Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

DEPARTMENT OF PATHOLOGY USER MANUAL

The following is a summary of changes to this edition of the document. Users are also informed of significant changes by memo. MEMO: MEM-GEN-2023-09

Change Details

Revision 18: July 2023

Section 2.6: Updated to include detail on booking appointments via Swiftqueue
Section 3.4. Table 4 updated to include NT-proBNP, B12 and Folate request forms
Section 9: Updated to include more information on how to provide feedback to Laboratory
Section 12: Added to include that estimates of measurement uncertainty are available to service users
Section 21: Updated to include electronic issue of red cells
Section 27.1: Updated to include urgent Haematology tests and batching of ESR tests
Section 27: Table 16: Updated to include more detail on HAEM sample validity and turn-around times and changed Sickle Cell Test to Sickle cell Screen
Section 27: Table 18 : Updated to add detail to ESR and Infectious Mononucleosis Screen on-call testing
Section 29: Changed order of Haematology sections - communication of critical results to follow normal reference ranges. Reference range data simplified.
Section 29: Table 21: Updated to clarify Reference Range source for APTT
Section 35: Removal of table of all adult reference ranges
Section 40.15: Updated to include more information on Blood Culture collection and that Blood Cultures must be transported to lab as soon as possible and within 4 hours.
Section 41.1 Table 30: Updated SARS-CoV-2/Flu A/B/RSV processing in line with current practice & current kits used for stability; updated all turnaround times to reflect target times and not min & max.
Section 41.2: **Table 31**: Updated to include CSF processed in house on call; & to include tissues in Other critical Microbiology Specimens
Section 43: **Included Table 33** for Communication of critical Micro results
Section 46: Added link to Pathology Webpage for access to referral test requirements

Revision 17: Sep 2022

Section 2.3, 8 & 37: Replacement of Chemical Pathologist Dr Michael Louw with Dr Paula O'Shea as Consultant Clinical Biochemist.
Section 3.4: Updated to include where necessary for patient care, the laboratory will communicate with users or their representatives, to clarify the user's request.
Section 3.4 Table 4: Updated to include LF-GEN-0133 Procalcitonin Request Form, Updated *LF-GEN-0118* to include */Flu A/ B/RSV in addition to SARS-CoV-2*
Section 4.6: Update to include ED-BB-0171: NTAG Patient Information Leaflet
Section 5.4: Updated to reflect new cut-off time of 12 noon on Fridays for GP samples and include description of drop-off box at Hospital Reception. Includes GP requests for renal function will exclude potassium by default and specimen requirements if potassium is required on a GP sample
Section 10: Updated to remove reference to previous data protection legislation, and include link to current HSE data protection policy
Section 15.1 Table 10: Updated Direct Antiglobulin test tube requirement to 6ml EDTA only, removal of 3ml EDTA. More detail added on the issue of factor concentrates.
Section 30: Units for MCHC changed to g/dL
Section 32.1 Table 24: Updated to reflect Potassium testing on GP samples. Added note that

Macroprolactin reflexed on Female samples with prolactin >600 m IU/L, Male samples with prolactin >550m IU/L. Updated to include Cortisol and Vitamin D in test repertoire
Section 34 Table 26: Updated to include Cortisol and Vitamin D reference ranges
Section 39: Included time limits of SARS-CoV-2/ Flu A, B/ RSV nasopharyngeal specimens
Section 39.1 Table 30 Included that small volume urine samples are suitable for Yellow Topped Monovette 10ml Tubes. Included extended respiratory panel as in house or referral sample.
Section 40.1 Table 31 Updated SARS-CoV-2/Flu A/B/RSV processing in line with current practice & current kits used for stability; updated all turnaround times to reflect target times and not min & max.
Section 41.2 Table 32 On call Tests-Included CSF s processed in –house and not referred.
Section 43: Included Table 34 for Communication of critical results
Section 40.2 Table 32: Updated to include info re times for testing of all Covid-19 samples as per ED-MIC-MEMO-2022-02. Updated to include addition of Flu A/B & RSV testing during Flu/RSV season.

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DEPARTMENT OF PATHOLOGY

1 INTRODUCTION

1.1 Scope and Purpose

The Department of Pathology is a clinical service and carries out investigations on specimens from patients as an aid to the diagnosis, management and treatment of disease. This manual is designed to give an overall view of the services available in the Department of Pathology. It is intended as a reference guide for users of the service including General Practitioners and Hospital-based personnel in Our Lady's Hospital, Navan. For ease of use, each discipline is described in a separate section of the manual.

The Department of Pathology provides a comprehensive service to Our Lady's Hospital, Navan. It includes:

- Blood Bank (Blood Transfusion Laboratory & Haemovigilance)
- Blood Sciences (Haematology and Biochemistry - described separately in this document)
- Microbiology

Any test requests that are not carried out on site are sent to appropriate referral laboratories.

The Department of Pathology services undergo continuous review through quality assurance and audit activities. The Department of Pathology is committed to performing activities in accordance with the requirements of the international standard ISO 15189.

The laboratory is willing to co-operate with the users or their representatives in clarification of test requests. If users of the service have any queries for improvements in connection with any aspect of the service, staff members will be pleased to discuss these or alternatively the comments/ suggestions may be submitted via email or in writing to the Laboratory Manager or individual Departmental Chief Medical Scientists.

The laboratory is open to patients and laboratory users to provide helpful information to aid the laboratory in the selection of the examination methods, and the interpretation of the examination results.

The Department of Pathology will, where appropriate, disclosure to service users and any other relevant persons, of incidents that resulted or could have resulted in patient harm, and records of actions taken to mitigate those harms. The Laboratory endeavours to treat patients, and their samples, with due care and respect, upholding the rights of patients to care that is free from discrimination.

Disclaimer

The information provided in this manual is a broad guideline of the services provided and is correct at the time of authorization. The Department of Pathology shall not be liable to users of the manual for any consequential action taken by the user other than to request the user to utilise the manual strictly as a guide reference only. The manual will be updated periodically; therefore any unauthorized printed copies are uncontrolled and must not be used as the information may be incorrect.

1.2 Responsibility

The Laboratory Manager in conjunction with the Laboratory Director is responsible for ensuring the implementation and maintenance of compliance as described in the manual.

1.3 Definitions

ADR: Carriage of Dangerous Good by Road

ALB: Albumin

ALP: Alkaline Phosphatase

ALT: Alanine Transaminase

APTT: Activated Partial Thromboplastin Time

AST: Aspartate Amino Transferase

BB: Blood Bank

B-HCG: Beta Human Chorionic Gonadotropin

BIO: Biochemistry

BT: Blood Transfusion

CIDR: Computerised Infectious Disease Reporting - National IT System to manage surveillance and control of Infectious Diseases

CK: Creatine Kinase

CMV: Cytomegalovirus

CRF: Chronic Renal Failure

CRP: C - reactive protein

C&S: Culture and Sensitivity

D & C: Dilation and Curettage

DCT: Direct Coombs Test

DOB: Date of Birth

ED: External Documents

ESR: Erythrocyte Sedimentation Rate

FBC: Full Blood Count

FSH: Follicle Stimulating Hormone

FT3: Free T3

FT4: Free T4

GEN: General

GGT: Gamma-Glutamyl Transferase

GP: General Practitioner

G&S: Group and Screen

HbS: Haemoglobin S

HCT: Haematocrit

HDL: High Density Lipoprotein

HF: Haemovigilance Form

HIV: Human Immunodeficiency Virus

HP: Haemovigilance Procedure

HPSC: Health Protection Surveillance Centre

HSE: Health Service Executive

HVS: High Vaginal Swab

IBTS: Irish Blood Transfusion Board

ICU: Intensive Care Unit

ID: Identity

IgA: Immunoglobulin A

IgG: Immunoglobulin G

IgM: Immunoglobulin M

INAB: Irish National Accreditation Board

INMRL: Irish National Mycobacterium Reference Laboratory

INR: International Normalised Ratio

IBTS: Irish Blood Transfusion Service

IT: Information Technology

LDH: Lactate Dehydrogenase

LDL: Low Density Lipoprotein

LF: Laboratory Form

LH: Luteinising Hormone

LIS: Laboratory Information System

LP: Laboratory Procedure

MCH: Mean Cell Haemoglobin

MCHC: Mean Cell Haemoglobin Concentration

MCV: Mean Cell Volume

MIC: Microbiology

MF: Management Form

MMUH: Mater Misericordiae University Hospital

MP: Management Procedure

MRN: Medical Record Number

MRSA: Methicillin-Resistant Staphylococcus aureus

MSU: Mid-Stream Urine

NPS: Nasopharyngeal swab

NVRL: National Virus Reference Laboratory

OLH: Our Lady's Hospital, Navan

PCC: Prothrombin Complex Concentrates

PCR: Polymerase Chain Reaction

PCT: Procalcitonin

PSA: Prostate Specific Antigen

PT: Prothrombin Time

QF: Quality Form

RA: Rheumatoid Arthritis

RBC: Red Blood Cell

RDW: Red Cell Distribution Width

RIQAS: Randox International Quality Assurance Scheme

SD: Solvent Detergent

TAT: Turnaround Time

TB: Tuberculosis

TSH: Thyroid Stimulating Hormone

UKNEQAS: United Kingdom & International External Quality Assessment System

VRE: Vancomycin-Resistant Enterococci

WEQAS: Welsh External Quality Assurance Scheme

ZN: Ziehl Neelsen

2 GENERAL INFORMATION

2.1 Location

The Department of Pathology is located on the ground floor of the hospital adjacent to the glass corridor linking the main hospital to the Regional Orthopaedic Unit. Access to the Department of Pathology is swipe card controlled.

2.2 Hours of Operation

A routine Department of Pathology service is available Monday to Friday during normal Laboratory hours. Outside of these hours, an emergency on-call service operates; contact with the on-call scientist can be made through the switchboard.

Table 1 - Hours of Operation

DEPARTMENT OF PATHOLOGY OPENING HOURS	
Monday- Friday	08.30 a.m. - 18.30 p.m.
On Call Service	18.30p.m. – 08.30 a.m. Monday to Friday and all day Saturday, Sunday & Public/Bank Holidays.
Phlebotomy In-Patient Service	08.00 a.m. -16.00 p.m. Monday to Friday, 08.00 a.m.– 13.00 p.m. Sat/Sun/Public Holiday
Phlebotomy Out-Patient Service	The Out-Patient Phlebotomy service is by appointment only. Appointments are made via the online service *Swiftqueue.com* Select: Navan Hospital – Adult Blood Tests Bloods can only be taken with a valid blood request form, signed by the patient's doctor.
Out-Patient Warfarin Clinic	Wednesday 8.30a.m.-11.30 a.m.
Clinical Laboratory Advice	See Table 2 for details
Medical Scientist On Call	It is the **responsibility of the requesting clinician** to make contact through the hospital switch board on 91 and speak to the Medical Scientist on-call.

2.3 Contact Details

Where scientific or clinical advice is required on medical indications and appropriate selection of available tests, the Department of Pathology welcomes any queries. Areas outside the hospital should make contact by dialling the Hospital Switchboard on 046 9021210 and then the relevant extension.

Table 2 – Contact Details

Department	Personnel	Telephone No.
Laboratory Director	Dr Su Maung	Contact via MMUH Switchboard (01 8032000)
Consultant Haematologist	Dr Su Maung	Contact via MMUH Switchboard (01 8032000)
Consultant Microbiologist	Dr Gregory Krizsan	OLH Switchboard
Consultant Clinical Biochemist	Dr Paula O'Shea	OLH Switchboard
Laboratory Manager	Ray O'Hare	Ext 2571
Blood Transfusion Chief Medical Scientist	Paulinus Okafor	Ext 2573
Haematology Chief Medical Scientist	Breda Melvin	Ext 2575
Biochemistry Chief Medical Scientist	Dervla O'Malley	Ext 2574
Microbiology Chief Medical Scientist	Carmel O'Reilly	Ext 2576
Haemovigilance Officer	Orla Dowling	Ext 2578 or 087 4101084 (In house queries only)
Quality Manager	Fiona McGough	Ext 2852
Laboratory Office	All General Enquiries	Ext 2701, 2577
Specimen Reception	Technical Enquires Only	Ext 2577
Out of Hours	Medical Scientist On-call Consultant Haematologist Consultant Clinical Biochemist Consultant Microbiologist	OLH Switchboard MMUH Switchboard (01 8032000) OLH Switchboard OLH Switchboard

Note: All numbers shown are for routine service, i.e. Monday to Friday. If contact is required outside routine service, dial 91 and ask to speak to the Medical Scientist who is providing the on-call service.

2.4 On Call Contact Details

On call staff must be contacted via the switchboard (046 9021210 or dial 91 if internal). Failure to do this may result in prolonged turnaround times for urgent requests.

2.5 Postal Address

The postal address is:

Department of Pathology

Our Lady's Hospital

Navan

Co. Meath

C15 RK7Y

2.6 Hours of Phlebotomy Service

The times of the Phlebotomy Service for is outlined in Table 1. Outpatients' blood tests can be booked online at *www.SwiftQueue.com*.

- Select: Navan Hospital – Adult Blood Tests
- Pick your desired timeslot to Book Online.
- Register to create an account (1st visit only)
- Arrive 5-10 minutes before your appointment

If you cannot access the online function,

- Phone 046-9078647 between the hours below ONLY:
- Monday, Tuesday, Thursday – 09.00a.m. – 13:00 p.m.

Access to the phlebotomy service is restricted to patients who are >36 months of age.

The **Warfarin clinic** is held on Wednesday in the Out-Patient Department 8.30 a.m.- 1p.m. At weekends and bank holidays, a ward round is provided by one phlebotomist in the morning to take essential bloods. For the remainder of the time, trained nursing and medical staff perform phlebotomy. Incomplete forms will not be processed and it is the responsibility of the requesting staff member to ensure that all request forms are completed correctly.

3 POLICY ON SAMPLE ACCEPTANCE

This policy applies to all specimens being submitted for analysis across all disciplines within the Department of Pathology. The purpose of the policy is to ensure:

- Standardization of requirements across all disciplines within the laboratory for compliance with INAB standards and ISO 15189
- Information on both the request form and the corresponding clinical specimen is sufficient to provide unequivocal traceability to ensure the correct results/products are issued to the correct patient
- The Department of Pathology receives adequate information so that identity and contact information of the requestor is available
- The Department of Pathology receives adequate information on the request form to permit correct analysis and interpretation of results
- The Department of Pathology records accurate and complete patient and specimen identification for each request received

3.1 Sample Acceptance

In order for any sample to be accepted for processing, it must meet certain acceptance criteria.

Ref: Table 3 below.

Request form: (See Section 3.4)

- In general, use of addressograph labels on request form is encouraged. Addressograph labels must be placed on all parts of the request form. Please ensure that the information provided is legible on all copies of this form.
- If labels are not used, the handwriting must be clearly legible (block capitals preferred) and in ball point pen to ensure the information is copied through to each part of the request form.
- In the case of General Practitioner requests, the use of the Medical Practice Stamp on the request form is preferred.

Specimen: (See Section 3.5)

- Hospital: The **electronic blood track system** is used to label the specimen. These are the only labels that are permitted on the specimens. Alternatively, specimens can be handwritten with all details completed. **All details on the Blood Transfusion Specimens must be hand written if they have not been labelled as part of the Electronic Blood Track System. For instruction on positive patient identification and specimen labelling with Blood Track**

PDAs refer to HP-GEN-0001 'Requesting Blood Products' available in Blood Bank folder on the hospital shared drive.

- GP: Addressograph label or handwritten samples are acceptable. The addressograph label used on the specimen must be of a size small enough to fit over the existing specimen label.

3.2 Sample Rejection

Sample requests will be rejected under the following circumstances:

- Samples do not meet the acceptance criteria for the department
- Leaking or spilled specimens
- Illegible samples
- Incorrect/insufficient/overfilled specimens
- The specimen container is out of date
- Specimens that compromise the validity of results (See Section 3.8)

This information will be available on the patient report, so that the reason for rejection is clear. Confirmation of rejection of samples will be made by phone if it is an urgent request.

3.3 Exceptions to Sample Rejection

Where there are problems with patient or sample identification, sample instability due to delay in transport or inappropriate containers, insufficient sample volume or when the sample is clinically critical or irreplaceable and the laboratory chooses to process the sample, the final report shall indicate the nature of the problem, and where applicable, that caution is required when interpreting the result.

Exclusions exist for irretrievable primary specimens. These include Histology Specimens, CSF, Blood Cultures, Aspirates, Tissue Samples, Line Tips, Bronchoalveolar Lavages and Intrauterine Contraceptives. In these cases, a *QF-GEN-0047 Specimen Rejection/Amendment Form* must be completed by the sample taker to allow the specimen to be processed.

Table 3 – Specimen and Request Form Acceptance

Details Required on Specimen	Details Required on Request Form
➢ Forename (unabbreviated) ➢ Surname (unabbreviated) ➢ Date of Birth ➢ MRN (If available. For Blood Transfusion, Typenex Number to be used if MRN unavailable) ➢ Date of Sample Collection ➢ Time of Sample Collection (if relevant to test) ➢ Unabbreviated specimen type and anatomical site of origin for Microbiology and Histology specimens (when several samples from the same patient are to be collected, including multiple pieces of tissue or slides) ➢ Signature of sample taker	The Request Form must contain the following details: ➢ Forename (unabbreviated) ➢ Surname (unabbreviated) ➢ Date of Birth ➢ MRN (If available. For Blood Transfusion, Typenex Number to be used if MRN unavailable) ➢ Gender The following details should be included: ➢ Patient address ➢ Clinician ➢ Source (Location where report to be sent) ➢ Date of Sample Collection ➢ Time of Sample Collection ➢ Signature or details of sample taker ➢ Requester's signature and contact number ➢ Test Request(s) ➢ Specimen type and anatomical site of origin for Microbiology and Histology specimens (unabbreviated) ➢ Clinical details/medications/antibiotic therapy/recent foreign travel if relevant

For Microbiology specimens, it is preferable to have time of collection but not critical, as turnaround times and shelf life of specimens are in days rather than hours as for other disciplines.

In some cases the test request may **reasonably** be inferred from the clinical details and/or the sample type, e.g. Nasal & Groin swab – perform MRSA screen, but otherwise the clinician can be phoned to clarify. To ensure the most appropriate microbiological investigation of samples and interpretation of results relevant clinical details and antibiotic therapy are desirable on the request form.

It is the responsibility of the person taking the sample to ensure the Department of Pathology is provided with complete and accurate patient identification details on both the sample request form and specimen container. Any deviation from the established collection procedures must be clearly recorded. Further information for each individual department is supplied in the relevant section of this manual.

3.4 Request Forms

It is important that the correct form is used for a particular test. There are a number of different request forms used for different analyses as outlined in **Table 4 – Request Forms**. One request may accompany multiple specimens. Each request accepted by the laboratory for examination(s) shall be considered an agreement. Where necessary for patient care, the laboratory will communicate with users or their representatives, to clarify the user's request.

Table 4 - Request Forms

Request Form	Test Requests
Blood Bank Request Form LF-GEN-0011	ABO & Rh D Grouping, Antibody Screens, Crossmatching, Direct Coombs Test, Blood Product Requests
Pathology General Request Form LF-GEN-0019	Haematology, Coagulation, Biochemistry & Referral Tests
Troponin-I Request Form LF-BIO-0024	Troponin-I Levels
Gentamicin/Vancomycin Request Form LF-GEN-0031	Gentamicin and/or Vancomycin Levels
Microbiology Request Form LF-GEN-0023	Microbiology Tests (Tests other than SARS-CoV-2, Flu A/ B/RSV)
SARS-CoV-2 / Flu A/ B/RSV Request Form LF-GEN-0118	SARS-CoV-2, Flu A/ B/RSV (Mobile phone number of patient or next of kin is mandatory on these request forms)
NT pro BNP request form (**All**) LF-BIO-0110	NT pro BNP levels **NTproBNP Request form**
B12 and Folate request form	B12 and Folate levels **B12 and Folate Request Form**
Request for Thyroid Function Outside Routine Hours LF-BIO-0026	Thyroid function requests outside routine hours
LF-GEN-0133 Procalcitonin Request Form	Procalcitonin (PCT)

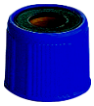
3.5 Specimen Collection

It is the responsibility of the doctor, nurse or phlebotomist taking the sample to:

- Ensure that all appropriate equipment is within date and all packaging is intact
- Explain procedure and rationale to patient answering any questions, thus ensuring an informed verbal consent is obtained. The Laboratory assumes that specimens submitted for testing were obtained with the consent of the patient.
- Check patient identification; confirm that the patient is fasting if required.
- Take samples into the appropriate containers for the tests required. Blood Tubes are available with different anticoagulants and the cap colour indicates the anticoagulant present. It is important to use the correct specimen container and to take the sample at the appropriate time. If more than one blood specimen is taken, specimens must be taken in a particular order. Fill the containers in the correct order as outlined in **Table 5: Order of Draw of Blood Tests.** Never pour blood from one tube into another. The preservative in the first tube could contaminate the second tube; this can greatly affect results and potentially compromise patient care.
- Dispose of all needles and contaminated materials into sharps bins when finished sampling. Specimens must not be sent to the laboratory with needles attached.
- Label the specimen container and ensure that the form is completed properly

3.6 Order of Draw of Blood Tests

Table 5: Order of Draw of Blood Tests

Specimen Volume	Order of Draw	Colour	Tube Contents	Assays	Special Instructions	Mixing Instructions
3ml	1		Trisodium Citrate Solution	PT, INR, APTT, D-Dimer, Fibrinogen	Fill tube to arrow line. Inadequately filled tubes cannot be used	After Blood Collection, gently Invert tube **4** times
5ml	2		Plain Gel Sep Clot Activator	All Biochemistry and Endocrinology e.g. TFT, Fertility, B12, Folate, Ferritin, PSA, Drug Levels e.g. Digoxin, Gentamicin, NT pro BNP and PCT A separate tube required for External Tests for Biochemistry, Immunology, Virology, etc.	Tubes must be labelled with the Full Name, DOB, MRN, Date & Time of collection and The Drawers Signature. *Addressograph labels are acceptable.*	After Blood Collection, Gently invert tube **5-10** times
3ml	3		EDTA	FBC, Blood Films, Infectious Mononucleosis Screen, HbA1C, Malaria, ESR, Troponin	Troponin-I must be taken in EDTA unless otherwise specified	After Blood Collection, Gently Invert tube **8-10** times
6ml	4		EDTA	Group and Screen, Crossmatch, DAT, Transfusion Reaction Investigation	TUBES MUST BE LABELLED WITH FULL NAME, DOB, MRN, DATE &TIME of COLLECTION and DRAWER SIGNATURE	After Blood Collection, Gently invert tube **8-10** times
4ml	**5**		Fluoride Oxalate	Glucose	STATE COLLECTION TIME, SPECIFY IF SAMPLE IS RANDOM OR FASTING	After Blood Collection, Gently invert tube **5-10** times
6ml	**6**		Na Heparin	Trace Elements only e.g. Zn, Lead etc.	Contact the Laboratory for Tubes	After Blood Collection, Gently invert tube **5-10** times

3.7 Laboratory Test Menu Guide

See following individual laboratory section for details of full test menu available.

3.8 Validity of Test Results

It is important that specimens are received in optimum condition and with relevant clinical information in order to ensure accurate results and interpretation of same. Factors, which should be taken into account when ordering tests, include, but are not limited to the following:

- Age of sample
- Haemolysis
- Lipaemia
- Icteric Samples
- Sample volume
- Container type
- Transport/Storage of sample
- Relevant clinical information
- Correct labelling of samples e.g. timed samples

3.9 Specimen Retention & Additional Testing

All specimens tested in the laboratory are retained for a minimum of 72 hours. If a specimen has been received in the department and testing for an additional parameter is required, the department should be contacted to assess the feasibility of using the initial specimen for analysis as age of specimen may affect the validity of the test results.

Ref: *LF-HAEM-0017 Turn Around and Validity times for Haematology Specimens*

Ref: *LI-BIO-0001 Sample Stability in Biochemistry*

Ref: *LP-BT-0001 Specimen Handling in Blood Transfusion*

Ref: *LP-MIC-0063 Specimen Reception in the Microbiology Laboratory*

A request form must accompany such a request but the lack of the request form will not impede the processing of an urgent request.

3.10 Reference Ranges (Biological Reference Intervals)

Reference ranges for test attributes are documented on all reports for quantitation results. Reference ranges can be age and gender specific and are supplied with each test report.

4 PHLEBOTOMY GUIDELINES

The importance of collecting an appropriate sample from the correct patient cannot be over emphasised. Patient diagnosis and treatment may be based on the results of specimen analysis and the implications of error are self-evident. Analysis of blood specimens is pointless and dangerous if the original specimen has been taken from the wrong patient, has been incorrectly labelled or has been compromised by poor collection technique.

The work of the phlebotomist involves the collection of blood using aseptic techniques and strictly adhering to standard precautions as history of infectivity of the patient may be unknown. The Vacutainer System is used for drawing blood from patients.

4.1 General Precautions

- Standard precautions must be observed when taking blood
- Disposable non-sterile gloves must be worn when taking blood and changed between patients
- Perform hand hygiene before and after the phlebotomy procedure
- When sampling blood from any patient, extreme care must be taken and every patient considered as potentially high risk
- Where a patient is in isolation, appropriate PPE must be worn. Dispose of PPE according to the correct procedure.
- All cuts and abrasions are covered with a waterproof dressing. Protective eye-ware (goggles) should be worn if deemed necessary
- Safe needle devices should be used - they should be disposed of in a sharps container. Each user of sharps is responsible for their safe and appropriate use and disposal.
- It is the policy of the Department of Pathology to treat all specimens and samples as potentially infectious or high risk. Blood stained or leaking samples will not be accepted by the department
- Spillage of blood must be avoided
- Care must be taken to prevent needle stick injuries when using and disposing of needles

4.2 Storage of Materials for Blood Collection

The Blood Collection System should be stored at room temperature. The blood tubes used must never exceed the expiry date.

4.3 Identifying the Patient

Accurate identification of the patient is essential. The mechanism by which the specimen is associated with the patient and the request form is of utmost importance. The phlebotomist, nursing staff or clinician must ask the patient to state their name and date of birth, check the patient's wrist band/identity and the request form information are correct before collecting the specimen as per hospital policy OLN-GEN-0013: Processes and Procedures for Patient Identification at Our Lady's Hospital Navan and HP-GEN-0001: Requesting Blood and Blood Products.

A properly completed request form is essential. The clinical staff who request the laboratory examination of the specimen are responsible for the correct completion of the request form. The person collecting the specimen is responsible for ensuring that the container is properly labelled.

4.4 The Conscious Patient

1. Ask the patient to state full name, address and date of birth.
2. Check the details given by the patient against the I.D. band and the patient's Request Form.
3. Resolve any discrepancy, no matter how trivial, before proceeding. If necessary seek assistance from nursing staff.
4. If unable to resolve discrepancies successfully, take a note and return the Request Form to the Clinical Nurse Manager or deputy for resolution.

Note:

The above procedure is not applicable for patients within the Out Patients Department as they are not required to wear I.D. band. However, for day ward transfusion patients they are in possessions of an armband at the time of sampling.

4.5 The Unconscious patient / confused patient or a patient who does not have English as their first language

1. Ask nursing staff to positively identify the patient (never rely on the I.D. band or chart attached to the bed).
2. Compare the data with details in the patients chart and on the patients I.D. band
3. Resolve any discrepancies before proceeding

4.6 Preparation of the Patient for Primary Sample Collection

The appropriate preparation of the patient for the requested test and that the specimen is collected correctly is the responsibility of the individual collecting the specimen.

4.7 Patient Consent

All procedures carried out on a patient need the informed consent of the patient. For most routine laboratory procedures, consent can be inferred when the patient presents himself or herself at a phlebotomy clinic with a request form and willingly submits to the usual collecting procedure, for example, venepuncture. Special procedures, including more invasive procedures, or those with an increased risk of complications to the procedure, may need a more detailed explanation and, in some cases, recorded consent. Procedure for in-patients is as follows: Introduce oneself to the patient, explain the procedure, seek consent for procedure and reassure the patient. In emergency situations, consent might not be possible; under these circumstances it is acceptable to carry out necessary procedures, provided they are in the patient's best interest. Refer to *ED-GEN-0039 HSE National Consent Policy.*

4.8 Procedure for Taking Samples

- Ensure the patient has a hospital identity wristband containing Name, MRN and DOB
- Ensure the Request Form is completed correctly
- Prepare all necessary equipment for venepuncture.
  (*See LP-PHL/GEN-0001: Blood Sampling in the Phlebotomy Department)*
- Ensure sample tubes are in date.
- At the time of sample taking the conscious patient must be asked to identify himself/herself by stating first name , surname and date of birth
- Ask the patient for any relevant clinical details, such as previous pregnancies, transfusions, fasting status, medication status, time of last dose, cessation of dose.
- Sample collection at pre-determined time or time intervals must be taken into consideration.
- Perform procedure and label the sample.
- If a patient is unconscious or confused, check the details on their wristbands against their medical notes and the Request Form and verify their identity with another staff member.

- If patient is genuinely unidentifiable, minimum identifiers acceptable are unique number and gender. A wristband should be applied once an MRN has been allocated and patient ID status follows Surname: Unknown Navan, First Name: Male/Female, DOB: todays date.
- There are no special requirements with regard to timing of collection of blood transfusion samples. Samples for Blood Transfusion are valid for 72 hours from the time of collection.

CRITICAL: All details recorded on sample container must be done at the patient's bedside, immediately post sampling by the sample taker. The collection of blood, labelling of tubes and placing of tubes into request bags must be performed at the patient's bedside in one continuous, uninterrupted event. Only one patient should be bled at a time to minimise the risk of error. Do not allow yourself to be distracted during this process. Samples not conforming to form and sample labelling criteria will be discarded and a new sample will be required.

4.9 Phlebotomy Timing Requirements for certain samples

- Fasting lipids, fasting glucose; patients should be fasting for 12 hours prior to blood sample being taken. Water may be drunk as desired, but no other fluids.
- Gentamycin; Trough level should be checked 16-24 hours after the first dose.
  Ref.: OLH Policies and Procedures *OLHN Adult Gentamicin Once Daily Dosing Guideline V.3, Jul 2018* on Hospital Shared drive.
- Vancomycin: Check first trough level on Day 3 (within 1 hour before dose given)
  Ref.: OLH Policies and Procedures, *OLHN Adult Vancomycin Dosing Guideline V.4, Jul 2021* on Hospital Shared drive.

4.10 Special Precautions for In-Patients

Do not draw from in-dwelling lines or cannula unless one is trained and authorised to do so

Do not draw blood from an arm with an infusion in progress. When infusions are in place on both arms ask staff if one can be switched off to allow venepuncture to take place. Advise staff when the procedure has been completed. Do not perform venepuncture on a limb, which is paralysed, or on a limb with evidence of oedema, or where surgery on auxiliary lymph nodes has taken place.

4.11 Haemolysed Samples

Factors in performing venepuncture, which may account for haemolysis includes:

- Using an improperly attached needle and blood tube so that frothing occurs
- Vigorous shaking or mixing of the specimen post phlebotomy.
- Failure to allow alcohol to dry
- Very slow flow into the collection tube
- Drawing blood from in-dwelling line
- Failure to release the tourniquet
- Drawing blood from a bruised area

4.12 Actions if Patient Problems are encountered

- If an artery is entered accidentally, remove the needle and apply pressure to the site. Seek nursing/medical assistance
- If the venepuncture site continues to bleed after three minutes, apply pressure to the site. Seek nursing/medical assistance
- If patient feels weak and is sitting, loosen clothing and provide reassurance
- If patient does not respond, seek nursing/medical assistance
- Never draw blood from a patient who is standing. A standing patient is more likely to faint than a patient who is sitting or lying down
- If a patient becomes nauseous, provide reassurance, make the patient comfortable and instruct the patient to breathe deeply and slowly
- If a patient develops convulsions, prevent the patient from injuring himself/herself
- If the patient objects to tests do not argue with the patient but emphasise the tests were requested by the doctor. Do not proceed without the consent of the patient
- All complications must be reported using the appropriate National Incident Management Form. See *ED-GEN-0210 HSE Incident Management Framework*

4.13 Action to be taken after Exposure Incident/Needle Stick Injury

- Encourage the puncture site to bleed and wash area/site thoroughly with water
- Identify patient source if possible
- When a splash of blood occurs to the eyes, nose, mouth or broken skin, wash immediately with water or a normal saline solution

- Seek any treatment required
- Report the incident as soon as possible to a senior member of staff and seek medical attention in the Emergency Department.
- All incidents must be reported using the appropriate National Incident Management Form. See *ED-GEN-0210: HSE Incident Management Framework*
- Follow procedure outlined in *ED-GEN-0088: Guidelines for the Emergency Management of Injuries and Post-Exposure Prophylaxis (PEP)*

4.14 Safe Disposal of Waste Material Used in Specimen Collection

Materials used in specimen collection should be treated as potentially hazardous and disposed of as per current hospital guidelines for Waste Management, *ED-GEN-0035 HSE Healthcare Risk Waste Management.*

5 DELIVERY, PACKING & TRANSPORT REQUIREMENTS FOR SAMPLES

5.1 General Information

Ref: *ED-GEN-0249: HSE Guidelines for the Preparation for Transport of Patient Specimens and Biological Materials*
https://healthservice.hse.ie/filelibrary/staff/preparation-for-transport-of-specimens-and-other-biological-materials.pdf

Specimen containers are purchased according to the guidelines issued by the Dangerous Goods Safety Advisor and comply with the U.N. Class 3373 standard. The integrity of specimen containers is considered when these are purchased, so as to minimise the risk of breakages, leakages etc.

It is the policy of the laboratory to treat all specimens as potentially infectious. Therefore, it is advisable to take universal precautions in the collection, packaging and the delivery of specimens being sent to the department for analysis.

Samples should be sent to the department as soon as possible to avoid specimen deterioration with subsequent inaccurate and possibly misleading analysis. If there is likely to be a delay between collection of samples and transport to the Laboratory seek advice from the relevant laboratory regarding sample stability.

During the out-of-hours period urgent referral of specimens can be arranged by the Medical Scientist on-call.

5.2 Special Handling Needs

Refer to Section 4.1: General precautions for PPE guidelines and best practice. Adopt scrupulous personal hygiene practices. Avoid all actions that promote contact between the hands and the eyes, nose or mouth before the hands have been thoroughly washed. Eating, drinking, chewing, smoking, the application of cosmetics or grooming in the specimen collection and processing area is forbidden. Cover any cuts, abrasions or other skin lesions to protect them against contamination before handling specimens.

Treat any puncture wounds or cuts sustained during work as per hospital sharps policy.

In the event that a glove becomes punctured, irrespective of whether a wound is sustained, remove the glove, dispose of it safely and wash hands before replacing the glove.

Gloves must be worn when there is a risk of skin contamination from the specimen. In the event that airborne droplet dispersion may occur, an appropriate containment microbiological safety cabinet should be used for specimen processing.

For transport outside the Department of Pathology, specimens are packaged in secondary packaging with a biohazard symbol and sufficient paper towels to absorb any spill and then placed in the approved container. Appropriate labelling is attached to the container box which conforms to DGP requirements U.N. 3373. The person who sends the specimen ensures that the container is appropriate, properly closed and is not externally contaminated by the contents.

The transport bag prevents the contamination of other containers, the hands of the specimen receptionist and the immediate environment. All unnecessary hand contact with the specimen containers is limited.

Refer to Section 36.1 for special handling precautions on 24 Hour urine containers with added acid.

5.3 Sample Delivery from within the Hospital

Specimens should be placed in the sealable transport bag attached to the relevant request form as soon as the specimen has been taken. Specimens and request forms are transported as soon as possible to the Department of Pathology by doctors, nurses, phlebotomists, porters, Medical Scientists and Laboratory Attendants.

5.4 Sample Collection/Delivery from External Locations

Primary Care Services provide a collection service for samples from external locations. All samples transported by road must comply with ADR transport regulations, and must be packaged as per ADR P650 Packing instructions. It is the responsibility of the sender to ensure that specimens are transported and packed in accordance with these regulations. ADR compliant packaging is provided by the Primary Care Service. Advice on compliance may be obtained from the Department of Pathology.

External specimens may also be deposited into a drop-off box at Hospital Reception labelled 'Laboratory Samples Only'. The last collection from the box is 15.30 p.m. Mon-Thurs and 12 noon on Fri. Any specimens left after these times will only be collected the next working day.

GP requests for renal function will exclude potassium by default.

If potassium is required on a GP sample

- The sample must be less than 4 hours old arrival into the laboratory
- The sample must be highlighted as urgent
- The sample must be packaged separately and presented to the courier as urgent to ensure there are processed within 4 hours
- A second sample for potassium is NOT required

Referral specimen temperature requirements, are detailed in *MF-GEN-0137 St James' Referral Test Codes, MF-GEN-0138 Referral Tests* and *Specimen Requirements for Eurofins Biomnis MF-GEN-0131 NVRL Referral Test Codes, LI-GEN-0002: Miscellaneous Referral Tests and Codes to specialised Referral Laboratories*

6 REPORTING OF RESULTS

6.1 Access to Results within Our Lady's Hospital

All results are available on Ward Enquiry on APEX once authorised. Staff who require access to results will be given individual log-on and password only after the application for access has been completed and signed off by their line manager. *MF-GEN-0068 LIS (APEX) Access Request Form* is used for this purpose and available on request from the Laboratory IT Co-ordinator.

6.2 Access to Results by GPs, Community Hospitals, Nursing Homes

Reports destined for locations outside the hospital are delivered by a Primary Care Delivery Driver or sent via An Post. They are also available via Healthlink to participating locations. Healthlink is the electronic link system provided by a Department of Health funded project which allows electronic links to be established between General Practitioners and Hospitals to allow for the timely, secure transfer of patient related administrative and clinical data. Results are available through Healthlink as soon as they are authorised in the laboratory.

If there is a request made to the laboratory office for GP reports, a report may be emailed to a secure healthmail email.

6.3 Release of Hospital Results to GPs

With regard to the process for requesting copies of Laboratory reports for patients who have attended Our Lady's Hospital Navan, a signed declaration of consent from the patient and a copy of the patients ID is required.

Alternatively, the HSE have confirmed that a letter or a healthmail email from the patient's GP with the following wording is acceptable:

'My Patient _____ _____, DOB ___/____/____ is not in a position to provide signed consent, however they have given me explicit consent to request a copy of their results from ___/____/____ when they attended the _____ department in Our Lady's Hospital Navan'.

6.4 Reports by Telephone

It is the policy of the Department of Pathology not to give results over the telephone unless results are at a critical level or a delay in receiving the results would cause a delay in treatment. A record of all telephoned results is held by the Department of Pathology.

7 QUALITY ASSURANCE

All examination procedures carried out in the Department of Pathology are subject to strict Internal Quality Control Testing and External Quality Assurance Assessment, which verify the attainment of the intended quality of results. Where results deviate from expected results, patient results are not issued until the underlying issue is resolved and all necessary re-testing undertaken.

The Department of Pathology participates in relevant available external third party assessment schemes. This includes schemes operated by:-NEQAS (UK, National External Quality Assurance Scheme), WEQAS, RIQAS, IEQAS, QCMD and Lab Quality, Finland. The Pathology Department is committed to participating in other schemes as they become available.

8 ADVISORY SERVICES

Scientific and medical advice on issues within the Laboratory's range of interest and competence is available. Clinical advice on ordering examinations and on interpretation of examination results is available through the Consultants. Advisory services are provided to individual cases in all disciplines. Advisory services help to enhance and promote the effective utilization of the Laboratory Service within OLH Navan.

Table 6 Advisory Services

Position	Name	Ext.	Direct Line
Consultant Haematologist	Dr Su Maung		MMUH Switchboard
Consultant Microbiologist	Dr Gregory Krizsan		OLH Switchboard
Consultant Biochemist	Dr Paula O'Shea		OLH Switchboard
Laboratory Manager	Mr Ray O'Hare	2571	046-9078571

The Consultants and or Medical Scientists can provide advice on the following:

- Choice of Examination
- Use of the Service
- Required Sample Type
- Clinical Indication
- Limitations of Procedure
- Required Frequency of Testing
- Interpretation of Results

9 COMPLAINTS/FEEDBACK

The goal of the Pathology Department is to ensure that our users receive accurate, reliable, meaningful and timely laboratory results. The Department of Pathology welcomes patients and laboratory users to provide helpful information to aid the laboratory in the selection of the examination methods, and the interpretation of the examination result.

If users encounter any problems with the services or have suggestions for service improvement, please contact the appropriate laboratory section via phone or email. Alternatively, *QF-GEN-0003 User Feedback Form* - is available from the Laboratory to record complaints/comments. All submissions are welcome.

Complaints are logged and handled within the Pathology Quality Management System. The laboratory will confirm whether the complaint relates to laboratory activities that the laboratory is responsible for and, if so, will endeavour resolve the complaint and provide the complainant with the outcome of the complaint.

Ref: QP-GEN-0008: Complaints Procedure

10 LABORATORY POLICY ON PROTECTION OF PERSONAL INFORMATION

The laboratory is fully compliant with the national standards on protection of personal information. It is the policy of the HSE that all data is processed and controlled in line with the principles of the GDPR and relevant Irish legislation to ensure the security and confidentiality of all personal data they collect and process on behalf of service users and employees. Data Protection rights apply whether the personal data is held in electronic format or in a manual or paper based form. Procedures are in place to detail the requirements for security, access, confidentiality and data protection, backup systems, storage, archive and retrieval and safe disposal of laboratory equipment and the pathology computerised systems. This procedure applies to any system that captures, stores, controls, manages or reports data subject to review.

Ref: *MP-GEN-0011 Management of Data and Information*

11 REPEAT EXAMINATION DUE TO ANALYTICAL FAILURE

It is the policy of the Department of Pathology in the event of an analytical failure to repeat the test using a back-up system or store the specimens in appropriate conditions until the cause of the

analytical failure is identified, corrected and the test repeated. The urgency of the outstanding request/s is reviewed by the relevant Consultant / Chief Medical Scientist.

12 MEASUREMENT UNCERTAINTY

Estimates of measurement uncertainty for measurement procedures are available to service users from the department which performs the measurement upon request. See section 2.3 for contact details.

BLOOD BANK

13 BLOOD BANK INTRODUCTION

The Blood Bank Department compromises of the Blood Transfusion Laboratory and the Haemovigilance and Traceability activities. Samples are subjected to stringent compatibility testing and procedures to ensure full traceability. The Blood Bank is accredited to ISO 15189 and AML-BB.

14 GENERAL INFORMATION

14.1 Services Associated with the Blood Bank

Table 7: Services Associated with the Blood Bank

SERVICE	DESCRIPTION
Blood Transfusion Laboratory	The Blood Transfusion Laboratory offers a comprehensive laboratory service for service users within Our Lady's Hospital, Navan including: • ABO & Rh D Grouping and Antibody Screening • Antibody Identification • Crossmatching Red Cells • Direct Antiglobulin Test • Phenotyping (if appropriate) • Suspected Transfusion Reaction Investigation (if indicated) • Provision of Blood Components (Plasma & Platelets) • Provision of Coagulation Factors
Haemovigilance Service	The Haemovigilance Service monitors practice to ensure that "the right patient gets the right blood at the right time" and associated Haemovigilance related issues. The Haemovigilance Officer may be contacted via Ext 2578 or 0874101084. All Haemovigilance procedures and guidelines for blood and blood product requesting, prescription and administration are available for users in the hospital shared drive in Blood Bank folder
Consultant Service	Dr Su Maung may be contacted via MMUH switchboard.

14.2Blood Bank Contact Details

Table 8: Blood Bank Contact Details

Section	Phone Extension Inside the Hospital	Phoning from outside the Hospital
Blood Bank	2573 – Routine Hours OLH Switchboard- Out of Hours	046 9078573

15 BLOOD BANK REQUESTS AND REQUIREMENTS

15.1Blood Bank Tests

All blood for Group & Screen, Crossmatch, Direct Antiglobulin Test, Antibody Investigation, *must be taken into a 6 ml pink top tube as shown below.*

Blood Track Labels only. Do not attach an Addressograph label to this tube.

Notes

- If blood track cannot be used to label a pre transfusion sample then the sample must be handwritten at the patient's bedside.
- For the unconscious /unidentified patient, the minimum information on the *LF-GEN-0011 Blood Transfusion Request Form* is a unique identification number (MRN assigned by IPMS) and the gender of the patient. *Request forms and samples are labelled "Surname: Unknown Navan, First Name: male/female, DOB: todays date".*
- IPMS downtime: The 'TYPENEX' armbands are available to identify patients who have no medical record number. (Place the band on the patients' wrist, cut off excess labels and send them to the Laboratory with the specimens). The Typenex armbands are stored in the Emergency Department, ICU and Laboratory Reception.

16 SPECIMEN PROCEDURE

16.1 Specimen Requirements

- One 6ml EDTA blood specimen is required for ABO Grouping and Rh (D) Typing and Antibody Screening.
- A second sample should be requested for confirmation of the ABO group of a first time patient prior to transfusion.
- The two samples must be taken independently of each other, by different sample takers or on the next phlebotomy round.
- If the crossmatch is required urgently, blood may be issued on the first group and a second sample sent to the laboratory as soon as it is practical.

Table 9 Requirements for Blood Bank Testing

REQUEST	SAMPLE/TEST REQUIREMENTS
Blood Group & Antibody Screen	Request Form for Blood Group and Antibody Screen (signed) and **6ml EDTA** Sample. A second *separate* sample is required to confirm blood group of a first time patient prior to transfusion.
Crossmatch of Red Cell Concentrate	Request Form for Blood Group, Antibody Screen and Crossmatch with required units of RCC and **6ml EDTA** sample. A second ***separate*** sample **IS** required to confirm blood group of a first time patient prior to transfusion. If a previous sample is within the validity period, a ***new*** Request Form stating required units of RCC and reason for transfusion is required. **Note: The Maximum Surgical Blood Ordering Schedule must be used.** For specific guidance on indications and dosage refer to *HP-GEN-0012 Blood and Blood Product Transfusion Information for Clinical Staff* available on the hospital shared drive
Emergency Issue of Red Cells	Request Form for Blood Group and Antibody Screen and **6ml EDTA** Sample. A second separate sample IS required as soon as possible to confirm blood group of a first time patient prior to transfusion.
Antibody Investigation	Request Form for Blood Group and Antibody Investigation and **6ml EDTA** Sample. (2 samples if referral to IBTS)

REQUEST	SAMPLE/TEST REQUIREMENTS
Direct Antiglobulin Test (DAT)	Request Form for Direct Antiglobulin Test (DAT)and **6ml EDTA** Sample ***or*** Sample for Blood Group and Antibody Screen from within the past 48 hours ***and*** a new Request Form for Direct Antiglobulin Test.
Investigation of Suspected Transfusion Reaction	Request Form for Investigation of Suspected Transfusion Reaction and **2 x 6ml SERUM** Sample, 3ml EDTA and 1st Urine specimen post transfusion. Contact the Clinical Haematology Team for advice as required. **Note: All suspected transfusion reactions must be reported to the Haemovigilance Officer.**
Plasma	Request Form for Blood Group and Antibody Screen (signed) and **6ml EDTA** Sample ***or*** Historic Blood Group and Antibody Screen and new Request Form with required volume/units of Plasma. For specific guidance on indications and dosage refer to *HP-GEN-0012 Blood and Blood Product Transfusion Information for Clinical Staff* available on the hospital shared drive **Contact the Haematology Team to ensure clinical validity of request for Plasma, if required.**
Issue of Platelets	Request Form for Blood Group and Antibody Screen (signed) and **6ml EDTA** Sample ***or*** Historic Blood Group and Antibody Screen and new Request Form with required volume/units of Platelets. For specific guidance on indications and dosage refer to *HP-GEN-0012 Blood and Blood Product Transfusion Information for Clinical Staff* available on the hospital shared drive **Contact the Haematology Team to ensure clinical validity of request for Platelets, if required.**
Issue of Factor Concentrates	Request Form for the required volume/units of Factor Concentrate • Prothrombin Complex (PCC) • Fibrinogen Concentrate • Factor VIII • Factor IX • Activated factor VIIa

REQUEST	SAMPLE/TEST REQUIREMENTS
	• Factor VIII + VWF For specific guidance on indications and dosage refer to *HP-GEN-0012 Blood and Blood Product Transfusion Information for Clinical Staff* available on the hospital shared drive If patients with an inherited bleeding disorder present to the hospital the National Centre for Coagulation Disorders in St James must be contacted for clinical advice. The Consultant Haematologist in the hospital must also be informed if a patient with an inherited bleeding disorder is admitted to the hospital. **Contact the Haematology Team to ensure clinical validity of request for Platelets, if required.**
NB: SPECIMENS AND REQUEST FORMS MUST BE COMPLETED AS OUTLINED IN THIS TABLE. WHERE THESE REQUIREMENTS ARE NOT MET, THE REQUEST MUST BE DISCARDED IN LINE WITH BLOOD BANK REGULATORY REQUIREMENTS.	

16.2 Time limits for sample processing

Samples for patients for elective surgery should be received before 2p.m. on the last routine working day before surgery. Samples for same day orthopaedic surgery should be received by 8.30 a.m. Other routine samples should be received before 3.30 p.m. Otherwise the sample is centrifuged (to ensure it is not haemolysed) and refrigerated immediately at 4ºC and processed within 24 hours. All urgent samples are processed without delay.

16.3 Table 10: Working Limits for Use of Stored Whole Blood for Pre-Transfusion Testing

Patient Type	Sample Type
	Whole blood at 2-8ºC
All Patients	Up to 72 hours[1]
[1] This is the time between the sample being taken and the subsequent transfusion. 7 days may be acceptable for chronically transfused patients with no alloantibodies, following multiple repeated transfusion episodes. This should be assessed by a haematologist and recorded on the LIS and patient's record and reviewed on an annual basis or immediately in the event of a change in serological status.	

Note: If sample stored at room temperature, it is valid up to 48 hours

16.4 Maximum Surgical Blood Order Schedule

The Maximum Surgical Blood Order Schedule is a tool for maximum provision of red cell concentrate for **routine** elective surgical procedures requiring intra-operative transfusion. The Maximum Blood Order Schedule specifies the standard blood requirement for elective surgical procedures performed at Our Lady's Hospital, Navan. Deviations from this list are queried in an effort to minimize unnecessary holding of blood stock, but, will be met if clinical needs dictate, after authorization by the Clinical Haematology Team. Ref.: *HF-GEN-0003 Maximum Blood Ordering Schedule*. This document is available on the hospital shared drive.

All patients now require a second confirmatory sample for blood grouping.

17 ELECTIVE SURGERY

For patients attending the Pre-Assessment Clinic, a sample for group and antibody screen will be taken at the clinic and a second sample will be taken on admission.

Please note that elective requests cannot be processed on-call.

17.1 Reservation Period for Cross-matched Red Cell Concentrates

Cross-matched blood is reserved for a minimum of 24 hours from the required date as indicated on the request form. The Blood Transfusion Laboratory should be notified if reservation > 24hours is required. As per the BCSH Guidelines, the sample is valid for 72 hours. As antibodies may develop in the patient's plasma post-transfusion, it is necessary to re-crossmatch units to be transfused beyond 72 hours after sample phlebotomy.

Table 11: Storage Conditions and Retention Times of Examined Specimens

Specimen Description	Storage Requirement	Storage Location	Minimum Retention Period
Red cells for group/antibody/crossmatch	2-8 °C	Blood Bank fridge	7days

18 FURTHER EXAMINATION OF THE PRIMARY SPECIMEN

Table 12: Rationale for additional Testing Initiated by the Blood Transfusion Laboratory

Test/Profile	Rationale for Additional Testing
Direct Antiglobulin Test	Investigation of Autoantibody; Investigation of Suspected Transfusion Reaction; Investigation of an incompatible crossmatch.
Antibody Investigation	Where a positive antibody screen is detected, an antibody investigation is carried out to identify the antibody or antibodies present in the patient's plasma.
Antigen Typing	Confirmation of identity of antibody detected;

18.1 Additional Testing Initiated by the Blood Transfusion Laboratory

Where further testing is relevant to the investigation it is the policy of the Blood Transfusion Laboratory to perform additional tests using the primary specimen if possible. The ward or the requesting clinician will be contacted if an additional sample is required.

18.2 Additional Testing Initiated by the Requestor

Where a clinician requires further testing to be carried out on a primary sample, this will be carried out where a request form detailing the requirements is sent to the Blood Transfusion Laboratory and where the current sample is suitable for further testing as described in Table 13 *Requirements for Additional Blood Bank Testing Initiated by the Requestor.*

Table 13: Requirements for Additional Blood Bank Testing Initiated by the Requestor

Test/Profile	Requirements for Further Testing
Crossmatch of Red Cell Concentrate	Most recent sample (<72 hours after collection time) for Blood Group and Antibody Screen and additional request form signed by the requesting doctor
Direct Antiglobulin Test	Most recent sample for ABO & Rh D Group must be <48 hours old.
Issue of Plasma	Any historic ABO & Rh D Group and Antibody Screen.
Issue of Platelets	Any historic ABO & Rh D Group and Antibody Screen.
Issue of Factor Concentrates	Blood Group not required.

19 EXTERNAL LABORATORY TESTING

Additional samples may be requested for referral to the Irish Blood Transfusion Service (IBTS) if results obtained in this laboratory prove inconclusive.

20 EMERGENCY OUT OF HOURS SERVICE

It is hospital policy to avoid routine transfusions out of hours. The out of hours transfusion service provided only applies to emergencies and to situations where patients cannot wait until the next routine period.

20.1 Emergency Issue of Blood

- In the event of an emergency, the Medical Scientist should be alerted to the nature of the emergency immediately by telephone.
- Verbal/telephone requests alone are not accepted. Requests must be made using an *LF-GEN-0011 Blood Transfusion Request Form.*
- Samples must be sent to the Blood Transfusion Laboratory as soon as possible.
- If blood is required immediately, consider the use of 2 Emergency Issue, O Negative units of uncrossmatched red cells in the top shelf of the 17-BT-005 Issue Fridge in the Blood Transfusion Laboratory.
- It is the requesting doctors' decision to use uncrossmatched blood.
- The *LF-BT-0022 Compatibility Report Form* containing the details of the 2 Emergency Issue, O Negative units of red cells is filed in the *LF-BT-0021 Compatibility Report Form Folder* located on the desk in the centre of the Blood Transfusion Laboratory.
- The person removing the O Negative Emergency Issue blood must verify removal of the red cells using Blood Track Kiosk. Refer to *HP-GEN-0002 Collection of Blood Products*.
- It is the responsibility of the doctor or nurse to inform the Medical Scientist of the removal of the 2 Emergency Issue, O Negative units of uncrossmatched red cells, so that replacements can be arranged.
- Refer to *HP-GEN-0003 Administration of Blood and Blood Products*.

- In the event of a suspected serious adverse reaction or serious adverse event, refer to *HP-GEN-0005 The Identification, Investigation, Management and Local Reporting of a Serious Adverse Reaction or Serious Adverse Event*

21 TURNAROUND TIME (TAT)

Most requests will be dealt with on the same day but where problems arise e.g. patients with atypical antibodies or special blood requirements this may take longer. Where these problems are known to exist, the Blood Transfusion Laboratory should be notified in advance.

To ensure that an urgent request is processed immediately upon receipt, the urgency must be communicated to the Blood Transfusion Laboratory by telephone.

Table 14: TAT for Requests Received in the Blood Bank

Test/Blood Products Requests	TAT (routine)	TAT (Urgent)
Blood Group and Antibody Screen +/- Crossmatch*	Same Day	1 Hour
Emergency Issue of blood	N/A	10 minutes
Antibody Identification	Same Day	2 Hours
Suspected Transfusion Reaction Investigation	Same Day	Same Day
Blood Products	See Section 10	See Section 10
Direct Antiglobulin Test	Same day	30 minutes

*Patients that are eligible for **electronic issue** of red cells may have units available in a shorter timeframe. Contact the Blood Transfusion Lab to check patients' eligibility.

Electronic issue (EI) is the selection and issue of red cell units where compatibility is determined by the Laboratory Information System (LIS) without serological testing (serological crossmatch) of donor cells against patient plasma. The ability to perform EI depends on robust IT rules and laboratory processes and on patient transfusion history and sample criteria as specified in international guidelines *(BSH IT and BSH Guidelines for pre-transfusion compatibility procedures in blood transfusion laboratories).*

Laboratory staff will advise on whether urgent requests for blood can be made available rapidly by EI

22 BLOOD PRODUCTS/COMPONENTS AVAILABLE FROM BLOOD TRANSFUSION

Table 15: Blood Products/Components available from the Blood Transfusion Laboratory

Blood Product	Details
Red blood cells	Stock item
Plasma	Stock item
Prothrombin Complex Concentrates	Stock item
Fibrinogen	Stock item
Platelets	Must be ordered from the IBTS through the Medical Scientist
Factor Concentrates	Stock item
Irradiated, CMV negative, or washed products	Must be ordered from the IBTS through the Medical Scientist

22.1Plasma

- Preparation / Thawing of plasma takes approximately 40 minutes.
- Once thawed the plasma should be used immediately. If delay is unavoidable, the plasma is stored in the blood transfusion laboratory at 4^0C and must be used within 5 days. Once thawed it cannot be refrozen.

22.2Prothrombin Complex Concentrates (PCC)

Please refer to *HF-GEN-0055 Prothrombin Complex Concentrate reconstitution guide* Octaplex details of dosage and administration, available on the hospital shared drive.

22.3Platelets

Platelets must be ordered through the Medical Scientist who will order directly from IBTS.

23 REPORTING OF TEST RESULTS

23.1Reporting of Results

Only trained and competent Medical Scientists are authorised to release results. All results, once authorised, are available on the Laboratory Information System (LIS). Hard copies are released when printed and are sent to pathology reception for delivery to the hospital wards.

23.2Telephoned Reports

It is the policy of this laboratory to telephone reports only when results for specific clinical parameters have reached critical levels:

- If an antibody is detected in a patient's specimen and that patient requires immediate surgery/blood transfusion but compatible blood is not available, the requesting doctor shall be immediately informed of the problem. The Consultant Haematologist shall also be contacted.
- Specimen and request form issues when critical shall be reported immediately to holder of bleep identified on the request form, or alternatively to nurse/ patient location.

Requests for verbal reports are discouraged. Results of patients groups are not given over the telephone. A written copy of the result can be issued if required.

24 ADVISORY SERVICES

- The Blood Transfusion laboratory and Haemovigilance Officer may be contacted for advice during routine hours. The on call medical scientist may be contacted through the OLH switchboard out of hours.
- Clinical queries may be addressed by contacting the Consultant Haematologist. Any queries 9:00a.m.-5p.m. (Mon-Fri) should be directed to Dr Su Maung, Consultant Haematologist **or** MMUH Haematology Registrar covering lab/consult (bleep 2925) through MMUH switchboard (01 8032000).
- Out of hours advice may be sought from on call Consultant Haematologist **or** MMUH Haematology Registrar covering lab/consult (bleep 2925) through MMUH switchboard (018032000).
- If Dr Maung is on leave, on call Consultant Haematologist can be contacted through MMUH switchboard for advice

25 FALSE MEDICINES DIRECTIVE

The EU Falsified Medicines Directive (FMD) is a Directive that safeguards public health by protecting the pharmaceutical supply chain from infiltration by falsified (or counterfeit) medicines. All medicines received need to be verified (Decommissioned) with the Irish Medicines Verification Organisation (IMVO) before supply to a patient. This process also applies to many blood products namely Plasma, PCC and Factor Concentrates.

HAEMATOLOGY

26 HAEMATOLOGY INTRODUCTION

26.1Service Description

Haematology comprises the study of blood disorders which affect blood cells, haemoglobin, blood proteins and the mechanism of coagulation.

26.2Contact Details

Section	Phone Extension Inside the Hospital	Phone Number from Outside the Hospital
Haematology/ Coagulation	2575 - Routine Hours OLH Switchboard- Out of Hours	046-9078575

27 HAEMATOLOGY TEST INDEX

27.1 Routine and Urgent Haematology Tests

Samples labelled urgent, samples from ICU, ED, MAU, MIU, samples marked as oncology and urgent phone call requests from clinicians are classified as urgent and given priority. Samples for ESR Analysis are batch tested and therefore, an urgent request for ESR analysis must be followed by a phone call classifying the request as urgent.

The turnaround times shown in **Table 16 – Haematology Tests and Table 17 – Coagulation Tests** are for routine samples. Urgent samples are processed within 1 hour of receipt in the laboratory.

Table 16 Haematology Tests

Test	Specimen Type	Additive Required	Volume Required ml	Container Type	Sample Validity & Other Considerations	Turnaround Time
FBC	Blood	K-EDTA	3.0	Blood Tube (Purple)	Must be <24 hrs old. For WCC, RBC HB and Platelet count only reported, < 48hrs.	Same Day In-patients, 24 hours GPs
Blood Film	Blood	K-EDTA	3.0	Blood Tube (Purple)	Must be <24 hrs old State Clinical Details	48 hours (M-F) If Consultant Review referral, 10 days
Reticulocytes	Blood	K-EDTA	3.0	Blood Tube (Purple)	Must be <24 hrs old	Same Day
ESR	Blood	K-EDTA	3.0	Blood Tube (Purple)	Must be <24 hrs old on refrigerated specimen	Same Day In-patients, 48 hours GPs
Sickle Cell Screen	Blood	K-EDTA	3.0	Blood Tube (Purple)	State Clinical Details, sample can be tested up to 2 weeks if refrigerated	24 hours
Infectious Mononucleosis Screen	Blood	K-EDTA or Gel Tube	3.0	Blood Tube (Purple)	State Clinical Details, Stored at 4-8°C, EDTA sample validity of 2 days, and 3 days if Serum/Plasma sample	24 hours
Malaria Screen Malaria Blood Film	Blood	K-EDTA	3.0	Blood Tube (Purple)	State Clinical Details Validity < 4hrs old	Same Day In-patients, 24 hours GPs

This is the sample tube used for Haematology Tests as Listed in Table 16

Table 17 Coagulation Tests

Test	Specimen Type	Additive Required	Volume Required ml	Container Type	Sample Validity & Other Considerations	Turnaround Time
Prothrombin Time (PT/INR)	Blood	Sodium Citrate	3.0	Blood Tube (Light Blue Top)	Samples must be <24hrs old and filled to the fill mark	Same day
Activated Partial Thromboplastin Time (APTT)	Blood	Sodium Citrate	3.0	Blood Tube (Light Blue Top)	Samples must be <4hrs old and filled to the fill mark	Same day
Fibrinogen	Blood	Sodium Citrate	3.0	Blood Tube (Light Blue Top)	Samples must be <4hrs old and filled to the fill mark	4 hours
D-Dimer	Blood	*Sodium Citrate	3.0	Blood Tube (Light BlueTop)	**Samples must be <4hrs old and filled to the fill mark	4 hours

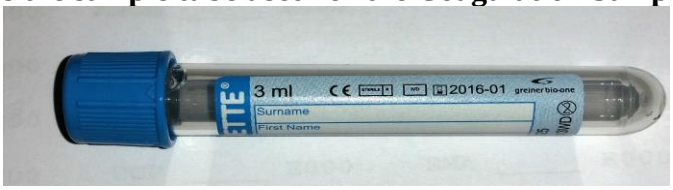
***** Haematocrit (HCT) results of > 0.55 L/L (Ratio) may lead to spurious coagulation results. The usual 3ml Coagulation tube has 0.3ml anticoagulant and 2.7mls blood i.e. 1:9 ratio anticoagulant to blood. Coagulation testing for PT/INR/APTT on Patients with Haematocrit result of >0.55 L/L (Ratio) from FBC sample, within 24hrs of Coagulation request, will need adjustment of the volume of anticoagulant in the Coagulation tube. This adjustment is done prior to phlebotomy for the coagulation test, by the laboratory staff, in the laboratory. The tube is then collected from the laboratory/delivered to the requesting department, for phlebotomy.

****** Indication for the D Dimer test and Well's score **must be** written on the request form. Analysis will only be performed according to the following Indications:

Indications for D-Dimer Analysis

- Suspected DVT with Wells score of 1 or less
- Suspected PE with Wells score of 4 or less
- Confirmed or suspected COVID
- Covid Positive **In-Patients**, analysis twice weekly only
- Requested by Consultant Haematologist or haematology team in MMUH

This is the sample tube used for the Coagulation Samples



27.2 On-Call Haematology Tests

The following tests are performed on-call. The urgency of the request should be agreed by telephone with the Medical Scientist on-call.

Table 18 Haematology On-Call Tests

Haematology On-Call Tests	
Full Blood Count (FBC)/Blood Film	Erythrocyte Sedimentation Rate (ESR) (If Query temporal arthritis)
Prothrombin Time /INR Ratio	Malaria Screen
Activated Partial Thromboplastin Time	Sickle Cell Screen
D-Dimer	Infectious Mononucleosis Screen (If indicated clinically and by FBC/blood film results)
Fibrinogen Levels	Reticulocyte Count

28 HAEMATOLOGY TEST INFORMATION

There is a vast range of Haematology tests available and information on the requesting and interpretation of these tests for use in the diagnosis and treatment of disease is well documented in numerous textbooks.

29 HAEMATOLOGY AND COAGULATION REFERENCE RANGES

Table 19: **Full Blood Count Reference Range Taken from LI-HAEM-0028**

Parameter	Units	2 – 6 years	6 – 12 years	Adult Male	Adult Female
RBC	**x 10^{12}/L**	4.0 – 5.2	4.0 – 5.2	4.5 – 5.5	3.8 – 4.8
Haemoglobin	**g/dL**	11.0 – 14.0	11.5 – 15.5	13.0 – 17.0	12.0 – 15.0
Hct	**L/L(Ratio)**	0.34 – 0.40	0.35 – 0.45	0.40 – 0.50	0.36 – 0.46
MCV	**fL**	75 – 87	77 – 95	83 – 101	83 – 101
MCH	**pg**	24 – 30	25 – 33	27 – 32	27 – 32
MCHC	**g/dL**	31 – 37	31 – 37	31.5 – 34.5	31.5 – 34.5
WBC	**x 10^9/L**	5 – 15	5- 13	4.0 – 10.0	4.0 – 10.0
Neuts	**x 10^9/L**	1.5 – 8	2 – 8	2 – 7	2 – 7
Lymphs	**x 10^9/L**	6 – 9	1 – 5	1 – 3	1 – 3
Monocytes	**x 10^9/L**	0.2 – 1.0	0.2 – 1.0	0.2 – 1.0	0.2 – 1.0
Eosinophils	**x 10^9/L**	0.1 – 1.0	0.1 – 1.0	0.02 – 0.5	0.02 – 0.5
Basophils	**x 10^9/L**			0.02 – 0.1	0.02 – 0.1
Platelets	**x 10^9/L**	200 – 490	170 – 450	150 – 410	150 – 410
RDW	**%**			11.6 – 14.0	11.6 – 14.0
Reticulocytes	**x 10^9/L**	30-100	30-100	50 - 100	50 - 100

Source: *Dacie and Lewis Practical Haematology 12th Edition*

Table 20: Pregnancy Reference Ranges LI-HAEM-0028

Parameter	Units	1st Trimester	2nd Trimester	3rd Trimester
WBC	X 109/L	5.7-13.6	6.2-14.8	5.9-16.9
Haemoglobin	g/L	11.0-14.3	10.0-13.7	9.8-13.7
MCV	fl	81 - 96	82 - 97	91 - 99
HCT	L/L(Ratio)	0.31 – 0.41	0.30 – 0.38	0.28 – 0.39

Reference: Haematological Values during Pregnancy (Blood Cells. A Practical Guide. Barbara J. Bain; third Edition)

Table 21: Coagulation Reference Ranges LI-HAEM-0028

Reference Range Source: **PT, APTT & Fibrinogen**: Locally established. **D-Dimer**: Instrumentation Laboratory Expected values Documentation & *ED-HAE-0175 BMJ 2013:346 Age related D-Dimer Ref Ranges*

PT/INR	PT 10.1 – 12.9 Secs INR*
APTT	25 – 36.5 Secs **
D-Dimer **	Up to 50 yrs <500 ng/ml FEU 51 to 60 yrs <600 ng/ml FEU 61 to 70 yrs <700 ng/ml FEU 71 yrs & over <800 ng/ml FEU Results higher than 128,000, **report as >128,000** Results <215, **report as <215**
Fibrinogen	1.7 – 4.5 g/l **

*INR. Please refer to clinical guidelines for the INR target for a given clinical condition
** These tests for Our Lady's Hospital patients only

Table 22: ESR Reference Ranges LI-HAEM-0028

ESR	UNITS	<17YRS	17-50YRS	51-60YRS	61-70YRS	>70YRS
MALE	**mm/hour**	**0-12**	**0-10**	**0-12**	**0-14**	**0-30**
FEMALE	**mm/hour**	**0-12**	**0-12**	**0-19**	**0-20**	**0-35**

Reference Range Source: Dacie and Lewis Practical Haematology

30 COMMUNICATIONS OF CRITICAL RESULTS

Table 23: Haematology Phoning Results, Adding Blood Films Classification of Critical Results:
RED – Communication required within **2 hours** **YELLOW** – Communication required within **24 hour**
Ref.: *ED-GEN-0246: National Laboratory Handbook: Communication of Critical Results for Patients in the Community*

TEST	PHONE	ADD FILM
Haemoglobin g/dl	**<5** If Hypochromic /Microcytic **<7** If Normochromic /Normocytic ≥20	**Male: <10g/dl** **Female: <9g/dl** (if not post-op) **>18g/dl**
MCV fl	NA	**<70** or **>105 fl**
MCHC g/dl	NA	**>37** make film on warmed sample if result persists after warming sample.
Platelets $x10^9$/L	**≤50** or ≥600 **≤30**	Platelet Count: <100 or >750 $x10^9$/L
RDW%	NA	>16 if Hb & MCV **Normal** >24 if Hb & MCV **Abnormal**
White Cell Count $x10^9$/L	**<2**or **≥30x**10^9/L	**<2**or **>20x10^9/L**
Neutrophils $x10^9$/L	**≤1.0** **≤0.5**	**<1.5** or **>20x10^9/L**
Lymphocytes $x10^9$/L	NA	**>5.0x10^9/L**
Monocytes $x10^9$/L	NA	**>1.5x10^9/L**
Eosinophils x10^9/L	NA	**>2.0x10^9/L**
Basophils $x10^9$/L	N/A	**>0.25**
COAG		
PT/INR**	**PT >115 Seconds** **INR >5.0**	NA
Please refer to Clinical Guidelines for the INR target for a given clinical condition		
APTT	**≥50 Seconds**	N/A
D-Dimer	**>7,650** If no previous test	N/A
Fibrinogen	**<1.5**	N/A
OTHER		
ESR	If Query temporal arthritis	>100 mm/hr
Infectious Mononucleosis Screen	Positive	**Add Film**
Sickle Cell Screen	Positive	**Add Film**
Malaria Screen	Positive	**Add thick and thin blood films**

31 ADVISORY SERVICES

Where there is uncertainty over the requesting or interpretation of Haematology Tests, the Haematology Department should be contacted for advice. Clinical queries may be addressed by contacting the Consultant Haematologist(s). All special Haematology Requests should be made in consultation with the Haematology Consultant(s). The Haematology Clinical Team in the Mater Hospital should be contacted by the Haematology Department if any patient has unexplained extremely critical results, such as a Platelet count of $<10x10^9$/L, Neutrophils <0.5, Pancytopenia, new suspected Acute Leukaemia or other Haematological Disorders.

- Any urgent haematology consultations during 9:00am-5pm (Mon-Fri) should be directed to Dr Su Maung, Consultant Haematologist **or** MMUH Haematology Registrar covering lab/consult (bleep 2925) through MMUH switchboard (018032000)
- Routine consultations should be discussed over the phone to MMUH Haematology Registrar covering lab/consult or Dr Su Maung, Consultant Haematologist through switchboard
- Consultations can also be requested by filling out the *LF-HAEM-0145 Request for In-patient Haematology Consultation* form. The form should be left at the reception for Dr Maung.
- If Dr Maung is on leave, on call Consultant Haematologist can be contacted through MMUH switchboard for advice
- Referrals for new haematology outpatient clinic will be triaged and all new patients will be seen in MMUH.

BIOCHEMISTRY

32 BIOCHEMISTRY INTRODUCTION

32.1Service Description

The Biochemistry Department is responsible for measurement of clinical constituents (ranging from ions to complex proteins) of body fluids, for use not only in the diagnosis of disease, but also in monitoring the course of disease, the effect of treatment, prognosis and screening. This Department also provides analysis of hormones, drugs and tumor markers.

Analyses that are not performed in the laboratory will be referred to external laboratories for testing when appropriate (see referral section of this user manual)

32.2Contact Details

Section	Phone Extension Inside the Hospital	Phoning from Outside the Hospital
Biochemistry	(Technical Queries only) 2574 - Routine Hours OLH Switchboard- Out of Hours	046 9078574

33 BIOCHEMISTRY TEST INDEX

33.1Routine Biochemistry Tests:

NOTE: In house urgent requests have a turnaround time of 90 minutes

Table 24: Routine Biochemistry Tests

Test/Profile	Specimen Type	Additive Required	Volume Required	Container Type	Turnaround Time
Clinical Chemistry					
Renal Profile Sodium, Potassium*, Creatinine, Urea Please note Potassium is not routinely offered to GPs. Potassium must be specifically requested, marked as urgent and arrive into the laboratory <4hrs after the sample is taken	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours – GPs
Liver Profile Total Bilirubin, ALT, ALP, GGT, Total Protein, Albumin	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours - GPs
Bone Profile Calcium, Phosphate, ALP, Mg, Albumin, Corrected Calcium	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours - GPs
Iron Profile Iron, transferrin saturation, transferrin, ferritin	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours - GPs
GP Profile RFT, LFT, Calcium, Lipids	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours - GPs
Fasting GP Profile RFT, LFT, Calcium, Fasting Lipids	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours - GPs
Fasting Lipid Profile Cholesterol, Triglyceride, HDL/LDL	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours - GPs
Troponin-I (In-patient only)	Blood	EDTA	4.0 ml	Purple Top Tube	90 minutes
Glucose	Blood	Fluoride Oxolate	4.0 ml	Grey Top Tube	Same day (In-patients) 24 hours - GPs
Total Bilirubin	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours - GPs
Procalcitonin	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	2 Hours
Total Protein/ALB/LDH	Fluids	None	1.0 ml	Universal Container	Same day
Glucose & Protein	CSF	None	0.5 ml	CSF tubes	2 hours
Amylase	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours - GPs

Test/Profile	Specimen Type	Additive Required	Volume Required	Container Type	Turnaround Time
Magnesium	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours - GPs
Uric Acid	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours - GPs
HbA1c	Blood	EDTA	4.0 ml	Purple Top Tube	48 hours
Vitamin D	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Specific Proteins					
C-Reactive Protein-CRP (Special Request GPs)	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours - GPs
Rheumatoid Factor (RA)	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours – GPs
NT-pro BNP	Blood	Serum	5.0 ml	Separate Red/Yellow Top Gel Separator Tube	1 Day
Transferrin	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same day (In-patients) 24 hours – GPs
Endocrinology					
Thyroid Stimulating Hormone (TSH)	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Free T4 (T4)	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Total T3 (T3)	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Follicle Stimulating Hormone (FSH	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Luteinising Hormone (LH)	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Oestradiol	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Cortisol	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Prostatic Specific Antigen (PSA)	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Progesterone	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Prolactin Please note Macroprolactin reflexed on Female samples with prolactin >600 m IU/L	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours

Test/Profile	Specimen Type	Additive Required	Volume Required	Container Type	Turnaround Time
Male samples with prolactin >550m IU/L					
B-HCG	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Haematinics					
B12	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Folate	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Ferritin	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Iron	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	24 hours
Transferrin Saturation	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same Day
Drugs					
Digoxin	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same Day
Lithium	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same Day
Paracetamol	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same Day
Antibiotic Therapies					
Gentamycin	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same Day
Vancomycin	Blood	Serum	5.0 ml	Red/Yellow Top Gel Separator Tube	Same Day
Urinary Chemistries					
Amylase	Random Urine	None	10-20mls	Universal Container	24 hours
Sodium/Potassium	Random Urine 24 Hour Urine	None	10-20mls Urine	Universal Container	24 hours
Microalbumin Albumin/Creatinine Ratio	24 Hour Urine	None	24 Hour Urine Collection	24 Hour Urine Container	24 hours
Protein	24 Hour Urine	Acidified Container	24 Hour Urine Collection	24 Hour Urine Container	24 hours
Creatinine Clearance	Random Urine 24 Hour Urine	None	10-20mls Urine	Universal Container	24 hours

This is the Red/Yellow top Gel Separator Serum tube used for Biochemistry Tests.

This is the grey top fluoride oxalate tube used for Blood Glucose Tests.

This is the purple top EDTA sample tube used for Troponin Tests

33.2On-Call Biochemistry Tests

The following tests are performed on-call. The urgency of the request should be agreed by telephone with the on-call Medical Scientist.

Table 25 On-Call Biochemistry Tests

On-Call Biochemistry Tests	
COMMON REQUESTS	**RARE REQUESTS**
Renal Profile	**Uric Acid**
Liver Function Tests	**CSF Glucose & Protein**
Bone Profile	**Digoxin (Consultant Request)**
Amylase	**Gentamycin/Vancomycin**
C-Reactive Protein	**Lithium**
Creatine Kinase (CK)	**Paracetamol**
AST	**HCG**
LDH	**TSH (Consultant Request) LF-BIO-0026 to be completed**
Glucose	
Troponin-I	

34 BIOCHEMISTRY TEST INFORMATION

There is a vast range of Biochemistry tests available and information on the requesting and interpretation of these tests for use in the diagnosis and treatment of disease is well documented in numerous textbooks.

35 REFERENCE RANGES

Age and sex specific reference ranges for all tests performed in the Biochemistry laboratory are included on test reports. Information on the source of these reference intervals are available from the laboratory, if required.

For pediatric reference ranges visit https://caliper.research.sickkids.ca please contact the laboratory for any assistance on this website

Please review **Table 26 for pregnancy related ranges**.

Table 26 displays pregnancy related reference ranges for all tests performed in the Biochemistry laboratory. All pregnancy related reference ranges have been sourced from http://perinatology.com/Reference/Reference%20Ranges/Reference%20for%20Serum.htm

Table 26: Pregnancy Related Reference Ranges LF-BIO-0096

Test	Units	First Trimester	Second Trimester	Third Trimester
Alanine Aminotransferase, ALT, Sgpt (Serum)	U/L	3-30	2-33	2-25
Albumin (Serum)	g/L	31 - 51	26 - 45	23- 42
Alkaline Phosphatase (Serum)	U/L	17 - 88	25 - 126	38 - 229
Amylase (Serum)	U/L	24 -83	16 -73	15 - 81
Aspartate Aminotransferase, Ast (Serum)	U/L	3 - 23	3 - 33	4 - 32
Bilirubin , Total (Serum)	µmol/L	1.7 - 6.8	1.7 - 13.7	1.7 - 18.8
Calcium, Total (Serum)	mmol/L	2.2 - 2.65	2.05 - 2.25	2.05 - 2.43
Chloride (Serum)	mmol/L	101 - 105	97 -109	97 - 109
Cholesterol, HDL (Serum)	mmol/L	1.04 - 2.02	1.35 - 2.25	1.24 - 2.25
Cholesterol, LDL (Serum)	mmol/L	1.55 -3.96	1.99- 4.77	2.62 - 5.8
Cholesterol, Total (Serum)	mmol/L	3.65 - 5.44	4.56 - 7.74	5.67 - 9.04
Cortisol	nmol/L	193-524	276-1159	331-1380
C-Reactive Protein (Serum)	mg/L		0.4 -20.3	0.4 - 8.1
Creatinine (Serum)	µmol/L	35 - 62	35 - 71	35 - 80
Creatine Kinase , Total (Serum)	U/L	27 - 83	25 -75	13 - 101
Estradiol (Serum)	pg /mL	188 - 2497	1278 - 7192	6137 - 3460
Ferritin (Serum)	ng/mL	6 - 130	2 - 230	0 - 166
Folate, Serum	ng/mL	2.6 - 15	0.8 - 24	1.4 - 20.7
Gamma Glutamyl Transferase Ggt (Serum)	U/L	2 - 23	4 - 22	3 - 26
Glomerular Filtration Rate (Gfr)	mL/min	131 - 166	135 - 170	117 - 182
Glucose, Fasting (Plasma)	mmol/L	-	4.2 - 4.4	4 - 4.3
Iron (Serum)	µmol/L	13 - 26	8-32	5-35
Lactate Dehydrogenase, LDH (Serum)	U/L	78 - 433	80 - 447	82 - 524
Magnesium (Serum)	mmol/L	0.67 - 0.92	0.63 - 0.92	0.46- 0.92
Phosphorus, Inorganic Phosphate (Serum)	mmol /L	1 - 1.49	0.81 - 1.49	0.9 - 1.49
Potassium (Serum)	mmol /L	3.6 - 5	3.3 - 5	3.3 - 5
Protein, Total (Serum)	g /L	62 - 76	57 - 69	56 – 67
Progesterone (Serum)	nmol/L	25.4 - 152. 6	-	314.8 - 1,087.5
Prolactin (Serum)	Miu/l	763-4516	2332 - 6996	2904-7886
Sodium (Serum)	mmol/L	133 - 148	129 - 148	130 - 148
Testosterone, Total (Serum)	mmol/L	0.9 -7.32	1.2 - 8.4	2.2 - 10.7
Thyroid Stimulating Hormone (TSH)	mIU/L	0.1 - 2.5	0.2 - 3	0.3 - 3
Total Iron-Binding Capacity, TIBC (Serum)	µmol/L	42 - 73	54 - 93	68 - 107
Triglycerides (Serum)	mmol/L	0.5 - 1.8	0.9 - 4.3	1.5 - 5.1
Thyroxine Free, Ft4 (Serum)	pmol/L	10.3 - 15.5	7.7 - 12.9	6.4 - 10.3
Urea Nitrogen , (Serum)	mmol/L	2.5 - 4.3	1.1 - 4.6	1.1 - 3.9
Uric Acid (Serum)	µmol/L	119 - 250	143 - 292	184 - 375
Vitamin D	pmol/L	52-169	187-416	156-309
1 Hour Oral Glucose Tolerance Test, OGTT (, Plasma)	mmol/L	Not required	Not required	7.2 or 7.8
2 Hour 75-G Oral Glucose Tolerance Test, OGTT, (Plasma)	mmol/L	5.1	-	10
24 Hour Potassium Excretion (Urine 24 Hour Collection)	mmol/24 h	-	17 - 33	14154
24 Hour Creatinine Clearance (Serum Creatinine, Urine 24 Hour Collection)	mL/min	-	69 - 140	55 - 136
24 Hour Sodium Excretion (Urine 24 Hour Collection)	mmol/24 hr	-	53 - 215	34 - 213
24 Hour Protein Excretion, Total , Quantitative, (Urine 24 Hour Collection)	g / 24 hr	-	-	0 - 0.26

36 COMMUNICATION OF CRITICAL RESULTS

Table 27 lists the critical results that are phoned to the relevant ward/clinician:
Category **A** – Communication required within **2 hours**
Category **B** – Communication required within **24 hour**

Biochemistry	Units	Range	Critical Phone limits	Urgency	*Notes*
ALT	IU/L	0 – 55	**> 825**	**B**	*+ Phone if ↑ pregnancy*
Amylase	IU/L	23 – 96	**> 480**	**A**	
Corrected Calcium	mmol/L	2.1 – 2.6	**≤ 1.8 or ≥ 3.0**	**A**	*If ↓↓↓ Query EDTA contamination*
CK	IU/L	30 – 200	**>5000**	**A**	
Creatinine	µmol/L	64–104 m, 49-90 f	**> 345**	**A**	*If Chronic Renal Failure is ruled out*
eGFR	mL/min		**<15**	**A**	
CRP	mg/L	0.2 – 5.0	**> 300**	**A**	*For all GP patients and on first occurrence in- patients*
Glucose	mmol/L	3.89 - 5.83	**<2.5 or > 25** **<2.7 or > 10**	**A**	*On a New patients* *On Pregnant women & Children*
Iron	µmol/L	5 – 25 m 4 – 27 f	**> 50**	**B**	
Magnesium	mmol/L	0.66 – 1.07	**< 0.41**	**A**	
Potassium	mmol/L	3.5 – 5.0	**≤ 2.5 or ≥ 6.0**	**A**	*Ref: LI-BIO-0035*
Phosphate	mmol/L	0.74 – 1.52	**≤ 0.3**	**A**	
Phosphate	mmol/L	0.74 – 1.52	**≤0.45 or ≥ 3.0**	**B**	*If ↑↑↑ ? >24hrs old*
Sodium	mmol/L	137 – 144	**≤ 120 or ≥ 155**	**A**	*If significantly↓ ? from a drip site*
Total Bilirubin	µmol/L	3.4 – 20.5	**> 175***	**A**	**On first occurrence*
Total Protein	g/L	64 – 83	**> 95**	**B**	*Suggest Immunoglobulins + SPEP*
Triglycerides	mmol/L	0 – 1.7	**> 20**	**B**	*>10 don't report HDL or LDL*
Urea	mmol/L	2.5 – 9.0	**>30***	**A**	**On first occurrence*

Drugs	Units	Range	Critical Phone limits	Urgency	*Notes*
Digoxin	nmol/L	0.8 – 2.0	**>2.5**	**B**	*Phone all above therapeutic range*
Gentamycin	mg/L	<1 (Daily) 0 – 2 (Pre) 4 – 10 (Post)	**>1** (Once ***Daily*** Dose) **>2** (Pre- ***Divided*** Dose) **>10** (Post ***Divided*** Dose)	**B**	*Phone the ward and the Consultant Microbiologist if result is above therapeutic range*
Lithium	mmol/L	0.6 – 1.2	**>1.5**	**B**	
Paracetamol	mg/L	10 – 30	**> 30**	**B**	*Phone the ward if result is above therapeutic range.*
Vancomycin	mg/L	15 - 20	**>20** (Single Dose)	**B**	*Phone the ward and the consu Microbiologist if result is above therapeutic range*
Immunoassay	**Units**	**Range**	**Critical Phone limits**	**Urgency**	***Notes***
Troponin I	ng/L	0 – 35	**>35 male** **>15.6 female**	**A**	*Refer to LI-BIO-0044 for Management of Acute chest pain*
Free T4	pmol/L	9 – 19	**>50**	**A**	*Phone All >30*
Prolactin	mU/L	73 – 409 Males 109 – 557 Females	**>1000**	**B**	*On first elevation, suggest Macroprolactin*
CSF	**Units**	**Range**	**Critical Phone limits**		***Notes***
CSF Glucose	mmol/L	2.2 – 4.4	**<2.2**	**A**	*Phone all below therapeutic range*
CSF Protein	g/L	0.15 – 0.45	**>0.45**	**A**	*Phone all below therapeutic range*

Category **A** – Communication required within **2 hours**
Category **B** – Communication required within **24 hour**

Refer to
LP-BIO-0013 Authorisation of results in Biochemistry
LI-BIO-0045 Management of Acute chest pain with hsTroponin
ED-GEN-0246 Communication of Critical results for Patients in the Community, National Irish Guidelines 2019

36.1 24 Hour Urine Collection

- Certain tests require the addition of strong acid as a preservative.
- The preservative is corrosive and can cause personal injury [burns] or damage to property.
- The patient should not urinate directly into the preservative.
- A clean jug or bottle should be used to collect the urine and then it should be slowly and carefully poured into the preservative container.
- If the acid should come in contact with skin or eyes, rinse immediately with cold running water and medical advice should be sought.

Procedure for 24 hour collection *for patients*:

1. *In the morning, empty your bladder into the toilet. Note the time. Note this time as 'Start Time' on the urine container label*
2. *Collect all urine for the next 24 hours into a clean jug and carefully pour the urine in to the Acid Container.*
3. *Between each addition, cap and mix the container. Keep the container cool at all times*
4. *The next day at the time already recorded on the container, (24 hours after the start time) empty your bladder and add this urine to the container. [If you need more time to produce this urine, then wait until you can and note this time on the container]*
5. *Ensure the container is correctly labelled with your Name and Date of Birth*
6. *Bring the container to the laboratory as soon as possible. Keep the container cool until such a time as you can transport it to the laboratory.*

Note:

- *Please note that it is important that all urine within the specified 24 hours is collected as loss of any urine from the sample will invalidate the results of the analysis.*
- *If you forget and lose a sample down the toilet, then please throw away all the urine collected and start another 24 hours having acquired another urine container from the laboratory. (Tel 046 9078701)*

37 BLOOD GAS ANALYZERS

Blood gas analyzers are placed in strategic locations in the hospital. If the analyzer is mal-functioning in a particular area, contact the Biochemistry Department to log the fault. The analyser that is designated as the back-up analyser for the particular area may be used in the interim time period.

Table 28: Location of Blood Gas Analysers and the Designated Back-up

Area	Designated Back-up
Accident & Emergency Department	ICU
ICU	Accident & Emergency Department

38 ADVISORY SERVICES

If advice is required on the appropriate selection of tests and interpretation of results, the Biochemistry Department should be contacted. The staff in the Biochemistry Department have access to the advisory services of Dr Paula O'Shea, Consultant Clinical Biochemist and the query can be re-directed to Dr Paula O'Shea if it is not possible to clarify the request locally.

MICROBIOLOGY

39 INTRODUCTION

39.1 Service Description

The Microbiology Department offers a range of diagnostic services in Microbiology. It is also involved in the reporting of notifiable diseases in conjunction with the Surveillance Scientist to the Health Protection Surveillance Centre (HPSC), Ireland's specialist agency for the surveillance and control of communicable diseases.

39.2 Contact Details

Location	Number
Microbiology Department	046 9078576 (extn 2576) - Routine Hours OLH Switchboard- Out of Hours
Microbiology Consultant	Contact through OLH Switchboard

40 SPECIMEN COLLECTION

Microbiology results depend largely on the type and quality of the specimen received. Therefore they should be both representative and fresh for optimum results. It is imperative that Microbiology specimens are delivered to the Laboratory immediately, delay may result in invalid results. With the exception of blood cultures, specimens not dispatched on same day should be stored at 4°C before analysis, Refer to Table 25 for special considerations.

Where possible, collect specimens before commencement of anti-microbial therapy. Please send an adequate amount of specimen. Please provide adequate clinical details and highlight if special or additional test required. Contact the Consultant Microbiologist if clinical discussion is required.

In the case of > 2 tests ensure relevant request forms and sufficient samples are sent.

Specimens that are not processed on day of receipt should be stored at 4°C.

Samples are rejected and not processed in the following circumstances:

- Samples that do not comply with the labelling criteria
- Leaking specimens that would pose a health and safety risk to staff
- Incorrect specimens for test requested
- Duplicate samples (on advice from Consultant Microbiologist/ in accordance with established procedure)
- Samples are too old for processing- > 4 days for swabs; > 4 days for urine in boric acid (green top); > 3 days for urine in monovette (yellow top); NPS > 48 hours at RT for SARS-CoV-2/ Flu A, B/ RSV when 4 plex kit available;

Unrepeatable samples: Amendments to these samples must be approved by the patient's Consultant, Register or Team. The sample taker must then attend the Laboratory and complete the *LF-GEN-0047 Sample Amendment Form.*

40.1 Microbiology Specimens and Sample Containers

Table 29: Microbiology Specimen and Sample Containers

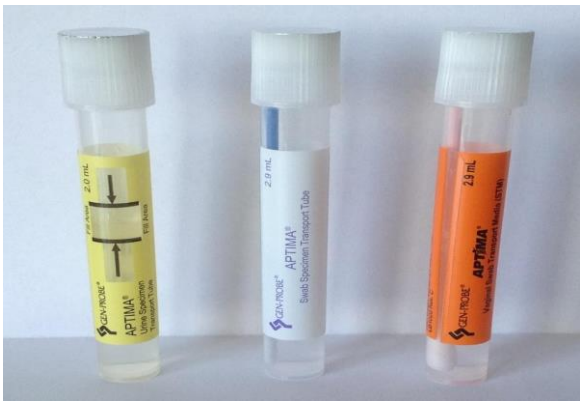
Sample/ Test	Container Type
Urines for Microscopy, C&S	Green Topped Boric Acid Monovette 10ml Tube
Small volume urine (< 2mls)	Yellow Topped Monovette 10ml Tubes – Bulk Packed
CSU for Microscopy, C&S	Yellow Topped Monovette 10ml Tubes – Sterile Packed
Faeces, Sputa, Joint, Ascetic & Plural Fluids, CSF	Universal Container – White Topped Tube 50mls
Collection of specimens from genital tract, wounds, MRSA	Transport Swab – Blue (Contain transport medium)
Blood	Blood Culture Bottles: Aerobic – Green, Anaerobic – Orange
CSF for Xanthochromia	Brown Plastic Tube – 10ml
Bordella pertussis	Peri-nasal swabs – Blue Top
Viral Culture	Viral Swabs – Pink Top
Adult Urine or Urethral Swab, ECS	Chlamydia Aptima Kits
Saliva (Mumps)	Oracol Saliva Collection System
SARS-CoV-2 /Influenza /RSV (Molecular) In-patients, admissions, staff, pre electives where required	Nasopharyngeal Swab (NPS)(red top with viral transport media) Ref.:*ED-MIC-078 Nasopharyngeal Specimen Collection*
SARS-CoV- 2 screen for pre electives where required	NPS in lysis buffer (orange top)- referral only
Extended respiratory panel	Red topped NPS- referral only
Influenza (GPs)	Throat swab +/ Nasal swab

Monovette Containers: Urine Specimens for Culture Only

Sterile Universal Containers – All Other Urine Samples, Faeces, Sputum, Aspirates

Transport Swabs – Throat, Wound, Ulcer, Abscess, Sinus Swabs

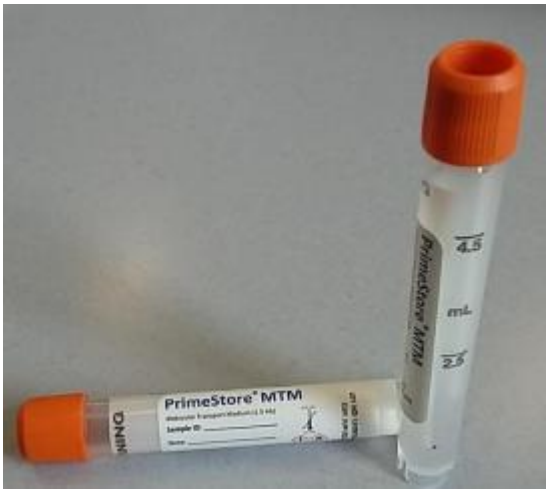
Aptima Swabs – HVS/Urethral Swabs for Chlamydia and Gonorrhea



Viral Transport Swabs for Culture

Red Topped Universal or Viral Transport Medium with Nasopharyngeal /Oropharyngeal Swabs for Flu, RSV, SARS-Co-V2 (Molecular Testing only)

Alternatively Orange Topped Nasopharyngeal Swab with Lysis Buffer for referral



Blood Culture Bottles for In-Patients Only

Mumps Swabs (Available on Request from the Laboratory)

40.2 Urines for Culture & Sensitivity

Mid-stream Urine (MSU): Avoiding the first part of voided urine and without interrupting the flow, approximately 20ml is collected into a sterile universal. An aliquot is then transferred to the Boric Acid Monovette up to the mark (10ml). Small samples (< 2ml) from babies/ children should be transferred to the yellow topped monovette without boric acid.

Clean Catch Urine: Thorough peri-urethral cleaning is recommended. The whole specimen is collected into a sterile container and then an aliquot is sent for examination.

Bag Urine: A sterile bag is taped over the freshly cleaned and dried genitalia and the collected urine is transferred to the specimen container

Catheter Specimen of Urine: This is collected into an individually wrapped yellow topped monovette by attaching directly to the catheter tube.

40.3 Faeces

The specimen may be passed onto a clean, dry, disposable bed-pan or similar container and a representative sample is transferred into the sterile faeces container.

40.4 Sputum

Sputum should be expectorated from the lower respiratory tract by deep coughing. When the cough is dry, physiotherapy, postural drainage or inhalation of an aerosol before expectoration may be helpful.

40.5 Genital Tract Specimens

Vaginal Specimens: These specimens should be taken with the aid of a speculum avoiding vulval contamination. The swab should be rolled firmly over the surface of the vaginal vault. For Trichomonas, the posterior fornix, including any obvious plaques should be swabbed.

Cervical Specimens: These specimens should be taken with the aid of a speculum avoiding vulval contamination. The swab should be rotated inside the endocervix.

Urethral Specimens: Contamination with micro-organisms from the vulva or foreskin should be avoided. For male urethra, if discharge is not apparent, attempts should be made to "milk" exudates from the penis. The patient should not have passed urine for at least one hour. The swab is passed gently through the urethral meatus and rotated.

40.6 MRSA Screening Swabs

For admission or ward screening, nasal and groin swabs are required for routine adult screening. If it is clinically or epidemiologically indicated, swabs can be taken from abnormal skin lesions (e.g. eczema, dermatitis, psoriasis, wounds, burns), manipulated sites (e.g. intravenous lines and urinary catheters) etc. Moisten swab in a small amount of sterile water or saline in a Universal Container before swabbing site.

Nasal Swab: Insert swab onto the lower end of the nostril. Swab the skin just inside the nostril by rubbing three times clockwise and three times anti-clockwise.

40.7 VRE/ CPE Screening Swabs

Rectal swabs are used for the basic screen on all patients. A stool sample may be taken and the sample swabbed using standard MW120 swab.

40.8 Upper Respiratory Swabs and Aspirates (Ear, Nose, Throat, Gum, Mouth, Tongue, Antral Wash-out, Endotracheal Tube)

Throat Swab: Sample the tonsillar area or posterior pharynx avoiding the tongue and uvula.

Nasal Swab: Sample the anterior nares by gently rotating the swab over the mucosal surface.

Mouth Swab: Sample any lesions or inflamed areas. The use of the tongue depressor or spatula will aid vision and avoid contamination from other parts of the mouth.

Aspirates: A minimum of 1mL is required for aspirates.

40.9Peri-nasal Swabs

This type of swab is required for investigation of *Bordetella pertussis* (Whooping Cough). The specimen can be obtained using a flexible wire swab. Bend the flexible wire of the swab in the shape of an arc. With the tip directed downwards, pass the swab gently along the floor of the nose for about two inches until it meets the resistance of the posterior wall of the nasopharynx. Allow the swab to remain in the nasopharynx for a moment so that secretions are absorbed onto the swab.

40.10 Nasopharyngeal / Oropharyngeal Swabs/ Aspirates (Flu/RSV/SARS-CoV-2)

Nasopharyngeal: Insert the swab into either nostril, passing it into the posterior nasopharynx. Rotate swab by firmly brushing against the nasopharynx several times

Oropharyngeal: Swab the posterior, tonsils and other inflamed areas. Avoid touching the tongue, cheeks and teeth with the swab when collecting specimens.

In both cases, remove and place the swab into the tube containing clinical/viral/molecular transport medium. Break swab at the indicated break line and cap the specimen tube tightly.

Nasal Aspirates: Transfer 600μL of the sample into the tube containing 3mL viral transport medium using a sterile pipette, cap the tube tightly.

Ref: https://www.cdc.gov/coronavirus/2019-nCoV/lab/guidelines-clinical-specimens.html

40.11 Eye Swabs

Retract the lower eyelid and stroke the tarsal conjunctiva with a swab and remove all purulent material.

40.12 Superficial Wound Swabs and Intravascular Cannulae Tips

Superficial Wound Swabs: Sample a representative part of the lesion. Soak the swab well in any pus or exudates. Samples of pus, if present, are preferred to swabs.

Intravascular Cannulae Tips: disinfect the skin around the cannula entry site. Remove the cannula using aseptic technique and cut approximately 4cm of the tip into a sterile container using a sterile scissors.

40.13 Swabs and Pus from Abscesses, Post-operative Wounds and Deep-seated Wound Infections

Aspirate pus and transfer to sterile Universal Container. If swabs are used, sample the deepest part of the wound to avoid superficial colonising microflora. Swabs must be well soaked in pus.

40.14 Fluids from Sites Normally Sterile

Sterile fluid specimens are collected by aseptic percutaneous aspiration or intraoperatively and transported in a clean, sterile container. Please alert laboratory if urgent gram stain is required. Collect also in EDTA Sample Tube specifically if cell count is required.

40.15 Blood Cultures

The optimal time for collection is before anti-microbial therapy for adults and during temperature spike. Two BacT/ALERT culture bottles are required, an aerobic bottle (green cap) and an anaerobic

bottle (orange cap). It is essential that great care is taken in the collection of blood for culture to ensure no contaminant is introduced that may be misinterpreted as a significant isolate.

Firstly prepare the skin

- Perform hand hygiene
- Apply a clean tourniquet if applicable to identify a vein
- Select a suitable venepuncture site
- Disinfect the skin at the venepuncture site for about a minute with a single wrapped alcohol swab.
- **Allow the skin to dry**; this will take a few minutes.
- Decontaminate hands again and apply clean gloves
- Avoid touching the venepuncture site after disinfection
- Follow the principles of Aseptic Non-Touch Technique (ANTT) Blood cultures should be performed aseptically.

Bottle preparation and venepuncture

- Perform hand hygiene
- Carefully remove the plastic cap from each blood culture bottle and avoid touching the rubber septum.
- Disinfect the septum with a single wrapped alcohol swab and **allow to dry**.
- Place the adapter cap over the blood culture bottle and press straight down to pierce the septum.
- Insert a needle or collection device.
- Hold the blood culture bottle upright and below the level of the draw site when filling with blood.
- Inoculate the blood into each bottle through the rubber septum.
- Withdraw **5-10mL** of blood in each bottle.
- Release the tourniquet and withdraw the needle and syringe.
- If a central line is present, withdraw the blood from the central line and from a peripheral vein also.
- Changing needles between venepuncture and inoculation of the bottles is not recommended as this carries the risk of needle stick injury.

- Mix gently by swirling bottles.
- Discard sharps and/or collection equipment into a sharps bin.
- Remove gloves and decontaminate hands.

Label the bottles appropriately using blood track labels, or by hand. Small addressograph labels may be used. Do not cover any part of the barcode label on the bottles.

Transport to the laboratory as soon as possible and within 4 hours from collection.

40.16 CSF and Meningitis Specimens

Specimens are collected preferably before initiation of antimicrobial therapy. Please alert laboratory before sending sample-both during routine hours and on call

The following specimens should be collected:

CSF: Collect aseptically in sequence into Universal Containers labeled 1, 2 and 3 for C&S. Collect 1mL in a 10mL brown plastic tube for xanthochromia. Please provide relevant clinical details if viral and/or bacterial PCR requested. Always send blood culture also when lumbar puncture performed.

EDTA Blood: This may be required for bacterial PCR.

CSF should always be dispatched to the laboratory immediately. Cells in CSF disintegrate and any undue delay may produce a cell count that does not reflect the clinical situation of the patient.

Ensure samples are handed directly to a Medical Scientist at Laboratory Specimen Reception.

40.17 ZN Stains/TB Culture

All ZN stains and TB cultures are performed in the Irish National Mycobacterium Reference Laboratory (INMRL) St James's Hospital. Samples are sent from the Microbiology Department by courier daily Monday to Friday.

Turnaround Times: ZN Stain – 24 hours; TB Culture – 7 weeks final negative result;

TB Sensitivity – 21 days from positive.

Specimen Collection

Take into an appropriate sterile specimen container and tighten the lid firmly. A separate sample and request form is required for TB/ZN and routine C&S.

Sputum samples should be from deep in the lungs (not saliva), 2-5mLs, procured on 3 consecutive days. Urine samples are only acceptable when a diagnosis of renal or milliary TB is suspected, an

early morning MSU or CSU should be taken in 3 consecutive days and relevant clinical details must be provided. Actual pus samples are more appropriate than pus swabs.

Reporting of Results for TB

All positive ZN smears or TB culture reports will be telephoned directly to the Microbiology Department. The Consultant Microbiologist, the clinical team and the IPCT are informed. Mycobacterium results are now available on CIDR and as such are communicated to the Public Health in this manner. Negative results will not be telephoned. Printed copies of ZN, TB culture, identification and susceptibility results will be sent out as soon as they become available.

41 MICROBIOLOGY TEST INDEX

41.1Routine Microbiology Tests

Table 30 Routine Microbiology Tests

Specimen	Test	Specimen Volume/ Type	Special Precautions/ Sample Stability	Turnaround Time
Abscess Fluid	C&S	Representative Sample	-	5 working days
Abscess Swab	C&S	Transport Swab	Maximum of 4 days old	5 working days
Anorectal Swab	GBS Screen	Transport Swab	Maximum of 4 days old	5 working days
Arterial Line Tip	C&S	4cm approximately	-	5 working days
Ascites Fluid	C&S, Microscopy Gram & Diff if indicated	2-5mL	For >1 department e.g. Biochemistry, Cytology, a separate form and increased volume is required **Less than 4hours, otherwise refrigerate**	5 working days
Broncho-alveolar Lavage	C&S, Gram	Total Sample	Where possible all specimens should be fresh and taken before antimicrobial treatment is started	5 working days
Bile Fluid	C&S, Gram	2-5mL	**Less than 4hours, otherwise refrigerate**	5 working days
Blood	C&S	510mLAnaerobic/ Aerobic	Do not remove or cover barcode labels on bottles. Do not refrigerate Deliver to laboratory as soon as possible but within 4 hours from collection.	Negative- 6 Positive-4
Bronchial Aspirate	C&S, Gram	Total Sample	**Less than 4hours, otherwise refrigerate**	5 working days

Specimen	Test	Specimen Volume/ Type	Special Precautions/ Sample Stability	Turnaround Time
Bronchial Washings	C&S, Gram	Total Sample	Where possible all specimens should be fresh and taken before antimicrobial treatment is started	5 working days
Central Line Tip	C&S	4cm approximately	-	5 working days
Cerebrospinal Fluid (CSF) ***Please phone Microbiology before specimen is taken***	Microscopy, Differential, Gram stain, Protein, Glucose C&S Xanthochromia Meningococcal / Bacterial PCR Viral PCR Oligoclonal Bands TB PCR	3 Numbered Samples Brown Plastic Tube for xanthochromia- Minimum 1mL + EDTA Blood + Serum sample Minimum 500µL Minimum 500µL	Alert Lab before sending samples Minimum Volume: 1ml x 3 samples. 1ml Essential for test- Referred Clinical Chemistry, Beaumont MMRL, Temple St Special request form NVRL SJH SJH	Microscopy-2 hours Culture- 4 days 2 days-Consultant request for urgent 7 working days 7 working days 7 working days See below
Cervical Swab	C&S, Gram (Wet Prep if appropriate)	Transport Swab	Inappropriate specimen pre puberty – take a vaginal swab	5 working days
Corneal Scrapings/Intraocular Fluids	Parasitology	Sterile Container	Contact consultant Microbiologist in advance	5 working days
CVP Line Tip	C&S	4cm approximately	-	5 working days
Ear Swab	C&S	Transport Swab		5 working days
Endotracheal Tube	C&S, Gram	Total Sample	-	5 working days
Eye Swab	C&S	Transport Swab	Maximum of 4 days old	5 working days
Eye Swab	*Neisseria gonorrhoeae*	Aptima Swab	Sent to the NVRL	7 working days
Eye Swab	*Chlamydia trachomatis*	Aptima Swab	Sent to the NVRL	7 working days
Faeces	Aerobic, C&S	Representative Sample	Do not overfill sample container	5 working days
Faeces	Occult Blood	Samples on 3 consecutive days	Referred. Point of care test available.	5 working days
Faeces	*C.difficile* Screen	Representative Sample		1 working day
Fluids	C&S	Sterile Container	**Less than 4hours, otherwise refrigerate**	5 working days
Fluids	Microscopy	Sterile Container	**Less than 4hours, otherwise refrigerate**	1 day

Specimen	Test	Specimen Volume/ Type	Special Precautions/ Sample Stability	Turnaround Time
Genital Swab	C&S	Transport Swab	Maximum of 4 days old	5 working days
Hair	Fungal Culture, Microscopy	Representative Sample	Sent to St James's Hospital	14-28 working days
HVS	C&S, Gram Stain, GBS, Hay's Criteria	Transport Swab	Aptima collection swab is recommended for detection of *Neisseria gonorrhoeae* & *Trichomonas vaginalis*	5 working days
Joint Aspirate	C&S,Microscopy, Gram & Differential Cell count if indicated	2-5mL	**Less than 4hours, otherwise refrigerate** -	5 working days
Mouth Swab	C&S, Gram Stain	Transport Swab	Maximum of 4 days old	5 working days
MRSA Swab [Nasal, Groin }	MRSA Screen	Transport Swab	Maximum of 4 days old -	4
Nail Clippings	Fungal Culture, Microscopy	Representative Sample	Sent to outside Laboratory	14-35 working days
Nasal Swab	C&S	Transport Swab	Maximum of 4 days old	5 working days
Nasopharyngeal Aspirate (NPA)	Extended Respiratory Virus Screen (referred) SARS CoV-2 /Flu /RSV	Red Topped 3mL Clinical Transport Media(CTM	48 hours at room temperature (RT) 10 days at 2-8 °C ***(OLHN patients only)*** ***Additional tests requests referred***	**In –house** 1 **Referrals to NVRL** 3-4 working days
Nasopharyngeal/ Oropharyngeal swab	SARS-CoV-2/ Influenza /RSV	Red Topped 3mL Clinical Transport Media(CTM) Orange topped 2ml (MTM) Lysis NPS swab	Stable x 48hrs@ RT; 7 days at 2-8 ˚C; Referred to NVRL Stable x 7 days @ RT 28 days at 2-8 ˚C ***(If service not available in house)***	**9hours** **Referrals to NVRL** TAT <72 hours
Perineal Swab	C&S	Transport Swab	Maximum of 4 days old -	5 working days
Pernasal Swab Query Pertussis	*Bordetella pertussis*	Use Perinasal Swab	Do not use ordinary transport swab	5-10 working days
Pleural Fluid	Microscopy Culture	2-5mL	**Less than 4hours, otherwise refrigerate** -	1 working days 5 working days
Pus	C&S, Gram Stain	Ideally, a minimum volume of 1mL of pus should be submitted.	Collect specimens before antimicrobial therapy where possible -	5 working days

Specimen	Test	Specimen Volume/ Type	Special Precautions/ Sample Stability	Turnaround Time
Rectal Swab	VRE/CPE	Transport Swab	Maximum of 4 days old	4
Sinus Aspirates	C&S	Sterile Container	**Less than 4hours, otherwise refrigerate**	5 working days
Skin Scrapings	Fungal Culture, Microscopy	Representative Sample	Referred to SJH	14-28 working days
Skin Swab	C&S	Transport Swab	Maximum of 4 days old	5 working days
Sputum	Aerobic C&S, Gram Stain	Representative fresh sample taken before antimicrobial treatment is started	Where possible all specimens should be from deep in the lungs, no salivary samples	5 working days
Sputum	Mycobacteria	Representative Sample	Please see TB Guidelines below	Referral to SJH Up to 8 Weeks
Throat Swab	C&S	Transport Swab	Maximum of 4 days old	4 working days
Tips	C&S	Sterile Container Cannulae should be collected in appropriate CE marked leak proof containers	Collect specimens before starting antimicrobial therapy where possible, transported and processed as soon as possible	5 working days
Tissue to include Bone, Biopsy, Joint Prosthesis & Bone Marrow	Gram stain Culture &S Enrichment Culture,	Representative Sample No larger than 2 cm^2 in size. (3 - 6 samples recommended).	Collect specimens before starting antimicrobial therapy where possible	1 5 9
Ulcer	C&S	Transport Swab	Maximum of 4 days old	5 working days
Urethral Swab	C&S, Gram Stain,	Transport Swab	Aptima collection swab is recommended for detection of *Neisseria gonorrhoeae* Maximum of 4 days old	**Referrals to NVRL** 1-6 working days
Urine	*Chlamydia trachomatis*	Aliquot of first void specimen	Aptima kits available from Microbiology	**Referrals to NVRL** Up to 7 working days
Urine	Microscopy Culture & S	Representative mid-stream sample at least 2mLs Yellow top < 2mls	Shelf-life is 96 hours in Monovette with Boric Acid (green top); 72 hours in Monovette without Boric Acid (yellow top).	Microscopy: 1 working day Culture: 5 working days
Urine	Pneumococcal and Legionella Antigen	Representative Sample Minimum 5 mL	-	1 working day
Urinary Catheter	Unsuitable Specimen	-	-	Not processed
Vaginal Swab	Hays Criteria Culture & S	Transport Swab	Maximum of 4 days old	5 working days
Viral Swab	Viral Culture	Pink Top Viral Swab	Sent to the NVRL	Up to 7 working days Request if urgent
Viral -Throat/ Nasal Swab	Influenza/ Respiratory screen	Pink Top Viral Swab	Sent to the NVRL	Up to 7 working days
Vomitus	Unsuitable	-	-	Not processed
Vulval Swab	C&S, Gram Stain	Transport Swab	Maximum of 4 days old	5 working days
Wound Swab	C&S, Gram Stain	Transport Swab	Maximum of 4 days old	5 working days

*** When received over lunch-time without advance notice**

- TATs given are for processing of specimens from date of receipt **Monday-Friday** within the Microbiology Laboratory
- Additional 48/72 hours must be added for TAT to include a week-end or Bank Holiday respectively.

41.2 On-call Microbiology Tests

The tests listed in Table 32 are performed on-call.

Table 31: On-call Microbiology Tests

Microbiology On-Call Multi-Disciplinary Tests
Blood Cultures: Blood Cultures received & incubated; Positive Blood Cultures- Gram Stain read and reported; Culture plates set up.
CSF: Performed in-house on call -TAT 2 hours
SARS-CoV-2/ Flu A/B & RSV : 9 hours SARS-CoV-2, Flu A/B & RSV will be tested during Flu/RSV season & as clinically required
Unspecified/other Emergency Microbiology Specimens: Consultant Microbiologist on-call must approve e.g. Joint-fluid, Gram stain &set up culture

41.3Additional Request Form

An additional request form is required for add on test requests.

42 SPECIMEN RETENTION TIME

The retention times for Microbiology specimens are listed below. Occasionally additional analyses may be required but may not always be possible due to the specimen processing procedure in Microbiology. In all cases, please contact the Microbiology Department for advice.

Table 32: Specimen Retention Time

Sample Type	Retention Time
CSF	3 months
Fluids & Tissues	7 days
Positive Blood Cultures	7 days
Significant Culture Plates	3 days
Sputum	7 days
Swabs for culture	7 days
Swabs (Molecular)	7 days
Urines	<2 days

43 COMUNICATION OF CRITICAL RESULTS

All CSF and urgent results will be phoned to the requesting clinician or ward. All significant results will be phoned to the relevant ward or doctor and the Consultant Microbiologist. Infection control results such as SARS-CoV-2 /Flu/CPE will be phoned to a member of the Infection Prevention & Control Team or the CNM3 out of hours as appropriate. All other infection control results will be communicated using the daily Infection Control print out. Notifiable diseases are reported to the Health Protection Surveillance Centre (HPSC). It is the legal responsibility of the requesting clinician to report all notifiable diseases. In OLHN, it is the responsibility of the surveillance scientist to notify HSE via CIDR of any notifiable diseases.

Table 33 Communication of Critical Results

Result	Communicated to :			ID/ Sens where applicable Communicated within: (hrs)
	IPCT (in-patient)	**Consultant Microbiologist (in-patient)	Ward/Requesting Clinician	
To be communicated within hours of receiving sample				
Positive Legionella Ag		√	√	**2**
Positive Gram stain on CSF		√	√	**2**
Sterile Fluid Gram stain (theatre)		√	√	**2**
C. difficile Toxin A/B Detected or PCR Positive	√	√	√	**4**
Positive *Norovirus*	√		√	**4**
Positive Pneumococcal Ag		√	√	**4**
To be Communicated within hours of getting result				
Probable CPE	√	√	√	**2**
Positive CSF culture	√	√	√	**2**
Sterile Fluid/Tissue Culture positive		√	√	**4**
Positive Blood culture ID :- Staph aureus/ Yeast/ *L.monocytogenes*/Strep/Salmonella and if in doubt		√	√	**2**
Blood Culture Gram stain -Yeasts/ GPC in chains/diplococci, GNB, GNCB.		√	√	**2**
Blood culture Positive meningococci (both in case of Gram-stain and culture result)	√	√	√	**2**
Blood Culture Gram stain positive – GPC clusters, diphtheroids, Other.			√	**4**
Group A Strep – in normally sterile sites	√	√	√	**4**
*Positive referred test- VTEC/TB/Bordetella (Stain and culture)	√	√	√	**4**
*Positive referred test- CPE	√	√	√	**4**
Positive SARS Co V2 , Flu A and B, RSV	√		√	**2**
To be communicated As soon as possible where necessary				
Sterile culture sensitivity releasing		√	√	**24**
**Any unexpected result/ unusual pathogen or MDRO where result would impact clinical management of patient		√	√	**24**
Positive referred test- other		√ **(if required)**	√	**24**

Ref. LP-MIC-0085 Communication of Significant Results in Microbiology

44 ADVISORY SERVICES

Contact the Microbiology Department for any queries in relation to any aspect of the service. The Consultant Microbiologist is available by telephone 24/7 via main hospital switchboard.

REFERRAL TESTS

45 INTRODUCTION

Many laboratory tests are performed in the Department of Pathology in Our Lady's Hospital, Navan. However, a number of specialised tests are sent to Referral Laboratories for processing.

This may be due to the requirement of:

- A unique or unusual service
- A service not available in Our Lady's Hospital, Navan
- A Specialist Service
- Confirmation of initial unusual findings
- Back-up service in the event of an unplanned interruption of the service

46 REQUESTING REFERRAL TESTS

The majority of referral tests should be requested on the 'Other Tests' section of the *LF-GEN-0019 Pathology General Request Form*.

Genetic tests require completion of specific forms depending on the referral laboratory used. Please contact Specimen Reception extn 2577 for further information.

External Tests must be requested on a separate Request Form with separate Blood Tubes.

- Please phone the Laboratory if in any doubt over sample requirements and sample type. Refer to Section 5.2 for special handling requirements for biological specimens.
- It is not possible to add an additional test request to a sample which has already been dispatched to a Referral Laboratory.

- Sufficient specimens **must** be provided for referral tests as multiple test requests may be sent to different laboratories. It is not feasible to use specimens already provided to the Biochemistry/ Haematology Department for other tests as these specimens are retained in that Department for a specified period of time should re-testing be required. It is not safe practice to split specimens from the original container.

The temperature requirements of referral specimens are available in the Hospital shared drive and the OLHN Pathology Services website as recorded on

MF-GEN-0137 St James' Referral Test Codes,

MF-GEN-0138 Referral Tests and *Specimen Requirements for Eurofins Biomnis*

MF-GEN-0131 NVRL Referral Test Codes,

LI-GEN-0002: Miscellaneous Referral Tests and Codes to specialised Referral Laboratories.

Specific tests details are available at

https://www.hse.ie/eng/services/list/3/acutehospitals/hospitals/navan/radiologyservicesatourladyshospitalnavan.html

47 SELECTION OF REFERRAL LABORATORIES

In order to ensure that a Referral Laboratory can provide a quality service, a number of areas are explored before selection of a particular laboratory including:

- Accreditation Status
- Turnaround Times
- Irish Reference Centre
- Test Profile
- External Quality Assurance Scheme Performance
- Cost

Ref.: *MF-GEN-0049 Evaluation of Supplier Form*

48 MAINTAINING A RECORD OF ALL REFERRED SPECIMENS

Details of the specimens are recorded in APEX and relevant referral logs as appropriate.