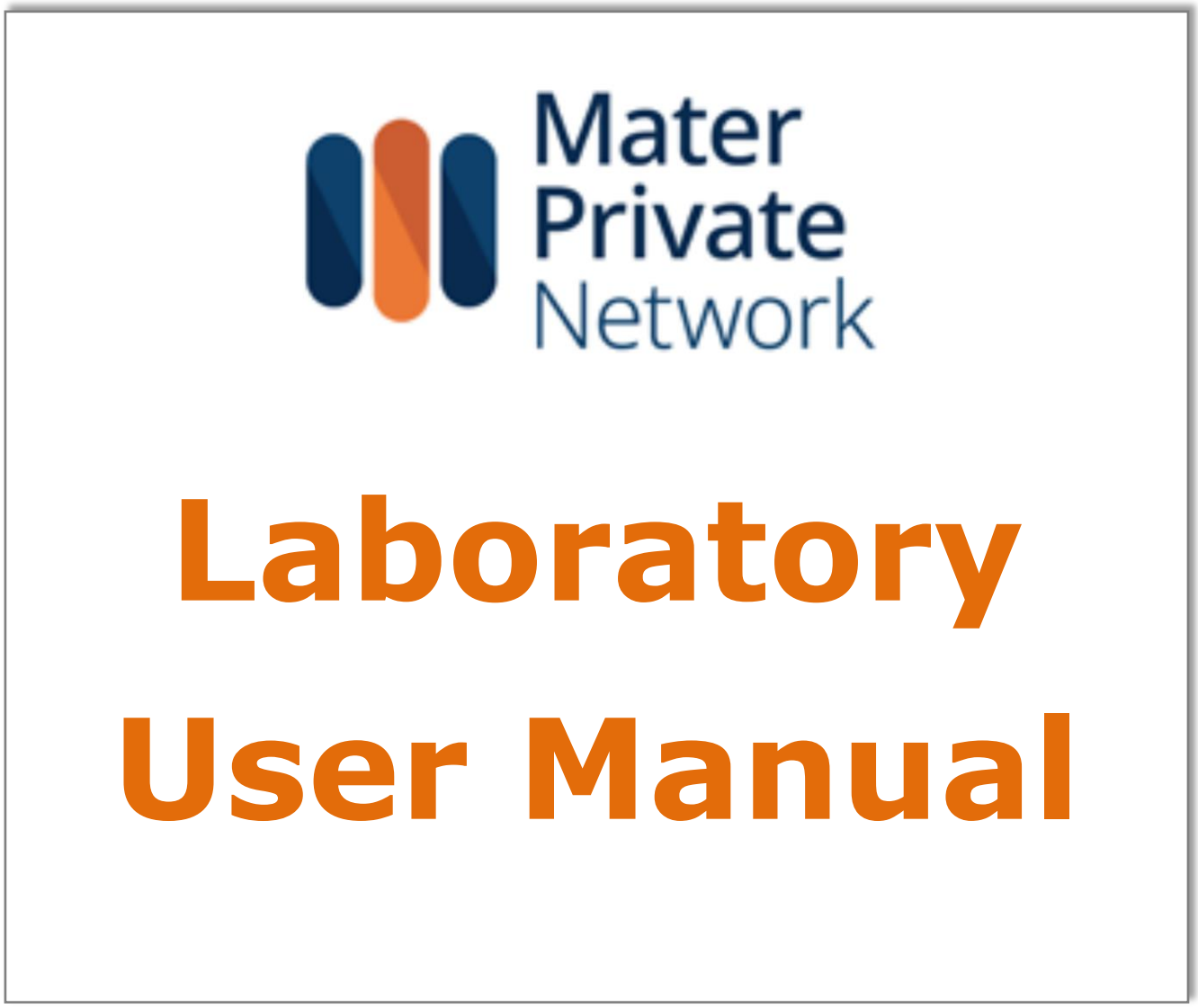
MATER PRIVATE NETWORK CORK – LABORATORY DEPARTMENT		
Owner, date: Mary Kennedy, 16/10/2024	**Document:** MPC-PP-LAB-002	**Revision:** 05
Reviewer, date: Mary Kennedy, Louise O'Callaghan, Mike Trevett 16/10/2024	**Date of issue:** 16/10/2024	**Review date:** 15/10/2025
Authoriser, date: Louise O'Callaghan, 16/10/2024	**Standards:** ISO 15189:2022 and JCI standards	

Title: User Manual



A – Z OF IN-HOUSE TESTS									
A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z				

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Contents

1.0 INTRODUCTION

This manual provides our users with information on the Laboratory team and services, clinical support and test requirements. Our core services are biochemistry, haematology, blood transfusion, microbiology, point-of-care testing and phlebotomy: there is an on call service outside of routine working hours. Cellular Pathology is referred to Mater Private Dublin.

Our team

We are a team of consultants, scientists, laboratory assistants, phlebotomist, quality manager and laboratory manager. Clinical advice and direction are provided by our laboratory consultants.

Quality management

Our quality management system ensures the services undergo continuous review and improvement. The Laboratory team is committed to acting in accordance with the requirements of ISO 15189:2022, AML-BB (articles 14 and 15 of EU Blood Directive 2002/98/EC) and Joint Commission International Hospital standards. We are ISO 15189-accredited for blood transfusion and haematology (FBC) and working towards full service accreditation.

Service scope: Only samples taken from patients 16 years of age or over are accepted. The appendix to this document provides information on our in-house tests. Details of tests referred to other laboratories are available in *MPC-FORM-LAB-012 Referral test index.*

Protection of personal information

All Laboratory personnel are legally and contractually bound to maintain confidentiality. Only Hospital staff with a personal swipe card can access the laboratory. Access to the Laboratory IT system (LIMS) is restricted to those with a personal username and password.

We welcome your feedback and appreciate input from all our users.

Prof Maria Fitzgibbon, Laboratory Director
Maria.Fitzgibbon@materprivate.ie

Mary Kennedy, Laboratory Manager
Mary.Kennedy@materprivate.ie

2.0 QUALITY POLICY

The Mater Private Network's Cork Laboratory provides in-house services for biochemistry, haematology, blood transfusion, microbiology and point-of-care testing. We are committed to providing high quality services to our users and ensuring patients' well-being, safety and rights are the primary considerations.

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

- Integrate procedures, processes and resources, manage risk and seize opportunities to support delivery of the best possible care for our patients.
- Establish, deliver and review objectives and plans in order to implement this policy.
- Ensure that all personnel are familiar with this annually-reviewed quality policy and adhere to Hospital policies and procedures to ensure user satisfaction, quality and safety.
- Commit to the health, safety and welfare of our staff and visitors to the department.
- Uphold professional values, good professional practice, impartiality, ethical conduct and patient confidentiality.

The laboratory will comply with ISO 15189:2022, JCI standards, AML-BB, EU Directive 2002/98/EC and INAB terms and conditions, regulations and policies, and environmental legislation for the services and tests provided.

The laboratory is committed to:

- Staff recruitment, training, competence, development and retention to provide a fit-for-purpose service to users.
- The proper procurement and maintenance of equipment and other resources needed for the provision of the service.
- The correct collection, transport and handling of specimens to ensure the quality of examinations.
- The use of examination procedures that will ensure the fitness-for-purpose of all tests performed.
- Ensuring results of examinations are timely, confidential, accurate and clinically useful.
- The annual assessment of user satisfaction, in addition to internal audit and external quality assessment, to identify and support opportunities for continual improvement.

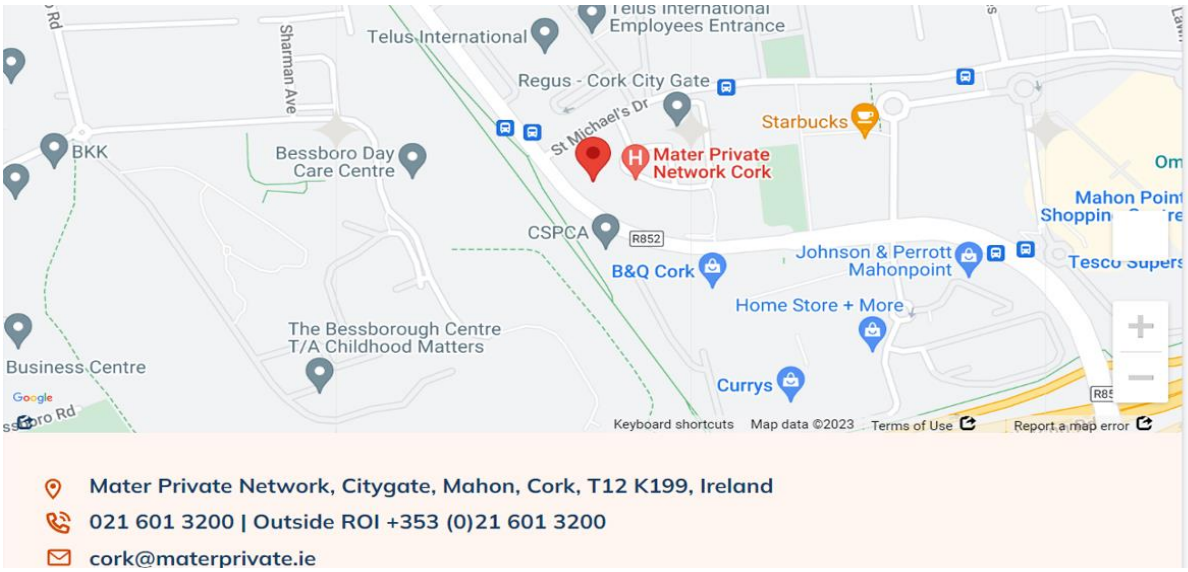
- The safe testing, distribution and transfusion of blood and blood products, and 100% traceability of blood components.
- The investigation and reporting of serious adverse events and reactions and reporting to the relevant authority, where applicable, in a timely manner.

3.0 GENERAL INFORMATION AND CONTACT DETAILS

3.1 Locations

The laboratory and laboratory office are in basement 2 (B2) of the main hospital building.

The phlebotomist is based on the ground floor of the Women's Health Centre.



3.2 Opening hours and cut-off times

Opening hours

Laboratory (routine):	Monday to Friday	07:00 – 19:00
Laboratory (on call):	At all other times for urgent requests Please note that the on call person is on site on Sat, Sun, public holidays from 09:00 – 12:30.	
Phlebotomy:	Monday to Thursday	07:00 – 16:00

Cut-off times

Requests for routine in-house blood tests received in the laboratory by 18:00 (Monday to Friday) are processed on the same working day. Microbiology samples received after 18:00 are refrigerated and processed the next working day.

3.3 Contact details and personnel

3.3.1 Laboratory contact details

Please email non-urgent queries to mpclabemailgroup@materprivate.ie

Area	**Number** *(021) 601-extn*
Hospital	(021) 601 3200
Laboratory	3411
Laboratory Reception	3380
Laboratory Office	3368
Blood Transfusion	Speed dial 4444 (or 3420)
Laboratory on call	Via Senior Nurse, 3416, and on Hospital on call rota.
Haemovigilance Officer	3315
Phlebotomist	3382
Pneumatic chute extension for lab	08

3.3.2 Key personnel

Position	**Name**	**Number** *(021) 601-extn*
Laboratory Director	Prof Maria Fitzgibbon	[via switchboard]
Laboratory Manager	Mary Kennedy	3368
Quality Manager	Louise O'Callaghan	3368
Chief Biomedical Scientist	Mike Trevett	3368
Senior Medical Scientist (Blood Transfusion)	Joyce Coughlan	3411
Senior Medical Scientist (Haematology)	Evelyn Sullivan	3411
Senior Medical Scientist (Biochemistry and point-of-care testing)	Aisling Twomey	3411
Haemovigilance Officer	Anne-Marie Healy	3315
Phlebotomist	Marie Murphy	3382

3.3.3 Laboratory Consultants

Area	Lead	Deputy/ cover	Contact
Laboratory Director	Prof Maria Fitzgibbon	Prof Peter O'Gorman	Contact the relevant Consultant via Mater Private Dublin switchboard, 01 885 8888
Clinical Biochemistry	Prof Maria Fitzgibbon	Dr Graham Lee	
Haematology, Blood Transfusion, Haemovigilance	Prof Peter O'Gorman	Dr Viviana Mohilitchi	
Microbiology	Dr Joy Baruah	[TBC]	083 349 8040

3.3.4 Role of Laboratory Consultants

The Laboratory Consultants provide clinical advice to the users of the service. They can advise on the appropriate choice of examinations and their clinical indications, the limitations of examination procedures and appropriate test frequency. They can also advise on clinical cases and interpretation of laboratory examinations.

The Clinical Biochemistry and Haematology/ Blood Transfusion consultants provide advice and not governance for the results received on samples processed in the Mercy University Hospital when the contingency arrangement is activated.

3.4 Out-of-hours arrangements

3.4.1 On call service

The on call service is for clinically urgent requests and operates from 7pm to 7am Monday to Friday and on Saturdays, Sundays and public holidays.

There is a scientist on site from 9:00 to 12:30 on Saturday, Sunday and public holiday mornings to process requests that cannot wait until the next working day.

The on call team is based off site and attends the laboratory in <30 minutes when called in (usually by the CNM3/ senior nurse in charge) for urgent requests.

The repertoire of tests available on call is below.

Renal, liver and bone profiles, amylase, CK, CRP, glucose, LDH, magnesium, Troponin, βHCG FBC, PT/INR, APTT, fibrinogen, D-Dimer

Urgent respiratory screen

Blood Transfusion:

- Type & Screen and, when required, antibody investigation
- Crossmatch
- Transfusion reaction investigation
- DAT (in urgent situations such as suspected haemolysis and as part of the transfusion reaction investigation)
- Products: red cells, platelets, plasma, fibrinogen

Other requests: for urgent requests outside the scope above, please contact the relevant laboratory consultant.

Referred tests: Blood cultures, CSF, needlestick samples are sent directly to Mercy University Hospital, MUH, from the clinical area

3.4.2 Storage of non-urgent samples out-of-hours

Discipline	**Out-of-hours storage**
Microbiology	Please store routine samples in Laboratory fridge no. 5 and record the details on form *MPC-FORM-LAB-054 Log of samples left in specimen fridge outside of working hours*. Copies of this form are available in the laboratory and on Q-Pulse. Samples stored in fridge no. 5 will be processed the next routine working day.
Histopathology	Histology and cervical smear thin prep samples can be brought to the laboratory at any time and are stored at room temperature. Outside of routine laboratory opening hours, please leave these on the laboratory bench.
Serology	Influenza AB, SARS-CoV-2 and *C. difficile* testing is carried out in-house between 08:00 and 17:30 Monday to Friday. Samples received outside of these hours will be tested on the next routine working day.
Other	Quantiferon: Quantiferon samples should be collected as described in *MPC-WI-MIC-001 Quantiferon-TB sample collection and incubation*. Please only collect these samples Monday to Thursday between 08:00 and 17.00. This is to enable prompt and sufficient incubation (16 - 24 hours) of the samples

Discipline	Out-of-hours storage
	in the laboratory before referral to the Mater Hospital, Dublin (MMUH). Collection tubes and instructions for patients (MPC-WI-MIC-002) are available from the Laboratory.

4.0 USER SATISFACTION AND COMPLAINTS

Each year a survey is sent to users of the Laboratory service. The aim of the survey is to obtain feedback from our users and stakeholders in order to understand how well the service meets their needs and requirements and to identify opportunities for improvement for the benefit of our patients.

Complaints, compliments, comments, suggestions and other feedback to the Laboratory Manager or Quality Manager (ext. 3368) or any member of the laboratory team**.** User feedback is recorded, reviewed and, where appropriate, logged as non-conformance and acted upon. Feedback is sent to users and discussed at laboratory meetings and the annual management review meeting.

Once a complaint is received (complaints are received in multiple ways: for example, verbally, in writing, via a third party), it is logged on Q-Pulse for further action. Initially the complaint is substantiated and then it is investigated. If possible, receipt of the complaint is acknowledged to the complainant and outcomes are shared. If the investigation is protracted, and where possible, updates are shared with the complainant. Once the investigation is complete, corrective (and usually preventive) actions are defined, documented and acted upon within an agreed timeframe. Timeframes are recorded in the complaint record in Q-Pulse.

Investigation and resolution of complaints does not result in any discriminatory actions. The resolution of complaints is made by, or reviewed and approved by, persons not involved in the subject of the complaint in question.

Patient feedback is sought monthly by the Hospital via an independent service provider. Patients may also feed back via the Hospital's website:

https://www.materprivate.ie/patient-feedback

5.0 CONSUMABLES

To order supplies from Stores, please email MPCStores@materprivate.ie with a populated Stores requisition form (MPH4359).

To order supplies from the Laboratory, please email mpclabemailgroup@materprivate.ie or telephone ext. 3380 between 8am and 6pm, Monday to Friday.

5.1 Stores supplies

- Request forms
- Sterile universal containers
- All tubes for blood collection
- Biopsy pots containing formalin
- Blood culture bottles
- Plain swabs (blue cap)
- Swabs for viral (Flu AB and SARS-CoV-2) investigation (pink cap)

5.2 Laboratory supplies

- 24-hour urine containers for timed collections. These may contain no preservative (plain) or acid (20mL of 5M molar hydrochloric acid) depending on the investigation requested.
- Urine containers and swabs for *Chlamydia trachomatis* and *Neisseria gonorrhoeae*
- Specimen bottles for Quantiferon
- Containers containing CytoLyt for fine needle aspiration
- Genetic tests request forms
- Cervical smear request forms
- Michel's medium for skin biopsies: please note that the Laboratory need to be notified at least one week before this is required.
- Buccal swabs (measles and mumps)
- Stool collection kits (calprotectin, Faecal Immunochemical Test (FIT))
- Point-of-care (POCT) testing supplies:
  Laboratory: Hemocue and Clinitek QC, cuvettes for Hemocue, maintenance and QC log books. Gas machine supplies (sensor cassettes, solution pack, printer paper, calibrators, log book).
  Pharmacy: Glucose and ketone meter QC and strips.

6.0 LABORATORY REQUESTS

A doctor, or a competent person with delegated authority, completes the appropriate request form and collects the required samples.

It is the responsibility of the requesting clinician and the person collecting the samples to ensure that request form is correctly filled in, the sample is taken from the correct patient and the correct label affixed to the sample vial(s) (or for blood transfusion, that the correct and complete details are hand-written on the bottle and form).

There are several request forms and it is important that the correct form accompanies each request: please contact us if unsure.

Blood Transfusion test requests forms are stored for at least 30 years. Microbiology request forms for in-house tests are stored 1 month. All other forms are retained for 3 months.

6.1 Request forms

Supplies of forms are available from Stores.

Request form	Reference
Blood Sciences [Biochemistry, Haematology]	MPC-FORM-LAB-035
Blood Transfusion	MPC-FORM-BT-001
Microbiology	LF-MICRO-0054
MPD Histopathology	LF-HIST-0074
MPD Immunology	LF-IMM-0026
MPD General Pathology	LF-GEN-0030
Coombe Women & Infants University Hospital Cytology	RF-CC

6.2 Completing the laboratory test request form

Large addressograph labels, preferably bar-coded, may be used for patient identification on the request form apart from for blood transfusion requests for which both forms and samples must be hand-written.

6.2.1 Required request form information

The information below is required and should be documented legibly on the request form. If sufficient detail is not provided, the requester will be contacted for clarification before

processing is commenced. Please see section 6.2.3 below for additional requirements for Microbiology and section 6.3 below for additional requirements for Blood Transfusion.

Completion of fields a to g on the form is essential for inpatients. Routine samples (except blood transfusion and histology) may be accepted without an MRN [Hospital Number] from outpatients. It is desirable that all fields are populated.

a. Forename and surname
b. Hospital number
c. Date of birth
d. Sex
e. Test requested
f. Location/ contact details of the patient
g. Requesting clinician
h. Destination for report
i. Specimen type
j. Anatomic site of origin [N.B. for histology, cytology and microbiology]
k. Clinical information (for example, Blood Transfusion history, relevant antibiotic therapy, fasting status, special timing relating to drug therapy)
l. Date and time of specimen collection
m. Signature of sample collector
n. Priority status- Routine/ Urgent

6.2.2 Tests/ investigations required

Commonly requested tests in biochemistry, blood transfusion, microbiology, immunology, haematology, cytology are listed on the request form and can be requested by ticking the relevant box.

When there is no tick box, please write the test details clearly on the request form.

6.2.3 Additional information

For Microbiology, specimen type and site, clinical details, antibiotic therapy details (including allergies) are required on request form to enable correct processing of the request: without this, minimal or sub-optimal testing may be undertaken.

For histology and cytology, the nature of the specimen, clinical details and the specimen date are required.

6.2.4 Use of specimen bags attached to request forms

Specimens must be attached to the request forms. This is important so that specimen containers and request forms are associated closely during transportation.

6.3 Blood Transfusion test request form completion

As well as populating all the information a – n in section 6.2.1 above, the following additional information must be provided on Blood Transfusion request forms:

- Date and time the type & screen/ cross-match is required
- Clinical condition/ reason for transfusion
- Patient transfusion history (if known): Indicate if the patient was previously transfused or transfused in last 3 months (date and details). Provide details of previous transfusions including the facility and date of transfusion.
- Obstetric history: Indicate if the patient is pregnant or was pregnant in past 3 months/ received Anti-D Immunoglobulin (provide date and details).
- Test and component/ product required: Group and Crossmatch. Group and Antibody Screen / Hold.
- Number and type of component/ product(s) (red cells, plasma, platelets) required, and the date and time they are needed.
- Special Requirements (if any) e.g. CMV Negative, Irradiated
- A clear indication of whether the tests/ services requested are urgent or routine.

When a blood transfusion request is urgent, the reason for urgency must be stated on the request form, and the Laboratory phoned in advance (speed dial 4444 or ext. 3420 (021-601-3420)). Please see section 15 below for further details.

6.3.1 Labelling blood transfusion bottles

The use of *addressograph labels* on Blood Transfusion specimens is not permitted; demographics must be handwritten on both the sample bottle and request form. All of the fields on the blood bottle must be populated legibly: surname, forename, DOB, hospital number [aka MRN], ward/ location, time [of sample collection], date [of sample collection], signature of person who collected the sample from the patient.

Samples received labelled with an addressograph label will be rejected and a fresh sample requested.

6.4 Type of specimen and anatomical site of origin

The specimen type should be recorded on all request forms.

In Microbiology and Histopathology, the specimen type and the anatomical site of origin must be recorded on the request form to ensure that appropriate tests are performed: this is important in the selection of testing and interpretation of results.

6.5 Clinical information

Clinical details are required on the request forms to record the reason for the test request, to aid result interpretation and to inform the selection of appropriate follow-on tests and analytical methods.

6.6 Identification of priority status (urgent requests)

Requests for urgent processing should be restricted to what is necessary for the immediate clinical management of the patient.
If in doubt, please contact the Laboratory and discuss:

- Which tests are needed
- The target time for test completion/ when results will be available on the Winpath
- Where results and reports are to be directed

Mark the request form clearly as 'URGENT', alert the Laboratory by phone (ext. 3380) and make arrangements for the sample to be transported urgently to the laboratory.

6.6.1 Urgent biopsies

In appropriate circumstances biopsies may be processed rapidly but only after discussion with the Histopathologist in Mater Private Hospital, Dublin (*01-885 8136)*.

6.7 Labelling for danger of infection

All samples must be treated as potentially infectious and universal precautions taken by all staff. The person who collects the sample and completes the request form for the laboratory examination is responsible for ensuring that both the form and the container are labelled to indicate a danger of infection when applicable. A hospital '*Inoculation risk'* sticker should be used as described in *MPC-PP-IC-069*.

MPC-PP-IC-069 Inoculation risk Infections: Procedure for caring for Patients with HIV, Hepatitis B and Hepatitis C infections

6.8 Add-on requests

Users may request additional tests on samples already sent to the Laboratory. These requests will be fulfilled if the Laboratory has sufficient volume remaining and the sample is still suitable for accurate and meaningful results to be generated. If an add-on test is required, please telephone the laboratory on ext. 3411 and the team will advise whether it is possible to add the request. If it is confirmed that the additional request can be fulfilled, please send a completed request form to the Laboratory to confirm the verbal request.

Samples are retained in the laboratory as follows:

Area	**Sample retention time (days after receipt)**
Biochemistry	7
Haematology	7
Blood Transfusion	14
Microbiology	3 days after issue of final report
Molecular	30

6.9 Requests for a repeat sample

Occasionally the requestor is contacted and a repeat specimen requested.
Some common reasons for this are:

- Failure of the initial testing process
- Samples that are incorrectly or not appropriately labelled and/ or if the details on the sample and/ or request form do not match E-Clinic fully
- Samples received were unsuitable for the test(s) requested (e.g. saliva for sputum test, urine for blood tests, sample in incorrect tube) or the sample is too old
- Insufficient sample received for all tests requested. In this case, test(s) for which there is sufficient volume will be performed. If the sample is not easily repeatable (e.g. CSF, fluids), the requesting clinician will be contacted to establish the priority order of testing.
- The need for further investigations
- Concern at authorisation stage over the validity of the results compared to, for example, recent previous results from the same patient
- Antibody investigations for Blood Transfusion

7.0 SAMPLE COLLECTION

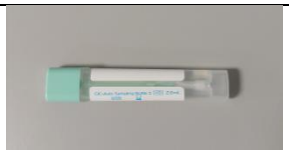
7.1 Sample collection and order of draw

The Sarstedt Monovette system is used for drawing blood: supplies include needles, Safety Multifly Set and Monovette bottles.

S-Monovette® tubes are sterile tubes of various sizes and with or without anticoagulant or preservative or gel separator. See below for order of draw and for full details, please refer to *MPC-FORM-LAB-060.*

Colour code (S-Monovette)	Anticoagulant/ preservative	Use
Blood Culture bottles	None	
Clear/ White Serum 7.5 mL	None	Immunology tests Digoxin, Vancomycin, Gentamicin
Green 3.0 mL	Sodium Citrate	PT/INR, APTT, D-Dimer, Fibrinogen **N.B. to fill to line**
Brown Serum Gel 7.5 mL	None	Renal, Liver, Bone, CRP, CK, magnesium, amylase, LDH, ferritin, NT-proBNP, thyroid function tests MPD Biochemistry tests Mercy (MUH) Biochemistry tests
Orange 4.9 mL	Lithium Heparin	βHCG, Hs-Troponin I Biochemistry tests referred to MMUH
Pink Large 7.5 mL	EDTA	Type & Screen, Crossmatch, Direct Antiglobulin Test (DAT)
Pink Small 2.7 mL	EDTA	Full Blood Count
Red 2.7 mL	ThromboExact	Platelet count (Pseudothrombocytopenia)
Yellow 2.7 mL	Fluoride EDTA	Glucose
Purple 3.5 mL	Sodium Citrate	ESR **N.B. to fill to line**

7.2 Samples collected by the patient

Test/ test type	Specimen container	Container available from	Instruction for use
24-hour (timed) urine collection (PLAIN, no preservative)		Laboratory	MPC-WI-LAB-015 24-hour urine collection
24-hour (timed) urine collection (ACIDIFIED, contains 20mL of 5M Hydrochloric acid) 		Laboratory	MPC-WI-LAB-015 24-hour urine collection
Random/ spot urine		Stores	MPC-WI-LAB-030 Mid-stream urine collection patient information leaflet
Faeces sample		Laboratory	MPC-WI-MIC-002 Faeces (stool) sample collection patient information leaflet
Faecal immunochemical test (FIT)		Laboratory	MPC-WI-LAB-024 FIT patient information leaflet

The instructions for collection provided by the Laboratory should be given to the patient. These are available on Q-Pulse or from the Laboratory.

MPC-WI-LAB-015 24-hour urine collection patient information leaflet

MPC-WI-MIC-002 Faeces (stool) sample collection patient information leaflet

MPC-WI-LAB-030 Mid-stream urine collection patient information leaflet

MPC-WI-LAB-024 FIT patient information leaflet

7.2.1 24-hour (timed) urine collections

Accurately timed, complete urine collections are essential for the integrity of the test. A 24-hour urine collection must be completed over a full 24 hour period. The following details should be recorded on the container:

a) Patient's full name
b) Date of birth
c) Hospital number [MRN]
d) Start time and date of collection
e) Finish time and date of collection

If the container is full before completion of collection, a second container can be used with the same preservative, and both sent to the laboratory at the same time. Label the containers 1 of 2, 2 of 2 etc.

If urine is not collected or accidentally discarded during the collection period, the test should be discontinued and started again.

The container should be stored in the refrigerator during the collection.

Once the timed collection is complete, the patient (or their representative) can deliver it directly to the laboratory in basement 2 (B2) during laboratory opening hours. Laboratory personnel will check that the required information is complete on the form and collection bottle as they are taking custody of the collection.

7.2.2 Stool sample collection

The following details should be recorded on the container:

a) Patient's full name
b) Date of birth
c) Hospital number (MRN)
d) Time and date of collection

The stool sample should be returned to the Laboratory within 24 hours of collection and kept refrigerated until returned to the Laboratory. Kits for stool collection containing a sample container, collection paper and instructions for use can be collected from the Laboratory.

MPC-WI-MIC-002 Collection of stool sample

7.2.3 MSU sample collection

The following details should be recorded on the container:

a) Patient's full name

b) Date of birth

c) Hospital number (MRN)

d) Time and date of collection

The MSU should be sent to the laboratory within 2 hours of collection or stored in the refrigerator and returned within 24 hours.

MPC-WI-LAB-030 Mid-stream urine collection

7.2.4 Urine microscopy and culture

A minimum of 1 mL of urine, preferably MSU, is needed, collected into a sterile container.

For information on other types of collections (clean catch urine, catheter urine, ileal conduit-urostomy, cystoscopy), please contact the laboratory.

7.3 Sample quality, haemolysis, icterus, lipaemia

Many tests are subject to interference whether biological or analytical.

When present, the Laboratory report will reference the more common interfering substances such as haemolysis, icterus (bilirubin interference) and lipaemia. Depending on the degree of interference and the test, some results will not be reportable. Haemolysis occurs when the cell membrane of the red blood cells is compromised. Even slight haemolysis can cause increased serum/ plasma values for tests such as potassium, phosphate, LDH and magnesium.

The following pre-analytical factors may cause haemolysis:

- Tourniquet applied too tightly or left on too long
- Needles with too small diameter
- Needles with too large a diameter for fragile veins
- Aspiration of tissue fluid after puncturing vein
- Transfer of blood into other containers with a syringe
- Shaking the sample instead of gently inverting
- Delayed separation of cells from serum/ plasma >3 hours
- Pulling the plunger of a syringe back too quickly

- Very slow flow into tube

Other factors that can affect sample quality and suitability include:

- Lipaemia and icterus
- Expiry date on tube exceeded: the additives only work if used prior to their expiry date
- Mixing ratios and specimen volumes – essential

It is essential that green citrate (coagulation) and purple (ESR) tubes are filled to the line.

Citrate tubes for coagulation tests that are either over- or under-filled are unsuitable. When collecting blood with a Safety Multifly needle and a Coagulation sample is requested and it is the first tube on the order of draw, avoid under-filling due to air in the tubing by first collecting a waste tube and discarding it. Then a second citrate sample is taken and filled to the indicated line on the tube.

- Mixing blood and tube additives. Failure to gently mix, dissolve and distribute anticoagulants and preservatives
- Disinfecting the puncture site incorrectly. Disinfection solution used should have air dried completely before the vein is punctured
- If collection from a horizontal catheter is unavoidable, great care should be taken to avoid contaminating the sample with remains of infusion solution
- Incorrect order of draw of samples
- Use of the wrong tube/ anticoagulant. Samples should never be poured from one tube into another tube, even if the tubes have the same anticoagulant.
- Failing to prepare the patient correctly e.g. fasting, collection at the wrong time of day, gestational age
- Failure to collect timed or mid-stream urine (MSU) specimens correctly

7.4 Disposal of consumables used during sample collection

It is the responsibility of the person performing the blood collection to ensure that all consumables used during the process, such as needles, butterfly needles and discard tubes, are disposed of correctly, safely and according to local procedures and policies.

Ensure safe disposal of materials used in specimen collection in the nearest sharps bin as described in *MPC-PP-IC-031 Management of sharps*. All materials used in specimen collection should be treated as potentially hazardous.

7.5 Patient identification and consent

The phlebotomist, nurse or doctor collecting the specimen must confirm the patient's identity verbally and must also check the patient's ID wrist band (Note the ID band is for inpatients and all blood transfusion samples). The patient must be informed of the reason for collection of the specimen.

Consent for phlebotomy is implied by the patient's co-operation (for example, presenting for phlebotomy with a doctor's referral request and extending the arm to have their blood taken). However, this gesture does not eliminate the right of the patient to an explanation prior to taking blood. Explicit written consent is required for some tests such as genetics studies. Please contact the Laboratory if unsure.

Please refer to Hospital policy *MPC-PP-GEN-078 Guidelines and policy for obtaining informed consent from patients.*

7.5.1 Conscious patients

Ask the patient their name and birth date. Note: *do not ask* 'are you Mr Smith?' Instead *do ask* "what is your name and date of birth?"

When an identity [ID] band is required to be worn [inpatients and all blood transfusion samples], positive identification of the patient is made using the identity band to ensure that the correct forename, surname, date of birth and hospital number (MRN) are recorded.

When an ID band is not worn [e.g. outpatients], the patient is identified by a verbal check of their name and DOB, a check of the request form and, when available, the patient's chart.

Patient identification is carried out according to the procedure described in *MPC-PP-GEN-111 Patient Identification and use of a Patient Identification band*.

If a patient is having a Blood Transfusion sample collected, a patient ID band must be worn. If they are an outpatient, a member of the reception team prints an ID band and attaches it on the patient's wrist. The patient then proceeds to where their blood will be drawn. The person drawing blood carries out the checks as described above. Once complete, the ID band is removed and discarded into confidential waste. For Blood Transfusion, the blood bottle and request form are hand-written.

7.5.2 Unconscious/ sedated patients, patients with communication difficulties

At the time of the first interaction with the patient the next of kin/ guardian will be requested to verify the patient's full name and DOB. These details are verified against the entry in the computer database or against the pre-printed request form/ patient's chart. When an identity band is required to be worn positive identification is made using the identity band. If an identity band is not worn the next of kin or guardian will be requested to confirm by confirming the patient's full name and date of birth.

- If a patient is not able to provide positive identification, the treatment, test or procedure must not be done and medication must not be given until the next of kin/ guardian is available to confirm identity (the exception to this is an emergency situation).

- For Blood Transfusion the person taking the sample (phlebotomist/ nurse/ doctor) signs both the specimen and the request form in the presence of the patient.

- The Laboratory treats all diagnostic specimens as potentially infectious. Universal precautions must be taken in the collection, packaging and the delivery of specimens to the laboratory.

  MPC-PP-IC-069 Inoculation risk Infections: Procedure for caring for Patients with HIV, Hepatitis B and Hepatitis C infections

7.6 Checking patient preparation

The appropriate preparation of the patient for the requested test and the correct specimen collection is the responsibility of the individual(s) requesting/ collecting the specimen. If in doubt, please contact the laboratory for advice.

The person drawing the sample confirms with the patient that they meet any pre-examination requirements such as fasting status, medication status and dietary restrictions.

Please note that 12 hours fasting is required for fasting bloods (for example for lipid profile, glucose).

7.7 Checking that the container/ bottle is labelled correctly

Having positively identified the patient, the person collecting the specimen (phlebotomist/ nurse/ doctor) must label the container correctly and completely with the patient's details, including their unique hospital number (MRN). It must be ensured that there can be no confusion about the identity of the patient or their specimen. Please refer to *MPC-PP-GEN-124 Policy on the Management of Specimens in all Departments in the Mater Private Cork*.

This is the first step in positive specimen identification. The identification data affixed to/ written on the specimen and container at source remains with that specimen throughout analysis.

7.8 Ensuring that the sample is collected correctly

Please ensure blood is collected into the appropriate tube, in the correct order (according to the order of draw sequence in section 7 above) with the correct anticoagulant (if any) and that the container is filled to the line to ensure the correct anticoagulant to blood mix ratio.
If a required test is not listed in this user manual or associated reference documents, please contact the laboratory: some less commonly requested tests require special collection and handling procedures.

For details of tests referred to external laboratories, please see *MPC-FORM-LAB-012 Referral test index*

7.9 Sample collection at 37 degrees Celsius

Some tests need to be collected and maintained at 37°C including Cryoglobulins and Cold Agglutinin Syndrome investigations. For these tests, please contact the laboratory the day before the samples are collected. The laboratory will provide a flask at 37°C for transport of the samples. For more information, please refer to *MPC-WI-LAB-026 Requests for Cryoglobulins*

7.10 Sample and specimen labelling

The criteria for acceptance, described below, are adhered to in the interest of patient safety. Failure to provide the required data shall lead to rejection of the request.

7.10.1 Labelling the specimen container/ sample bottle

Labelling must be carried out at the patient's side directly after phlebotomy.

All samples from inpatients and those with a wrist ID band must be labelled with a minimum of three identifiers on the bottle/ container. Request forms and samples from other patients must be labelled with a minimum of two identifiers. Three identifiers must be recorded for Blood Transfusion without exception.

Always use collection tubes, swabs and other supplies that are in date: blood taken into expired collection tubes will be unsuitable for analysis. Bottles must never be pre-labelled.

The following identifiers must be on the container:

a) Patient's forename and surname
b) Inpatient's hospital number (MRN)
c) Date of birth
d) Destination for report
e) Date and time of sample collection
f) Identity of person who collected the sample

a, b and c are essential requirements.
a, b, c, d, e, f are essential requirements for Blood Transfusion.

Labelling on all specimens for Blood Transfusion testing must be by hand.

Specimens for other laboratories can be labelled with small addressograph labels. Where no addressograph labels are available clear handwritten labelling is accepted.

When placing sample into specimen carrier bag, ensure that details on specimen correspond to details on form.

7.10.2 Category A Pathogens [Risk Group 4]

The laboratory is not suitably equipped and does not provide a diagnostic service for category A pathogens. If a category A pathogen is discovered incidentally, the Department of Public Health must be notified immediately and this will be done by MPC Health and Safety Manager or Infection Control team. Please contact the Infection Control team to discuss and see 17.8.1 below.

<u>Other high risk samples</u>

All samples from patients with suspected TB must be clearly labelled as 'Suspected TB'. Please telephone the Laboratory before sending. This will help to minimise the exposure to the laboratory staff and allow samples to be handled safely. See also section 6.7 above.

8.0 STORAGE AND TRANSPORT OF SAMPLES

8.1 Pre-analytical storage

To maintain their quality and suitability, please ensure that all samples are transported to the Laboratory in a timely manner. Collect samples requiring immediate handling between 08:00 and 17:00 Monday to Friday only.

- Storage at room temperature

  The following must not be stored in a fridge: routine biochemistry, coagulation, blood cultures, CSF samples, surgical specimens, cervical cytology (smears), specimens in formalin.

- 24-hour urine containers should be returned to the Laboratory in the urine collection bags given to patients when the empty collection containers are provided. The container should be put into laboratory fridge 5 if delivered outside of laboratory working hours.

- Coagulation samples must be sent to the laboratory as soon as possible after collection as they are stable for only 4 hours. Samples collected for patients on Heparin are only valid for 2 hours from the time of collection.

- Histology specimens

  Put the histology specimen(s) pots into a biohazard bag immediately after collection and checking, ensuring that the pot is closed and sealed properly and that the patient's details on the pot are correct and complete. The specimen pot should be placed in the sealable pocket of the bag and this should then be closed properly. The request form should be placed in the open compartment so that in the event of leakage the request form is not contaminated and the leakage is contained.

  Place the histology specimens into a larger rigid plastic box upright in the rack provided for transportation to the laboratory.

  Histology specimens in 10% buffered formalin (see hazards below) should be stored at room temperature. Do not refrigerate.

Storage outside of working hours

- Routine cytology samples should be placed in Laboratory fridge number 5 outside of laboratory working hours.
- Smear samples/ cervical cytology should be stored at room temperature. Do not refrigerate.
- Microbiology samples taken outside of routine laboratory hours should be taken to the Laboratory and stored in Fridge 5 in the designated tray for processing or referral the following day. The log sheet (*MPC-FORM-LAB-054)* on the door of the fridge should be completed and signed.
- Blood cultures must be received in the Mercy University Hospital within four hours of being taken and should always be stored at room temperature. Do not refrigerate.

If in doubt, please contact the Laboratory (ext. 3411) for specific information on collection conditions for particular tests. Further information is available on *MPC-PP-GEN-124 Policy on the Management of Specimens in all departments in the Mater Private Cork*

8.2 Sample transport

It is essential that samples are transported safely to ensure safe custody and maintain integrity and suitability.

Correct arrangements ensure that:

- Transport is within a timeframe appropriate to the nature of the requested examinations.
- Transport is within a temperature interval specified for sample collection and handling to ensure the integrity of the samples.
- The safety of staff transporting specimens, the safety of other staff, patients and members of the public is maintained.
- The Pneumatic Transport System (PTS), if appropriate for the sample type, is the preferred method of delivery of samples to the laboratory.

Use of plastic bags for samples and forms

Most samples are able to be transported to the Laboratory in the plastic biohazard bag pouch with the request form in the bag sleeve. Transport bags are single use.

This system has the following benefits:

- Limits unnecessary hand contact with specimen containers

- It is easier to identify a leaking container among a batch. Please note that sample containers that are contaminated on the outside must not be sent to the laboratory.
- Helps to prevent a leaking container from contaminating other containers, request forms, the hands of the person sorting a batch and the immediate environment. Some specimens are sent to outside laboratories as described in *MPC-FORM-LAB-012 Referral test index*.

Blood cultures, histology specimens, or venous/ arterial blood gas syringes must never be sent via the pneumatic tube system.

Please contact the Laboratory (ext. 3411) and let us know to expect urgent requests.

Some samples require special handling such as protection from light, immediate freezing, transport within a defined temperature interval, within a time frame appropriate to the nature of the examination.

If in doubt about the container required or the special requirements please refer to the *Referral test index MPC-FORM-LAB-012* or contact the Laboratory for advice.

8.3 Sample transport using taxis and couriers

Routine couriers are arranged via the main Hospital reception team.

If the usual taxi company cannot fulfil an urgent need, there are contingency arrangements for use of Blood Bike South (for example, if the cars used by the taxi company cannot reach the destination because of congestion, accident, marathon). Blood Bike South can be contacted on 087 719 0369 or via email CONTACT@BLOODBIKESOUTH.IE

When sending samples by courier, ensure the package is sealed/ tamper-proof.

8.4 Model rules for sample transport

- Secure transport carriers must be used, such as boxes or deep-sided trays. They must not be over-filled.
- The transport boxes or trays must not be used for any purpose other than carrying specimens.
- The boxes or trays must be made of a smooth impervious material such as plastic or metal which can be easily disinfected and cleaned and that will retain liquid if there is leakage.

- The boxes or trays must be disinfected and cleaned each week and whenever contaminated by the department using them.
- Cover any cuts or grazes on your hands with a waterproof dressing.
- If you drop and break a specimen, follow the local procedure for cleaning it up using the spill kit for your area. If you have not been trained in use of the spill kit, seek help from someone senior. Report the accident to your supervisor as soon as possible.
- When sending samples externally, ensure the package is sealed/ tamper-proof.

8.5 Hazards of formalin

If there is a spillage of formalin, a trained and competent person can use the formalin spill kit in Theatres to clear it up and then log the incident on the Flex Manager system for follow-up.

Table: Dangers of 10% formalin

	Acute toxicity	**Serious long-term health hazard**	**Corrosion**
DANGER 10% formalin			

10% formalin first-aid measures

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a doctor.

After eye contact: rinse out with plenty of water. Remove contact lenses. Consult a doctor or ophthalmologist.

After inhalation: fresh air. Immediately call in doctor. If breathing stops: immediately apply artificial respiration, if necessary also oxygen.

After swallowing: immediately drink water (two glasses at most). Consult a doctor.

9.0 ACCEPTANCE REQUIREMENTS

9.1 Acceptance criteria

Specimen bottles/ pots and request forms must be labelled and populated as described above in section 6. See below for rejection of specimens that do not meet the required criteria.

9.2 Reasons for rejection

Specimens will be rejected for, but not limited to, the reasons listed below and, to safeguard patient safety, will not be processed. Rejected requests will be recorded on the patient's record on the Laboratory IT system [LIMS] and a report will be dispatched to the requester. The clinical area and senior nursing team will be informed and a repeat specimen will be requested by telephone.

If a Wrong Blood in Tube (WBIT) is suspected, the Assistant/ Director of Nursing (A/ DON) will be notified and all samples associated with a WBIT query will rejected.

Common reasons for rejection:

- Sample received unlabelled
- Sample incorrectly labelled
- Sample and form do not contain essential identifiers
- Sample and form do not contain the same essential identifiers
- Sample has leaked
- Incorrect type of sample
- Incorrect volume of sample
- Gross haemolysis
- Sample too old for analysis
- Blood Transfusion samples will be rejected if there is not an exact match between the essential identifiers on the form and bottle
- Blood Transfusion requests with addressograph labels on the sample blood bottle will be rejected
- Blood Transfusion samples (and forms) must have the signature of the person who carried out the phlebotomy.

9.3 Exceptions

In exceptional circumstances, when a request would under usual circumstances be rejected, if the sample is clinically critical or irreplaceable (for example, surgical specimens/ biopsies, CSF, pus from an abscess excised in theatre or other specimens apart from blood), senior Laboratory staff together the clinician may agree to proceed with processing the request.

In these cases the following procedure will apply:

- The requesting clinician will be contacted and invited to come to the Laboratory and identify and label the specimen and request form to resolve any discrepancies.

- The clinician/ requester will also complete *MPC-FORM-LAB-062 Non-Compliance Disclaimer Form*. These retrospective amendments are recorded on the patient's record on the LIMS in detail as well as who amended the record and that caution is required when interpreting the result.

- This form is filed in the Laboratory and associated with the laboratory non-conformance. A copy of *MPC-FORM-LAB-062* and the specimen request form associated with the non-conformance are scanned and uploaded as an attachment on Q-Pulse.

If the demographics cannot be confirmed, the specimen is rejected and is booked on to LIMS and a report is issued stating that specimen could not be identified.

9.4 Laboratory receipt procedure

Date and time of receipt in the laboratory are recorded on the request form. Specimens are labelled with a unique laboratory accession number and then recorded in the LIMS linking the unique laboratory accession number to the patient's details provided on the request form.
Trained Laboratory personnel evaluate the specimens to ensure that they meet the relevant acceptance criteria.

If separation of the primary sample into a secondary container is required, all portions of the primary sample are unequivocally traceable to the primary sample. This is achieved by ensuring all sample containers are labelled with the patient's unique laboratory accession number, name, DOB and, when applicable, MRN.

10.0 REPORTS

We strive to ensure that testing is carried out in compliance with our quality standards and reported in the specified timeframe.

Whilst we do telephone critical and some other results (see section 10.3 below), it is the responsibility of the requestor to follow up on the results of tests they have requested. Results are available electronically using Winpath Ward Enquiry (to which access is available from the IT department) and hard copy reports are issued on the day of test completion.

10.1 Paper reports

Laboratory reports are printed on yellow paper. Reports for patients on Wards 1, 2 and 3 are sent via the Pneumatic Tube System (PTS) directly to the wards twice daily (Monday – Friday). All other reports are collected by Medical Records and distributed to Consultant's secretaries daily.

10.2 Winpath Ward Enquiry

In general, results once authorised are available electronically on the ward PC's. These results are accessed via Winpath Ward Enquiry.

10.3 Telephoned reports

We will telephone results when these conditions apply:

- There is a note on the request form requesting results to be telephoned
- The results fall within alert or critical intervals
- The result deviates significantly from previous results
- Urgent action by clinical staff is required
- To notify the requester that testing will be delayed, and where the delay may compromise patient care

A record of all telephoned results is added to the laboratory IT system. The record includes the date and time of the phoned report, staff member notified and results conveyed. Any difficulty in notifying staff of results by telephone is recorded. All telephoned reports are followed by a hard copy report.

Please note:

We do not give Blood Group results over the telephone.

We do not give results directly to patients.

10.4 Emailed reports

Results can be emailed using secure e-mail. If a report is requested from an external source, hospital form *MPC-FORM-GEN-094 Consent for request/ release of medical records to/from another medical facility/Consultant or Physician* must be completed before the report will be sent. This form is available on Q-Pulse and is emailed to the requestor. Results cannot be released until this form has been completed and returned.

Unless they are known, the identity of the caller will also be confirmed by independently establishing the correct telephone number for that practice/ source and by calling that

number back. Please note that reports are never emailed to personal accounts such as Gmail or Hotmail as they do not meet our security requirements.

The recipient's email will be confirmed as secure before results are sent. Secure emails are available for Mater Private Dublin, HSE addresses (@HSE.ie), Eurofins (@eurofins-biomnis.ie) and Mercy Hospital (@muh.ie). Hospital IT is contacted for advice if there is any doubt about the safety of emailing patient information to a given email address.

10.5 Supplementary reports

Where additional information comes to light following an initial report having been sent out, a supplementary report is issued to the requestor. Supplementary reports are issued for Blood Transfusion for Weak D testing or extended phenotyping.

10.6 Amended reports

Where it is discovered that an issued report or result available to view is incorrect or contains false or incomplete information, a revised or amended report is issued and the requestor/ clinical area informed. The revised report shows the detail of the amendment, the time and date of the change and the name of the person responsible for the amendment.

The original hard copy report in the patient's chart is marked as incorrect and the amended report describes that it is, and how it is, different from the original. The amended report is affixed to the original in the patient's chart.
Both the original and amended/ corrected information are retained in the audit trail on Winpath [the laboratory IT system] so that there is a complete audit trail of the change, who made it and when.
Amended reports are recorded as non-conformances and investigated so that corrective and preventive actions are defined, transparent and acted upon.

10.7 Copy reports

There is a facility to print copy reports to additional clinicians/ locations. Such requests may occur at registration on receipt in the laboratory or additional reports may be requested after report authorisation and release of primary report. All additional reports issued after the primary report are stamped as copies.

10.8 Delayed reporting

When a delay in release of results may compromise patient care, the delay is communicated to the requestor/ clinical area. This is done by telephoning and recording the call on the Laboratory IT telephone log for the patient concerned.

Where the issue affects a number of clinical areas/ patients, a mass communication is sent to users by email and a non-conformance is recorded on Q-Pulse.

10.9 Measurement uncertainty

All laboratory tests and investigations have some uncertainty in the measurement system. Please take this into consideration when interpreting results.

Contributions to uncertainty derive from both pre-analytical factors (for example: sampling, sample preparation, portion selection, transit time, time between collection and analysis) as well as the measurement/ analytical system (for example: calibrators, reference materials, volume, equipment, environment, specimen condition and operator skill).
For further information on performance specifications or indicators of uncertainty of measurement for particular tests, please contact the Laboratory.

10.10 Reference ranges

Reference ranges are reported with test results, when applicable. Quantitative results outside the reference range appear in bold print with **H** for High or **L** for Low beside the result.
Reference ranges are derived from the assay kit manufacturer or by reference to national or international clinical guidelines. When appropriate for the test, these reference ranges are age- and/ or sex-related.
Changes to reference ranges (for example, because of a change in the technology in use) are notified to users prior to implementation and for at least three months after on the laboratory report.
Please contact the Laboratory for further information on reference ranges.

10.11 Accredited and unaccredited test reporting

Where possible, tests are referred to laboratories accredited to the ISO15189 standard.

10.12 Reports on results from referral laboratories

Reports from external referral Laboratories are either printed (for example, from cdxconnect.eurofins.com or Healthlink) or received as a hard copy by post.

Where safe to do so, these results are manually entered into Winpath and the original hard copy report is sent to the consultant. Results from complex testing such as genetics studies are not transcribed into Winpath to avoid error: they are recorded in Winpath as having been received and the referral laboratory report is sent to the requestor and a copy kept in the Laboratory.

10.13 Turnaround times

The laboratory turnaround time is the time from receipt in the laboratory to the time the results are available to users. The current target is to report at least 80% of results within the assigned turnaround time. We monitor our performance regularly and report on it monthly to the Hospital's governance and risk team.

Urgent results may be available sooner (depending on the test) and requests for fast-tracking must be accompanied by a phone call (ext. 3411) to enable us to prioritise these samples.
If the published turnaround times may be exceeded, for example because of equipment planned maintenance or fault, users are notified.
Microbiology published turnaround times are for routine specimens. In some cases, the turnaround time may be extended if the cultures are complicated, additional testing is needed and/ or external referral is required. Please contact us if there are queries about a particular sample.

Turnaround times for each test are listed in the appendix to this document.

10.14 Critical results and alert limits

Results are critical when the patient may require rapid clinical attention to avert significant morbidity or mortality. The senior nurse in each hospital department (and on occasion the RMO/ consultant responsible for the patient care) is notified within a maximum of 30 minutes of result availability in the Laboratory.

If the Medical Scientist is unable to make contact with the senior nurse in the clinical area, they will contact the hospital ADON or DON and they will inform the relevant ward.

Please note: When a critical result is generated from a point-of-care device, the responsibility lies with the person who performed the test to notify the RMO/ Consultant/ Nurse overseeing the care of the patient.

For further information, please refer to Laboratory document *MPC–PP-LAB–003 Reporting of Results* and Hospital document *MPC-PP-NUR-082 Critical Test Policy*

10.14.1 Biochemistry critical results

TEST	LOW	HIGH
Sodium[1]	< 120 mmol/L	> 150 mmol/L
Potassium[1]	< 2.5 mmol/L	> 6.5 mmol/L
Chloride[2]	< 75 mmol/L	> 125 mmol/L
Urea[1]	N/A	> 30 mmol/L
Creatinine[1]	N/A	> 354 µmol/L and/ or a delta check >100 µmol/L
Alanine Aminotransferase (ALT) [1]	N/A	> 825 U/L (15*ULN)
Aspartate Aminotransferase (AST)	N/A	> 800 U/L
Bilirubin[2]	N/A	> 257 µmol/L
Inorganic Phosphate[2]	< 0.3 mmol/L	> 2.9 mmol/L
Magnesium[1]	< 0.4 mmol/L	> 2.5 mmol/L
C-Reactive Protein (CRP)[1]		> 300 mg/L
Creatine Kinase (CK) [1]	N/A	> 5000 U/L unless MI
Glucose[1]	< 2.5 mmol/L	> 25 mmol/L
Amylase[1]	N/A	> 485 U/L (5*ULN)
Calcium[1]	< 1.8 mmol/L	> 3.5 mmol/L
Beta HCG (βHCG)		> 5 U/L
HS-Troponin I[6]	N/A	> 50 ng/L Post PCI Troponins are not telephoned
Free T4	N/A	> 40 pmol/L
Gentamicin [sample at ≥18h after last dose]	N/A	> 2 mg/L

10.14.2 Point-of-care testing critical results

TEST	LESS THAN VALUE	GREATER THAN VALUE
ARTERIAL BLOOD GASES		
pH[1]	< 7.2	> 7.6
Carbon Dioxide (pCO_2)[2]	< 2.5 kPa	> 8.9 kPa
Oxygen ($_pO_2$)[2]	< 5.7 kPa [2]	N/A
Lactate[1]	N/A	> 4.0 mmol/L
Total Haemoglobin concentration (ctHb)	<8 g/dL Phoned on all occurrences	>18.0 g/dL Phoned on all occurrences
Calcium [ionised calcium](cCa^+)[5]	< 0.8 mmol/L	> 1.6 mmol/L
Sodium concentration (cNa^+)[1]	< 120 mmol/L	> 150 mmol/L
Potassium concentration (cK^+)[3]	< 2.8 mmol/L	> 5.8 mmol/L
Glucose meter		
Glucose[1]	< 2.5 mmol/L	> 25.0 mmol/L
Ketone meter		
Ketones	0.6 - 1.5 mmol/L and blood glucose is > 16.7 mmol/L	
Hemocue		
Haemoglobin **N.B. Confirm abnormal haemoglobin results with a lab FBC**	< 8 g/dL Phoned on <u>all</u> occurrences	> 18 g/dL Phoned on <u>all</u> occurrences
Hemochron		
Activated Clotting Time (ACT)	ACT is used to monitor heparin during and after specific procedures in the Cath Lab. Results are closely monitored	

TEST	LESS THAN VALUE	GREATER THAN VALUE
	by the person performing the test and are under the direct supervision of the consultant. The heparin dosage is adjusted accordingly.	
Clinitek Urinalysis		
Beta HCG	-	>5.0 IU/L

[1]The Royal College of Pathologists-Communication of critical unexpected pathology results. MPC-EX-BIO-0010

[2]Critical Limits of Laboratory Results for Urgent Clinician notification. eJIFCC vol 14 no 1: http://www.ifcc.org/ ejifcc/vol14no1/140103200303n.htm. MPC-EX-BIO-0009

[3]Mater Misericordiae University Hospital (MMUH) Policy on blood gas analysis LP-POC-001

[4]Health Service Executive: Communication of Critical Results for Patients in the Community MPC-EX-LAB-033

[5]Approved by Consultant Clinical Biochemist

[6]Determined by Consultant Clinical Biochemist and Consultant Cardiologist

10.14.3 Haematology critical results

Test	Lower Limit	Upper Limit	Comments
INR	-	> 1.5	Coagulation: Not on anticoagulant
INR		>4.5	Coagulation: Patient ON anticoagulant
APTT	-	> 45 secs	Coagulation: Not on anticoagulant
APTT	-	>120 secs	Coagulation: Patient ON anticoagulant
Fibrinogen	< 1.5 g/L	-	
D Dimer		> 1.0 mg/L	
Haemoglobin	< 8.0 g/dL	> 18.0 g/dL	Phoned on ALL occurrences
Platelets	< 100 x10^9/L	> 800 x 10^9/L	

Test	Lower Limit	Upper Limit	Comments
Neutrophils	< 1.0 x10^9/L	-	Phoned on ALL occurrences
WBC	< 3 x10^9/L	> 25 x10^9/L	First time presentation. In the event of a substantial, clinically significant change in WCC of rapid onset, inform clinical team.
Malaria	-	-	All Malaria requests are phoned to the consultant microbiologist PRIOR to the sample being taken
Other	-	-	All blood film reports from Haematology Consultant are emailed to requesting clinician

Please note that the above critical values have been assigned by the Consultant Haematologist.

10.14.4 Blood Transfusion critical results

The Laboratory informs the user of any blood transfusion special requirements. This can include, but is not limited to, the following:

- The results are abnormal or unexpected
- The result deviates significantly from previous results
- Group discordance
- Positive DCT (not related to prophylactic Anti-D administration)
- The presence of a rare clinically significant irregular antibody

When the presence of an antibody is identified, the Medical Scientist reporting the results onto the LIMS will also email the relevant consultant with the report.

10.14.5 Microbiology critical results

Critical results are phoned directly to the relevant senior nurse (and on occasion also to the RMO/ Consultant).

Test	Critical result	Phoned by	Phoned to
Blood culture	All positive blood culture gram stain results	Medical Scientist/ Consultant Microbiologist, MUH	Registered Nurse/ RMO/Consultant MPC
Joint Fluid	All positive joint fluid/tissue gram stain & culture results	Medical Scientist, MPD	Consultant Microbiologist MPC

Test	Critical result	Phoned by	Phoned to
CSF	All positive CSF gram stain results	Scientist/Consultant Microbiologist, MUH	Registered Nurse/ RMO/Consultant MPC

10.14.6 Histology critical results (MPD)

Critical results are telephoned by the Consultant Pathologist, when appropriate, directly to the requesting clinician. Pathologists immediately notify clinicians when examination results for urgent samples/ frozen sections are available.

Critical results include:

- Unexpected malignancy
- Fat in endometrial curetting
- Fat in GI biopsy
- Life threatening infection
- Cardiac biopsies if rejection grade is >1R
- Acid fast bacilli
- Amended reports

10.14.7 External laboratory critical results

The critical alert values for samples processed in MPD are in the User Handbook: https://www.materprivate.ie/our-services/medical-scans-tests/pathology-laboratories

During on call hours, the Medical Scientist will communicate the results verbally to the requesting clinician/ ward.

Referral laboratories will communicate critical results directly to the requesting clinician or to the Laboratory for onward communication to the requestor.

11.0 BIOCHEMISTRY

11.1 In-house test repertoire

Please note that all serum samples (brown or white cap) must be left for 30 minutes after collection to allow the blood to clot before centrifugation. All other tubes containing additives should be inverted gently 5-6 times after sample collection to ensure mixing.

Test A-Z (common abbreviation)	Sample type	TAT	Adult reference range	Precautions[1]

Title: User Manual

Test A-Z (common abbreviation)	Sample type	TAT	Adult reference range	Precautions[1]
Alanine Aminotransferase (ALT)	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	0 - 50 IU/L	
Albumin	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	35 - 50 g/L	
Alkaline Phosphatase (ALP)	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	30 - 130 IU/L	
Amylase	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	28 - 100 IU/L	Affected by haemolysis
Aspartate Aminotransferase (AST)	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	11 - 34 U/L	Affected by haemolysis
Total Bilirubin	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	5 - 24 µmol/L	Affected by haemolysis
NT-proBNP	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	<125 ng/L	
Calcium	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	2.18 - 2.60 mmol/L	
Chloride	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	95 - 108 mmol/L	Affected by haemolysis
C-Reactive Protein (CRP)	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	0 - 5.0 mg/L	
Creatine Kinase (CK)	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	F: 33 - 208 IU/L M: 44 - 272 IU/L	
Creatinine	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	<u>Up to 40y</u> F: 44 - 88 µmol/L M: 53 - 106 µmol/L <u>Up to 60y</u> F: 44 - 97 µmol/L M: 53 - 115 µmol/L <u>> or = 60y</u> F: 44 - 106 µmol/L M: 62 - 115 µmol/L	
Ferritin	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	F: 4.6 – 204 ng/mL M: 21.8 - 275 ng/mL	Affected by haemolysis
Gamma Glutamyl Transferase (GGT)	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	F: 0 – 37 IU/L M: 0 – 54 IU/L	Affected by haemolysis
Gentamicin[3]	**Serum (no gel) 7.5 mL**	Routine:2 hours Urgent:70 min	Please refer to www.nchd.ie	Fill out request form fully incl. time of sample, dose and time of last dose.

Title: User Manual

Test A-Z (common abbreviation)	Sample type	TAT	Adult reference range	Precautions[1]
Glucose	**Fluoride EDTA 2.7 mL**	Routine:2 hours Urgent:70 min	3.7 - 6.0 mmol/L	
Beta HCG (βHCG)	**Lithium Heparin 4.9 mL**	Routine:2 hours Urgent:70 min	< 5 IU/L	
Lactate Dehydrogenase (LDH)	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	125 – 220 IU/L	Affected by haemolysis
Magnesium	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	0.70 - 1.0 mmol/L	Affected by haemolysis
Inorganic Phosphate	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	0.74 - 1.52 mmol/L	Affected by haemolysis
Potassium[2]	**Serum-Gel[2] 7.5 mL**	Routine:2 hours Urgent:70 min	3.5 - 5.3 mmol/L	Affected by haemolysis
Sodium	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	133 - 146 mmol/L	
Thyroid Stimulating Hormone (TSH)	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	0.35 - 4.94 mIU/L	
Free thyroxine (Free T4, FT4)	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	9.0 - 19.1 pmol/L	
Total Protein	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	64 – 83 g/L	Affected by haemolysis
HS-Troponin I	**Lithium Heparin 4.9 mL**	Routine:2 hours Urgent:70 min	F: <16 ng/ L M: < 34 ng/L	MPC-FORM-LAB-122 *Clinical Guideline hs-cTnI algorithm*
Urea	**Serum-Gel 7.5 mL**	Routine:2 hours Urgent:70 min	2.1 - 7.1 mmol/L	
Vancomycin[3]	**Serum (no gel) 7.5 mL**	Routine:2 hours Urgent:70 min	Please refer to www.nchd.ie	Fill out request form fully incl. time of sample, dose and time of last dose.

Notes:

1. All analytes should be tested as soon as possible after sample collection as *in vitro* stability varies. If immediate testing is not possible in the Laboratory, the sample will be centrifuged and stored until analysis is carried out. Please allow serum samples to clot for 30 mins before being sent to lab.
2. Please note in cases of suspected pseudohyperkalaemia, a Lithium Heparin tube is recommended for potassium analysis, sent alongside a paired serum sample collected at the same time for comparison.

3. Please refer to www.nchd.ie for guidance on antimicrobial dose adjustments and monitoring. It is very important that the request form is populated fully, with time of specimen, dose given and time of last dose. Pre-dose/ trough samples are most useful guide for monitoring antibiotic therapy and specimens that are not trough may be rejected: optimal times are gentamicin collected at ≥18h from last dose and vancomycin collected at ≥10h from last dose.

Blood gases

Arterial blood gases/ venous blood gases (ABG, VBG)

Use the safePICO blood gas heparinised syringe for all blood gas samples.

TAT: 30 minutes

Ensure there are no air bubbles and analyse immediately after collection (up to a maximum 30 minutes but ideally within 5 – 10 mins of collection). See also section 11.8 below.

Test **(common abbreviation)**	**Adult reference range ARTERIAL**
pH	7.35 - 7.45
Carbon Dioxide (pCO_2)	4.5 – 6.0 kPa
Oxygen (pO_2)	11.0 - 14.5 kPa
Oxygen Saturation (sO_2)	95 - 98% (85 - 90% if venous)
Base Excess $Cbase(Ecf)_c$	-2.3 to +2.3 mmol/L
Bicarbonate ($cHCO_3^-$)	22.4 - 25.8 mmol/L
Total Haemoglobin Concentration (ctHb)	F: 11.5-16.5 g/dL M:13.0-18.0 g/dL
Fraction of Oxyhaemoglobin in Total Haemoglobin (FO2Hb)	94 - 98%
Fraction of Carboxyhaemoglobin in Total Haemoglobin (FCOHb)	<1.5%
Fraction of Methaemoglobin in Total Haemoglobin (FMetHb)	0.4 - 1.5%
Sodium Ion Concentration (cNA^+)	133 - 145 mmol/L
Potassium Ion Concentration (cK^+)	3.6 - 5.0 mmol/L

Test (common abbreviation)	**Adult reference range ARTERIAL**
Chloride Ion Concentration (cCL^-)	95 – 105 mmol/L
Calcium Ion Concentration (cCa^{2+})	1.10 - 1.28 mmol/L
D-Glucose Concentration (cGlu)	3.5 - 6.0 mmol/L
L(+)-Lactate Concentration cLac	0.5 - 2.0 mmol/L

11.2 Biochemistry profiles

The test profiles defined below are available.

Profile	**Tests included in profile**
Renal	Sodium, Potassium, Chloride, Urea, Creatinine
Liver	Total Protein, Albumin, Total Bilirubin, Alkaline Phosphatase, γ-GT, ALT, AST
Bone	Calcium, Inorganic Phosphate, Alkaline Phosphatase, Albumin
Thyroid Function Tests (TFTs)	TSH, Free T4

11.3 Biochemistry tests provided by MPD

Please refer to the MPD's Laboratory User Handbook for the most up to date sample requirements, turnaround times, reference ranges and critical values.
https://www.materprivate.ie/our-services/medical-scans-tests/pathology-laboratories

11.4 Sample volume

It is preferable that blood tubes, especially those containing preservative, are filled to the line. This reduces the risk of insufficiency or of interference from a preservative. Every effort will be made to try to maximize the use of any sample: however, when a sample bottle is less than half full, please indicate the tests that are of greatest importance.

11.5 Processing and testing fluids

Please send fluids in a sterile universal container. When measurement of pH and glucose is required, transfer some fluid into a heparinised blood gas syringe and sent to the laboratory immediately for analysis.

All samples from patients with suspected TB [or any other high risk organism] must be clearly labelled as *Suspected TB* or *High Risk*. Please telephone the Laboratory before sending. This will help to minimise the exposure of the laboratory staff and allow samples to be handled safely. See also section 6.7 above.

Fluid	Laboratory	Analytes
Cerebrospinal Fluid (CSF)	Mercy University Hospital	CSF Glucose, CSF Protein. Send a blood glucose fluoride sample at the same time.
Pleural Fluid[1]	Mater Private Cork	Amylase, Total Protein, LDH and Albumin: sterile universal container. Send a serum sample for total protein at the same time. For pH and Glucose: as soon as fluid is collected, take a sample into a heparinised blood gas syringe and expel all air.
Pleural Fluid[1]	Mater Private Dublin	Cytology
Pleural Fluid[1]	Mater Private Dublin	Gram Stain, Cell count, Culture & Sensitivity

[1] Please see *MPC-WI-LAB-002 Processing Pleural Fluids*

11.6 Sample rejection in biochemistry

Reasons for rejection include:

- Unlabelled or incorrectly labelled sample
- Incorrect sample type
- Incorrect additive used for 24-hour/ timed urine collection.
- Insufficient sample volume
- Haemolysis: depending on the degree of haemolysis, the request may be fulfilled partially or not at all.
- Contamination: often due to incorrect order of draw. For example, if an EDTA sample is taken before the serum – gel for biochemistry, this can affect the potassium and calcium measurements.
- Drip contamination: samples taken from an arm with an infusion or a line may yield falsely elevated or decreased results.

- Age: samples/ analytes will deteriorate if there is prolonged transit time.
- Clotted serum (not allowed to stand for sufficient time)

11.6.1 Factors affecting sample quality

The following factors should be considered:

- Timing: off-site blood collection, delayed centrifugation, leakage of RBCs.
- Temperature: blood gases and potassium
- Exposure to light: bilirubin, vitamins, porphyrins
- Clots, air bubbles: blood gases (ABG)
- Gross haemolysis, icterus, lipaemia

Tests which may be affected include the following but are not limited to:

- Potassium: Testing should be as soon as possible after sample collection. Samples that are not centrifuged within 2 hours of collection may show an artificial elevation in potassium.

- Glucose: Glucose decreases by 5-7%/ hour in unseparated samples at room temperature. Use of fluoride EDTA tubes is preferable to avoid this.

If a sample is rejected, the requestor is informed and it is advised that a repeat sample is taken. This is recorded on the Laboratory IT Winpath system on the patient's record.

11.7 Urine collection

11.7.1 Containers for 24-hour urine collections

These are available in the Laboratory. The containers may contain acid or no preservative, depending on the tests requested. Universal/ MSU containers are available from the stores department.

Patients are provided with an information sheet from the laboratory on the 24-hour collection. This is also available on Q-Pulse MPC-WI-LAB-015 *24-hour urine collection patient information leaflet*

Test	**Plain bottle for timed collection**	**Bottle with acid (HCl) for timed collection**	**Random (spot) urine**
Albumin	√		
Amylase	√		√

Test	Plain bottle for timed collection	Bottle with acid (HCl) for timed collection	Random (spot) urine
Bence Jones Protein (BJP)	√ (Quantification)		√
Calcium	√		√
Catecholamines	See metanephrines below		
Chloride	√		√
Citrate	√		
Copper	√		
Cortisol	√		
Creatinine	√		√
*Creatinine Clearance	√		
Haemosiderin	√		
Magnesium		√	√
Metanephrines, 5HIAA (Consider plasma metanephrines as first line investigation in the diagnosis of Phaeochromocytoma	√		
Microalbumin creatinine ratio			√
Oxalate		√	
Phosphate		√	
Potassium	√		√
Protein	√		√
Protein creatinine ratio			√
Sodium	√		√
Urate (uric acid)	√		
Urea	√		√
Glucose			√

*A serum creatinine, collected within 24 hours of the urine collection, is needed to calculate creatinine clearance.

11.7.2 Urine storage and preservation

Urine collections should be sent to the laboratory promptly once complete. The urine container should be stored in the refrigerator during the collection.

For 24-hour collections the request form should state the start time and end time of the collection. If more than one container is used, send all to the lab together once the collection is finished.

11.8 Blood gases

There are two blood gas analysers (Radiometer ABL90 Flex Plus) in the Hospital, one in the Laboratory on level B2 and the other in the Cath Lab control room. These are available for use by Laboratory and Hospital clinical staff when trained and competent to do so.
Once collected, blood gases samples must be transported immediately to the Laboratory a maximum of 30 minutes post venepuncture (ideally within 5 – 10 mins of collection) and should never be sent via the chute system or with needles attached.

The procedure for blood gas analysis is as follows:

1. A pre-heparinised Radiometer blood-gas safePICO syringe is recommended. Exclude all air, and mix in the heparin by rolling between the palms or placing onto the automatic mixer on the ABL90 FLEX Plus, to prevent clotting. If a sample is clotted it cannot be tested and may cause a blockage on the blood gas analyser.

2. Blood gas samples with large air bubbles should not be processed as CO_2 and O_2 are affected. Expel air bubbles from the blood gas sample by gently tapping on the side of the syringe to bring the air bubbles to the top. Then expel them by pressing the plunger. A vented tip cap helps in protecting you from blood exposure after blood collection. The vented tip cap forms a closed system, allowing expulsion of air bubbles and minimising the risk of blood exposure.
3. Blood gas samples should be analysed immediately. If this is not possible, analyze the sample within a maximum of 30 minutes of collection (ideally within 5 – 10 mins of collection).
4. Lactate is analysed on the blood gas analysers using blood gas heparinised syringes.

11.9 Dynamic function tests

The following documents available on Q-Pulse:

- Oral glucose tolerance test: *MPC-PP-NUR-091 Guidelines for performing an Oral Glucose Tolerance Test.*
- Dexamethasone suppression test: *MPC-WI-LAB-011 Dexamethasone Suppression Test*
- Short Synacthen test: *MPC-WI-LAB-012 Short Synacthen Test*

For clinical advice on dynamic function tests, please contact Professor Maria Fitzgibbon, Consultant Clinical Biochemist, by telephoning switchboard (ext. 3200) or MPD Clinical Biochemistry Dept. on 01-885 8134.

11.10 Interpretation of Troponin I results

In addition to the reference range and critical range for hs-Troponin I, an algorithm is also used to indicate if serial testing is necessary and to aid interpretation of the results.

MPC-FORM-LAB-122 Clinical Guideline hs-cTnI algorithm

12.0 POINT-OF-CARE TESTING

Point-of-care testing (POCT) in MPC is overseen by a multidisciplinary POCT committee. The committee advises the Hospital management team on all aspects of POCT including risk, benefits, resources required, new proposals and present and future strategy and provides clinical governance for the POCT service by ensuring that the organisation's systems and processes for monitoring and improving the quality of POCT services are in accordance with best practice.

The POCT repertoire is blood gas analysis, glucose, ketone, pregnancy testing, urinalysis, ACT, haemoglobin, SARS-CoV-2 and Flu AB testing.

The laboratory is responsible for the management of POCT testing. Daily management (including maintenance, QC and sample processing) is the responsibility of the users. Every user is responsible for ensuring that they have up-to-date training and competence and have read and comply with the relevant procedures, working instructions, user manuals, safety data sheets and kit inserts for each test.

Further details are in *MPC–PP–LAB-004 Management of Point-of-Care Testing*

13.0 IMMUNOLOGY

All immunology testing is referred out, both to MPD's Immunology department and to other laboratories**.** Details are in document *MPC-FORM-LAB-012 Referral test index* and further information is in the MPD User Handbook: https://www.materprivate.ie/our-services/medical-scans-tests/pathology-laboratories

14.0 HAEMATOLOGY

14.1 Haematology test repertoire

When not run in-house, tests are referred preferentially to MPD. For a detailed list of haematology tests carried out in MPD, please refer to the User Handbook: https://www.materprivate.ie/our-services/medical-scans-tests/pathology-laboratories

Details of haematology tests sent elsewhere are in *MPC-FORM-LAB-012 Referral test index*.

14.1.1 Haematology in-house tests

Test	Specimen type	Special consideration	Turnaround time	Reference ranges (Adult)
Full Blood Count (FBC)	**K EDTA 2.7 mL**	Clotted samples cannot be processed Optimum sample processing within 8 hours of collection WBC, RBC, HgB, MCV and PLT are stable for up to 24 hours	Routine: 2 hours Urgent: 45 mins	WBC: 4.00 - 11.00 x $10^{9/}$L RBC F: 3.80 - 5.80 x $10^{12/}$L RBC M: 4.50 - 6.50 x $10^{12/}$L HGB F: 11.5 - 16.5 g/dL HGB M: 13.0 - 18.0 g/dL HCT F: 0.37 - 0.47 x L/L HCT M: 0.40 - 0.54 x L/L MCV: 80.0 - 100.0 f/L MCH: 28.0 - 32.0 pg MCHC: 32.0 - 36.0 g/dL RDW: 11.0 - 15.0% PLTS: 150 - 400 x $10^{9/}$L
Erythrocyte Sedimentation Rate (ESR)	**Na Citrate 4NC 3.5 mL**	ESR testing is carried out for: Temporal Arteritis, Polymyalgia Rheumatica, Multiple Myeloma, Giant cell arteritis (GCA)	2 hours	Female: 0 – 20 Male: 0 - 10
Prothrombin Time (PT)	**Na Citrate 9NC 3 mL**	Must be analysed within 4 hours of collection. Correct blood volume in tube essential: fill to line on bottle	Routine: 2 hours Urgent: 80 mins	11.4 - 15.0 seconds

Test	Specimen type	Special consideration	Turnaround time	Reference ranges (Adult)
International Normalised Ratio (INR)	**Na Citrate 9NC 3 mL**	Must be analysed within 4 hours of collection. Correct blood volume in tube essential: fill to line on bottle	Routine: 2 hours Urgent: 80 mins	Determined by clinical state and PT result.
Activated Partial Thromboplastin Time (APTT)	**Na Citrate 9NC 3 mL**	Must be analysed within 4 hours of collection. Correct blood volume in tube essential: fill to line on bottle	Routine: 2 hours Urgent: 80 mins	24.8 – 34.4 secs.
D-Dimer	**Na Citrate 9NC 3mL**	Must be analysed within 4 hours of collection. Correct blood volume in tube essential: fill to line on bottle	Routine: 2 hours Urgent: 45 mins	<0.50 µg/mL
Fibrinogen	**Na Citrate 9NC 3mL**	Must be analysed within 4 hours of collection. Correct blood volume in tube essential: fill to line on bottle	Routine: 2 hours Urgent: 45 mins	2.0 – 4.0 g/L

14.1.2 MPD Haematology test repertoire

All blood films (morphology) and manual differentials are referred to the MPD Haematology department. Please refer to: https://www.materprivate.ie/our-services/medical-scans-tests/pathology-laboratories

Test	Specimen type	Turnaround time
B12	**Serum-Gel 7.5 mL**	24h from receipt in MPD
Serum folate	**Serum-Gel 7.5 mL**	24h from receipt in MPD

14.2 Information about Haematology tests

1. A Full Blood Count (FBC) is a white cell count including differential, red cell counts, haemoglobin, haematocrit (HCT), red cell indices and platelet count.
2. From the results of red cell indices, anaemia is classified as normochromic, hypochromic, microcytic or macrocytic and further investigations organised.
3. A blood film will be examined if requested with relevant clinical information or if indicated by the FBC result. In the presence of a normal FBC, there are few indications for routine film examination (possible infectious mononucleosis, malaria).
4. Reticulocyte counts are useful to check for increased red cell production e.g. haemorrhage, haemolysis, haematinic therapy (iron, vitamin B12 or folic acid) or investigating unexplained anaemia.
5. Eosinophil counts will be determined with the differential and expressed as an absolute number. A variety of conditions can lead to an increased count e.g. hyper-sensitivity states, parasitic infections or skin disease.
6. Erythrocyte Sedimentation Rate (ESR) is not a reliable test for confirming health or diagnosing disease. It has a role indicating inflammation and following the effects of therapy e.g. giant cell arteritis (GCA), Temporal Arteritis, Polymyalgia Rheumatica and Multiple Myeloma. Except in the case of GCA it is not an emergency test.
7. Coagulation studies can be confusing if their management is not informed. For the most reliable results, blood must be in the laboratory within one hour of sampling and not taken from heparinised I.V. lines or bungs.
8. PT/INR, APTT and FBC (for platelet count) are the most frequently used tests for initial screening of haemostasis.
9. D-Dimers are a reliable indicator of thrombosis.
10. INR monitors anticoagulant therapy with Vitamin K antagonists. The INR will also be prolonged with excess heparin anticoagulation, disseminated intravascular coagulation (DIC) and in rare extrinsic coagulation factor deficiencies i.e Factor II, Factor VII Factor VII or Factor X.
11. APTT is the most useful measure of heparin therapy. APTT results should be 1.5 to 2.5 times patient's baseline value or the midpoint of the reference range. Prolonged values are seen in moderate to severe haemophilia, Christmas or Von Willebrand disease. Rarely DIC or circulating anticoagulants e.g. lupus is found to cause prolonged values.

14.3 Factors that could significantly affect the test or interpretation of the result

Haemoglobin: it is important to avoid haemolysis either during or after the collection of the blood specimen, otherwise the result is invalid.

Red cell count: there is a moderate fluctuation during the 24 hours of about 4 per cent probably related to exercise meals and fluid intake. Strong emotions such as fear cause a temporary increase in the red cell count.

Platelets: pseudothrombocytopenia due to platelet aggregation (clumping) in EDTA blood may be found. This artefact is of no clinical significance, can be identified in the laboratory and resolved by supplying a thromboexact specimen for platelet count only.

While red cell, white cell and platelet numbers are stable for at least 24 hours in EDTA, progressive morphological changes in a blood film are however inevitable.

14.4 Use of the Thromboexact sample tube

In some instances, including pseudothrombocytopenia, it may be necessary to collect a patient sample using a 'Thromboexact' sample tube. The laboratory will inform the user when this is applicable and provide the tube to the clinical area.

15.0 BLOOD TRANSFUSION

15.1 General blood transfusion information and contact details

There is an in-house blood transfusion laboratory service for which all blood and blood products are supplied by the IBTS.

The BT laboratory can be contacted via speed-dial number 4444 or ext. 3420.

Please refer to *MPC-PP-HAE-005 Policy on the Transfusion of Blood & Blood Products* for further detailed information.

15.2 Blood Transfusion sample collection and labelling requirements

- To protect our patients, please note that there is zero tolerance of labelling errors

- N.B. The patient must be wearing an identification (I/D) band when Blood Transfusion samples are collected. Details are in *MPC-PP-GEN-111 Patient Identification and use of patient identity band*.

- The sample type is 7.5 mL EDTA KE tube (Sarstedt Monovette®)

Details on all transfusion blood sample bottles must be handwritten clearly and completely (using a biro or, preferably, a fine-tipped permanent marker).

For more information, please see document *MPC-PP-HAE-020 Policy on taking a sample for type and screen*.

Grossly haemolysed or lipaemic specimens may not be suitable for testing: please contact the Laboratory to discuss.

15.3 Blood Transfusion request form supplies and completion requirements

The transfusion request form is MPC-FORM-BT-001 and supplies of these forms are available from Stores.

Request form completion requirements are below and should be handwritten clearly (preferably in block capitals) using biro or (preferably) a fine-tipped permanent marker, on the form.

N.B. Please ensure the information on the form matches that on the sample bottle exactly.

Information	**Format and notes**
Surname	The patient's formal/ given surname, checked against official I/D (passport, driving licence, health insurance card). The spelling must be correct and nicknames cannot be used.
First name	The patient's formal/ given forename, checked against official I/D (passport, driving licence, health insurance card). The spelling must be correct and nicknames cannot be used.
Hospital number (MRN)	Mnnnnn (the number of numbers (n) may vary)
Date of birth	Format dd/mm/yyyy or dd/mm/yy
Address	Include the address details
Sex	Specify whether female or male
Consultant	Consultant's name
Ward	Specify ward or location

Information	**Format and notes**
Urgency	Whether urgent and if lab has been informed.
Tests required	What is required and for when i.e. Type & Antibody Screen or Type & Crossmatch.
Product type, quantity, date and time required	Number of units required (if Type & Crossmatch required).
Special requirements	Special requirements for products requested (if required) CMV Negative and/ or Irradiated. See also MPC-PP-HAE-025 *Special Requirements Algorithm* as guidance but note that the consultant looking after the patient should make this decision.
Sample taken by/ declaration	The nurse/ doctor/ phlebotomist who took the sample must print and sign their name in this section of the form and document the date and time the sample was taken.
Clinical details/ reason for request/ transfusion history	Clinical condition (the reason for request such as pre-op or low Hb), most recent haemoglobin, transfusion and transplantation history (when available), blood group (if known) and obstetric history/ pregnancy status when applicable
Once the sample reaches the laboratory, changes cannot be made to the sample or the request form without exception: this is Hospital policy. Once all details are checked and correct, place the sample tube in a plastic pouch and send to MPC laboratory with the form via the pneumatic tube or by hand, unless the sample requires urgent processing. If it is urgent, contact the laboratory [speed dial 4444] and follow the procedure described in section 15.3.2 below.	

15.3.1 Routine requests

Routine (elective) requests received in the MPC Laboratory are processed within 7 days and typically within 48 hours of receipt.

15.3.2 Urgent requests

If a request is urgent, follow the process below.

1. Inform the laboratory by using speed dial 4444 (direct dial 021 601 3420 or ext 3420) and make a verbal request for urgent processing.

2. Send the samples and form to the laboratory, ensuring completion of form and sample bottle matches the requirements.

The person who sends the specimen is responsible for ensuring that the primary container is appropriate, properly closed and is not externally contaminated by the contents.

15.4 Blood Transfusion samples and turnaround times

Test	Sample type	Turnaround time[1]
Type & Screen (aka Group & Hold, Group & Save) (Routine)	K EDTA 7.5 mL	24 – 48 hours unless indicated as urgent[2]
Type & Screen (Urgent)	K EDTA 7.5 mL	Type/ Group known: 2 hours Type/ Group unknown: 3 hours
Crossmatch[3]	K EDTA 7.5 mL	Approximately 24 hours unless urgent. 2 hours if urgent and valid sample in lab
Direct Antiglobulin Test (DAT)	K EDTA 7.5 mL	24 hours
Antibody investigation	K EDTA 7.5 mL	3 days
Transfusion reaction investigation	Please see section 15.10 below	Patient-specific
HLA typing N.B. A special request form is needed: please contact the IBTS to obtain it[4]	K EDTA 7.5 mL	Approximately 2 weeks
HLA antibodies N.B. A special request form is needed: please contact the IBTS to obtain it[4]	Serum-Gel 7.5mL	Approximately 2 weeks
Platelet Alloantibodies N.B. A special request form is needed: please contact the IBTS to obtain it[4]	Serum-Gel 7.5mL	Approximately 2 weeks

[1] Turnaround time is calculated from time of receipt in the laboratory

[2] A positive antibody screen will increase the turnaround time.

[3] An add-on Crossmatch can only be performed if a current valid sample is available.

[4] Contact Dublin IBTS on 01 432 2800

All other test details can be found in *MPC-FORM-LAB-012 Referral Test Index*.

15.5 Blood products and turnaround times

Product	Sample type	Turnaround time[1]
Red cells/ CMV negative/ irradiated	K EDTA 7.5 mL	Routine: 24 hours Urgent: 2 hours
Octaplas	K EDTA 7.5 mL	30 minutes
Platelets	K EDTA 7.5 mL	2 hours
Octaplex	K EDTA 7.5 mL	From Pharmacy. <30 minutes
Albumin	N/A	From Pharmacy. <30 minutes
Fibrinogen concentrate	N/A	<1 hour
Coagulation factor concentrates	N/A	2 – 4 hours (IBTS)

[1] Turnaround time from request to availability

15.6 Crossmatch requests

Sample validity for crossmatch timeframe depends on the patient's history.

72 hour validity: pre-transfusion samples are only valid for 72 hours [72 hours from time of sample collection to end of transfusion] if the patient has been pregnant or transfused or transplanted in the past three months or if their transfusion or obstetric history cannot be established.

7 day validity: pre-transfusion samples are valid for 7 days if none of the criteria above apply.

Note that a crossmatch cannot be carried out on the first sample on that patient received in our laboratory. Crossmatching can only occur on second (or subsequent) samples (i.e. the 'two sample rule' described below).

Two sample rule

Patients have their blood group confirmed on two different samples, drawn on two different occasions ideally by two different persons before their first transfusion. This is to mitigate the risk of an ABO incompatible transfusion.

15.7 Maximum (surgical) blood ordering schedule (MBOS/ MSBOS)

A Maximum Surgical Blood Ordering Schedule is a mechanism to maximise usage of blood and minimise wastage in elective surgery. A Maximum Surgical Blood Ordering Schedule can reduce the workload of unnecessary crossmatching and issuing of blood and optimise stock management. The MSBOS only applies to elective surgery.

Please see *MPC-PP-HAE-001 Maximum Blood Ordering Schedule* for details.

15.8 Massive/ life-threatening haemorrhage pathway

Please refer to *MPC-PP-GEN-118 Transfusion Management of Life Threatening Haemorrhage* for details of how to respond to massive haemorrhage pathway activation.

15.9 Blood Products

All blood products listed below are provided in-house unless otherwise indicated.

15.9.1 Red Cells

RCC (red cell concentrate) is supplied by the laboratory on a named patient basis.

If a patient has special requirements, such as CMV negative or irradiation, this should be indicated to the laboratory prior to ordering the red cells. CMV negative or irradiated blood will be ordered in from the IBTS and the additional turnaround time is approximately one hour.

15.9.2 Emergency Uncrossmatched O RhD Negative red cells

Two to four emergency Group O RhD Negative units are held in the Blood Fridge (Serial No: 2051566, Asset No: 03104, Fridge number 11) in the Laboratory on level B2. Further emergency uncrossmatched O RhD Negative red cells can be requested directly from the laboratory by telephone.

The decision to transfuse uncrossmatched blood lies with the requesting Consultant. If the emergency O Rh D Negative units are used they will be replaced by the laboratory team, once they are informed.

15.9.3 Platelets

Platelets are a group-specific product and therefore the laboratory requires a type & screen sample prior to ordering platelets from the IBTS.

15.9.4 Octaplas

LG-octaplas is human plasma pooled and treated for virus inactivation. It contains human plasma proteins which are important to maintain normal clotting characteristics and is used the same way as fresh frozen plasma (FFP).
Frozen units of Group AB plasma are held in the laboratory: please contact the laboratory if this is required and the laboratory team will defrost the product and advise when it is ready for collection.

Please refer to *MPC-PP-HAE-009 Guideline for use of LG Octaplas* for further information.

15.9.5 Human Albumin (Flexbumin)

Flexbumin is used to replace blood volume loss resulting from trauma such as a severe burns or an injury that causes blood loss. This medicine is also used to treat low albumin levels caused by surgery, dialysis, abdominal infections, liver failure, pancreatitis, respiratory distress, bypass surgery and many other conditions.

Flexbumin is provided by Pharmacy (200g/L in a 100mL size). Pharmacy may also have Human Albumin (Baxalta) 50g/L in 500mL size in stock but 200g/L is most commonly used.

Please refer to *MPC-PP-HAE-005 Policy on the transfusion of Blood & Blood Products* for further information.

<u>Pharmacy</u>

Order human albumin (flexbumin) or Octaplex stock using the pharmacy requisition form, MPC-PP-MED-014, which a Clinical Pharmacist reviews during working hours.

Pharmacy opening hours: 9am – 5pm Mon-Fri, 8am – 12pm Sat. Closed Sunday and BH. Telephone ext. 3207.

Out-of-hours policy (MPC-PP-MED-10) applies thereafter requiring 2 nursing staff members to obtain stock.

15.9.6 Prothrombin complex concentrate (Octaplex™)

Octaplex is a coagulation factor concentrate, specifically Prothrombin complex concentrate. A limited stock is held in MPC Pharmacy. This is used for the reversal of warfarin in major or life-threatening bleeds.

Octaplex is stored in the Pharmacy fridge and also in the Cath Lab. There is enough for at least 2 doses. It is logged on Pharmacy's critical medicines list which is double checked monthly. Pack replenishment is generally 1 working day from the wholesaler. If, very exceptionally, additional stock were needed, it can be obtained from another hospital in the city.

15.9.7 Fibrinogen concentrate (Riastap® or Fibryga®)

Fibrinogen concentrate is stored in the Blood Issue Fridge (Serial No: 2051566, Asset No: 03104, Fridge number 11) located in the MPC Laboratory on level B2. This is indicated for acute blood loss with fibrinogen deficiency.

Please refer to *MPC-PP-HAE-005 Policy on the transfusion of Blood & Blood Products* for further information.

15.9.8 Other Blood Products

Requests for other blood products not listed above, such as Factor Concentrates, Cryoprecipitate, Anti-D Immunoglobulin, should be discussed with the Consultant Haematologist (contact via switchboard).

15.10 Suspected transfusion reaction

MPC-PP-BT-013 Laboratory Investigation of Transfusion Reactions

MPC-FORM-BT-020 Transfusion Reaction Investigation Form

MPC-PP-HAE-011 Policy on the Management and Reporting of Transfusion Reaction, Adverse Events and Near Miss Incidents

Any unfavourable response by a patient to the transfusion of blood components/ products is described as a transfusion reaction or Serious Adverse Reaction (SAR).

If a transfusion reaction is suspected, follow these steps:

- Stop the transfusion but do not disconnect the unit.

- Call the clinician [i.e. the RMO for that area or patient's consultant] to review the patient urgently.

- If the attending clinician confirms a suspected transfusion reaction, inform the Haemovigilance officer (call ext. 3315 during office hours or leave a message/ email out-of-hours) and the ADON/ senior nurse in charge and then disconnect the unit.

- Follow the algorithm in document *MPC-FORM-HAE-001 Blood Component and derivatives transfusion and prescription record*.
- Return all implicated blood/ product packs with administration/ giving set attached to the MPC lab. Also send the relevant samples and completed transfusion reaction investigation form [FORM-HAE-001].

- Blood product packs should be stored at room temperature while awaiting investigation.

- Out-of-hours: Send type & screen, DAT, blood packs and giving sets to the laboratory. Send FBC, renal and liver profiles, LDH to our laboratory and the patient's blood cultures to MUH.

Table: Investigation of a possible transfusion reaction

Transfusion reaction investigation test/profiles	**Specimen type**	**Special requirements** (Take all samples after a suspected transfusion reaction)
Type and screen and DAT	**2 x K EDTA** **7.5 mL**	Specimens and forms must be correctly and completely populated.
Full Blood Count	**K EDTA** **2.7 mL**	
Full coagulation screen	**Na Citrate 9NC** **3 mL**	
Renal Profile, Liver Profile, LDH, BNP	**Serum-Gel** **7.5 mL**	
Hs-Troponin I	**Lithium Heparin** **4.9 mL**	

Transfusion reaction investigation test/profiles	Specimen type	Special requirements (Take all samples after a suspected transfusion reaction)
Haptoglobins	**Serum-Gel 7.5 mL**	
MSU (Urobilinogen)	**MSU**	Test at point-of-care on Clinitek Status instrument.
Blood Cultures	**Aerobic and Anaerobic bottles**	
All Blood Packs including giving sets (used and unused)		All Blood Packs and Giving Sets are sent to the IBTS for culture

15.11 Collection and delivery of blood, blood components and blood products

All movement of blood, platelets, plasma and fibrinogen is documented for monitoring on *MPC-FORM-HAE-054 Blood Product Ledger:* blood and platelets are recorded on the Blood Track electronic system. Please refer to *MPC-PP-HAE-016 Procedure for ordering and receiving blood products* for further details.

16.0 HAEMOVIGILANCE

16.1 General haemovigilance information

Haemovigilance is "A set of organised surveillance procedures relating to serious adverse or unexpected events or reactions in donors or recipients and the epidemiological follow-up of donors." (Directive 2002/98/EC)

The main objectives of the Haemovigilance function are:

- To ensure the safety of the transfusion system
- Educate staff in best transfusion practice
- Show that problems are recognized and effectively managed
- Ensure compliance with legal requirements
- Improve public confidence in the safety of blood and blood components
- Ensure 100% traceability

- Manage Serious Adverse Reactions, Serious Adverse Events and Near-Misses as appropriate

16.2 Blood Transfusion positive patient identification

- Misidentification at blood sampling may lead to fatal ABO-incompatible blood transfusion. Evidence shows that inadequately or mislabelled samples carry a significantly increased risk of containing blood from the wrong patient.

- A patient identification band must be worn by all in-patients at time of both sample collection and when receiving a blood transfusion. The patient is instructed not to remove the identification band because it is also required for pre-transfusion bedside checking.

  To ensure accuracy and legibility, the ID band should be printed, from the hospital's computerised patient administration system. The minimum identifiers on the Identification band are:

  1. Last name
  2. First name
  3. Date of birth
  4. Unique Patient Hospital Number
  5. Sex

- Details on all samples MUST be hand-written (ask the patient, check their wrist band and chart at the bedside) for Blood Transfusion. All handwritten details must be legible.

- Collection of the sample and labelling (hand-written) of the sample tubes must be performed as one uninterrupted process involving one member of staff and one patient at the patient's bedside.

  See *MPC-PP-HAE-020 Policy on the taking of a sample for a Type & Screen +/- Crossmatch.*

- The blood tube must never be pre-populated. The blood tube must never be populated with the patient's information anywhere apart from beside the patient.

- British Standards in Haematology (BSH) guidelines recommend that laboratories have a 'zero tolerance' policy for rejecting samples that do not meet minimum sample labelling and collection requirements: this is in place in our Hospital.

16.3 Traceability (Legal Requirement)

A traceability tag is attached to each blood component issued.
The nurse/ doctor administering the blood product must complete, sign, date and time the tag. The signed tab must be placed in the traceability box which is in the locked treatment room on Ward 2, Ward 3 and Theatres. The Haemovigilance Officer (HVO) collects these tags from the traceability boxes and returns them to the MPC Laboratory, where the blood product is end fated on the Blood Track system.

A photocopy of the tag is kept at MPC and the tag is returned to the Laboratory. This process is documented by the HVO in the Blood Ledger (*MPC-FORM-HAE-054)* in the lab and updated in the Haemovigilance database, maintained and managed by the HVO on the shared K drive.

Further details are in *MPC-PP-HAE-028 Policy on the Use of the Bag and Tag Compatibility/ Traceability Label in Transfusion Practice*

When emergency Group O Negative uncrossmatched blood is used, the nurse/ doctor administrating the blood should complete the Patient Identifiers on the traceability label. '*The traceability form for transfusion confirmation of non-assigned blood components'* which is provided with each unit of RCC should be fully populated by the nurse/ doctor administering the blood. The completed form is then returned to traceability box as described in MPC-PP-HAE-028.

When emergency Group O Negative uncrossmatched blood is used, the Laboratory will re-order replacement units for the Hospital from the IBTS. To do so, follow the usual procedure for ordering stock described in *MPC-PP-HAE-016 Procedure for Ordering & Receiving Blood Products*

Traceability of all blood is a mandatory and statutory requirement. Failure to comply with the traceability system may compromise patient safety and will result in an investigation and follow-up via the non-conformance process.

16.4 Notification of Serious Adverse Events and Reactions (SAE and SAR)

Any near misses, serious adverse events (accidents and errors) related to the collection, testing, processing, storage and distribution of blood and blood components which may have an influence on their quality and safety, as well as any serious adverse reactions observed during or after transfusion which may be attributed to the quality and the safety of blood and blood components, are notified to the competent authority, the National Haemovigilance Office (NHO). The NHO will submit these reports as serious adverse events (SAE) to the Health Products Regulatory Authority (HPRA), which in turn submits an annual report to the European Commission.

Notification procedure for suspected reactions, events, near misses

1. Who to contact

Contact the HVO (ext. 3315) when on duty.
If HVO is not on duty, notify the Nurse Practice Development Co-Ordinator (deputy HVO) on ext. 3437. If neither the HVO nor deputy HVO is available, notify the CNM in charge and ADON/ DON, ext. 3416.

2. Initial reporting

The HVO/ deputy HVO/ CNM in charge/ ADON/ DON:

a. Reports the incident to the laboratory (4444 or on call via 3416)
b. If not already done, informs the patient's primary consultant.
c. Logs the reaction/ adverse event/ near miss as an incident on the Flex system

3. Investigation

The HVO will review the Flex investigation form and the patient's medical record and discusses the findings with Blood Transfusion Consultant. Where appropriate the HVO will report serious adverse reactions and serious adverse events to the NHO using the appropriate template available via https://www.giveblood.ie

Completed forms will be emailed to haemovigilance@ibts.ie. The HVO will retain a copy of this anonymised initial report and any subsequent detailed reports in order to update the MPC Blood Transfusion Committee. All other documentation is retained in the patient's medical record as described in *MPC-PP-GEN-103 Patient Medical Records Policy*.

4. Detailed review, reporting and follow-up

The Haemovigilance Officer will liaise with the blood transfusion laboratory staff, Consultant Haematologist and patient's clinician in the follow up of the results. A root cause analysis may need to be carried as described in *MPC-PP-RM-005 Incident / Reporting Management Policy*. The Haemovigilance Officer/ relevant staff will take part in this investigation as requested and needed.

In the event of a confirmed transfusion reaction the Haemovigilance Officer will document details regarding the reaction investigation, follow up and recommendations where applicable in the patient's clinical notes. The HVO will 'end fate' the unit on Blood Track by indicating 'reaction' in the register and on the electronic blood management system. The event will be closed out with follow up letter/ report to patient's consultant if required. A hard copy of the report will be posted by mail to consultant and a copy of the close out report will be placed in the patient medical record when appropriate.

A report of any suspected transfusion reactions/ adverse events will be prepared by the HVO and discussed at the MPC Blood Transfusion committee meeting. The event will be closed out with follow up letter/ report to patient's consultant if required. A hard copy of the report will be posted by mail to consultant and a copy of the close-out report will be placed in the patient medical record when appropriate.

All adverse events, near miss and non-compliances relating to transfusion and occurring in the clinical area, are reported and managed as per the *Incident / Reporting Management Policy MPC-PP-RM-005*.

5. Trend analysis

The HVO will review all haemovigilance-related incidents and report these to the blood transfusion committee quarterly. The Quality department will notify the HVO of any transfusion-related incident and the HVO will keep a log of events to allow analysis of trends or recurring problems. Incidents are discussed at regular multi-disciplinary team meetings (Hospital incident management meeting and Quest and BT Committee) which help determine and disseminate preventative and corrective actions.

Further details are in *MPC-PP-HAE-011 Policy on the Management and Reporting of Transfusion Reaction and Adverse Events.*

17.0 MICROBIOLOGY

17.1 Requesting microbiology investigations

1. Use the Microbiology request form (form LF-MICRO-0054).

2. Complete the request form fully including patient details, location, clinician, specimen date and time, specimen type or site, antibiotic therapy details (including allergies) and relevant clinical details.

3. Telephone the laboratory (ext. 3411) for add-on tests on samples already in the laboratory, preferably on the day the sample is taken. When it is confirmed by the Laboratory that it is possible to proceed with the additional test, send a request form to the laboratory for this test.

4. Discuss requests for additional tests that are not routinely carried out in the laboratory with the Consultant Microbiologist (contact via Switchboard).

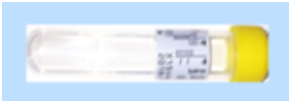
17.2 Collection and transport guidelines for microbiology specimens

- Where possible, collect specimen before the administration of antimicrobial therapy.
- Collect specimen with as little contamination from indigenous microbial flora as possible to ensure that the sample will be representative of the infective site.
- Collect specimen using sterile equipment and aseptic technique to avoid introduction of foreign micro-organisms.
- Collect an adequate amount of specimen. Inadequate amounts may yield false negative results.
- Identify the specimen source and/ or specific site correctly so that proper culture media will be selected during processing in the laboratory.
- Specimens should be transported to laboratory as soon as possible. If processing is delayed, refrigeration is preferable to storage at room temperature, with the exception of Blood cultures and CSFs which must always be kept at room temperature.
- Please note blood cultures must be incubated at Mercy University Hospital within 4 hours of collection.
- Please contact the laboratory (ext. 3411) to discuss if unsure.

17.3 Sample collection

Collect the sample into the appropriate container. Please contact the laboratory if unsure of correct container. Samples should be accompanied by a completed Microbiology request form.

Request	Container	Container supplier
Urine , CSF, Sputum Faeces, Tissue, Fluid	Sterile universal container 	Stores
Swabs for Bacterial Culture (C&S, MRSA, CPE, VRE etc.)	Amies Transport Swab (Blue top) 	Stores
Chlamydia trachomatis & Neisseria gonorrhoeae detection **Urine Sample**	Cobas Liat PCR Sample kit 	Laboratory (ext. 3411)
Endocervical Sample	Cobas PCR Dual swab Sample kit 	Laboratory (ext. 3411)
Measles & Mumps virus detection in saliva	Buccal swab (Oracol) 	Laboratory (ext. 3411)
Rectal swab for PCR	Copan double swab	Laboratory (ext. 3411)

Request	Container	Container supplier
		
Blood Culture	Aerobic and Anaerobic bottles 	Stores
Fluids from sterile sites	Aerobic and Anaerobic bottles 	Stores
Viral swab – Influenza, Covid-19 and virus detection e.g. herpes, chicken pox etc.		Stores
Swabs for Influenza A, B and SARS-CoV-2 (only for Cobas Liat, in-house)		Laboratory (ext. 3411)

17.4 Microbiology test information

Microbiology testing is carried out in our Cork laboratory, our Dublin laboratory, Mercy University Hospital and other laboratories.

17.4.1 In-house Microbiology tests

Specimen types, turnaround times and storage conditions for Cork in-house tests are listed in the table below.

Test/ investigation	Sample type	Volume required mL	Container	Turnaround time (during routine hours)	Storage conditions if transport to Laboratory delayed
MRSA screen	Nasal and groin swabs and, if present, also send swab of wounds, sites of damaged or abnormal skin, intravenous line insertion sites, CSUs and sputum, if expectorating.	N/A	Amies Transport Swab (Blue top)	2 working days Mon-Thurs	Fridge 4-8˚C
VRE, CPE screen	Rectal swab	N/A	Amies Transport Swab (Blue top)	2 working days Mon-Thurs	Fridge 4-8˚C
Influenza A/B/RSV	Nasopharyngeal swab	N/A	Viral UTM swab 	3 hours	Fridge 4-8˚C
SARS-CoV-2	Nasopharyngeal and oropharyngeal swab	N/A	Viral UTM swab 	Urgent: 2 hours Routine: 1 working day	Fridge 4-8˚C
Respiratory panel (including SARS-CoV-2)	Nasopharyngeal and oropharyngeal swab	N/A	Viral UTM swab 	Urgent: 2 hours Routine: 1 working day	Fridge 4-8˚C
C. difficile toxin	Faeces. Formed faeces specimens will not be tested for *C. difficile* unless specifically requested by Consultant Microbiologist.	5 - 10 mL	Sterile universal container	4 hours	Fridge 4-8˚C
Norovirus	Faeces	5 - 10 mL	Sterile universal container	1 working day	Fridge 4-8˚C
Legionella urinary antigen	Urine	10 mL	Sterile universal container	3 hours	Fridge 4-8˚C
Pneumococcal urinary antigen	Urine	10 mL	Sterile universal container	3 hours	Fridge 4-8˚C

17.4.2 Microbiology tests (MPD)

VRE, CPE, MRSA cultures requiring further investigation are referred to Microbiology MPD for confirmatory and sensitivity testing.

For all other microbiology tests and for information on sample requirements, turnaround times and reference ranges, please refer the Microbiology section of the Mater Private Dublin Laboratory User Handbook, available at
https://www.materprivate.ie/our-services/medical-scans-tests/pathology-laboratories

Transport to MPD

Please ensure all Microbiology specimens are brought to the Cork laboratory before 08:30 each morning for transportation to Dublin at the earliest opportunity

17.4.3 Microbiology tests (Mercy University Hospital, MUH)

During routine hours, specimens are sent to MUH via the MPC laboratory. Out of hours, specimens are sent directly from the wards to MUH.

Please refer to the Mercy Hospital's user manual for sample requirements, turnaround times and reference ranges:

https://www.muh.ie/images/Pathology/A-Z-Test-Directory-to-Lab-User-Manual-Rev-6.pdf

Test/ investigation	Specimen type	Volume required mL	Container	Turnaround Time (during routine hours)	Storage conditions if transport to Laboratory delayed
Blood Culture	Blood State specimen type (e.g. peripheral, arterial) *See MPC-PP-IC-076 Guidelines on Blood Culture Specimen collection*	8-10 mL blood in each blood culture bottle N.B. If other blood tests are required, always collect blood cultures first.	Aerobic and Anaerobic bottles  Inoculate Aerobic bottle first then the anaerobic bottle. Do not use if liquid is cloudy or sensor at base of bottles is not grey before inoculation. Do not cover or remove bar code labels Do not cover grey	Positive: results are phoned as soon as available (most organisms are detected within 24-48 hrs). Negative: 5 days Negative ?Endocarditis: 10 days (as requires extended culture)	Blood cultures must be incubated at Mercy University Hospital within 4 hours of collection. Do not send in pneumatic tube system Do not refrigerate

Test/ investigation	Specimen type	Volume required mL	Container	Turnaround Time (during routine hours)	Storage conditions if transport to Laboratory delayed
			sensor layer at the base of bottles.		
Cerebrospinal Fluid, CSF	CSF Therapy should not be delayed unnecessarily pending lumber puncture.	Ideally, a minimum volume of 1 mL CSF is collected sequentially into separate containers which should be numbered appropriately. See section 17.6 below.	Sterile universal container	Microscopy: Within two hours of receipt in MUH. Culture: Preliminary:24 hours, Final: 48-72 hours Testing is treated as urgent.	Transport specimens immediately after collection Do not send in pneumatic tube system
Blood/ body fluid exposure specimens/ needle-stick injuries (Hep B surface antigen, Hep C, HIV and Hep B antibodies)	Clotted blood See *MPC-PP-OH-003 'Procedure to be followed for a Blood & Body Fluid Exposure'*	7.5mL	White bottle	4 hours after receipt at MUH - anytime	Send to MUH immediately after collection

17.5 Blood Culture

For the majority of patients, two blood culture sets are recommended. A second or third set taken from a different site not only increases yield but also allows recognition of contamination.

In most conditions other than endocarditis, bacteraemia is intermittent, given it is related to the fevers and rigors which occur 30 - 60 minutes after the entry of organisms into the bloodstream. Specimens should be taken as soon as possible after a spike of fever.

Ideally, blood cultures should be taken prior to antimicrobial treatment. When already receiving antimicrobials, blood culture should be collected just before the next dose is due when antimicrobial concentration in the blood is at the lowest. Any recent antimicrobial therapy can have a significant effect on blood culture results by decreasing the sensitivity of the test. This may be of particular importance in those patients receiving prophylactic antibiotics and who are at high risk of bloodstream infections. If patients have received

previous antimicrobial treatment, bacteraemia should be considered even if blood culture results are negative.

Blood culture volume is the most significant factor affecting the detection of organisms in bloodstream infection. There is a direct relationship between blood volume and yield, with approximately a 3% increase in yield per mL of blood cultured. False negatives may occur if inadequate blood culture volumes are submitted.

17.6 Cerebrospinal fluid (CSF)

- All specimens should be taken before antimicrobial therapy where possible, but therapy should not be delayed unnecessarily pending lumber puncture.
- Collect the CSF sequentially into separate containers numbered 1, 2 and 3 (upward). Collect 1 mL of CSF into each container, if possible.

- Send the first and last specimens for microbiology (MUH) examination and specimen no. 2 to Biochemistry (MUH) for testing of CSF protein. Add 200 µL of CSF to a fluoride tube for CSF glucose analysis and send a concurrent blood sample in a fluoride tube for blood glucose for comparison. If a sample of CSF is not in a fluoride tube, testing cannot be carried out on CSF more than 1 hour old.

- Complete a request form for each of Biochemistry and Microbiology (i.e. two request forms are needed) and send with the specimens.
- If only one sample of CSF is collected, send it to Microbiology first.

- Send the specimens to the laboratory as soon as possible. If the specimen is more than 2 hours old on receipt the cell count may not be accurate owing to cell disintegration.

- Routine hours: During MPC laboratory opening hours, phone the laboratory to inform them a CSF is being taken and transport it to the MPC laboratory urgently. Do NOT send CSF specimens in the pneumatic tube system.

- Out-of-hours: Send the CSF directly to the Laboratory, Mercy University Hospital urgently.

- Where other CSF investigations are requested, additional volume of specimen may be required. Please contact the MPC laboratory (ext. 3411) for quantities required for tests before taking the specimen, if possible.

17.6.1 Investigation of Meningitis

When bacterial infection is suspected do the following in addition to taking the CSF:

- Collect blood cultures
- Collect EDTA sample for Meningococcal and Pneumococcal PCR
- Collect a bacterial throat swab

When viral meningitis is suspected do the following in addition to taking the CSF:

- Collect a faeces specimen
- Collect a viral throat swab
- Request viral PCR on the CSF request form (Herpes simplex virus, Varicella zoster virus, Enterovirus (Coxsackie Echo)).

  Please note that 500µL of CSF is required for viral PCR.

17.6.2 Sub-arachnoid haemorrhage (SAH)

If SAH is suspected, CSF specimens 1 and 3 must be sent to Biochemistry in Cork University Hospital (CUH) for red cell count. In SAH the red cell count in both specimens will be similar whereas in traumatic CSF the red cell count will decrease in specimen 3. State clearly on the request form '?Subarachnoid haemorrhage' or '?SAH'.

CUH: telephone 021 492 2000. On call Medical Scientist bleep 199 biochemistry, bleep 375 microbiology

17.6.3 CSF reference ranges

https://www.muh.ie/images/Pathology/A-Z-Test-Directory-to-Lab-User-Manual-Rev-6.pdf

Parameter	**Reference range**
Leucocytes	0 - 5 cells/cmm
Erythrocytes	0 - 10 cells/cmm
Glucose	≥ 60% of simultaneously determined plasma concentration
Protein	0.2 - 0.4 g/L (<1% of serum protein concentration)

These values represent the upper and lower limits of normality. A specimen is considered positive when the white cell count (leucocytes) is elevated i.e. outside the normal CSF values in the table above.

17.7 Infection Prevention and Control

The Hospital's infection prevention and control team provides advice and consultation on all aspects of infection control.

Contact the infection control nurse via MPCInfectioncontrol@materprivate.ie or on ext. 3259.

17.8 Reporting Microbiology Results

Tests carried out by MPD and MUH are authorized by the relevant team in those hospitals.

MPC negative tests are authorized by the Microbiology Medical Scientists.

MPC positive tests are authorized by the Microbiology Medical Scientists (with delegated authority from the Consultant Microbiologist) and the Consultant Microbiologist is informed. The Microbiology Medical Scientists inform the IPC team when the result is clinically significant.

Microbiology laboratory reports are printed daily (Monday - Friday). The reports are checked against the original or copy of the request form to ensure the patient details, clinician and tests performed are correct. The reports are then filed per clinician.

Microbiology reports in which sensitivities are reported are scanned and emailed directly to the patient's consultant on the day the report is printed.

Once Microbiology results are checked and authorised in the laboratory, they are available on Winpath Ward Enquiry.

17.8.1 Reporting of suspected outbreaks of infection

When an outbreak of infection is suspected, clinical staff must inform the Infection Control Nurse immediately to ensure prompt control and monitoring of the situation. The Consultant Microbiologist may be contacted out of hours if required by the site manager or clinician on call.

Notifiable diseases are reported to the Health Protection Surveillance Centre by a laboratory scientist. They are reported on the day identified unless there is uncertainty about the result (for example, if unclear whether past or current infection) in which case reporting is done when the uncertainty has been removed.

For further information, please refer to the current version of the list of notifiable diseases available at https://www.hpsc.ie/notifiablediseases

17.8.2 Other infectious diseases

Other infections which are of importance as far as spread in hospital/ patient welfare is concerned must be notified to the Infection Control team; these are:

1. All methicillin (oxacillin) resistant staphylococcal infections
2. All ESBL positive isolates
3. All positive Carbapenemase producing enterobacteriacae
4. All Vancomycin resistant enterococci
5. All positive *Clostridium difficile* A&B screens
6. Positive blood cultures
7. Other exceptional resistant pathogens (e.g. VRSA / penicillin resistant GC)

17.9 Microbiology sample storage

When there is a delay in sending urines, swabs, fluids, faeces, tissues, viral swabs and sputum to the laboratory, these should be refrigerated. If samples are taken outside of the laboratory's routine hours, they should be placed on the top shelf of Fridge 5 in the laboratory (except CSF and blood cultures). The form *Log of samples placed in specimen fridge outside of working hours* MPC-FORM-LAB-054 on the fridge door should be completed.

Please note that CSF and Blood Cultures must not be refrigerated. These specimens should be sent to the Mercy University Hospital as soon as possible. Where there is an unavoidable delay in sending blood cultures and CSFs, the specimens should be stored at room temperature.

18.0 HISTOLOGY AND CYTOLOGY

18.1 General histology and cytology information

Histology and non-gynae cytology: The Mater Private Hospital Dublin (MPD) Histology department provides a service in surgical pathology and cytology and all specimens are sent there from MPC by courier daily, Monday to Friday. Specimens collected at the weekend are sent on Mondays (Tues if Mon is a public holiday).

The routine working hours for Histology in MPD are 08:00 – 17:00 Monday to Friday.
The MPD Histology department can be contacted directly on 01-8858136.

Cervical cytology: Specimens are sent to Eurofins Biomnis for combined Thinprep PAP test and High Risk HPV DNA. The turnaround time is 10 working days. Please contact Stores for pots and brushes and contact the laboratory for further information.

18.2 Reports and turnaround times

18.2.1 Histology and cytology turnaround times (TAT)

The turnaround times apply from when the sample is received in MPD. Histology samples are received in the MPC lab daily and are delivered by courier to MPD the same or next working day.

Specimen type	**Target TAT (80%)**
Routine Histology specimens	15 working days
Special stain	15 working days + up to 7 days
Immunocytochemistry	15 working days + up to 7 days
Non-gynae cytology	10 working days maximum. Usually reported within 48h

18.3 Histology advice outside normal working hours

No out-of-hours service is provided. Queries can be discussed with the Consultant Histopathologists when they are available. Details of their availability and contact details can be obtained by contacting MPD on 01-8858136.

18.4 Histology specimens

Specimens should be brought to the MPC laboratory in 10% buffered formalin unless special investigations requiring fresh tissue are requested. Any fresh specimens must be brought to the attention of a Medical Scientist.

A visual check is performed on acceptance of specimens in the laboratory at MPC before transport to MPD.

18.4.1 Urgent Histology

Urgent specimens are dealt with on an individual case basis following consultation with the Medical Scientists and/ or Consultant Pathologist in MPD. The turnaround times of urgent cases varies according to the type of tissue to be processed, the optimum fixation time required and the complexity of the case.

The urgent specimen should be clearly marked URGENT on the request form.

18.5 Histology specimens requiring special handling

18.5.1 Muscle Biopsies

Muscle Biopsies are sent directly from the clinical area to the neuropathology department at Cork University Hospital. The biopsy should be sent immediately FRESH. Telephone CUH on (021) 492 2519 in advance of sending the muscle biopsy.

Dimensions

The muscle biopsy must be at least 1.5cm x 1.5cm x 1.5cm in size. For certain suspected metabolic or mitochondrial disorders, a larger sample may be required for molecular or biochemical analysis. Please contact the Neuropathologist at CUH to discuss the case in advance.

Packaging

Universal safety precautions for fresh tissue should apply and the biopsy should be wrapped in cling film to avoid drying out during transport.

Transport

The biopsy should be delivered directly to a staff member in the CUH Neuropathology Dept. Instruct the taxi driver/ courier not to leave specimen at CUH laboratory reception and the muscle biopsy should reach the CUH department by 4pm. On receipt of the specimen a staff member will telephone the requestor to confirm that the tissue has arrived safely.

Turnaround

Muscle histochemistry is performed in batches once weekly, on Wednesdays. The turnaround time is approximately 3 weeks.

Additional information is available in the protocol for muscle biopsy (available from the CUH Neuropathology Dept.).

18.5.2 Lymph Nodes

Lymph nodes for suspected lymphoma should be brought immediately to the Laboratory and brought to the attention of a Medical Scientist. The Histopathology Department in MPD can be contacted for further instruction.

18.5.3 Sural nerve biopsies and peripheral nerve biopsies

Nerve biopsies are dispatched via the MPC Laboratory to the Neuropathology department at Cork University Hospital. The biopsy should be sent immediately FRESH. Telephone CUH on (021) 492 2519 in advance of sending the biopsy.

Please indicate on the request form the clinician to whom the result should be sent and if a copy is needed for another clinician.

For any further queries please contact the Neuropathology laboratory (021 4922519) or Dr Bermingham (021 4920475).

Packaging

The biopsy can be wrapped in gauze lightly moistened with NORMAL SALINE, to keep moist during transport.

Transport

The biopsy should be delivered directly to a staff member in the Neuropathology Dept. Instruct the taxi driver/ courier not to leave specimen at CUH laboratory reception and the muscle biopsy should reach the CUH department by 4.pm. On receipt of the specimen a staff member will telephone the requestor to confirm that the tissue has arrived safely.

Turnaround: 3 weeks. Certain cases may take longer.

18.5.4 Specimens requiring both microbiological culture and histology

Specimens requiring microbiological investigation (e.g. valves) should be received fresh to the laboratory and always given to Microbiology before any formalin is added.

18.5.5 Skin biopsies for Immunofluorescence

Please give the MPC Laboratory at least one week's notice so that a fresh supply of Michel's medium can be obtained. Skin biopsies for Immunofluorescence should be brought to the laboratory placed in Michel's medium. They are dispatched via the Laboratory to the referral laboratory [St John's in the UK].

18.5.6 Breast cyst aspirate

Place in CytoLyt solution and send to MPD. CytoLyt is available from MPC Laboratory.

18.5.7 Bronchial aspirate

These should be sent to the MPC Laboratory in a universal container pre-filled with CytoLyt solution (CytoLyt is available from the Laboratory) without delay.

18.5.8 Brushings from other sites

Place the brush in CytoLyt solution (available from the Laboratory) and send to the MPC Laboratory.

18.5.9 Fine Needle Aspiration Cytology

Sites of aspiration include breast, thyroid and lymph nodes. The techniques require several passes of fine gauge needle through the organ with negative pressure on the syringe. Place the aspirate into CytoLyt solution (approximately 20 - 25mls in a universal container), the needle can them be washed out using the fluid. Transport to the MPC Laboratory immediately.

18.5.10 Sputum

Best results are achieved with freshly obtained sputa following chest physiotherapy with early morning sputum before the patient has eaten. Contamination with large amounts of saliva or food leads to inadequate specimens. Multiple specimens (usually x 3) may be necessary, but these should be sent on three separate days, not all taken at one time. Send in sterile sputum pots (universal). Telephone us and let us know if there is a high suspicion of TB and write this on the request form too. Sputa are sent to MPD.

18.5.11 Urine

Best results are achieved with a fresh voided specimen, preferably not the first in the morning. Specimens at cytoscopy or from catheterised patients should be labelled accordingly. No fixative is required but prompt transportation is recommended to avoid unnecessary repeat tests. Send in universal sterile container. It is not necessary to send multiple specimens.

How to take a urine specimen for cytology:

- This is usually requested to screen for abnormal cells from the bladder.
- This should not be taken the first time urine is passed after waking in the morning. Any time after this is appropriate.
- It is preferable to collect the urine at the end of the stream rather than the beginning.
- Collect urine into the sterile container provided until half full.
- Close container tightly and label the specimen.
- Place in plastic bag with form provided

18.5.12 Other Cytological Examinations

Examination of fluids and aspirates may be performed on request. Please contact the laboratory beforehand.

19.0 ON CALL SERVICE

19.1 In-house tests

Urgent and non-deferrable requests taken after 19:00 on weekdays and at weekends and public holidays should be sent to the laboratory for processing.

The requesting clinician/ clinical area will be notified of the availability of results by telephone.

The Mercy University Hospital processes all MPC blood cultures, blood/ body fluid exposure tests and CSFs.

Tests not listed below may be urgent from time to time and will be carried out following agreement by the consultant pathologist for that area to safeguard patient safety and care.

Biochemistry on call: Renal, liver and bone profiles, amylase, CK, CRP, glucose, LDH, magnesium, Troponin, βHCG.

Haematology: FBC, PT/INR, APTT, fibrinogen, D-Dimers. ESR when clinically indicated (e.g. temporal arteritis)

Blood Transfusion:

- In-house type & screen [aka group & screen], crossmatch, DAT, antibody investigation, transfusion reaction investigation and issue of blood/ blood products
- Laboratory staff will handle all blood deliveries from IBTS
- Emergency Group O Rh D Negative stock available
- Collection of blood and use of Blood Track unchanged
- Ext 4444 will be monitored from 7am to 7pm Monday to Friday. At other times contact the senior nurse in charge on 3416.

19.2 Referred tests

Table: On call tests referred to Mercy University Hospital, MUH

Test	Sample
Blood Cultures	Aerobic and anaerobic bottles
CSF Glucose and Protein	Sterile universal (fluoride for glucose)
CSF Microbiology	Sterile universal
Digoxin	Serum Gel 7.5 mL
Lithium	Serum Gel 7.5mL
Malaria Screen	K EDTA 2.7 mL
Monospot	K EDTA 2.7 mL
Paracetamol	Serum Gel 7.5mL
Salicylate	Serum Gel 7.5mL
Sickle Screen	K EDTA 2.7 mL

19.3 Clinical advice

Consultant Haematologist (blood transfusion, haematology and haemovigilance) via Mater Private Dublin switchboard (01 885 8888)

Consultant Clinical Biochemist via Mater Private Dublin switchboard (01 885 8888)

Consultant Microbiologist 083 349 8040

19.4 Packaging samples for referral

Put the samples and a copy of the request form or test slip into a biohazard bag. The bag has two compartments: the sealable pouch is for the specimen container/ bottle and the outer sleeve is for the request form [note the request form must never be put in the same compartment as the specimen].

Ensure that sufficient absorbent material is placed in the bag with the specimen to absorb the full liquid content. The samples should be placed into these absorbent pouches.

Use only approved boxes (available from stores and with the UN3373 mark).

20.0 REQUEST REFERRAL

Tests not available in MPC are referred to third-party laboratories. Where possible, work is referred to laboratories accredited to the ISO 15189 standard. Details of the specimen requirements, referral laboratory and a list of all tests referred can be found on *MPC-FORM-LAB-012 Referral Test Index.*

Laboratory specimen referral dispatch and report handling is described in *MPC-PP-LAB-015 Specimen Referral and Dispatch.*

21.0 ASSOCIATED DOCUMENTS

Documents referenced within this manual are available on the Hospital's Q-Pulse system.

22.0 REFERENCES

ISO 15189:2022, JCI Hospital Standards

APPENDIX: ALL IN-HOUSE TESTS A- Z

A

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Haematology	Activated Partial Thromboplastin Time (APTT)	Citrate 9NC (green cap) 3 mL	Routine:2 hours Urgent: 80 min	24.8 – 34.4 secs	Must be analysed within 4 hours of collection. Correct blood volume in tube essential: fill to line on bottle
Biochemistry	Alanine Aminotransferase (ALT)	Serum Gel (brown cap) 7.5 mL	Routine: 2 hours Urgent: 70 min	0 - 50 IU/L	
Biochemistry	Albumin	Serum Gel (brown cap) 7.5 mL	Routine: 2 hours Urgent: 70 min	35 - 50 g/L	
Biochemistry	Alkaline Phosphatase (ALP)	Serum Gel (brown cap) 7.5 mL	Routine: 2 hours Urgent: 70 min	30 - 130 IU/L	
Biochemistry	Amylase	Serum Gel (brown cap) 7.5 mL	Routine: 2 hours Urgent: 70 min	28 - 100 IU/L	Affected by haemolysis

MATER PRIVATE NETWORK CORK – LABORATORY DEPARTMENT		
Owner, date: Mary Kennedy, 16/10/2024	**Document:** MPC-PP-LAB-002	**Revision:** 05
Reviewer, date: Mary Kennedy, Louise O'Callaghan, Mike Trevett 16/10/2024	**Date of issue:** 16/10/2024	**Review date:** 15/10/2025
Authoriser, date: Louise O'Callaghan, 16/10/2024	**Standards:** ISO 15189:2022 and JCI standards	

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A

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Arterial blood gases (ABG)	Heparinised syringe	Testing done at point-of-care or immediately on receipt in the laboratory	pH 7.35 - 7.45 pCO2 4.5 – 6.0 kPa pO2 12.0 - 14.5 kPa Oxygen saturation 95 - 98% Base excess -2.3 - +2.3 mmol/L Bicarbonate 22.4 - 25.8 mmol/L	Carry out testing as soon as possible after collection, preferably within 10 minutes and no longer than 30 minutes. Remove any air bubbles as soon as possible after collection and roll between palms to mix and prevent clotting. Do not transport in pneumatic air tube system.
Biochemistry	Aspartate Aminotransferase (AST)	Serum Gel (brown cap) 7.5 mL	Routine: 2 hours Urgent: 70 min	11 - 34 U/L	Affected by haemolysis

B

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Beta HCG	See under H (HCG)			
Biochemistry	Bilirubin/ total bilirubin (TBIL)	Serum Gel (brown cap)	Routine:2 hours Urgent: 70 min	5 - 24 µmol/L	Affected by haemolysis

B

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
		7.5 mL			
Biochemistry	Blood gases	See under A, Arterial blood gases (ABG)			
Blood Transfusion	Type & Screen, Type & Crossmatch, antibody investigation, DAT	K EDTA (pink cap) 2.7 mL	See Section 15 above	N/A	Note zero tolerance of labelling errors and discrepancies
Biochemistry	Brain natriuretic peptide (NT-proBNP, BNP)	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent: 70 min	<125 ng/L	Analyse as soon as possible or spin/ separate N-terminal pro brain natriuretic peptide

C

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Calcium	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent: 70 min	2.18 - 2.60 mmol/L	
Microbiology	Carbapenemase-producing Enterobacterales and Vancomycin-resistant Enterococcus (CPE/ VRE screen)	Site: rectal swab/ stool Swab: Amies Transport Swab (Blue top)	2 working days Mon - Thurs	N/A	Store in fridge at 4 - 8°C
Biochemistry	Chloride (Cl)	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent: 70 min	95 - 108 mmol/L	Affected by haemolysis
Microbiology	Clostridioides difficile toxin A & B (*C. difficile, C. Diff, Clostridium difficile)*	5 - 10 mL of loose or liquid faeces in sterile universal container	4 hours	N/A	Store in fridge at 4 - 8°C Please note that formed faeces specimens are not tested for *C. difficile* unless requested by Consultant Microbiologist.
Microbiology	Covid	See under S (SARS-CoV-2)			
Biochemistry	C-Reactive Protein (CRP)	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent: 70 min	< 5.0 mg/L	
Biochemistry	Creatine Kinase (CK)	Serum Gel (brown cap)	Routine:2 hours Urgent: 70 min	F: 33 - 208 IU/L M: 44 - 272 IU/L	Analyse as soon as possible or spin/ separate

C

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
		7.5 mL			
Biochemistry	Creatinine	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent: 70 min	Up to 40y F: 44 - 88 µmol/L M: 53 - 106 µmol/L Up to 60y F: 44 - 97 µmol/L M: 53 - 115 µmol/L > or = 60y F: 44 - 106 µmol/L M: 62 - 115 µmol/L	Analyse as soon as possible or spin/ separate.

D

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Haematology	D-Dimer (DD, EDD)	Citrate 9NC (green cap) 3 mL	Routine:2 hours Urgent: 45 min	<0.50 µg/mL	Must be analysed within 4 hours of collection. Correct blood volume in tube essential: fill to line on bottle

E

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Haematology	Erythrocyte Sedimentation Rate (ESR)	Na Citrate 4NC (purple cap) 3.5 mL	2 hours	Female: < 20 Male: < 10	Please ensure full sample is taken and mix well by inverting gently 4-5 times. ESR testing is only carried out for Temporal Arteritis, Polymyalgia Rheumatica, Multiple Myeloma, Giant cell arteritis (GCA)

F

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Ferritin	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent: 70 min	F: 4.6 – 204 ng/mL M: 21.8 - 275 ng/mL	Analyse as soon as possible or spin/ separate.
Haematology	Fibrinogen	Na Citrate 9NC (green cap) 3mL	Routine:2 hours Urgent: 45 min	2.0 – 4.0 g/L	Must be analysed within 4 hours of collection. Correct blood volume in tube essential: fill to line on bottle

F

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Free T4	See under T (Thyroid function tests)			
Microbiology	'Flu'	See under I (Influenza)			
Haematology	Full Blood Count (FBC, Complete Blood Count, CBC)	K EDTA (pink cap) 2.7 mL	Routine:2 hours Urgent: 45 min	WBC 4.00 - 11.00 x $10^{9/}$L RBC (F) 3.80 - 5.80 x $10^{12/}$L RBC (M) 4.50 - 6.50 x $10^{12/}$L HGB (F) 11.5 - 16.5 g/dL HGB (M) 13.0 - 18.0 g/dL HCT (F) 0.37 - 0.47 x L/L HCT (M) 0.40 - 0.54 x L/L MCV 80.0 - 100.0 f/L MCH 28.0 - 32.0 pg MCHC 32.0 - 36.0 g/dL RDW 11.0 - 15.0% Platelets 150 - 400 x $10^{9/}$L	Clotted samples cannot be processed Optimum sample processing within 8 hours of collection. WBC, RBC, MCV, haemoglobin, and platelets are stable for up to 24 hours after collection.

G

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Gamma-Glutamyl Transferase (GGT, Gamma GT)	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent: 70 min	F: 0 - 38 IU/L M: 0 – 55 IU/L	Affected by haemolysis
Biochemistry	Gentamicin	Serum Plain (clear cap) 7.5 mL	Routine:2 hours Urgent: 70 min	Target pre-dose level in once daily dosing: <1 mg/L	Analyse as soon as possible or spin/ separate. If the samples is not trough, the request will not be processed.
Biochemistry	Glucose	Fluoride EDTA (yellow cap) 2.7 mL	Routine:2 hours Urgent:70 min	3.7 - 6.0 mmol/L	

H

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Beta HCG (βHCG)	Lithium Heparin (orange cap) 7.5 mL	Routine:2 hours Urgent: 70 min	< 5 IU/L	
Biochemistry	Hs-Troponin I	See under T (Troponin)			

MATER PRIVATE NETWORK CORK – LABORATORY DEPARTMENT		
Owner, date: Mary Kennedy, 16/10/2024	**Document:** MPC-PP-LAB-002	**Revision:** 05
Reviewer, date: Mary Kennedy, Louise O'Callaghan, Mike Trevett 16/10/2024	**Date of issue:** 16/10/2024	**Review date:** 15/10/2025
Authoriser, date: Louise O'Callaghan, 16/10/2024	**Standards:** ISO 15189:2022 and JCI standards	

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I

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Inorganic Phosphate	See under P (Phosphate)			
Microbiology	Influenza A/B/RSV detection	Nasopharyngeal swab Viral UTM swab	3 hours	N/A	Store in fridge at 4 - 8°C 
Haematology	International Normalised Ratio (INR)	Na Citrate 9NC 3 mL	Routine:2 hours Urgent:80 mins	Determined by clinical state and PT result.	Must be analysed within 4 hours of collection. Correct blood volume in tube essential: fill to line on bottle

L

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Lactate Dehydrogenase (LDH)	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent:70 min	125 – 220 U/L	Analyse as soon as possible or spin/ separate. **Affected by haemolysis**

L

Microbiology	Legionella urinary antigen	10 mL Urine Sterile universal container	3 hours	N/A	Store in fridge at 4 - 8°C

M

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Magnesium	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent:70 min	0.70 - 1.00 mmol/L	Analyse as soon as possible or spin/ separate **Affected by haemolysis**
Microbiology	MRSA screen	Amies Transport Swab (Blue top)	2 working days, Mon-Thurs	N/A	Store in fridge at 4 - 8°C Nasal and Groin swabs and, if present, also send swab of wounds, sites of damaged or abnormal skin, intravenous line insertion sites. CSUs and sputum if expectorating.

N

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Microbiology	Norovirus detection	5-10 mL Faeces Sterile universal container	1 working day	N/A	Store in fridge at 4 - 8°C
Biochemistry	NT-proBNP	See under B (BNP)			

P

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Inorganic Phosphate (phosphate, phosphorous, PO4)	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent:70 min	0.74 - 1.52 mmol/L	Analyse as soon as possible or spin/ separate. **Affected by haemolysis**
Microbiology	Pneumococcal urinary antigen	10 mL Urine in sterile universal container	3 hours	N/A	Store in fridge at 4 - 8°C
Biochemistry	Potassium**	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent:70 min	3.5 - 5.3 mmol/L	Analyse as soon as possible or spin/ separate **Affected by haemolysis**

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P

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Total Protein	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent:70 min	64 – 83 g/L	Analyse as soon as possible or spin/ separate **Affected by haemolysis**
Haematology	Prothrombin Time (PT)	Na Citrate 9NC 3 mL	Routine:2 hours Urgent:80 min	11.4 - 15.0 seconds	Must be analysed within 4 hours of collection. Correct blood volume in tube essential: fill to line on bottle

R

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Microbiology	Respiratory panel (including SARS-CoV-2)	Nasopharyngeal and Oropharyngeal Viral UTM swab	Urgent: 2 hrs Routine: 1 working day	N/A	Store in fridge at 4 - 8°C 
Microbiology	RSV	See under I (Influenza)			

S

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Microbiology	SARS-CoV-2 detection ('Covid')	Site: Nasopharyngeal and Oropharyngeal Swab: Viral UTM	Urgent: 2 hours Routine:1 working day	N/A	Store in fridge at 4 - 8°C 
Biochemistry	Sodium (Na)	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent:70 min	133 - 146 mmol/L	

T

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Thyroid Function Tests (TFT: TSH, FT4)	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent:70 min	TSH: 0.35 - 4.94 mIU/L Free T4: 9.0 - 19.1 pmol/L	
Biochemistry	Total Bilirubin	Serum Gel (brown cap) 7.5 mL	Routine:2 hours Urgent:70 min	5 - 24 µmol/L	Analyse as soon as possible or spin/ separate. **Affected by haemolysis**
Biochemistry	Total Protein	Serum Gel	Routine:2 hours	64 – 83 g/L	Analyse as soon as possible or spin/

T

		(brown cap) 7.5 mL	Urgent:70 min		separate **Affected by haemolysis**
Biochemistry	Hs-Troponin I	7.5 mL Lithium Heparin	Routine:2 hours Urgent:70 min	< 16 ng/L (f) < 34 ng/L (m)	See MPC-LAB-FORM-122 on Q-Pulse for clinical guidance.

U

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Urea	Serum Gel 7.5 mL (brown cap)	Routine:2 hours Urgent:70 min	2.1 – 7.1 mmol/L	Analyse as soon as possible or spin/ separate

V

Discipline	Test A - Z (common abbreviation)	Sample type	Turnaround time	Adult reference range	Special precautions
Biochemistry	Vancomycin	Serum	Routine:2 hours Urgent:70 min	See nchd.ie	Analyse as soon as possible or separate. If not trough, the request will not be processed.