a feto-maternal bleed is suspected as a cause of anaemia in a newborn (Note: indicated for both RhD Positive and RhD Negative women)

Sample Requirements:

- A blood sample for ABO & RhD Group of the mother is collected at the same time as the FMH test.

- An EDTA sample (FBC tube) for FMH estimation should be collected after a gap of 30-45 minutes post-delivery/sensitising event, to allow for any FMH to be dispersed in the maternal circulation. If a maternal sample is not taken within 2 hours, a sample should be taken ASAP. Addressograph labels are not permitted on FMH samples. The use of BloodTrack to label the FMH sample is recommended.
- Complete a Blood Transfusion request form (See Section 6.2) for Kleihauer test and ABO & RhD testing and provide full clinical details including blood group and date & time of sensitising event/trauma/delivery along with gestation details.
- **Post-natal patients:** Cord blood sample from the baby for ABO & RhD Group, ABO & RhD Group and FMH sample from the mother are sent to the BT Lab as a bundle for processing.

Procedure When Additional Anti-D is Required:

- If the Kleihauer is positive and the FMH is calculated as ≥6 mL, FMH quantitation by flow cytometry is performed by the Coombe Women & Infants University Hospital to quantify the volume of the bleed. The result will be telephoned to the laboratory at RHM and the laboratory staff will notify a senior clinician i.e. (registrar/consultant in Obstetrics Dept.) with the result.
- Contact the Consultant Haematologist for management of a patient requiring large doses of Anti-D immunoglobulin. The additional Anti-D should be administered as soon as possible after the sensitising event and preferably within 72 hours.
- The baby's FBC should be monitored.
- Intravenous Anti-D if required is given as per manufacturer's instructions.
- Following administration of additional Anti-D immunoglobulin, repeat the Kleihauer test in 48-72 hours to ensure clearance (48 hours if the anti-D was given IV).
- In the event of large bleeds (greater than 24 mL), the mother should be counselled about the possibility of sensitisation and an antibody screen should be checked at 6 months post-delivery.

20 Reference Ranges & Uncertainty of Measurement

20.1 Uncertainty of Measurement

Uncertainty of Measurement is defined as quantification of the doubt about the measurement result. It is the policy of the laboratory at RHM to determine the uncertainty for all examination methods used to report measured quantity values on patient's samples. Each department has a document listing the current uncertainties calculated for each test. These are available to all service users upon request.

20.2 Reference Ranges

The following pages list the reference ranges attributed to tests performed in the laboratory. The majority of these are provided by the manufacturer of the test method used. Others are produced by the Pathology Harmonisation Group. Please contact the appropriate department if you have any queries on the basis of a stated reference range.

20.2.1 Clinical Chemistry – Serum Ranges

Test	Age/Gender/Cycle Time	Reference Range	Units
ALT	<1 year	10-49	U/L
	1-10 years	10-29	U/L
	Male 10-18 years	9-44	U/L
	Female 10-18 years	8-27	U/L
	>18 years	10-49	U/L
Albumin	<1 year	28-48	g/L
	1-16 years	37-49	g/L
	>16 years	35-50	g/L
ALP	<6 months	145-495	U/L
	6 months-1 year	155-404	U/L
	1-10 years	149-349	U/L
	10-12 years	186-440	U/L
	Male 12-15 years	202-618	U/L
	Female 12-15 years	75-419	U/L
	Male 15-18 years	59-294	U/L
	Female 15-18 years	54-143	U/L
	>18 years	46-116	U/L
Amylase	<6 months	20-55	U/L
	6 months-1 year	20-63	U/L
	1-18 years	32-117	U/L
	>18 years	30-118	U/L
AST	<1 year	25-90	U/L
	1-7 years	27-49	U/L
	7-13 years	20-40	U/L
	Male >13 years	17-44	U/L
	Female >13 years	16-28	U/L
Bilirubin – Total	<2 weeks	<104	µmol/L
	2 weeks-12 years	5-14	µmol/L
	>12 years	<21	µmol/L
Bilirubin – Direct	<10 years	<1.7	µmol/L
	Male >10 years	1.7-13.8	µmol/L
	Female >10 years	1.7-10.3	µmol/L
Calcium	<2 years	2.2-2.7	mmol/L
	>2 years	2.1-2.65	mmol/L

Test	Age/Gender/Cycle Time	Reference Range	Units
Adjusted Calcium (adj. Calcium)	>18 years	2.2-2.6	mmol/L
Carbamazepine	Therapeutic Range	4-12	mg/L
Chloride	<1 year	103-112	mmol/L
	>1 year	95-108	mmol/L
Cholesterol		<5	mmol/L
CK	<14 years	58-312	U/L
	14-18 years	56-541	U/L
	Male >18 years	44-272	U/L
	Female >18 years	33-208	U/L
Cortisol	Random - AM Sample	>515	nmol/L
	Pre Synacthen - AM Sample	185-619	nmol/L
	Pre Synacthen - PM Sample	95-462	nmol/L
	Post Synacthen	>515	nmol/L
	Pre DXST – AM Sample	185-619	nmol/L
	Pre DXST – PM Sample	95-462	nmol/L
	Post DXST	<50	nmol/L
Creatinine (Jaffe)	<2 years	13-26	µmol/L
	2-5 years	18-38	µmol/L
	5-10 years	26-58	µmol/L
	10-15 years	35-65	µmol/L
	Male 15-18 years	45-86	µmol/L
	Female 15-18 years	43-74	µmol/L
	Male >18 years	62-115	µmol/L
	Female >18 years	49-90	µmol/L
Creatinine (Enzymatic)	<2 years	13-26	µmol/L
	2-5 years	18-38	µmol/L
	5-10 years	26-58	µmol/L
	10-15 years	35-65	µmol/L
	Male 15-18 years	45-86	µmol/L
	Female 15-18 years	43-74	µmol/L
	Male >18 years	53-97	µmol/L
	Female >18 years	44-71	µmol/L
CRP		<10	mg/L
Digoxin	Therapeutic Range	0.5-1.0	µg/L
Ferritin	<1 year	6 -430	µg/L
	1-13 years	13-90	µg/L
	Male 13-18 years	11-138	µg/L
	Female 13-18 years	7-77	µg/L
	Male	23-322	µg/L
	Female	10-291	µg/L
Folate		3.8-24	µg/L
Free T3	1 month-2 years	5.1-8	pmol/L
	2-12 years	5.1-7.4	pmol/L
	>12 years	4.7-7.2	pmol/L
Free T4	<1 month	10-36	pmol/L
	1 month-1 year	10-26	pmol/L

Test	Age/Gender/Cycle Time	Reference Range	Units
	>1 year	9.8-23	pmol/L
Pregnancy FT4	1st Trimester	11.7-19.4	pmol/L
	2nd Trimester	11.7-17.8	pmol/L
	3rd Trimester	10.0-16.8	pmol/L
FSH	Male	1.4-10.8	IU/L
	Female: - Follicular	2.5-10.2	IU/L
	- Mid-cycle	3.4-33.4	IU/L
	- Luteal	1.5-9.1	IU/L
	- Menopause	N/A	IU/L
Gentamicin	Trough	<1.0	mg/L
GGT	<6 months	8-143	U/L
	6 month- 11 years	<7-33	U/L
	Male 11-18 years	9-31	U/L
	Female 11-18 years	<7-22	U/L
	Male >18 years	11-67	U/L
	Female >18 years	8-53	U/L
HDL Cholesterol		>1	mmol/L
Iron	<14 years	3-30	µmol/L
	Male 14-18 years	9.5-35	µmol/L
	Female 14-18 years	4-29	µmol/L
	Male >18 years	12-31	µmol/L
	Female >18 years	9-30	µmol/L
LDH	<1 year	228-438	U/L
	1-12 years	207-383	U/L
	Male 12-18 years	136-293	U/L
	Female 12-18 years	146-279	U/L
	>18 years	120-246	U/L
LDL Cholesterol		<3	mmol/L
Lithium	Therapeutic Range	0.4-1.0	mmol/L
LH	Male	1.5-9.3	IU/L
	Female: - Follicular	1.9-12.5	IU/L
	- Mid-cycle	8.7-76.3	IU/L
	- Luteal	0.5-16.9	IU/L
	- Menopause	N/A	IU/L
Magnesium	<1 month	0.77-1.05	mmol/L
	>1 month	0.69-0.92	mmol/L
Non-HDL Cholesterol (Non HDLc)		<3.8	mmol/L
Oestradiol	Male	69-146	pmol/L
	Female: - Follicular	72-529	pmol/L
	- Mid-cycle	235-1309	pmol/L
	- Luteal	205-786	pmol/L
	- Menopause	69-118	pmol/L
Paracetamol		No range quoted, refer to Section 14.5.12	mg/L
Phenobarbitone	Therapeutic Range	10-40	mg/L
Phenytoin	Therapeutic Range	5-20	mg/L

Test	Age/Gender/Cycle Time	Reference Range	Units
Phosphorous	<1 year	1.55-2.5	mmol/L
	1-5 years	1.36-2.06	mmol/L
	5-14 years	1.32-1.87	mmol/L
	14-18 years	0.97-1.71	mmol/L
	>18 years	0.78-1.65	mmol/L
Potassium	<28 days	3.4-6.0	mmol/L
	28 days-1 year	3.5-5.5	mmol/L
	>1 year	3.5-5.3	mmol/L
Potassium – Direct	<1 month	3.4-6.0	mmol/L
	1 month-1 year	3.5-5.5	mmol/L
	>1 year	3.5-5.3	mmol/L
Progesterone	Male	0.9-3.9	IU/L
	Female: - Follicular	0.98-4.4	IU/L
	- Luteal	10.6-81	IU/L
	- Menopause	0.7-2.3	IU/L
	- 1st Trimester	36-286	IU/L
	- 2nd Trimester	81-284	IU/L
	- 3rd Trimester	154-1343	IU/L
Prolactin	Male	45-375	mIU/L
	Female: - Non-pregnant	56-619	mIU/L
	- Pregnant	206-4420	mIU/L
	- Post-menopausal	38-430	mIU/L
PSA ***(Referral Range)*** * *See note below*	Male: - <40 years	<2	µg/L
	- 40-49 years	<2	µg/L
	- 50-59 years	<3	µg/L
	- 60-69 years	<4	µg/L
	- 70-79 years	<5	µg/L
PTH (Intact)		1.95-8.49	pmol/L
Rheumatoid Factor		<14	IU/mL
Salicylate		No range quoted	mg/L
Sodium	<16 years	135-145	mmol/L
	>16 year	135-146	mmol/L
Sodium – Direct	<16 years	135-145	mmol/L
	>16 years	135-136	mmol/L
Testosterone	Male	7-37	nmol /L
Theophylline	Therapeutic Range	10-20	mg/L
ThCG	Female: - Non-pregnant	<3.0	IU/L
	- 2-4 weeks	39-8,388	IU/L
	- 5-6 weeks	861-88,769	IU/L
	- 6-8 weeks	8636-218,085	IU/L
	- 8-10 weeks	18,700-244,467	IU/L
	- 10-12 weeks	23,143-181,899	IU/L
	- 13-27 weeks	6303-97,171	IU/L
	- 28-40 weeks	4360-74,883	IU/L
Total Protein	<1 year	46-67	g/L
	1-6 years	59-72	g/L
	6-18 years	63-77	g/L

Test	Age/Gender/Cycle Time	Reference Range	Units
	>18 years	57-82	g/L
Transferrin	Male	1.88-3.02	g/L
	Female	1.93-3.08	g/L
Transferrin Saturation		16-45	%
Triglyceride	Fasting	<1.7	mmol/L
	Random	<2	mmol/L
TSH	<2 days	5-40	mIU/L
	3 days-2 years	0.87-6.15	mIU/L
	2-12 years	0.67-4.16	mIU/L
	13-18 years	0.48-4.17	mIU/L
	>18 years	0.3-4.8	mIU/L
	1st Trimester	0.1-3.5	mIU/L
	2nd Trimester	0.5-3.8	mIU/L
	3rd Trimester	0.6-4.6	mIU/L
Troponin (HSTnI)	Male	<53	ng/L
	Female	<39	ng/L
Urea	<1 year	1.4-6.4	mmol/L
	Male 1-16 years	3.2-7.9	mmol/L
	Female 1-16 years	3.2-6.4	mmol/L
	>16 years	3.2-8.2	mmol/L
Uric Acid	<1 year	95-351	µmol/L
	1-12 years	131-333	µmol/L
	Male 12-18 years	173-494	µmol/L
	Female 12-18 years	173-405	µmol/L
	Male >18 years	200-430	µmol/L
	Female >18 years	140-360	µmol/L
Valporate	Therapeutic Range	50-100	mg/L
Vancomycin	Trough	10-20	mg/L
Vitamin B12		211-911	ng/L
Vitamin D	Deficient	<30	nmol/L
	Sufficient	>50	nmol/L
	Upper Safety Limit	<125	nmol/L

*Note: For PSA, adjust these decision thresholds for the method bias (%) quoted on the laboratory report

20.2.2 Clinical Chemistry – Plasma Ranges

Test	Gender/Comment	Reference Range	Units
Albumin	<1 year	28-48	g/L
	1-16 years	37-49	g/L
	>16 years	35-50	g/L
ALT	<1 year	10-49	U/L
	1-10 years	10-29	U/L
	Male 10-18 years	9-44	U/L
	Female 10-18 years	8-27	U/L
	>18 years	10-49	U/L
ALP	<6 months	145-495	U/L
	6 months-1 year	155-404	U/L
	1-10 years	149-349	U/L

Test	Gender/Comment	Reference Range	Units
	10-12 years	186-440	U/L
	Male 12-15 years	202-618	U/L
	Female 12-15 years	75-419	U/L
	Male 15-18 years	59-294	U/L
	Female 15-18 years	54-143	U/L
	>18 years	46-116	U/L
Amylase	<6 months	20-55	U/L
	6 months-1 year	20-63	U/L
	1-18 years	32-117	U/L
	>18 years	30-118	U/L
Ammonia	<1 week	0-120	µmol/L
	1 week-1 month	0-95	µmol/L
	>1 month	0-65	µmol/L
Bilirubin – Total	<2 weeks	<104	µmol/L
	2 weeks-12 years	5-14	µmol/L
	>12 years	<21	µmol/L
NT-proBNP		<400	pg/mL
Calcium	<2 years	2.2-2.7	mmol/L
	>2 years	2.1-2.65	mmol/L
Adjusted Calcium (adj. Calcium)	>18 years	2.2-2.6	mmol/L
Chloride	<1 year	103-112	mmol/L
	>1 year	98-107	mmol/L
CK	<14 years	58-312	U/L
	14-18 years	56-541	U/L
	Male >18 years	44-272	U/L
	>18 years	33-208	U/L
Creatinine (Jaffe)	<2 years	13-26	µmol/L
	2-5 years	18-38	µmol/L
	5-10 years	26-58	µmol/L
	10-15 years	35-65	µmol/L
	Male 15-18 years	45-86	µmol/L
	Female 15-18 years	43-74	µmol/L
	Male >18 years	62-115	µmol/L
	Female >18 years	49-90	µmol/L
Creatinine (Enzymatic)	<2 years	13-26	µmol/L
	2-5 years	18-38	µmol/L
	5-10 years	26-58	µmol/L
	10-15 years	35-65	µmol/L
	Male 15-18 years	45-86	µmol/L
	Female 15-18 years	43-74	µmol/L
	Male >18 years	53-97	µmol/L
	Female >18 years	44-71	µmol/L
CRP		<10	mg/L
Ethanol		N/A	mg/dL
GGT	<6 months	8-143	U/L
	6 month- 11 years	<7-33	U/L

Test	Gender/Comment	Reference Range	Units
	11-18 years	9-31	U/L
	11-18 years	<7-22	U/L
	>18 years	11-67	U/L
	>18 years	8-53	U/L
Glucose	Random	3.6-7.7	mmol/L
	Fasting	3.3-6.0 **See comments below	mmol/L
	1 hour PP	**See comments below	mmol/L
	2 hour PP	**See comments below	mmol/L
	Gestational Fasting	**See comments below	mmol/L
	Gestational 1 hour	**See comments below	mmol/L
	Gestational 2 hour	**See comments below	mmol/L
	Glucose challenge test * See note below	</= 7.5	mmol/L
HbA1c	Normal non-diabetic range	20-42	mmol/mol
	Diabetic Goal	<53	mmol/mol
Lactate		0.5-2.2	mmol/L
Magnesium	<1 month	0.77-1.05	mmol/L
	>1 month	0.69-0.92	mmol/L
Potassium	<28 days	3.4-6.0	mmol/L
	28 days-1 year	3.5-5.5	mmol/L
	>1 year	3.4-5.0	mmol/L
Sodium	<16 years	135-145	mmol/L
	>16 year	135-146	mmol/L
Total Protein	<1 year	46-67	g/L
	1-6 years	59-72	g/L
	6-18 years	63-77	g/L
	>18 years	57-82	g/L
Urea	<1 year	1.4-6.4	mmol/L
	Male 1-16 years	3.2-7.9	mmol/L
	Female 1-16 years	3.2-6.4	mmol/L
	>16 years	3.2-8.2	mmol/L
Uric Acid	<1 year	95-351	µmol/L
	1-12 years	131-333	µmol/L
	Male 12-18 years	173-494	µmol/L
	Female 12-18 years	173-405	µmol/L
	Male >18 years	200-430	µmol/L
	Female >18 years	140-360	µmol/L

* **Glucose Challenge Test:** Reference change for glucose challenge test 3.5-7.49 mmol/L. Glucose >7.5mmol/L at 1 hour supports a diagnosis of GDM.

<u>Comments sent out with the glucose reference ranges</u>:**

Random Glucose

Random glucose of ≥11.1mmol/L in a symptomatic patient supports diagnosis of Diabetes Mellitus. In absence of unequivocal hyperglycaemia, confirm by repeat testing.

Fasting glucose

- Fasting glucose 3.3-6.0 mmol/L
- Fasting glucose 6.1-6.9. 'Increased risk of Diabetes'
- Fasting glucose ≥7.0. Fasting glucose ≥7.0 in a symptomatic patient supports diagnosis of Diabetes Mellitus. In absence of unequivocal hyperglycaemia, confirm by repeat testing.

Glucose Tolerance Test

1. Fasting glucose: See result for 2 hour glucose sample for OGTT interpretation
2. 1 hour glucose: See result for 2 hour glucose sample for OGTT interpretation
3. 2 hour glucose:
   - Normal glucose homeostasis: Fasting Glucose <6.1 AND 2 hour Glucose <7.8 mmol/L
   - Impaired Fasting Glucose (IFG): Fasting Glucose 6.1-6.9 AND 2 hour Glucose <7.8 mmol/L
   - Impaired Glucose Tolerance (IGT): Fasting Glucose <7.0 AND 2 hour Glucose >7.7 and <11.1 mmol/L
   - Diabetes Mellitus: Fasting Glucose ≥7.0 OR 2 hour Glucose ≥11.1 (Classical symptoms). IF asymptomatic, repeat testing e.g. oGTT, fasting/random glucose with at least 1 result in diabetic range is required for diagnosis

Gestational Glucose Tolerance Test

1. Gestational Fasting: In OGTT (75g), GDM diagnosis is supported by a baseline (0h) sample ≥5.1. See 1 hour and 2 hour results, as applicable.
2. Gestational 1 hour: GDM diagnosis is supported by a 1 hour sample >10.0 (OGTT: 75g). See 0 hour and 2 hour result (as applicable).
3. Gestational 2 hour: GDM diagnosis is supported by a 2 hour sample ≥8.5 (OGTT, 75g). See also 0 hour and 1 hour results.

Post Natal Glucose Tolerance Test

1. Post-natal fasting:
   - For post-natal testing, increased risk of diabetes if baseline glucose is ≥5.6 mmol/L. Please also see result for 2 hour glucose sample for OGTT
2. Post-natal 1 hour:
   - See Fasting Glucose and 2 hour Glucose results (as applicable)
3. Post-natal 2 hour:
   - For post-natal OGTT, increased risk of diabetes if 2 hour glucose is ≥7.8 mmol/L (ADA 2016)
   - Normal glucose homeostasis: Fasting Glucose <6.1 AND 2 hour Glucose <7.8 mmol/L
   - Impaired Fasting Glucose (IFG): Fasting Glucose 6.1 to 6.9 AND 2 hour Glucose <7.8 mmol/L
   - Impaired Glucose Tolerance (IGT): Fasting Glucose <7.0 AND 2 hour Glucose >7.7 and <11.1 mmol/L
   - Diabetes Mellitus: Fasting Glucose ≥7.0 OR 2 hour GLU ≥11.1 (Classical symptoms). IF asymptomatic, repeat testing e.g. oGTT, fasting/random glucose with at least 1 result in diabetic range is required for diagnosis

20.2.3 Clinical Chemistry – Urine Ranges

Test	Gender/Comment	Reference Range	Units
Ur Albumin – 24 hour		*See comment below	mg/24 hours
Ur Amylase – Random	Normal	<650	U/L
Ur Calcium – 24 hour		2.5-7.5	mmol/24 hours
Ur Chloride – 24 hour		110-250	mmol/24 hours
Ur Creatinine – 24	Male	7.7-21.3	mmol/24 hours

Test	Gender/Comment	Reference Range	Units
hour	Female	5.9-14.1	mmol/24 hours
Creatinine Clearance	Male	61-147	mL/minute
	Female	59-151	mL/minute
Ur Potassium – 24 hour		25-125	mmol/24 hours
Ur Protein		0.01-0.14	g/24 hours
Ur Sodium – 24 hour		40-220	mmol/24 hours
Albumin/Creatinine Ratio	Male Normal	<2.5	mg/mmol
	Female Normal	<3.5	mg/mmol
	Microalbuminuria	2.5-25	mg/mmol
	Proteinuria	>25	mg/mmol
Protein/Creatinine Ratio (PCR)	Normal	<15	mg/mmol
	Trace proteinuria	15-44	mg/mmol
	Clinical Proteinuria	45-100	mg/mmol
	Marked Proteinuria	>100	mg/mmol
	Nephrotic range proteinuria	>450	mg/mmol
Gestational PCR	Normal	<30 Normal in Pregnancy	mg/mmol

20.2.4 Clinical Chemistry – CSF Ranges

Test	Age	Reference Range	Units
CSF Glucose		60% plasma value	mmol/L
CSF Protein	<28 days	0.65-1.5	g/L
	29-56 days	0.5-0.9	g/L
	>56 days	0.05-0.35	g/L
CSF Lactate		1.1-2.2	mmol/L

20.2.5 Immunology

Test	Age/Clinical Significance	Reference Range	Units
IgG	<14 days	6.50-12.10	g/L
	<1 month	1.62-7.32	g/L
	<6 months	2.96-10.06	g/L
	<1 year	3.00-9.16	g/L
	<3 years	4.28-11.53	g/L
	<6 years	5.54-11.98	g/L
	<9 years	6.43-11.31	g/L
	<12 years	6.58-12.86	g/L
	Adult	6.80-15.30	g/L
IgA	<14 days	0.07-0.49	g/L
	<1 month	0.08-0.80	g/L
	<6 months	0.29-1.37	g/L
	<1 year	0.29-1.37	g/L
	<3 years	0.37-1.11	g/L
	<6 years	0.68-1.80	g/L
	<9 years	0.90-1.66	g/L
	<12 years	0.90-2.69	g/L

Test	Age/Clinical Significance	Reference Range	Units
	Adult	0.68-3.75	g/L
IgM	<14 days	0.07-0.23	g/L
	<1 month	0.17-0.80	g/L
	<6 months	0.24-0.70	g/L
	<1 year	0.48-1.07	g/L
	<3 years	0.31-1.27	g/L
	<6 years	0.37-1.53	g/L
	<9 years	0.37-1.53	g/L
	<12 years	0.47-1.53	g/L
	Adult	0.40-2.30	g/L
IgE – Total	0-1 year	0-13	kU/L
	<3 years	0-32	kU/L
	<6 years	0-56	kU/L
	<10 years	0-85	kU/L
	>10 years	0-100	kU/L
IgE – Specific	Absent/Undetectable/ Negative (Normal)	<0.10	kAU/L
	For special use only: clinical relevance undetermined	0.10-0.35	kAU/L
	Low level of sensitisation	0.36-0.70	kAU/L
	Moderate level of sensitisation	0.71-3.5	kAU/L
	High level of sensitisation	3.6-17.5	kAU/L
	Very high level of sensitisation	>17.5	kAU/L
Alpha-1 Antitrypsin		0.90-2.00	g/L
Ceruloplasmin		22.0-60.0	mg/dL
Haptoglobin		0.30-2.00	g/L
Complement C3		0.90-1.80	g/L
Complement C4		0.10-0.40	g/L
Beta-2 Microglobulin		0.70-1.80	mg/L
TPO Antibodies	Negative	<25	IU/mL
	Equivocal	25-35	IU/mL
	Positive	>35	IU/mL
tTG Antibodies	Negative	0-7	IU/mL
	Equivocal	7-10	IU/mL
	Positive	>10	IU/mL

20.2.6 Haematology – FBC

Test	Age/Gender	Reference Range	Units
WBC	Birth – 2 days	10.0-26.0	$x10^9/L$
	3 days – 6 days	7.0-23.0	$x10^9/L$
	7 days – 1 month	6.0 -22.0	$x10^9/L$
	1 month – 2 months	5.0-19.0	$x10^9/L$
	2 months – 3 months	5.0-15.0	$x10^9/L$
	3 months – 1 year	6.0-18.0	$x10^9/L$
	1 – 2 years	6.0-16.0	$x10^9/L$

Test	Age/Gender	Reference Range	Units
	2 – 6 years	5.0-15.0	$x10^9/L$
	6 – 12 years	5.0-13.0	$x10^9/L$
	Adult	4.0-10.0	$x10^9/L$
RBC	Birth – 2 days	5.0-7.0	$x10^{12}/L$
	3 days – 6 days	3.9-6.6	$x10^{12}/L$
	7 days – 14 days	3.9-6.3	$x10^{12}/L$
	14 days – 1 month	3.6-6.2	$x10^{12}/L$
	1 month – 2 months	3.0-5.4	$x10^{12}/L$
	2 months – 3 months	3.1-4.3	$x10^{12}/L$
	3 months – 1 year	4.1-5.3	$x10^{12}/L$
	1 – 2 years	3.9-5.1	$x10^{12}/L$
	2 – 12 years	4.0-5.2	$x10^{12}/L$
	Adult Male	4.5-5.5	$x10^{12}/L$
	Adult Female	3.8-4.8	$x10^{12}/L$
Hb (Hgb)	Birth – 2 days	14.0-22.0	g/dL
	3 days – 6 days	15-21	g/dL
	7 days – 14 days	13.5-21.5	g/dL
	14 days – 1 month	12.5-20.5	g/dL
	1 month – 2 months	11.5-16.5	g/dL
	2 months – 3 months	9.4-13.0	g/dL
	3 months – 2 years	11.1-14.1	g/dL
	2 – 6 years	11.0-14.0	g/dL
	6 – 12 years	11.5-15.5	g/dL
	Adult Male	13.0-17.0	g/dL
	Adult Female	12.0-15.0	g/dL
Hct	Birth – 2 days	0.45-0.75	L/L
	3 days – 6 days	0.45-0.66	L/L
	7 days – 14 days	0.42-0.66	L/L
	14 days – 1 month	0.31-0.71	L/L
	1 month – 2 months	0.33-0.53	L/L
	2 months – 3 months	0.28-0.42	L/L
	3 months – 1 year	0.3-0.4	L/L
	1 – 2 years	0.3-0.38	L/L
	2 – 6 years	0.34-0.40	L/L
	6 – 12 years	0.35-0.45	L/L
	Adult Male	0.40-0.50	L/L
	Adult Female	0.36-0.46	L/L
MCV	Birth – 2 days	100-120	fL
	3 days – 6 days	92.0-118	fL
	7 days – 14 days	88.0-126.0	fL
	14 days – 1 month	86.0-124.0	fL
	1 month – 2 months	92.0-116.0	fL
	2 months – 3 months	87.0-103.0	fL
	3 months – 1 year	68.0-84.0	fL
	1 – 2 years	72.0-84.0	fL
	2 – 6 years	75.0-87.0	fL
	6 – 12 years	77.0-95.0	fL

Test	Age/Gender	Reference Range	Units
	Adult	83.0-101.0	fL
MCH	Birth – 1 month	31-37	pg
	1 month – 3 months	30-36	pg
	3 months – 1 year	24-30	pg
	1 – 2 years	25-29	pg
	2 – 6 years	24-30	pg
	6 – 12 years	25-33	pg
	Adult	27-32	pg
MCHC	Birth – 2 days	30-36	g/dL
	3 days – 6 days	29-37	g/dL
	7 days – 1 month	28-38	g/dL
	1 month – 2 months	29-37	g/dL
	2 months – 3 months	28.5-35.5	g/dL
	3 months – 1 year	30-36	g/dL
	1 – 2 years	32-36	g/dL
	2 – 12 years	31-37	g/dL
	Adult	31.5-34.5	g/dL
RDW	<12 years	11-16	%
	Adult	11.6-14.0	%
Platelets	Birth – 2 days	100-450	$x10^9$/L
	3 days – 6 days	210-500	$x10^9$/L
	7 days – 14 days	160-500	$x10^9$/L
	14 days – 1 month	170-500	$x10^9$/L
	1 month – 2 months	200-500	$x10^9$/L
	2 months – 3 months	210-650	$x10^9$/L
	3 months – 2 years	200-550	$x10^9$/L
	2 – 6 years	200-490	$x10^9$/L
	6 – 12 years	170-450	$x10^9$/L
	Adult	150-410	$x10^9$/L
Neutrophils	Birth – 2 days	4.0-14.0	$x10^9$/L
	3 days – 6 days	3.0-5.0	$x10^9$/L
	7 days – 14 days	3.0-6.0	$x10^9$/L
	14 days – 1 month	3.0-7.0	$x10^9$/L
	1 month – 2 months	3.0-9.0	$x10^9$/L
	2 months – 3 months	1.0-5.0	$x10^9$/L
	3 months – 1 year	1.0-6.0	$x10^9$/L
	1 – 2 years	1.0-7.0	$x10^9$/L
	2 – 6 years	1.5-8.0	$x10^9$/L
	6 – 12 years	2.0-8.0	$x10^9$/L
	Adult	2.0-7.0	$x10^9$/L
Lymphocytes	Birth – 2 days	3.0-8.0	$x10^9$/L
	3 days – 6 days	2.0-8.0	$x10^9$/L
	7 days – 1 month	3.0-9.0	$x10^9$/L
	1 month – 2 months	3.5-16.0	$x10^9$/L
	2 months – 3 months	4.0-10.0	$x10^9$/L
	3 months – 1 year	4.0-12.0	$x10^9$/L
	1 – 2 years	3.5-11.0	$x10^9$/L

Test	Age/Gender	Reference Range	Units
	2 – 6 years	2.0-9.0	$x10^9/L$
	6 – 12 years	1.0-5.0	$x10^9/L$
	Adult	1.0-3.0	$x10^9/L$
Monocytes	Birth – 2 days	0.5-2.0	$x10^9/L$
	3 days – 6 days	0.5-1.0	$x10^9/L$
	7 days – 1 month	0.1-1.7	$x10^9/L$
	1 month – 2 months	0.3-1.0	$x10^9/L$
	2 months – 3 months	0.4-1.2	$x10^9/L$
	3 months – 1 year	0.2-1.2	$x10^9/L$
	1 – 12 years	0.2-1.0	$x10^9/L$
	Adult	0.1-1.0	$x10^9/L$
Eosinophils	Birth – 2 days	0.1-1.0	$x10^9/L$
	3 days – 6 days	0.1-2.0	$x10^9/L$
	7 days – 14 days	0.1-0.8	$x10^9/L$
	14 days – 1 month	0.1-0.9	$x10^9/L$
	1 month – 2 months	0.2-1.0	$x10^9/L$
	2 months – 12 years	0.1-1.0	$x10^9/L$
	Adult	0.02-0.5	$x10^9/L$
Basophils		0.02-0.10	$x10^9/L$
LUC		0.0-0.4	$x10^9/L$
Reticulocytes	Birth – 2 days	120-400	$x10^9/L$
	3 days – 6 days	50-350	$x10^9/L$
	7 days – 1 month	50-100	$x10^9/L$
	1 month – 2 months	20-60	$x10^9/L$
	2 months – 3 months	30-50	$x10^9/L$
	3 months – 1 year	40-100	$x10^9/L$
	1 – 12 years	30-100	$x10^9/L$
	Adult	50-100	$x10^9/L$
ESR	0 – 12 years	0-10	mm/hour
	Male	0-15	mm/hour
	Female	0-20	mm/hour

20.2.7 Haematology - Coagulation

Test	Age/Comment	Reference Range	Units
PT	0-1 day	10.1-15.9	Seconds
	2-5 days	9.5-15.9	Seconds
	6 days-1 month	9.3-14.3	Seconds
	1-3 months	9.6-14.2	Seconds
	3-6 months	10.7-13.9	Seconds
	>6 months	11.5-16.0	Seconds
INR		0.8-1.2	
APTT	0-1 day	31.5-54.5	ng/mL
	2-5 days	25.4-59.8	ng/mL
	6 days-1 month	25.6-55.2	ng/mL
	1-3 months	24.1-50.1	ng/mL
	3-6 months	28.1-42.9	ng/mL

Test	Age/Comment	Reference Range	Units
	>6 months	25-36	ng/mL
APTTr	0-5 days	0.7-1.2	
	6 days-1 month	0.7-1.9	
	1-3 months	0.7-1.7	
	3-6 months	0.7-1.4	
	>6 months	0.7-1.2	
Fibrinogen		2.0-4.0	g/L
D-dimer	Value <500 ng/mL suggests acute venous thromboembolism is unlikely	<500	ng/mL

Please note that all reference ranges stated on Haematology reports do not take into account pregnancy status or gestational age at birth. Please use clinical interpretation in such instances.

20.2.8 Haematological Values during Pregnancy

Taken from: Blood Cells. A Practical Guide. Barbara J. Bain; 3rd Edition

Parameter	First Trimester	Second Trimester	Third Trimester*	Trimester Not Stated
RBC ($x10^{12}$/L)	3.52-4.52	3.20-4.41	3.10-4.44	3.10-4.52
Hb (Hgb) (g/dL)	11.0-14.3	10.0-13.7	9.8-13.7	9.8-14.3
HCT (L/L)	0.31-0.41	0.30-0.38	0.28-0.39	0.28-0.41
MCV (fL)	81-96	82-97	91-99	81-99
WBC ($x10^9$/L)	5.7-13.6	6.2-14.8	5.9-16.9	5.7-16.9
Neutrophils ($x10^9$/l)	3.6-10.1	3.8-12.3	3.9-13.1	3.6-13.1
Lymphocytes ($x10^9$/L)	1.1-3.5	0.9-3.9	1.0-3.6	0.9-3.9
Monocytes ($x10^9$/L)	0.0-1.0	0.1-1.1	0.1-1.1	0.0-1.1
Eosinophils ($x10^9$/L)	0.0-0.6	0.0-0.6	0.0-0.6	0.0-0.6
Basophils ($x10^9$/L)	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1
Platelets ($x10^9$/L)	174-391	171-409	155-429	155-429
NRBCs ($x10^9$/L)	0.0	0.0	0.0	0.0

** Third trimester reference range is applicable for 6 weeks post delivery*

Suggested literature:

- Laboratory values in normal Pregnancy. F. Gary Cunningham. University of Texas Southwestern Medical Centre. Department of Obstetrics and Gynaecology, Dallas, TX, USA

- BSH Guidelines on the management of Iron deficiency in pregnancy. - Haemoglobin
- Total and differential leukocyte counts percentiles in normal pregnancy. Samuel Lurie 2006 European Journal of Obstetrics and Gynaecology - WBC's and Neutrophils
- Fibrinogen Non Pregnant range: Abbassi-Ghanavati M, Greer LG, Cunningham FG. Pregnancy and laboratory studies: a reference table for clinicians. Obstet Gynecol. 2009 Dec;114(6):1326-31 – Fibrinogen
- Adult APTT range: NMH Validation - APTT range for NMH population – Pregnant.

Sources :

- **FBC:** *Dacie and Lewis Practical Haematology. 12th Ed. Elsevier 2017*
- **ESR Range Source:** *Mosby's Diagnostic and Laboratory Test Reference. 14Th Ed. Elsevier 2019*
- **Coagulation Range Source:** *Am. Jour. Paed Haem / Oncology 12(1): 95-104 1990*

21 INDICATION OF COST OF VARIOUS TESTS & BLOOD PRODUCTS*

Tests Performed at RHM	Cost (€) *(Incl. VAT)*	Blood Products	Cost (€)
Glucose	0.05	Unit of Blood (RCC)	295.00
Urea	0.05	Octaplas	116.00
Amylase	0.57	Platelet Concentrate	650.00
PSA	0.32	Anti-D	72.50
Digoxin	3.22		
CRP	0.47		
SPE	11.90		
Immunofixation	52.80		
HbA1c	1.21		
Free T4	0.30		
TSH	0.37	**Tests Sent to External Laboratories**	**Cost (€)**
Ferritin	0.22	Chromosome Analysis	237.00
Vitamin B12 & Folate	0.94	ANCA	15.00
AED (per drug)	€7-13/test	Cardiolipin Antibodies	45.00
Troponin	4.92	Sickle Cell	101.58
NT-proBNP	3.0	Thrombophilia Screen	156.00
Vitamin D	1.10	Testosterone Female	19.00
PTH	7.12	Lamictal	34.00
Blood Culture (per bottle)	4.70	Aspergillus Antibodies	30.92
FBC	0.47	Intrinsic Factor	31.74
Retic	4.04	Anti CCP	15.00
PT/INR	0.67	Hepatitis A	11.00
APTT	0.95	Hepatitis B	11.00
D-dimer	11.00		
tTG	6.00		
Mixed Allergy Screen	16.00		
Individual Allergen	12.00		
Influenza	59.00		
Covid-19 (PCR)	59.00		
CPE (PCR)	36.00		
Enterovirus(PCR)	103.00		
Norovirus(PCR)	85.00		
Clostridium Difficile(PCR)	44.00		
Lactate	0.75		

*Prices quoted are for reagents only and do not take overheads and staffing costs into account