Department of Pathology

The Coombe Hospital

Users Handbook

(Primary Sample Collection Manual)

CONTENTS

1 Introduction

1.1 Purpose and Scope

This Pathology User Handbook or Primary Sample collection manual is designed to provide information for patients and users of the services of the Pathology Department which includes Point of Care testing (POCT), Phlebotomy and Mortuary Services.

This manual provides information on the scope and the limitations of the services provided by the Departments within the Pathology Laboratory and will facilitate the proper use of the service.

1.2 Cross reference to Standards

ISO 15189 (2022)	Clause 4.3 Requirements regarding Patients
	Clause 7.2.2 Laboratory Information for patients and users
	Clause 7.2.4 Primary Sample Collection and Handling

1.3 Definitions and Abbreviations

EQA	External Quality Assessment
FBC	Full Blood Counts
FMH	Feto maternal haemorrhage
FRHD	Fetal RHD screening test
GTT	Glucose Tolerance Test
HVO	Haemovigilance Officer
INAB	Irish National Accreditation Board
ISO	International Standards Organisation
IVD	In vitro diagnostic products
LIMS/LIS	Laboratory Information Management System
MTOP	Medical Termination of Pregnancy
MU	Measurement Uncertainty
PNC	Pathology Nonconformance
POCT	Point of Care/Near Patient Testing
PQ	Performance Qualification
TAT	Turnaround Time
TCH	The Coombe Hospital

2 General Information

The Pathology Department aims to provide a quality driven, patient centred service for the maternity, gynaecological and neonatal patients of this tertiary referral hospital. We ensure this by recruiting suitably qualified and trained staff, assessing the quality of our service to ISO 15189 standards and by working in a research driven evidence-based pathology laboratory.

The department is committed to ensuring confidentiality of information is maintained throughout its routine and research activities, all pathology staff are required to work in accordance with the department confidentiality procedure PATH-MGT-PPG-40.

2.1 The location of the Pathology Department Laboratories and access

The Pathology Department is located to rear of the main hospital building and can be accessed by following the direction signs.

Hospital Staff can access the building with their Identification badge, however agency staff will need a swipe card from the Hospital Main Reception Desk.

During routine hours (Monday to Friday 8 am to 6pm Delivery drivers, Service Engineers, Couriers, Taxi drivers or visitors, please go to the Pathology Reception and ring the bell for assistance in the entrance. Access may also be obtained via the NCSL Building, ring for assistance at the door.

2.2 Hours of business and service provided

Pathology Department		
Pathology Department		**Hours of Business**
Pathology reception/ Laboratory Office	**Routine**	**09.00-17.00**
Routine Diagnostic Service Haematology Transfusion Medicine Clinical Biochemistry Microbiology POCT Histopathology	**Full repertoire of tests available**	**08.00-18.00** **08.00-17.00**
Saturday Diagnostic Service: Haematology Transfusion Medicine Clinical Biochemistry Microbiology	**Restricted essential service only**	**09.30-13.00**
On-call Diagnostic Service Haematology Transfusion Medicine Clinical Biochemistry Microbiology	**Emergency non-deferrable tests only**	**All hours outside Routine and Saturday services** *See section 3 for further details*
Pathology Department Quality & IT	**Routine**	**08.00-18.00**
Pathology Management	**Routine**	**08.00-18.00**
Phlebotomy		**Hours of Business**
Phlebotomy in Out Patients Department (OPD) Monday- Thursday Friday	**Routine Service**	 **07.30-17.00** **07.30-13.00**
Phlebotomy GTT service Monday -Friday	**Routine service**	 **07.30-13.00**
Laboratory provided specimen collection service		**Hours of Business**
Monday- Friday	**Routine Service**	**08.30-17.00**
Mortuary		**Hours of Business**
Monday - Friday	**Routine Service**	**08.00-17.00**
Additional availability may be facilitated following discussions with Pathologist and Mortuary staff		

2.3 Pathology Department Telephone Numbers

Key Locations/Personnel	Post Holder	Phone Number
Director of Pathology	Prof John O'Leary	5641
	Personal Secretary	5609
Consultant Microbiologist	Dr Niamh O'Sullivan	5695
Consultant Haematologist	Dr Catherine Flynn	5695
Consultant Chemical Pathologist	Dr Vivion Crowley	5327
Laboratory Manager	Martina Ring	5678
Pathology IT Manager	Norbert Clarke	5688
Pathology Quality Manager	Edel Galvin	5027
Haemovigilance Officer (HVO)	Sonia Varadkar	Bleep 137/5657
Transfusion Medicine		5279
Haematology		5700
Biochemistry		5327
Microbiology		5278
Andrology (booking)		5326
Histopathology (Laboratory located within NCSL building)		5701
Laboratory specimen collection/stores service	Keith Farrell	Bleep 181
Laboratory Office/ Pathology Reception		5326, 5459, 5460, 5608
Laboratory Fax		4085680
Other Pathology Locations		
Phlebotomy in OPD		5640
Phlebotomy for GTT located currently beside Private Clinic		5069
Mortuary		5274

2.4 Accessing pathology results using Results Enquiry on Laboratory Information System (LIS)

Log Directly into LIS- icon on PC's in clinical areas

Enter username & password, choose 1 Pathology (Results Enquiry), Enter the patient number

Note:

Please enter the full number in the format below:

Adults H00123456

Neonates B12342024

Neonatal admissions X00012024

This will display a list of the pathology requests for the patient, numbered 1.2,3 etc on the left of the screen, in chronological order with the most recent at the top
Choose the number required to view the results.

Type S to return to the result list and choose next request

Note on viewing FBC results
FBC results are displayed on multiple pages
See bottom of screen, Page 1 of 1 etc
To go to page 2 type **F**, to go back to page 1 type **B**
To return to results list press function key **F6** and choose **S**

To view cumulative reports for a request
Choose **P** for **P**revRes
Then choose **R** for **R**equestsTests
This will display all previous results for that requested item
Follow the on-screen menu for PageDown etc
To log out press function key F6 until the system logs out and "[Connection closed by host]" is visible on the bottom of screen.
Requesting Access to LIS: Contact Pathology IT Manager or Laboratory Manager by email, indicating why access is sought and provide Staff ID number for set up.

2.5 Quality in Pathology

The Pathology Department is committed to providing a Quality Focused Pathology Service to our patients and service users.

Accredited departments adhere to ISO 15189 accreditation under our registration 218MT with the Irish National Accreditation Board (INAB) including POCT for ward Blood Gas testing and Pregnancy testing.

All tests carried under 218MT are subject to External Quality Assurance.

The Pathology Laboratory has a process for determining Measurement Uncertainty (MU) of all quantitative test methods used in the Pathology Department and all departments regularly review estimates of measurement uncertainty. This information is available from departments on request.

2.6 Advisory Services

The Pathology Department consists of Biochemistry, Haematology, Transfusion Medicine, Microbiology, Histopathology and POCT. Advice is available on the choice of examinations and the use of the service, including repeat frequency and required type of sample. Where appropriate, interpretation of the results of examinations shall be provided.

Staff grade	Advice available	Contact details
Medical Scientists, Biochemists,	Labelling & specimen requirements Choice of examinations Clinical indications and limitations of examination procedures and interpretation of results	Department phone numbers
Clerical Staff	Hours of operation, labelling requirements, deal with phone queries and provide validated report results.	Lab office 4085326
Laboratory Aides	Hours of operation, labelling requirements and provide results in specific circumstances- e.g. Pregnancy tests in Microbiology	Department phone numbers
Haemovigilance Officer (HVO)	Questions relating to the traceability of blood and blood products	Bleep 137, 4085657
Histopathology queries		Rota is available in the Lab Office - 4085326
Clinical Transfusion Medicine or Haematology queries refer to the Consultant Haematologist.		Rota and bleep lists are available in the transfusion medicine laboratory 4085279 or via hospital reception 4085380.
Clinical Microbiological or Infection control queries are provided by the Consultant Microbiologist. This cover also incorporates Andrology.		Via secretary on 4085695 or bleep #194 or via hospital reception 4085380.
Clinical chemistry/ biochemistry queries are directed to the Consultant Chemical Pathologist. This includes queries for POCT Pregnancy testing, blood gases or glucose testing		416 2935 or mobile number available at reception 4085380.

2.7 Complements and Complaints

Compliments are always gratefully received whether in person, by email or letter/card.

Informal queries may be made by telephone to the appropriate department, Laboratory Manager or a Department Consultant.

Formal complaints must be made to the Laboratory Manager *(mring@coombe.ie)*, or the Consultant of the specific department. Formal complaints are documented under the Pathology non-conformance (PNC) procedure and are fully investigated.

Results of investigation and details of any corrective action implemented will be relayed in the writing to the complainant.

Internal Pathology Procedures used to manage complements or complaints received are documented within PATH-QTY-PPG-10 Non-Conforming Work, Actions to address risk and Opportunities for Improvement.

2.8 Feedback opportunities for Patients and External Users of our Services

Pathology management strive at all times to ensure that patients' well-being, safety and rights are primary considerations in the provision of our services.

The Pathology Department provides opportunities for patients and laboratory users to provide helpful information to aid the laboratory in the selection of the examination methods, and the interpretation of the examination results.

Any such feedback is welcomed and can be emailed to pathologyfeedback@coombe.ie.

3 On call service

Service times

Monday to Friday	18.00hrs to 20.00 hrs	2-staff members on duty
Monday to Thursday	20.00hrs to 08.00 hrs (next day)	2-staff members on duty
Friday	20.00hrs to 09.30 hrs (next day)	2-staff members on duty
Saturday	13.00hrs to 09.30 hrs (next day)	2-staff members on duty

Sunday and Bank Holidays all day- 2 staff members on duty

In all cases contact On-Call Scientists on **Speed dial #4287**

Only those specimens that the on-call personnel have been notified about i.e. via the ON-CALL system will be analysed during on call hours

- Emergency / non-deferrable tests should only be requested during on call hours
- On call Tests that are available and specific ordering criteria are noted in Table below
- Labelling procedures as described in section 4 must be adhered to.
- **Speed dial #4287** when the specimen is sent to the laboratory via the chute or with a porter/healthcare assistant
- The on-call staff have a 10-minute window to respond to any call, please allow for this time window as they may be completing an analysis that requires complete attention, or they may not be in proximity to a telephone.
- If the request is of a stat nature, contact the hospital reception staff to call the Pathology on-call mobile - this should only be used in EXCEPTIONAL circumstances.
- Abnormal results will be telephoned to the requesting ward or Doctor.
- Results once authorised by the on-call staff will be available to view on Laboratory Information System.
- Turn-around times (TAT's) for on call samples that are notified will be in keeping with urgent TAT's, however this may not be always possible due to the staffing limitations of the service and other work that may be in process.

ON-CALL TEST REPETOIRE

Biochemistry	Haematology	Transfusion Medicine	Microbiology
U&E - Urea & Electrolytes(Adult) **U&E Urea & Electrolytes**(Neonatal) **LFT Liver Function Tests** **PET Profile** *Check the back of Biochemistry 1 Form for details*	**FBC** **Retics**	**Adult blood group and antibody screen** (Processed if no previous history on file only. If previous history on file, samples are held in case products are required)	CSF culture & microscopy Blood culture incubation
Glucose (fluoride samples) **Bilirubin** (Total & Direct) **Calcium, Magnesium, Phosphate** **Amylase** **Cardiac Enzymes**: • CK • LDH **CSF**: Protein & Glucose- Plain for both and Fluoride- glucose only **Ammonia**	**Coagulation Screen** • PT • APTT • Fibrinogen	Paediatric blood group and Direct Coombs Test may be performed only in the following cases and requires direct consultation with on-call scientist: • Maternal red cell antibodies present • Severely jaundiced babies at risk of exchange • Baby requiring blood products	Positive Blood Culture Analysis Urinary HCG- Pregnancy test SARS CoV-19- only with strict adherence to request algorithm
Blood Gas Analysis * Available if analysers & their back-ups not working Lactate- available in Lab if analysers in NICU & Theatre* not working *If POCT Analyser unavailable: (Blood gas analysis for NICU/SCBU and Theatre and Cord/ Scalp pH for D/S)		Cross-match requested by Consultant or Registrar Issue of blood products (except Anti-D)	**Consultant requested:** • Urine Culture & sensitivity • Urine Direct microscopy • Swab Culture & gram stain
Consultant requested: Urinary electrolytes **CRP**- analysed once rec'd by 10pm each night, after that must be **Consultant Requested**	**All other tests carried out in the Pathology Dept. during normal working hours may be available following direct consultation by the requesting Consultant / Registrar with the on-call member of staff on duty.**		**^^NB^^ Please NOTE** **Consultant requested** – the requesting consultant MUST speak directly with the on – call staff or test will held over until the following routine day

Refer to GG-ONCALLTESTS-I

4 Policy on Protection of Personal Information

The proper management of data and information in the Pathology Laboratory is essential for the provision of the service. The Pathology Laboratory adheres to Patient Confidentiality, General Data Protection Regulation (EU) 2016/679 and Data Protection Act 2018. The Coombe Hospital's privacy statement is available at **https://www.coombe.ie/privacy-statement**

The Pathology Laboratory retains the following information in relation to each test request received, for defined minimum retention periods, based on regulatory and best practices guidelines.

This information may include some or all of the following:

- Patient full name.
- Patient Hospital record number.
- Patient Date of Birth.
- Date/time of collection, date/time of receipt in the laboratory and date/time of report for each specimen.
- Clinical information provided by requesting clinician.
- The test result and interpretation of test requested, where appropriate.
- Requesting clinician and address.
- Request procedures.

5 Consent

For most routine laboratory procedures, consent can be inferred when the patient presents themselves at phlebotomy with a referral request from a doctor and willingly submits to venepuncture.

Patients in a hospital bed can refuse venepuncture. The refusal should be documented in the patient's chart, signed and dated.

Invasive procedures, or those with an increased risk of complications to the procedure, will need a more detailed explanation and, in some cases, written consent.

In emergency situations, consent might not be possible; under these circumstances it is acceptable to carry out necessary procedures, provided they are in the patient's best interest.

A consent form is required to be signed by a patient prior to collection of samples for genetic testing. In these cases, an explanation of the clinical procedure may be required to enable informed consent, along with more detailed explanations such as the importance of the provision of patient or family information. A consent form is required to be signed by a patient prior to collection for andrology processing.

6 Requests for Specimen Analysis in Pathology

6.1 Instructions for completion of the request form and specimen label

The Pathology Department has formalised a procedure document detailing the labelling requirements for patient specimens and request forms.

This specimen reception procedure is put in place to maximise the safety of patient care, by ensuring the correct investigation(s) is performed on the right specimen and the correct results are issued at the right time for the right patient

- Pathology staff **will not** change unique patient identifiers.
- Pathology staff **will not amend details on either the specimen or request form**. Where specimens or request forms are received without the minimum essential identification criteria, the requester will be informed immediately.
- Hospital Staff should familiarise themselves with each discipline's specific requirements, as there may exist a slight variation in labelling requirements due to the nature of the specimen, its destination within the department and type of request.
- It is the responsibility of the **person requesting a test** (requester) to ensure that request forms are completed according to the Pathology Departments minimum criteria for specimen acceptance. (See 6.3)
- It is the responsibility of the **person taking the sample** to ensure that the specimens are correctly labelled according to the Pathology Departments minimum criteria for specimen. (See 6.3)

6.2 Preparation of the patient

6.2.1 Consent

All patient procedures should have the consent of the patient before they are carried out.

From a laboratory perspective this involves having samples taken from them (the patient) for analysis, the patient must be advised why the test is necessary and what samples will be taken - samples include blood samples, urine samples, swabs etc.

At all times a patient has the right to refuse to have samples taken and, on these occasions, it is necessary that this refusal is documented in the patient's chart.

6.2.2 Confirm patient identification

The patient should be asked to state without prompting their full name and date of birth, this confirms the right patient is having specimens taken.

Staff taking a sample should check that the request form details and the specimen details are identical prior to sending to the laboratory for analysis.

Phlebotomy must not proceed until the person taking the sample is satisfied as to the correct identity of the patient.

6.2.3 Preparing the patient

It is vital the patient is made aware of what test the medical staff are requesting, to assist in their diagnosis of an illness/condition or to ensure care that has already been given is effective. All phlebotomy shall be in accordance with section 7 of this manual. For non-blood samples is vital that clinical staff ensure in date, sterile containers are utilised- see individual Pathology department for specifics.

Clinical staff must ensure the patient satisfies any necessary pre-examination criteria for example that they are fasting for specific tests, that they are a sufficient time from the last administration of a medication, or that the timing of an examination is appropriate- for example in a GTT series.

6.2.4 Patient self-sampling

On occasions patients may be requested to bring a sample to the Pathology department for analysis. Instructions must be provided to the patient to ensure appropriate samples collection is carried out and that confidence can be given in the results obtained. Examples of such situations include: urine prior to antibiotic therapy commencing, semen sample, 24hr urine collection. Patient instruction leaflets are available for such situations. Appropriate labelling should occur of such specimens, and patients should be made aware of appropriate storage temperatures, prior to bringing the specimen to the pathology department.

6.2.5 Healthcare Waste

All materials used in obtaining a specimen should be disposed of in accordance with the hospitals waste procedure.

6.3 Specimen requirements and means of identification

The Pathology Department requires the following:

- Specimen and Request form **must** contain the **same Essential identifiers**
- Use of Hospital addressograph labels are permitted on request forms, but should be used with caution particularly on neonatal specimens where the small version of the label is desirable-
    - Note: exception Transfusion Medicine as described below.

Transfusion Medicine

- **ALL** Specimen tubes for the Transfusion Medicine Department must be hand-written and legible.
- All Transfusion Specimens with addressograph labels will be **rejected** and must be repeated.

6.4 Criteria for Specimen Acceptance

The tables below indicate the **Essential Data** the Pathology Department requires on specimens and request forms, for Specimen Acceptance.

- Samples or request forms with the 'H00' prefix omitted are acceptable once the unique six-digit portion of the number is present.
- Samples or request forms on neonates are acceptable with the 'X00' prefix omitted are acceptable once the unique six-digit portion of the number is present.

6.4.1 Requirements on Specimens and Request forms for All departments except Transfusion Medicine

SPECIMEN (all departments except Transfusion Medicine)

ESSENTIAL	DESIRABLE
Patient's Surname, Forename *	Signature of specimen taker
Hospital Number	
Date of Birth	
Date and time – (Essential in the case of multiple or serial specimens- refer to department requirements)	
Histopathology: **Specimen & Form** Biological hazard warning An addressograph label must be placed on both the form and the body of the specimen bucket.	
Biochemistry 24hr Urine collection bottles **must** be labelled (see Patient Information leaflet	

*** For multiple births forename' Twin-One' 'Twin-Two' etc not Baby**

REQUEST FORM (all departments except Transfusion Medicine)

ESSENTIAL	DESIRABLE
Patient's Surname, Forename * *(Surname and forename be identified as such when handwritten)*	Relevant Clinical Information/ History *
Date of Birth	Patient's sex
Hospital Number	Team/Consultant
Address *(when hospital number not available)*	Signature of specimen taker
Date of sample collection *(Biochemistry, Haematology, Histopathology, Microbiology)*	
Time of sample collection *(Biochemistry, Haematology, Histopathology, Microbiology)*	Report destination
Tests requested *(Except Histopathology)*	**Coagulation** Details of anticoagulant therapy
Specimen Type	
Microbiology: Specimen type / site sampled Relevant clinical details to assist in interpretation of culture results.	Details of anti-microbial therapy/ allergies Patient category
Biochemistry: Date and time for multiple or serial specimens	Clinical Details- for Metabolic tests
Histopathology: **Placenta-** satisfy placenta acceptance criteria - see section 9.6.2 **Specimen type/Site** (i.e. uterine currettings, pipelle biopsy etc)	**Desirable information includes:** • Requesting consultant • Location of patient

ESSENTIAL	DESIRABLE
Specimen Type, Date/Time- It is compulsory the specimen Type, Date/Time of sample is taken, is recorded on the histopathology request form. If these are omitted from the form the Laboratory Staff cannot accept the sample until this is rectified by the person/department who took the sample. It is the responsibility of the Mid Wife /Nurse/Doctor to ensure these are identified on the request form to avoid a delay in processing samples.	• Clinical details (also aids in the interpretation of results)
Genetics: consent must be provided for testing- sample will not be processed without patient signature.	Clinical Details- to assist in interpretation of results

*** For multiple births forename 'Twin-one', forename 'Twin-Two' etc not Baby**

6.4.2 Requirements for Transfusion Medicine

TRANSFUSION MEDICINE SPECIMEN

All Specimens MUST be handwritten, no addressograph labels accepted.

ESSENTIAL	DESIRABLE
Patient's full name (correct spelling) *	Date & Time of sample collection
Date of Birth	Ward or unit
Hospital Number (or 1st line of address or Eircode for primary care samples)	
Signature of person who has taken specimen	

*** For multiple births forename 'Twin-One' 'Twin-Two' etc. not Baby**

TRANSFUSION MEDICINE REQUEST FORM

Addressograph labels are accepted on all request forms.

ESSENTIAL	DESIRABLE
Patient's full name (correct spelling) *	Signature of person who has taken specimen
Date of Birth	
Hospital Number (or address for primary care samples)	If baby, full name of mother & hospital number of mothers
Date & Time of sample collection	
Test requested	Relevant Clinical Information/ Past Obstetric and Transfusion history
Number and type of blood product or component (if required)	Clinical diagnosis and indication for transfusion (if Pre-Operative indicate the procedure)
Signature / name of requester if blood product or component required	
GP Practice (primary care samples only)	Contact no of person who has taken specimen

*** For multiple births forename 'Twin-One' 'Twin-Two' etc. not Baby**

For any non-conformity with the above requirements, the request will be rejected and a repeat sample requested. No amendments are allowed on samples or request forms in Transfusion Medicine.

NB. If the time of phlebotomy is not provided on either the form or sample the laboratory will default the collection time to 00:00. This may shorten the time sample will be valid for cross-matching. Refer to PATH-TM-INS-49 for further information on primary care Transfusion sample requirements.

6.4.3 Requirements for partner samples

SPECIMEN

Samples taken from partners must be labelled with the following information

ESSENTIAL	DESIRABLE
Surname, Forename	Date and time **(Essential** in the case of multiple or serial specimens - refer to department requirements)
Date of Birth	Signature of specimen taker (**Essential** for Blood Transfusion samples)
1st line of address or Eircode	

Under no circumstances should an addressograph label for an antenatal patient be placed on a partner's sample.
Samples labelled in this manner will be rejected.

REQUEST FORM

ESSENTIAL	DESIRABLE
Patient's Surname, Forename	Relevant Clinical Information/ History *
Date of Birth	Team/Consultant
Address	Signature of specimen taker
Name and Hospital Number of partner*	
Date of sample collection *(Biochemistry, Haematology, Microbiology)*	Report destination
Time of sample collection *(Biochemistry, Haematology, Microbiology)*	Clinical Details
Tests requested	
Specimen Type	

***Do not place addressograph label of antenatal patient in the top-left portion of the request form normally reserved for an addressograph. Only the details of the partner should be written in this area.**
Details of the antenatal patient should be given in the 'Clinical Details' area of the request form (preferably by writing 'Partner Of' followed by small label containing name and hospital number of antenatal patient).

6.5 Criteria for Specimen Rejection and Specimen / Request Form Amendment

The requestor will be contacted in the event of any of the examples below occurring:

- Specimen/form received unlabelled
- Specimen/form incorrectly labelled
- Specimen and form do not contain the same essential identifiers
- Specimen that has leaked extensively
- Incorrect volume of specimen/specimen type

If the specimen is for **Transfusion Medicine** it will be rejected immediately**.**

The Pathology Department appreciates that certain specimens **cannot be repeated** and hallows for amendments to either the specimen or the request form to take place in these specific exceptions.
These are:

- Histopathology Specimens
- Biochemistry- Blood Gases/Scalp pH/Cord pH and 24hr Urine Collections
- Microbiology-CSF Specimens/ Blood Cultures / Specimens taken prior to antibiotic therapy commencement.

If the specimen is one of the above exceptions, procedures are in place to allow for amendments to either the specimen/form. This involves staff coming to the laboratory to make the required amendments.

Histopathology Specimens:
Specimens that don't comply with the above criteria will be returned to source and the Team / Midwife / Nurse / Doctor who dealt with the patient's sample must amend the patient's sample/information as appropriate.
The signature of the person making the amendment on the request form will be accepted as confirmation that the specimen is correctly labelled and belongs to that patient.

This person must also close out a specimen amendment form/clinical incident form specific to this case.
The signature of the person making the changes & specimen amendment form is accepting the specimen is correctly labelled and belongs to that patient the amendment is made on.
In the case of Fresh Specimens for storage at -70ºC to -80ºC or for Frozen Sections that do not comply with the above criteria; the Midwife / Nurse / Doctor who dealt with the patient's sample must be contacted and come to the histopathology laboratory immediately to amend the patient's sample/information as appropriate. The signature of the person making the amendment on the request form will be accepted as confirmation that the specimen is correctly labelled and belongs to that patient. Similarly, the signature of the person making the changes & filling out the specimen amendment form/clinical incident form is accepting the specimen is correctly labelled and belongs to that patient the amendment is made for.

Note: Once specimen/ forms are accepted, the specimens are examined prior to analysis, and in certain cases will not be analysed –particularly if the serum/plasma is haemolysed after centrifugation, the requestor will be contacted in this event.

6.6 Specimen Precautions

All blood specimens, swabs and small specimen containers are required to be sent to the laboratory within the specimen bag attached to the request form. This allows such specimens to be transported in the chute system in a safe manner, ensuring if any leakages occur they are contained. Exceptions include:

- Large histopathology specimens- transported via collection service
- 24hr Urine collections -transported via collection service or by hand
- Genetic specimens requiring sign in- transported by hand

If specimens are being sent to the Pathology Department from patients with a known infectious status, it is vital this information is given to the Pathology staff on the request form. Although all specimens are handled in the pathology department as if they are infectious, additional steps may be taken where there is a known infectious specimen for example additional fixation time for known Hepatitis /HIV positive specimens in histopathology, additional safety measures required when processing samples from patients with suspected, or confirmed, SARS-CoV-2 infection.

6.7 Procedures for requesting analysis

6.7.1 Routine requests

Routine requests for pathology services may be sent via the pathology portering service, the pneumatic transport system or brought in person to the laboratory. See 2.1 above for details of how to access the Pathology Department.

6.7.2 Urgent Requests

Urgent requests must be notified directly to the appropriate laboratory department by phone:

- To ensure that arrangements are in place for the rapid processing and reporting
- So that if there is any delay in receipt, steps can be taken to locate the specimen.

Urgent specimens that arrive in the laboratory without prior arrangement, run the risk of being delayed, even if they are labelled urgent.

6.7.3 Requests for Additional add-on Tests (Verbal Requests)

On occasions additional tests may be required following initial review of results by clinical staff. It will be necessary to contact the appropriate Pathology Department to ensure the suitability of the specimen in the laboratory for additional testing as depending on time intervals and storage conditions certain analytes are not available for subsequent testing.
Once an additional request is made verbally a new completed request for the additional examination must be sent to the Department.

6.7.4 Time limits for requesting additional examinations

Please contact the relevant department to discuss the suitability of the retained specimens for further examinations.

6.7.5 Repeat examinations due to analytical failure or further examinations of same primary sample

Please contact the relevant department to discuss requirements

6.7.6 Referral of specimens for texting at referral laboratories.

All specimens for testing at referral laboratories must be sent in the first instance to the Pathology Department of this hospital for registration on the LIS and appropriate packaging before dispatch.
There are strict packaging and transport regulations governing the transport of pathology specimens and specimens must not be sent directly from wards or clinics to other laboratories in “jiffy” bags or other unapproved packaging.

6. 8 Requesting advice

Pathology Medical and scientific staff are available to provide advice on tests that may be required, frequency of testing or additional interpretative information if required by clinical staff.

7 Phlebotomy

Patients attending the Phlebotomy Room in the OPD or GTT service, **MUST** present with completed laboratory request forms.

Phlebotomy must not proceed until the person taking the sample is satisfied as to the correct identity of the patient.

All first visit patients must bring their charts to phlebotomy. Consent for first visit bloods is checked in the chart, if is not present the phlebotomist will either return the patient to the midwife who took the history for consent, or the phlebotomist will consent the patient directly if the patient has not yet been to the midwife for medical history.

7.1 Performing venepuncture

Where there are specific requirements are required such as fasting, these must be checked before performing venepuncture

Choice of site

- Do not use arm with arterial venous fistula
- For patients requiring repeated treatments such as chemotherapy avoid veins suitable for cannulation and treatment
- Avoid using the arm on same side post mastectomy.

Number of attempts

Two attempts ONLY should be made at venepuncture, then refer to another Phlebotomist. If first attempt is unsuccessful venepuncture should be carried out on another limb. Alternate site distal to the first venepuncture site may be used for patients with difficult access. Phlebotomists may use butterfly / needle and syringe in exceptional circumstances only.

Blood collection System

Use closed blood collection system in accordance with manufacturer's recommendations. Check expiry date on all specimen bottles. Ensure order of draw is in accordance with 5.2 below.

Inadequate Sample volume

In the case of a difficult venepuncture the Phlebotomist may prioritise samples, then refer back to requestor of the difficulties encountered.

Disposal of Material used in specimen collection

Alcohol swabs and gloves should be disposed of into yellow waste bag. Needles should be disposed of into sharps-bin.

7.2 Sarstedt S-Monovette System Tube Guide including Order of Draw

Blood Specimens should be taken in the following order:

Colour Code	Tube type / Order	Investigations
	Serum 1st (White)	Hepatitis screening & PCR, HIV, Viral Screens. CRP, Antibiotics, Iron & TIBC, Electrophoresis, Lithium. Hormones including TFTs (Endocrinology) Anti-Epileptic drugs. Fructosamine All immunology except CD4 or cryoglobulins. Tumour Markers Anti-phospholipid screen, Complement, Erythropoietin, Haptoglobins
	**Sodium Citrate** **2nd (Green)**	All Coagulation testing.
	**Lithium Heparin** **3rd (Orange)**	All Biochemistry Profiles including CRP and bile acids. Troponin (TNT).
	**EDTA** **(Blood Transfusion)** **4th (Red)**	Group, Antibody Screening, Crossmatch and DCT
	**EDTA** **5th (Red)**	Haemoglobin, FBC, , malaria screen, Infectious Mononucleosis, CD4 counts, Cyclosporin, G6P, HPLC, Hereditary Spherocytosis screen, Oxidative burst test, Pyruvate Kinase HbA1C, Gentamicin HIV viral load/ PCR
	Fluoride EDTA 6th (Yellow)	Glucose and alcohol.

7.3 Procedure Venepuncture-Action/Rationale

	Action	Rationale
1.	Gather all equipment required.	To prepare for procedure.
2.	Approach patient in a confident manner.	To reassure patient.
3.	Identify patient according to procedure	To positively identify the patient
4.	Check that all the identity details correspond with the request form exactly.	To ensure that all details are correct
5.	Check consent if first visit patient	To ensure documented consent is present in the patients' chart.
6.	Allow the patient to ask questions and discuss any problems, which have previously arisen.	A relaxed and well-informed patient is more conducive to the venepuncture procedure.
7.	Ensure the patient is sitting comfortably with his/her arm supported, and is not chewing or eating.	To assess risk of potential problems during procedure, and to ensure the patient is not chewing, or at risk of asphyxiation.
8.	If patient has history of fainting encourage to lie down for procedure.	To reduce the risk of the patient moving their limb causing a failed procedure.
9.	A facility for patient to lie down if required should be available.	May be required in case of syncope or hypoxic convulsions.
10.	Explain procedure to patient.	To allay anxiety and gain co-operation.
11.	Wash hands, according to hospital policy	To reduce risk of cross infection
12.	Don gloves.	To prevent contamination of blood.
13.	Examine the patient's veins and elicit the patient's preference when selecting an access site. However nurse, phlebotomist to check all sites to assess the best access.	To identify the most suitable vein to involve the patient in the treatment
14.	Proceed from the hand towards the forearm during the examination.	To identify the most suitable vein To use veins distally to minimise loss of veins available due to scar tissues damage
15.	Apply tourniquet two inches above potential venepuncture site.	To reduce venous return thus making veins more palpable.
16.	Only standard tourniquet device to be used.	To reduce the risk of injury.
17.	Allow time for veins to stand. (Tourniquet maximum duration 1 minute)	To assist in identifying the most suitable site and reduce risk of injury to limb.
18.	Before swabbing palpate vein. (If pulsating do not puncture). If appropriate ask patient to pump a fist to distend the vein. If necessary use warming blanket or soak the arm in luke-warm water to encourage vasodilation.	Encouraging vasodilatation relieves spasm and improves blood flow, which in turn relieves the pain. Also minimize the need to attempt venepuncture more than once.
19.	Swab skin with alcohol swab and allow to dry. Do not touch venepuncture site after swabbing.	To prevent microbial contamination from skin flora of patient.
19.	Anchor vein with finger.	To immobilise vein

	Action	Rationale
20.	When multiple samples are required, it is recommended to loosen tourniquet (but leave in situ) as soon as possible, e.g. after 1st sample.	For patient comfort and to avoid vein stasis
21.	Place dry sterile swab over vein, remove needle, apply gentle pressure. Dispose of sharps into sharps bin. Dispose of sterile swabs into yellow bin.	To avoid bruising Safe disposal of material. Safe disposal of material.
22.	If appropriate, ask patient to hold swab over the vein applying gentle pressure and keeping the arm straight while samples are labelled	To avoid bruising
23.	Label bottles immediately after the venepuncture. Handwrite blood transfusion tubes (signature of person taking the sample in the case of blood transfusion specimen). Note: **pre-labelling of blood samples is specifically prohibited.**	To ensure proper patient identification and minimise the risk of incorrect labelling. To prevent incorrect sample being taken with the possible adverse consequence of incompatible blood transfusion.
24.	Check venepuncture site for signs of oozing.	To ensure puncture site is not bleeding and to minimise bruising.
25.	When bleeding ceased apply a dressing - Non-allergic where appropriate. Ensure no restrictive clothing in place above venepuncture site.	To minimise risk of infection and reduce patient discomfort. Tight clothing would continue to reduce venous return acting as a tourniquet and may result in continued bleeding.
26.	Blood samples for transport to the pathology laboratory must be placed in an appropriate transport box with request forms. It is important to check that all specimen containers/tubes are properly sealed. Blood samples should be transported to the laboratory in a suitable, secure container and delivered to the specimen reception or appropriate laboratory area with minimal delay.	To reduce risk of cross infection. To ensure that samples and request forms arrive safely in the appropriate laboratory. To avoid leakage and contamination of transporting and laboratory staff.
27.	Telephone the laboratory if the sample is urgent	So that the Laboratory Scientific staff can prioritise it.
28.	Dispose of gloves into biohazard bag.	To avoid cross infection

7.4 Patient Information for Phlebotomy – see PATH-PHLE-FRM-2

So, you are to have a blood test:

Preparation:

- Some tests require you to fast. Your doctor will advise you of this and any special requirements.
- Your doctor/Midwife/nurse will advise if you are to withhold medication prior to test.
- Sips of water may be allowed.
- Fasting includes no gum, tea coffee etc.

To minimize length of fast attend early on day of test.

While your tests are important for your diagnosis and treatment, you have the right to refuse test.

N.B. **Bring your request form or doctors letter with you.**

Inform phlebotomist if you:

(a) feel weak
(b) have history of fainting, bleeding disorder or epilepsy.
(c) are on Warfarin, Aspirin or other blood thinning medication.
(d) have needle phobia.
(e) are aware of any reason to avoid one arm, e.g. relevant history of previous breast surgery, dialysis, axillary gland clearance or stroke.

What to expect.

- All needles, holders or syringes, are disposable, one use only.
- Approved tourniquet will be used.
- Phlebotomist will ask you to state your name and date of birth.
- Phlebotomist will clean hands and wear fresh gloves for each procedure.
- You may feel slight discomfort or sting when skin is punctured, however should you experience severe, persistent pain, inform phlebotomist, who may terminate procedure.
- It is sometimes necessary to repeat procedure where first attempt is unsuccessful. Phlebotomist will refer to a colleague if more than two attempts are necessary.
- Some slight bruising may occur but maintaining pressure on site for a minute reduces the risk of bruising.
- Do not carry heavy bags on affected side for one hour following test.
- If fasting try to eat as soon as allowed after test.
- If you feel weak or dizzy, or have any problem following test, please inform phlebotomist, who may:

  Advise you to rest for a while.
  Offer you a drink of water.
  Advise you to attend, or transfer you to an emergency department.
  Advise you not to drive until fully recovered.

While every attempt is made to call patients in rotation, it may sometimes be necessary to call a patient out of turn, for medical reasons. Your understanding is appreciated.

8 Specimen Collection Service and Pneumatic Transport System (Chute system)

The Pathology Department provides a specimen collection service: Mon-Fri 09.00-17.30. If urgent specimens need to be brought to the laboratory from areas that do not have access to the chute system, **bleep number 181** during these times.

All routine specimens should be stored in the designated areas in wards/clinics for collection or sent to the laboratory during routine hours or sent via the Pneumatic Transport System (Chute system).

Where specimens are taken outside of routine hours, particularly for Microbiology, such specimens must be stored in the ER fridge if not sent via the Chute to the Laboratory, this fridge is emptied Mon-Sat.

Specimen transport within the hospital is monitored through audit and test performance.

8.1 Pneumatic transport system - Description

A pneumatic transport system has been installed for the transport of patient specimens to the laboratories. This system, commonly referred to as "the chute", propels the carrier units or "pods", by compressed air to and from locations fitted with a station.

Station Number	Location
1	Haematology laboratory
2	Biochemistry laboratory
3	Microbiology laboratory
4	Delivery Suite, 2nd floor
5	Theatre, 3rd floor
6	St Gerard's Ward, 4th floor
7	Corridor, SCBU, 2nd floor
8	Delivery Suite - Theatre

8.2 Pneumatic transport system - Operating instructions

a. Open the carrier and carefully roll the request form around the specimen, and then place into the carrier. (Do not overfill the carrier or crush the request form, use a second carrier if necessary). Close the carrier
b. Enter the address number – check display for correct entry
c. Place the carrier into the receiver (The system will transport only one carrier at a time, therefore if there is a carrier already in the system there may be a delay before the carrier is moved)
d. Do not send Histopathology samples via the Chute system.

e. Coagulation samples for assays other than routine coagulation screens (e.g. Thrombophilia Screens, Factor Assays & Von Willebrand Screens) should NOT be sent in the tube system
f. CSFs for Microbiological Analysis CANNOT be sent via the Chute system.
g. Blood Cultures CAN be sent via the Chute system and MUST be delivered within 4 hours of sampling.

9 Specimen analysis

9.1 Examination process

The examination process is the method used by the pathology department to provide results on the analyte requested, to provide a diagnosis on the tissue or cells sent, or to identify any pathogenic (infection causing organisms) in a specimen as requested by a clinician.
Each pathology department selects its methods for Laboratory and POCT testing based on current best practice, manufactures instructions, national or international guidelines so that they are the most appropriate method to carry out the analysis required by clinicians in a given patient population. Methods will vary across Laboratories and POCT devices due to the nature of the testing and the patient population that is being serviced.

9.2 Factors that may influence Laboratory & POCT results

It is vital that all relevant clinical information is provided to the laboratory when requesting a test. Factors such as coagulation therapy, electrolyte therapy, medications such as antibiotic therapy/ or previous Anti-D administration may impact on the test result and if details are not provided, there may be an impact on additional tests, interpretation of results and comments provided by laboratory personnel.
The quality of samples received may impact on test results, for example:

- Haemolysis in blood sample may interfere with direct bilirubin analysis, electrolyte results, AST, ALK, CK, LDH, phosphate and magnesium or blood transfusion reactions.
- EDTA changes may be seen in haematology samples not processed promptly
- Lipemic samples may be rejected as it inters with measurement methods
- Clots in a POCT sample may limit the testing ability within an analyser

9.3 Storage of examined specimens

Transfusion Medicine, Haematology, Biochemistry and Microbiology specimens are retained for one week. The exception being negative blood culture vials which are discarded when culture is completed; between 5 and 7 days after set up on instrument.

Histopathology specimens are stored for one month from the date of authorisation of the final report.

POCT samples are disposed once tested within the ward setting, within Biochemistry they are retained as per Biochemistry samples for 1 week.

10 Laboratory Test Repertoire

The section will provide a list of the laboratory's repertoire including specimens required, **specimen volumes, special precautions, turnaround time and reference ranges** (where applicable).

11 Transfusion Medicine

Contact number: **4085279**

Clinical advice on ordering of examinations or products and on interpretation of results is provided by Consultant Haematologist Prof C Flynn or deputy (on-call rota available from Hospital Reception)

11.1 Availability of Transfusion Testing

Inpatient adult samples received outside of routine cut-off hours (08:00 – 16:00 Mon – Fri; 09:30 – 11:00 Sat) are only processed where there is no patient history on file or if blood products are required (except Anti-D). All other adult samples are held and can be processed if products are subsequently required. Neonatal samples are not processed outside of routine cut-off hours unless specifically requested by telephone and are held for next day processing. Outpatient samples received after 16:00 Mon – Fri are processed on the next routine day. Post-delivery cord/FMH samples received after 16:00 Mon – Fri (10:00 Sat and Sun) are processed the next day.

11.2 Transfusion Sample requirements and Turnaround Times

Test/Product	Sample Required	Maximum Turn Around Time URGENT*	Maximum Turn Around Time ROUTINE
Group & Antibody Screen^	7.5mL EDTA KE	Inpatient – 6 hours** Outpatient – 24 hours	
Neonatal Group^	Cord Sample: 7.5mL EDTA KE Venous Sample: 4.9 mL EDTA KE	30 minutes	6 hours
Direct Coombs Test^	Performed on **Group & Antibody Screen** or **Neonatal Group** sample	30 minutes	6 hours
Red Cell Units	Performed on **Group & Antibody Screen** sample (sample valid for cross-match for 72 hours post phlebotomy)	Uncrossmatched - 10 mins** Crossmatched – 1 hour**	4 hours**
Paedipack	**Neonatal Group** sample required if patient has not previously been grouped twice	90 minutes if new Paedipack required** 20 minutes for subsequent splits	
Platelets	**Group & Antibody Screen** sample is required for adults unless a sample has been processed within the previous 7 days. **Neonatal Group** sample is required for neonates if patient has not previously been grouped twice	90 minutes# (Platelets are not stored in-house and must be ordered from the IBTS on a named patient basis)	
Plasma (LG-Octaplas)	**Group & Antibody Screen** sample is required for adults unless a sample has been processed within the previous 7 days. **Neonatal Group** sample is required for neonates if patient has not previously been grouped twice	50 minutes#	1 hour#
Anti-D Issue	**Group & Antibody Screen** sample is required unless a sample has been processed within the previous 7 days	2 hours#	6 hours

Test/Product	Sample Required	Maximum Turn Around Time URGENT*	Maximum Turn Around Time ROUTINE
		NB: Anti-D only issued during routine hours and on Sat & Sun mornings	
Fibrinogen	No sample required	20 minutes	
Albumin	No sample required	30 minutes	
Coagulation Factor Products	No sample required	20 minutes	2 hours
Antibody Identification^	7.5mL EDTA KE	4 hours	2 Days¥
Red Cell Phenotyping^	Performed on **Group & Antibody Screen** or **Neonatal Group** sample	2 hours	3 Days¥
Antibody Titration^	Performed on **Group & Antibody Screen** sample	3 Days¥	
Post Natal FMH Estimation	7.5mL EDTA KE 30mins - 2 hours after delivery	72 hours Processed Monday, Wednesday & Friday (expect Public Holidays) by Flow Cytometry and reported in afternoon. Samples not likely to meet 72-window by Flow Cytometry testing are processed Saturday/Public Holiday morning by Kleihauer.	
Transfusion Reaction Investigation	7.5mL EDTA KE Contact Laboratory on 5279/5661	Depending on type of reaction	
FRHD Screen	7.5mL EDTA KE	2 weeks Referred to: IBTS, National Blood Centre	
HLA typing	Contact Laboratory on 5279/5661	3 weeks Referred to: IBTS, National Blood Centre	
Platelet Antibodies			
Foetal Genotyping			

Test/Product	Sample Required	Maximum Turn Around Time URGENT*	Maximum Turn Around Time ROUTINE
Anti-D Quantitation^ **Anti-c Quantitation^**	7.5mL EDTA KE	5 – 7 days¥ Referred to: IBTS, National Blood Centre	

*Urgent requests must be phoned to the laboratory

** Depending on antibody status. Patients with antibodies may require additional 4 hours processing time.

#Turn Around Time may be up to 1 hour longer if patient has not previously been grouped or (for Anti-D issue) antibody screen has not been performed in previous 7 days

^Request may be added on to sample already in the laboratory up to 7 days post phlebotomy. Add on requests must be phoned to the laboratory and a new request form completed.

¥These tests are only processed during routine days. Maximum TAT indicated does not include Sat/Sun/Public Holiday

Please note grossly haemolysed samples are unsuitable for Transfusion testing

NB. The TAT quoted above are the target maximum TAT. However, please be aware that the quoted TAT may not always be met if a large number of multiple products are ordered simultaneously, particularly during the on-call period. Please contact the Transfusion Medicine Laboratory on extension 5279/5661 to determine the estimated time of availability of blood products for a particular patient

11.3 Information on test methods used in Transfusion

The Grifols testing system is used in the Transfusion Medicine department for the majority of testing performed. Two Grifols Erytra Eflexis analysers are in use for automated testing of samples, which is the primary method of testing for most assays. For various reasons samples may need to be tested by manual techniques (e.g. additional testing to interpret antibody identification, anomalous grouping or antibody screen results, samples with insufficient volume for automated processing, assay not available on Grifols analyser). The manual methods in use are the set-up of samples in Grifols DG Gel Cards manually (which

may be read and interpreted manually, or read and interpreted on the Grifols DG Reader) and/or the use of tube techniques. Additionally, requests may need to be referred to a referral laboratory for additional and/or confirmatory testing.

The following table outlines the primary and alternate methods used for each assay in Transfusion Medicine. Where a request is partially or entirely processed using an alternate method, a comment will be added to the report to indicate the tests processed by an alternate technique. Where a request is referred to a referral laboratory for additional/confirmatory testing, the tests performed in the referral laboratory, the identity of the laboratory and the accreditation status of the test will be indicated on the Coombe report via a comment. If there are no comments in relation to method used on the report, then the request was processed using the primary method for that assay.

Assay	Primary Method	Alternate Methods	Reasons for alternate method being used	Reasons for referral
Group	Automated Grifols method	Manual Grifols method Tube technique	Small volume Anomalous results Confirm group (e.g. tube group in emergency)	Anomalous results Weak D reactions (genotyping required)
Antibody Screen – no antibodies detected	Automated Grifols method	Manual Grifols method Tube technique	Small volume Anomalous results Emergency situation	N/A
Antibody Screen – antibodies detected	Automated Grifols method with manual interpretation ± use of secondary panels set-up by manual Grifols method	N/A	N/A	Quantitation of Anti-D and Anti-c Complex antibodies where identity cannot be confirmed by methods in use in the Coombe.
Antibody Titre	Automated Grifols method	Manual Grifols method	Small volume Titre >64	Titration of antibody to high frequency antigen

Assay	Primary Method	Alternate Methods	Reasons for alternate method being used	Reasons for referral
DAT	Automated Grifols method	Manual Grifols method	Small volume Anomalous results	N/A
Antigen Typing – C, c, E, e, C^w, K, k, Fy^a, Fy^b, Jk^a, Jk^b, M, N, S and s antigens	Automated Grifols method	Manual Grifols method	Small volume (of sample or reagents)	If genotyping required (e.g. recently transfused patient or patient with positive DAT)
Antigen Typing – Le^a, Le^b, P1 antigens	Tube technique	N/A	N/A	N/A
Crossmatch	Automated Grifols method	Manual Grifols method Tube technique	Small volume Anomalous results Emergency situation	Complex antibody where sample cannot be processed in house.
FMH Estimation (post-delivery)	Flow Cytometry on Beckman Coulter DxFLEX	Kleihauer	Baby group unknown Flow cytometer downtime Testing on Sat/PH Baby/mother RhD variant	Flow cytometer downtime and FMH by Kleihauer >4mL

11.4 Requests for Blood Components/Products

See Clinical Procedures /Guidelines for the Transfusion of Blood Products/ Components Folder Section 2

When blood components/products are required in an **EMERGENCY** please inform Transfusion Medicine Laboratory (Ext 5279, On-call 145) and advise staff on the emergency situation and the degree of urgency.
A correctly completed request form must follow telephone requests. Emergency blood is available for adults and babies in the Delivery Suite Blood Fridge for immediate use.

11.3.1 A written signed request form must be received for all blood components/products.

11.3.2 **Red Cell Concentrates (RCCs):** Blood is crossmatched for adults on receipt of a sample and written signed request form. If only one group has been processed previously, the patients' blood group should be confirmed by a second Group & Save sample taken during a separate phlebotomy episode.
Alternatively, if the patient has already been grouped twice, a group/hold sample taken within the last 72 hours (7 days for Placenta Previa patients) can be used on the receipt of a written signed request form. If additional blood is required a repeat sample is required if patient is > 72 hours post transfusion.

11.3.3 **Paedipacks (5 X 50mL splits):** Paedipacks can be requested for babies on receipt of a written signed request form if baby is already grouped twice. Maternal samples for antibody screening will be requested if one has not already been received.
The first split of the Paedipack must be transfused on day of request. The remaining splits are stored in the transfusion medicine laboratory and are immediately available on request until expiry date except where irradiated blood is required.

11.3.4 **Platelets:** Platelets can be requested for all patients who have already been grouped twice on the receipt of a written signed request form. Platelets are NOT stored in hospital laboratory and are ordered from the IBTS as required.
The Medical scientist(s) on duty will inform ward when platelets are available and they must be transfused ASAP.

11.3.5 **Frozen Plasma:** Can be requested for all patients who have already been grouped twice, on the receipt of a written signed request form. This component is stored frozen in the laboratory and can be available within 50 mins (this is to allow time for thawing) from request.

11.3.6 **Fibrinogen Concentrate:** The Fibryga vial contains 1g. of fibrinogen and is for use in lieu of Cryoprecipitate which became unavailable from mid-2009. Up to 5g of Fibryga can be issued from the laboratory for a patient without seeking consultant

haematologist permission. 3-4 one-gram vials will raise the adult patient's fibrinogen by 1g. approximately.

11.3.7 **Anti-D immunoglobulin (Ig):** (See Anti-D Administration Guideline on hospital intranet)

Antenatal: Issue of Anti-D Ig can be requested on receipt of a signed request form.

Postnatal: Anti-D IgG is issued routinely to all RhD-negative mothers who have RhD-positive babies.

11.3.8 **Albumin and Coagulation Factor Concentrates:** Albumin and Factor Concentrates can be requested on receipt of a written signed request form (no blood group required.) Please check with transfusion medicine laboratory before request as only a limited amount of factor concentrates is stocked in the laboratory. Novo 7 must be requested through the Consultant Haematologist.

11.3.9 **Exchange Transfusion:** The transfusion medicine Laboratory MUST be informed at least 24 hours in advance of the procedure. This is to ensure the availability of fresh antigen negative blood. Blood for exchange transfusion can be requested on receipt of a maternal sample taken at least 24 hours but not more than 72 hours pre-exchange with a written signed request form.

The Transfusion Medicine Laboratory CANNOT GUARANTEE blood availability unless informed 24 hours prior to exchange

11.3.10 **Intrauterine Transfusion (IUT):** The senior staff of the transfusion medicine laboratory (Ext: 5279) MUST be notified if IUT has been performed in external hospital.

11.5 Prescription of Blood Components/Products

See Clinical Procedures /Guidelines for the Transfusion of Blood Products/ Components Folder Section 5

11.6 Maximum Blood Ordering Schedule

See Clinical Procedures /Guidelines for the Transfusion of Blood Products/ Components Folder Section 10

11.7 Guideline for Anti-D administration to Rh-D Negative Women and Estimation of Fetomaternal Haemorrhage

See Clinical Procedures /Guidelines for the Transfusion of Blood Products/ Components Folder Section 11 and hospital intranet

11.8 Management of Acute Massive Haemorrhage

See Clinical Procedures /Guidelines for the Transfusion of Blood Products/ Components Folder Section 12 and hospital intranet

11.9 Management of Acute Transfusion Reaction

See Clinical Procedures /Guidelines for the Transfusion of Blood Products/ Components Folder Section 7 and hospital intranet

11.10 Critical phoning limits

When urgently requested blood products (except Anti-D) are ready for collection, the clinical area the product was ordered from will be contacted by telephone.

Antibody quantitation results are phoned to the Rhesus Clinic at the following limits:

- Anti-D >4.0 IU/ml or an increase of >1.0 IU/ml
- Anti-c >7.5 IU/ml or an increase of >1.0 IU/ml

Results of FMH by flow cytometry are phoned where the volume is >12mls

Positive DAT results are phoned.

12 Biochemistry

The Biochemistry Department provides a comprehensive clinical biochemistry service encompassing biochemistry, endocrinology and Point of Care services.
Specialised testing is also provided for other hospitals around the country. This section outlines the use of the laboratory and many of the tests available. It is not comprehensive. Advice should be sought from the Biochemistry Department if there are queries.
The Biochemistry Department provides a full repertoire during Pathology Department working hours as described above. It should be noted that essential routine maintenance, calibration and quality procedures are performed every morning and results may be delayed between 08:30 am and 10:00 am.
Biochemistry Analyser Platforms:

- Routine Biochemistry – Abbott Architect c8000
- Roche Cobas – Immunoassay and Hormone Analysis
- Blood Gases and Metabolites – RapidPoint 400/500 and RapidLab 1240/1265.

Note: Serum samples (clotted blood) require one-hour clotting time from time of receipt prior to analysis.

Reference ranges are supplied with biochemistry results:

1. Gynaecological: adult female range for non-pregnant women
2. Maternity: reference range for 36 weeks pregnancy
3. Paediatric: Full term neonate less than 3 months old.
4. Glucose: Fasting reference range supplied

Some tests are not supplied with reference ranges, as interpretation depends on the clinical question and clinical guidelines. Such tests include hCG, Progesterone, and some Urine Biochemistry. Please contact Biochemistry Department for assistance in interpretation.

12.1 Test Repertoire (In-house) during routine hours

<u>Paediatric Profiles & Volumes</u> (Profiles are listed on the back of the request forms)
A 300µl sample of the recommended sample type is sufficient for the profiles indicated below, depending on the haematocrit of the baby. If many tests are required, a further 300µl sample of the indicated type is recommended.
Exception: TFTs – minimum 500µl is required for analysis.

Urea and Electrolytes (UE)	Urea, Na, K, Cl, Ca, Mg, PO4, Creatinine (enzymatic)
Total Parenteral Nutrition (TPN)	Urea, Na, K, Cl, Ca, Mg, PO4, Albumin
Growing Bloods (GB)	Urea, Na, K, Cl, Ca, Mg, PO4, Albumin, ALP
Liver Function Tests (LFT)	Albumin, Bilirubin, Globulin, ALP, AST, ALT, Total Protein

Bilirubin (SBR) Total Bilirubin, Direct Bilirubin

<u>Adult Profiles & Volumes</u> (Profiles are listed on the back of the request forms)

2.7ml sample of the recommended type is sufficient.

Urea and Electrolytes (UE): Urea, Na, K, Cl, Creatinine (enzymatic)

Liver Function Tests (LFT): Albumin, Bilirubin, Globulin, ALP, AST, ALT, Total Protein

Pre-eclampsia (PET): UE, LFT, Urate

Comments will be added to the report in the event of potential analytical interference such as haemolysis. Haemolysis interferes with the following tests: AST, Potassium, LDH and Direct Bilirubin.

12.2 Biochemistry Sample requirements and Turnaround Times

Note: Turnaround times may be affected by analyser maintenance activity.

Test	Sample Type	Turnaround Time - Routine	Turnaround Time - Urgent	Special Comments
Routine Biochemistry				
Urea & Electrolytes	LiHep (orange)	3 hours	1 hour	
Liver Function Tests	LiHep (orange)	3 hours	1 hour	
Calcium, Magnesium, Phosphate	LiHep (orange)	3 hours	1 hour	
Bilirubin (Total & Direct)	LiHep (orange)	3 hours	1 hour	Wrap in tin-foil for sending
LDH (IFCC)	LiHep (orange)	3 hours	1 hour	
Urate (Uric acid)	LiHep (orange)	3 hours	1 hour	
Gamma-GT	LiHep (orange)	3 hours	1 hour	
Total Bile Acids	LiHep (orange)	3 hours	1 hour	Fasting
Ammonia	LiHep (orange)	3 hours	1 hour	Send immediately
CRP	LiHep (orange) or Serum (white)	4 hours	1 hour	Serum requires 1hr clotting from time of receipt prior to analysis
CK	LiHep (orange) or Serum (white)	4 hours	1 hour	Serum requires 1hr clotting from time of receipt prior to analysis
Fructosamine	Serum (white)	1 week		Reported corrected as 70g protein. Note: protein result used for calculation purposes

Test	Sample Type	Turnaround Time - Routine	Turnaround Time - Urgent	Special Comments
Glucose	Fluoride-EDTA (yellow)	4 hours	1 hour	State time of sampling and whether sample is fasting or random
Gentamicin	EDTA (red)	4 hours (Mon-Fri)		State whether pre or post dose or random. Post sample not required in once a day regimen. Gentamicin can be done on call as per consultant requested.
Vancomycin	Serum (white)	1 working day		Sample analysed in St. James' Hospital
Blood Gases including electrolytes, glucose, lactate and Haemoglobin	Electrolyte-balanced Heparin syringe/capillary sample	15 minutes		Send immediately. Notify laboratory
Urine Biochemistry				
24hr urine Protein and/or Creatinine (enzymatic)	24-hour urine (plain container)	4 hours (Mon-Fri)		Container Must be labelled with Patient Label
Protein/creatinine (enzymatic) ratio	Random urine	4 hours (Mon-Fri)	1 hour	
Creatinine (enzymatic) clearance	24-hour urine (plain container)	4 hours (Mon-Fri)		Take blood for plasma creatinine during collection
Urine Electrolytes	Random (MSU)	4 hours (Mon-Fri)		
Endocrinology and Immunoassay				
FSH, LH, Prolactin, Oestradiol	2.7ml Serum(white)	4 hours (Mon-Fri)		
TFTs	2.7ml Serum(white)	4 hours (Mon-Fri)		
bHCG	2.7ml Serum(white)	4 hours (Mon-Fri)		

12.3 Biochemistry Reference Ranges.

Results are supplied with reference ranges applicable to term new-borns up to 14 days old, paediatric patients from 15 days to 1 year, adult female, adult male and maternity patients.

TEST (Plasma/Serum)	Units	Maternity (36-40/40	Neonate (0-14days)	Paed (15d to 1 yr.)	Adult Female	Adult Male
Sodium	mmol/L	132 - 145[7]	133 - 146[2]	133 - 146[2]	133 – 146[2]	133 – 146[2]
Potassium	mmol/L	3.4 – 4.9[5]	3.4 – 6.0[2]	3.5 – 5.7[2]	3.5 – 5.3[2]	3.5 – 5.3[2]
Chloride	mmol/L	94 - 107[5]	98 - 113[1]	98 - 107[1]	95 – 108[2]	95 - 108[2]
Urea	mmol/L	1.1 – 4.2[7]	1.0 – 8.2[3]	1.2 – 6.0[3]	2.5 – 7.8[2]	2.5 – 7.8[2]
Creatinine (Enz)	umol/L	39 – 71[5]	29 – 82[3]	9 - 32[3]	49 – 90[1]	64 - 104[1]
Total Protein	g/L	50 - 66[7]	46 – 70[1]	44 - 71[3]	60 - 80[2]	60 - 80[2]
Albumin	g/L	27 - 39[7]	33 - 45[3]	28 - 47[3]	35 - 50[2]	35 - 50[2]
AST	U/L	<53[6]	32 - 162[3]	20 - 67[3]	5 - 34[1]	5 – 34[1]
ALT	U/L	<41[6]	5 - 33[3]	5 - 33[3]	0 - 55[1]	0 -55[1]
Alk Phos	U/L	93 - 356[5]	90 - 273[3]	134 - 518[3]	30 - 130[2]	30 - 130[2]
GGT	U/L	9 - 40[6]	23 - 219[3]	8 - 127[3]	9 - 36[1]	12 – 64[1]
LDH (P→L)	U/L	141 - 255[6]	309 - 1222[3]	163 - 452[3]	125 - 220[1]	125 – 220[1]
CK	U/L	0 - 138[5]	0 - 244[7]	30 – 220[8]	0 - 168[1]	30 - 200[1]
Total Bilirubin	umol/L	0 - 19[6]	3.3 – 283.8[3]	0.8 – 11.7[3]	0 - 20[2]	0 - 20[2]
Direct Bilirubin	umol/L	0 – 3[7]	5.7 – 12.1[3]	0.8 – 5.2[3]	<5[1]	<5[1]
Glucose (Fast)	mmol/L	3.0 – 5.0[7]	2.5 – 3.3[7]	3.3 – 5.5[9]	3.3 – 5.5[9]	3.3 – 5.5 [9]
Calcium	mmol/L	2.0 – 2.42[5]	2.13 – 2.74[3]	2.13 – 2.74[3]	2.10 – 2.55[1]	2.10 – 2.55[1]
Phosphate	mmol/L	0.85 – 1.45[6]	1.30 - 2.6[2]	1.3 – 2.4[2]	0.8 – 1.5[2]	0.64 – 1.52[1]
Magnesium	mmol/L	0.61 – 0.87[5]	0.82 – 1.62[3]	0.81 – 1.27[3]	0.7 – 1.0[2]	0.7 – 1.0[2]
Amylase	U/L	0 – 96[1]	16 - 108[4]	2 – 50[3]	23 - 96[1]	25 – 125[1]
CRP	mg/L	0 - 5[7]	0 .3 – 6.1[3]	0.1 – 1.0[3]	0 - 5[1]	0 – 5[1]
Urate	umol/L	150 - 390[7]	164 – 757[3]	94 – 377[3]	140 - 360[2]	200 – 430[2]
Ammonia	umol/L	18 - 72[1]	0 – 100[4]	<50[2]	18 - 72[1]	18 – 72[1]
Fructosamine	umol/L	205 - 285[7]				
Bile Acids	umol/L	0 - 10[7]				
Urine Protein	g/day	0 – 0.3[7]	0.3 – 1.2 g/L[4]	0 – 0.3[1]	0 - 0.3[1]	0 – 0.3[1]

Urine Creat (Enz)	mmol/L	3.9 – 9.4[1]			3.9 – 9.4[1]	5.1 – 14.2[1]
Urine Sodium	mmol/day	37–149[10]	<4.4 mmol/kg/day[4]	<4.4 mmol/kg/day[4]	40 – 220[1]	40 – 220[1]
Urine K+	mmol/day	11–35[10]	<2.3 mmol/kg/day[4]	<2.3 mmol/kg/day[4]	25–125[1]	25 – 125[1]
Urine Calcium	mmol/day	0.8–4.2[10]			2.5 – 7.5[1]	2.5 – 7.5[1]
Urine Chloride	mmol/day				110–250[1]	110–250[1]
Urine Urea	mmol/day				428 – 714[1]	428 – 714[1]
CSF Protein	g/L		0.15 – 1.3[1]	0.15 – 0.8[1]		
CSF Glucose	mmol/L		3.33 – 4.44[1]	3.33 – 4.44[1]		

References:

1. Abbott Architect C8000 kit insert
2. Pathology Harmonisation UK
3. CALIPER study. Crit Rev Clin Lab Med (2017)
4. Alder Hey Children's Hospital, Liverpool UK
5. Tietz Clinical Chemistry 3rd edition. Table 48-3
6. Larsson A, Reference values for clinical chemistry tests during normal pregnancy. BJOG:115:874(2008)
7. Coombe Women's Hospital established range
8. Royal College of Paediatrics and Child Health (www.rcpch.ac.uk)
9. Biochemistry Dept, St James Hospital, Dublin
10. Williams Obstetrics 24th edition 2014 Appendix I.

12.4 Critical Limits: Outside which results are telephoned to the wards and clinicians.

	Neonatal		Ref	Maternity		Ref	Gynaecology		Ref	Comments
	Low	High	Range	Low	High	Range	Low	High	Range	
Sodium	<130	>150	133-146	<128	>150	132-145	<128	>150	133-146	
Potassium	<3.0	>6.0	3.4-6.0	<2.9	>5.5	3.4-4.9	<2.9	>5.5	3.5-5.3	
Chloride		>125	98-113	<90	>120	94-107	<90	>120	95-108	
Urea		>15.0	1.0-8.2	N/A	>15	1.1-4.2	N/A	>15	2.5-7.8	
Creatinine - Enzymatic		>100	29-82	N/A	>100	39-71	N/A	>100	49-90	Also, if increase of 26 over baseline
Glucose	<2.5	>15.0	2.5-3.3	<3.0	>10	3.0-5.0	<3.0	>10	3.3-5.5	Fasting reference

	Neonatal		Ref Range	Maternity		Ref Range	Gynaecology		Ref Range	Comments
	Low	High		Low	High		Low	High		
										range supplied
Magnesium	<0.4	>1.8	0.82-1.62	<0.4	N/A	0.61-0.87	<0.4	>2.0	0.7-1.0	
Calcium	<1.8	>2.9	2.13-2.74	<1.9	>3.0	2.0-2.42	<1.9	>3.0	2.1-2.55	
Phosphate	<1.0	>2.7	1.3-2.6	<0.4	N/A	0.85-1.45	<0.4	N/A	0.8-1.5	
Total Bilirubin	N/A	>250	3.8-284	N/A	>30	0-19	N/A	>40	0-20	>200 phoned for day 1 neonates
Direct Bilirubin	N/A	>20	5.7-12.1							
Albumin	<21	N/A	33-45	<23	N/A	27-39	<25	N/A	35-50	
AST	N/A	>150	32-162	N/A	>70	<53	N/A	>100	5-34	
ALT	N/A	>150	5-33	N/A	>60	<41	N/A	>100	0-55	
CK	N/A	>500	0-244	N/A	>250	0-138	N/A	>300	0-168	
LDH	N/A	>1500	309-1222	N/A	>350	141-255			125-220	
ALP	N/A	>700	90-273	N/A	N/A	93-356				* <1 month old
Urate				N/A	>500	150-390				
Amylase				N/A	>100	0-96	N/A	>100	23-96	
CRP	NA	>20	0.3-6.1	N/A	>10	0-5.0	NA	>30	0-5.0	
CSF-Protein & Glucose	Always phone results			Always phone results			Always phone results			Note if glucose from Fluoride/CSF
PCR				N/A	>0.05	<0.03				
24hr Urine-protein					>0.5g					
Bile Acid				N/A	>15	0-10				Fasting reference

	Neonatal		Ref Range	Maternity		Ref Range	Gynaecology		Ref Range	Comments
	Low	High		Low	High		Low	High		
										range supplied
Gentamycin	N/A	>10.0	<1 Trough 5-10 Peak	N/A	>2 Trough >10 Peak	<1 Trough 5-10 Peak	N/A	>2 Trough >10 Peak	<1 Trough 5-10 Peak	
FT4	Phone all abnormal results			N/A	>30	See LIS	N/A	>30	10.3-24.5	
TSH	Phone all abnormal results				>10	0.2-3.5		>10	0.4-4.0	If >2 days for low limit

12.5 Full Hypoglycaemia Work-up-Profile (Newcastle work-up)

The diagnosis of the cause of hypoglycaemia in infants under 12 months requires analysis of the physiological response to hypoglycaemia. Measurement of plasma insulin, cortisol, and β-hydroxybutyrate at the time of hypoglycaemia will usually identify the cause.

Samples MUST be collected when the patient is hypoglycaemic and put into the correct vials. Failure to do so will negate the investigation. It may be the only opportunity to obtain samples on which a diagnosis can be made.

Please inform the Biochemistry lab at Ext 5327 between 08:00 and 18:00, Monday to Friday (or Scientist on call (Speedial) outside these hours), when samples are being sent
(Samples will be forwarded to Biochemistry Dept. Children's Health Ireland (CHI) Temple Street for analysis.)

The following samples are required listed **in order of priority:**

Tube	Volume Required	Investigation (LIS Code)	Laboratory Processing
Fluoride Heparin Yellow Top (Glucose Tube)	1.3 ml whole blood	Glucose Lactate B-OH Butyrate	Send to lab immediately for separation and freezing @ -20C

Tube	Volume Required	Investigation (LIS Code)	Laboratory Processing
Serum Tube White Top	1.3 ml whole blood	Cortisol Growth Hormone Insulin	Send to lab immediately for separation and freezing @ -20C NB - Haemolysed samples are unsuitable for Insulin assay.
Serum Tube White Top	1.3 ml whole blood	C-peptide	Send to lab immediately for separation and freezing @ -20C
Li. Heparin Tube Orange Top	1.3 ml whole blood	Ammonia Amino acids	Send to lab immediately for separation and freezing @ -20C
Blood Gas Syringe	1.0ml blood	Blood gas analysis	Analyse immediately on POCT analyser
Guthrie card	2 drops blood	Acylcarnitine (ACYR)	Acylcarnitine card, allow to dry and send to lab for storage in brown envelope
Urine	Minimum 5 ml	Organic acids	Send to lab immediately for freezing @ -20

Samples must be delivered <u>immediately</u> to the laboratory for processing.

Full clinical details MUST be given on the request form including the time of collection.
If the plasma glucose measured in CHI (Temple St) Lab is >3.0mmol/L, samples will not be analysed for metabolites but will be stored in the referral laboratory for 6 weeks. These may subsequently be analysed at the request of the consultant in charge.

13 Biochemistry Assays Referred to External laboratories

Please note that certain samples may be labile and require rapid transport or specific environmental conditions when being couriered to the destination laboratory. Some samples must be sent immediately to the external laboratory for analysis due to the nature of the test requested. Users are requested to confirm optimal time for sampling in these instances, as samples received outside routine working hours may be unsuitable for analysis. e.g. Samples for VLCFA are to be received in the external laboratory within 24 hours of sampling.
It is recommended that samples are to be taken in the morning (Preferably Monday-Thursday), and notify the laboratory when sending.
The table below contains the most common external tests requested.

Test	Specimen Type / Volume	Details	Destination	Turnaround Time
Phenobarbitone	2.7ml Serum		TDM Special Biochemistry Section, Chemical Pathology, Beaumont Hospital Ph: 809 2678 / 2671	10 working days
Phenytoin (Epanutin)				
Valproic Acid (Epilim)				
Carbamazepine (Tegretol)				
Theophylline (Aminophylline)				
Alpha 1 anti-Trypsin (levels & phenotyping)	2.7mL Serum **(adult) (White tube)** 1.3mL Serum	Separate	Biochemistry, Beaumont Hospital, Dublin 9 Tel: 01-8092351 for AAT **if level low reflexed on to** Alpha One Suite, Smurfit Building	10 working days

Test	Specimen Type / Volume	Details	Destination	Turnaround Time
	Minimum 250µL serum required **(paediatric) (White tube)**		RCSI, Beaumont Hospital, Dublin 9 Tel: 01-8093800	
Ferritin	2.7ml Serum		Nutritional Laboratory, St James's Hospital Dublin 8	10 working days
Folate	2.7ml Serum			
Vitamin D	2.7ml Serum			
Vitamin B12	2.7ml Serum			
PTH	1.5ml Serum ***on ice***	Send to lab immediately for separation and freezing.	Metabolic Lab St Vincent's Hospital Elm Pk, D4	10 working days
NT-proBNP	2.7 mL Serum (adult)		Biochemistry St James's Hospital Dublin 8 Ph 4162066	10 working days
Osmolality	300ul LiHep plasma 2ml urine			
Troponin T	2.7 mL LiHep (adult) 150 uL LiHep (paed)	Indicate whether 0 hour, 6 hour or 12 hour sample		
CA125	2.7 mL Serum			

Test	Specimen Type / Volume	Details	Destination	Turnaround Time
Digoxin (Lanoxia)	2.7 mL Serum			
Free T3	2.7ml Plasma		Biochemistry Lab Mater Hospital Dublin 7 01-8032383	10 working days
Testosterone	2.7ml Serum		Endocrinology, St James's Hospital, Dublin 8 Ph 01-4162991	10 working days
Androstenedione	2.7ml Serum	Minimum 90µl serum required for analysis. Service 8am-8pm only	Endocrinology, St James's Hospital, Dublin 8 Ph 01-4162991 Biochemistry, St James's Hospital Ph 01-4162066	10 working days
SHBG	2.7ml Serum			
Vancomycin	0.3ml Serum			
Gentamicin-Sunday testing only	0.3ml Serum		Biochemistry, St James's Hospital Ph 01-4162066	3 working days
Cortisol (paediatric)	1ml Li Heparin		Biochemistry, St James's Hospital Ph 01-4162066 Biochemistry CHI CRUMLIN, D12 01-4096427	10 working days
17-OH Progesterone (paediatric)	1ml Li Heparin			

Test	Specimen Type / Volume	Details	Destination	Turnaround Time
Pyruvate	Contact Lab	Refer to Newcastle Work-up (BB-NEWCASTLE-I) **FOLLOW EXACTLY**	Biochemistry CHI CRUMLIN, D12 01-4096427 Drug Treatment Centre Trinity Court, Pearse St, Dublin 2	10 working days
Urine for Toxicology	1ml – 5ml Urine			
Galactose	See **Galactose-1-Phosphate**			
Galactose (screen)	See **Beutler Test**	(Clinical Details and patient address **must** be supplied)	Metabolic Lab Temple Street Ph: 01- 8741751 **International Destination** Biochemical Genetics Laboratory Dept of Clinical Chemistry Birmingham Childrens Hospital NHS Trust Steel House Lane, Birmingham B4-6NH Tel: 00441213339999	10 working days
Galactose-1-phosphate (monitoring)	**2** X 1.3mL Li Hep **(Orange tube)**	**<u>Do not separate</u> Contact Lab before sampling**	Metabolic Lab Temple Street Ph: 01- 8741751	20 working days

Test	Specimen Type / Volume	Details	Destination	Turnaround Time
		Collect samples prior to starting Galactose free feeds. **Must reach external lab <24hours from sampling**	**International Destination** Biochemical Genetics Laboratory Dept of Clinical Chemistry Birmingham Childrens Hospital NHS Trust Steel House Lane, Birmingham B4-6NH Tel: 00441213339999	
Acyl Carnitine	4 spots on Temple St Bloodspot card	Send to lab immediately for freezing (Clinical Details **must** be supplied)	Chemical Pathology, Sheffield Children's Hospital, UK	
Carnitine (total and free)	0.5 mL Li Hep plasma with 5 mL urine	(Clinical Details **must** be supplied) Send to lab immediately for separation & freezing (Clinical Details **must** be supplied)		

Please phone the Biochemistry Department for information on other tests.

14 Point of Care (POCT)

A POCT service may be defined as a quality-assured pathology service using analytical devices (including test kits and analysers), provided near to the patient rather than in the traditional environment of a clinical laboratory.
The Coombe Hospital has a POCT committee through which all issues regarding POCT are managed and the Pathology Department has responsibility for governance of the POCT service.

Note that the existence of this governance structure does not negate the responsibility of the individual analyst to work in a competent manner. The onus is on the Midwife/Nurse Manager or Head of each unit to ensure that all authorised operators have been trained and demonstrated competence. The individual conducting the analysis is accountable for the results they generate using POCT devices.

Test Profiles (Blood Gas):
Tests depend on the blood gas analyser used and are displayed on the screen.
Tests include pH, pCO2, pO2, Sodium-direct, Potassium-direct, Chloride-direct, ionised calcium, haemoglobin, methaemoglobin, glucose and lactate. Calculated tests include Base excess and actual Bicarbonate.
POCT tests use different methodologies to laboratory-based tests.
Haemoglobin results need to be confirmed with a laboratory method before any decisions are made with respect to blood transfusion.
Samples should be collected anaerobically into an electrolyte – balanced heparinised blood gas syringe or capillary and analysed promptly.

14.1 Blood Gas and Metabolite Reference Ranges

	Neonatal Arterial		Neonatal Artertial Blood Gas Ref Range	Comments	Neonatal Venous	Neonatal Capillary	Maternity		Maternity Arterial Blood Gas Ref Range	Non Maternity Arterial		Non-Maternity Arterial Blood Gas Ref Range	Non-Maternity Venous
	Low	High			Blood Gas Reference Ranges	Blood Gas Reference Ranges	Low	High		Low	High		Blood Gas Reference Range
pH			7.29- 7.45(1)	Term 24 hours	7.31-7.41 (8)	7.31-7.47 (9)			7.39-7.47 (11)			7.31-7.42(5,6)	7.30-7.43 (15)
pCO2 kPa			3.59-5.32(5)	Arterial	5.33-6.93 (8)	3.8 -6.5 kPa (9)			4.7-5.99 (11)			4.26-5.99(5,6)	5.1-7.7 (15)
pO2 kPa			7.2-12.7(6)	24 h old	3.99-6.66 (8)	4.3-8.2kPa (9)			10.0-14.8 (11)			11.04-14.36 (5,6)	RI (15)
Acutal Bicarbonate mmol/L			17.5-28.7(6)		22-27 (8)				22.9-27.7(11)			21.2-27.0(6)	22-30 (15)
Standard Bicarbonate			17-25(2)			18-26 mmolL(9)			22.9-27.7(11)			21.2-27.0(6)	
Base Excess(b/ecf)			-10 to -2(6)		-10 to -2 mmol/L (8)	-2.5 to +2.5 4(9)			-0.4 - 3.2(11)			-2.3 -+2.7(6)	-2.0 to 4.5 (15)
Sodium (Na+) Direct mmol/L	<120	>155(16)	133-146(2)	Up to 1 week old			<120	>155(16)	132-145(12)	<120	>155(16)	136-145(5,6)	
Potassium (K+) Direct mmol/L	<2.6	>6.5(16)	3.5-5.5(2)	Capillary higher			<2.6	>6.5(16)	3.5- 5.0 (12)	<2.6	>6.5(16)	3.4-4.4(5,6)	
Chloride (Cl-) Direct mmol/L	<75	>125	95-110(2)				<75	>125	94-107 (12)	<75	>125	98-107(5,6)	
Lactate mmol/L		>5	< 2.9(4)					>5	0.51-2.50(14)		>5	0.56-1.39(5,6)	0.4-2.0 (15)
Glucose mmol/L	<2.5	>25(16)	2.5 - 3.3(3)	Fasting			<2.5	>25(16)	3.0-5.0 (12)	<2.5	>25(16)	3.5-5.3 (5)	
Calcium (ionised) mmol/L	<0.8	>1.6	1.1-1.4(1)	Lowest at 24h old			<0.8	>1.6	1.15-1.33(13)	<0.8	>1.6	1.15-1.33(5,6)	1.15-1.30 (15)
Haemoglobin g/dl	<8.5	>23(16)	14 - 22(7)	Birth			<8.5	>23(16)	10.8-17.2 (11)	<8.5	>23(16)	12-15(7)	
Carboxyhaemoglobin (%)		>20% (17)	<3.0% (17)					>20% (17)	<3.0% (17)		>20% (17)	<3.0% (17)	<3.0% (17)
Oxyhemoglobin (%)			58.0-79.0%(17)						58.0-79.0%(17)			58.0-79.0%(17)	58.0-79.0%(17)
Deoxyhemoglobin(%)			20.0-38.0%(17)						20.0-38.0%(17)			20.0-38.0%(17)	20.0-38.0%(17)
Methemoglobin(%)		>10%(17)	<2.0% (17)					>10%(17)	<2.0% (17)		>10%(17)	<2.0% (17)	<2.0% (17)

Reference: PATH-POC-INS-15 Rev 2.

14.2 Biochemistry Point of Care

Approved devices in use in this hospital include the following analysers:

RapidLab 1240 Blood Gas analysers in the Delivery Suite
Tests: pH and Base Excess (and pCO2 and pO2)
Recommended minimum volume 0.1 ml

RapidPoint 500 analyser in the Neonatal Unit
Tests: Blood gases, electrolytes, ionised calcium, glucose, haemoglobin and lactate.
Recommended minimum volume 0.2 ml

RapidLab 1240 and Rapid Point 500/500e analyser in Theatre
Tests: Blood gases, electrolytes, ionised calcium, glucose, haemoglobin and lactate.
Recommended minimum volume 0.2ml

Hemocue 201+ glucose meters on the wards in the Delivery Suite, in the Neonatal Unit, in the Baby Clinic and in Theatre.

Only trained personnel are allowed to operate these devices. Training can be requested from the Biochemistry Department on extension 5327.
A backup Rapidpoint 500 available in the Biochemistry Department. However, this model is not suitable for scalp pH measurement. It is important to identify and remove clots from samples before analysis as clots may produce erroneous results and / or leave the POCT device unusable until cleared.

14.3 Microbiology Point of Care

Pregnancy testing in the Emergency Room
Only trained staff are allowed report on the test strips provided.
Training can be requested from the Hospital Point of Care co-ordinator.

15 Haematology

Contact number: **4085700**

Clinical advice on ordering of examinations and on interpretation of results is provided by consultant haematologist Prof Catherine Flynn or the deputy (on-call rota available from Hospital Reception)

15.1 Routine Haematology test repertoire

Haematology Tests	Specimen^ Paed	Specimen^ Adult	Min Vol	Max age of sample for processing§	Maximum Turn Around Time URGENT	Maximum Turn Around Time ROUTINE	Availability of Testing
Full Blood Count (FBC)	1.6 ml EDTA	2.7 ml EDTA	0.5 ml	8 hours (unrefrigerated) 24 hours (refrigerated)	60 mins	120 mins	Available on a 24/7 basis
Reticulocytes	Performed on FBC sample			6 hours (unrefrigerated) 24 hours (refrigerated)	60 mins	120 mins	
Blood Film	Performed on FBC sample			8 hours	60 mins	4 hours	08:00 – 17:00 Mon – Fri¥ 09:30 – 12:00 Sat¥
Kleihauer*	N/A	2.7ml EDTA	0.5 ml	96 hours	Maximum TAT is 72 Hours		08:00 – 15:00 Mon – Fri¥ 09:30 – 11:00 Sat¥

Haematology Tests	Specimen^ Paed Adult	Min Vol	Max age of sample for processing§	Maximum Turn Around Time URGENT ROUTINE	Availability of Testing
Malaria Screen	Performed on FBC sample		3 hours	Only requests with recent travel history to endemic region, previous infection and/or strong clinical suspicion of malaria will be processed urgently (i.e. within 3 hours). Other requests have an 8-hour TAT (if received in routine day, before 2pm cut-off). Positive malaria and query Plasmodium knowlesi samples are sent for confirmation to the Malaria Reference Laboratory (MRL). Verbal results available 2 working days after receipt in the MRL for microscopy, 4 working days for PCR.	Please contact laboratory if malaria screen required. Note that outside of 08:00 – 15:00 Mon – Fri, staff member may need to be called in

^Clotted samples are ***not suitable*** for analysis**.** Lipaemia can interfere with Haemoglobin analysis and Haemoglobin, MCH & MCHC may not be reportable on highly lipaemic FBC samples.

*Samples for Kleihauer **must be** hand-labelled. Kleihauer requests are processed on RhD Negative women who are at least 20 weeks gestation. Samples are only processed on RhD Positive women in the event of IUD, infant with severe unexplained anaemia or if laboratory is contacted by phone by consultant obstetrician.

§Laboratory must be contacted by phone for add-on requests and a new request form completed. Blood cell morphology is affected by storage in EDTA, therefore it may not always be possible to report on blood film or malaria screen add-ons. EDTA samples should be refrigerated if not transported immediately to laboratory.

¥Urgent requests for blood film or Kleihauer may be facilitated outside of these hours if required (e.g. RhD Negative patient nearing 72 hours since a potentially sensitising event). Otherwise they will be read on the next routine day. Consultant must contact the laboratory if required urgently.

15.2 Coagulation test repertoire

Coagulation Tests	Specimen		Minimum Volume	Maximum Turn Around Time		Availability of Testing
	Paed	Adult		URGENT	ROUTINE	
Coagulation Screen (PT, APTT & Fibrinogen)	1.4 ml Na citrate (green)*	3.0 ml Na citrate (green)*	1 correctly filled tube	60 mins	2 hours	Available on a 24/7 basis
Lupus Anticoagulant (includes Coagulation Screen)	1.4 ml Na citrate (green)*	3.0 ml Na citrate (green)*	2 correctly filled tubes	N/A	4 weeks	Batch performed approximately once every 2 weeks

*All coagulation specimens must be filled to the green mark on the sample bottle. Under, Overfilled, Clotted or Haemolysed specimens **are not** suitable for analysis. Patients with a Haematocrit >0.550 l/l should have the volume of anticoagulant in the tube adjusted before phlebotomy. Please contact the Haematology Laboratory for an adjusted Na Citrate tube for these patients **before** phlebotomy.

Coagulation samples must be processed / separated within 4 hours of phlebotomy and should be kept at room temperature.

Coagulation assays may be added on to a coagulation sample already in the laboratory for up to **4 hours** after phlebotomy. The laboratory must be contacted by phone for add-on requests and a new request form completed.

Thrombophilia Screen sample requirements outlined in section 9.4.5 below include Coagulation Screen and Lupus Anticoagulant

Coagulation samples for assays other than routine coagulation screens (e.g. Thrombophilia Screens, Factor Assays & Von Willebrand Screens) **should NOT be sent in the tube system.**

15.3 Critical Limits: above/below which results are telephoned

Full Blood Counts		Coagulation	FMH (Kleihauer or flow cytometry)	External Results	Malaria Screens	Blood Films
Haemoglobin*		Unexplained prolonged **PT** or **APTT*** **INR*** >4.0 for patients on warfarin	>12mL	All results phoned from external hospital e.g. factor assays, Haemoglobinopathy etc.	All malaria screen results are phoned	If blasts are seen#
Adult	<8 g/dL					
Neonate	<13 g/dL					
Platelets	<100 x 10^9/L* <25 x 10^9/L¥	**Fibrinogen** <2.0 g/L				Thrombocytopenia with schistocytes*
White Cell Count*		Prolonged APTT/PT, Low Fibrinogen in conjunction with low platelets i.e. **suggestive of DIC***				
Adults						
In Labour	>25 x 10^9/L					
All others	>20 x 10^9/L					
Neonates	<5; >50x10^9/L					

#May be discussed with Consultant Haematologist before phoning

****If results remain stable results will not be repeatedly phoned unless specifically requested***

¥Platelet counts of <25 x 10^9/L will be phoned on each instance

Attempts will be made to phone details of any inpatient samples that have to be rejected e.g. clotted, insufficient, unlabelled etc.

Any requests that have a 'phone' request on them will also be phoned

All above phoning limits apply to adult and neonatal results, unless otherwise indicated.

Assays performed in the department and not listed above do not have critical phoning limits.

15.4 Biological Reference Ranges

Reference ranges for FBC parameters for normal infants from birth to six months of age

(Source available from Haematology Laboratory on request)

Parameter	Birth	Day 3	Day 7	Day 14	1 Month	2 Months	3-6 Months
RBC ($x10^{12}$/L)	5-7	4-6.6	3.9-6.3	3.6-6.2	3.0-5.4	3.1-4.3	4.1-5.3
Hb (g/dL)	14-22	15-21	13.5-21.5	12.5-20.5	11.5-16.5	9.4-13	11.1-14.1
HCT (L/L)	0.45-0.75	0.45-0.67	0.42-0.66	0.31-0.71	0.33-0.53	0.28-0.42	0.30-0.40
MCV (fL)	100-120	92-118	88-126	86-124	92-116	87-103	68-84
MCH (pg)	31-37	31-37	31-37	31-37	30-36	30-36	24-30
MCHC (g/dL)	30-36	30-37	28-38	28-38	29-37	28.5-35.5	30-36
WBC ($x10^9$/L)	10-26	7-23	6-22	6-22	5-19	**5-15**	6-18
Neutrophils ($x10^9$/L)	4-14	3-5	3-6	3-7	3-9	1-5	1-6
Lymphocytes ($x10^9$/L)	3-8	2-8	3-9	3-9	3-16	4-10	4-12
Monocytes ($x10^9$/L)	0.5-2.0	0.5-1.0	0.1-1.7	0.1-1.7	0.3-1.0	0.4-1.2	0.2-1.2
Eosinophils ($x10^9$/L)	0.1-1.0	0.1-2.0	0.1-0.8	0.1-0.9	0.2-1.0	0.1-1.0	0.1-1.0
Basophils ($x10^9$/L)	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1
Platelets ($x10^9$/L)	100-450	210-500	160-500	170-500	200-500	210-650	200-550
Reticulocytes ($x10^9$/L)	120-400	50-350	50-100	50-100	20-60	30-50	40-100
NRBC ($x10^9$/L)	Birth – 8 Days	0 – 5.4	8 Days – 1Month	0 – 0.1	>1 Month	0 - 0	

Reference ranges for FBC parameters for normal adult females

(Source available from Haematology Laboratory on request)

Parameter	Gynaecological	First Trimester	Second Trimester	Third Trimester*	Trimester Not Stated
RBC ($x10^{12}$/L)	3.8-4.8	3.52-4.52	3.20-4.41	3.10-4.44	3.10-4.52
Hb (g/dl)	12-15	11.0-14.3	10.0-13.7	9.8-13.7	9.8-14.3
HCT (L/L)	0.36-0.46	0.31-0.41	0.30-0.38	0.28-0.39	0.28-0.41
MCV (fL)	83-101	81-96	82-97	91-99	81-99
MCH (pg)	27-32	27-32	27-32	27-32	27-32
MCHC (g/dL)	31-37	31-37	31-37	31-37	31-37
RDW (CV %)	11.6-14	11.6-14	11.6-14	11.6-14	11.6-14
WBC ($x10^9$/L)	4-10	5.7-13.6	6.2-14.8	5.9-16.9	5.7-16.9
Neutrophils ($x10^9$/L)	2-7	3.6-10.1	3.8-12.3	3.9-13.1	3.6-13.1
Lymphocytes ($x10^9$/L)	1-3	1.1-3.5	0.9-3.9	1.0-3.6	0.9-3.9
Monocytes ($x10^9$/L)	0.2-1.0	0.0-1.0	0.1-1.1	0.1-1.1	0.0-1.1
Eosinophils ($x10^9$/L)	0.02-0.5	0.0-0.6	0.0-0.6	0.0-0.6	0.0-0.6
Basophils ($x10^9$/L)	0.02-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1
Platelets ($x10^9$/L)	150-410	174-391	171-409	155-429	155-429
Reticulocytes ($x10^9$/L)	50-100	50-100	50-100	50-100	50-100
Reticulocytes (%)	0.5-2.5	0.5-2.5	0.5-2.5	0.5-2.5	0.5-2.5
NRBC ($x10^9$/L)	0.0 – 0.0	0.0 – 0.0	0.0 – 0.0	0.0 – 0.0	0.0 – 0.0

*Third Trimester reference range applies for 6 weeks post-delivery.

Reference ranges for Coagulation Screen assays
(Source available from Haematology Laboratory on request)

Assay	Day 1	Day 5	Day 30	Day 90	Adults
PT (seconds)	10.1 – 15.9	9.5 – 15.3	9.3 – 14.3	9.6 – 14.2	*
APTT (seconds)	31.3 – 53.6	25.4 – 59.8	25.6 – 55.2	24.1 – 50.1	*
Fibrinogen (g/L)	1.67 – 3.99	1.62 – 4.62	1.62 – 3.78	1.07 – 3.79	*

*Please contact Haematology Laboratory for current adult coagulation reference ranges

Expected or normal results for other Haematology assays

Assay	Expected result for normal patients
Lupus Anticoagulant	Negative
Kleihauer (FMH)	<2 mls
Malaria Screen	No malaria parasites seen
Blood Film	Normal morphological picture*

*Normal morphological picture varies between neonates and adults.
Contact haematology laboratory or haematologist for advice on interpretation of blood film comments

15.5 Haematology and Coagulation Assays Referred to External laboratories

Samples for external analysis are only referred during routine hours, unless otherwise arranged by telephone with laboratory.

Test	Specimen	Volume		Lab/Hospital	Turn Around Time	
		Adult	Paed		URGENT	ROUTINE
Haemoglobinopathy Screen	EDTA (red) Clotted (white)	2 x 2.7ml 1 x 2.7ml	2 x 1.6ml	Adult – Haematology, St James Hospital (SJH) Neonate – Children's Health Ireland at Crumlin (CHIC)	Verbal Report 48 – 72 hrs	3 weeks
G-6PD	EDTA (red)	2 x 2.7ml	2 x 1.6ml	Adult – Haematology, SJH Neonate – Kings College Hospital, London	Verbal Report 48 – 72 hrs	7 Days 10 Days
Pyruvate Kinase	EDTA (red)	2 x 2.7ml	2 x 1.6ml	Northern General Hospital, Sheffield	Verbal Report 48 – 72 hrs	10 Days
CD 4 (T and B cell subsets)	EDTA (red) ***Must be sent within 24 hrs.***	1 x 2.7ml	**N/A**	Immunology, SJH	Verbal Report 48 – 72 hrs	3 weeks
Paediatric T and B cell subsets	EDTA (red) ***Must be sent within 24 hrs.***	N/A	1 x 1.6ml	Haematology, CHIC	Verbal Report 48 – 72 hrs	3 weeks

Test	Specimen	Volume		Lab/Hospital	Turn Around Time	
		Adult	Paed		URGENT	ROUTINE
Thrombophilia Screen ***Coagulation Screen*** ***Lupus Anticoagulant*** ***Antithrombin*** ***Factor VIII: C Assay*** ***Protein C Assay*** ***Protein S Assay*** ***APCR*** ***(Factor V Leiden will be performed if necessary from APCR result)***	Na citrate (green)* EDTA (red)	6 x 3ml (sufficient for Coagulation Screen and Lupus Anticoagulant also) 1 x 2.7 ml	Discuss with Haematology Lab for availability of testing if required	Coagulation Screen & Lupus Anticoagulant processed in Coombe Remaining assays processed in National Coagulation Laboratory (NCL), SJH **Medical and relevant family history required & SJH Thrombophilia genetic consent referral form.**	N/A	7 weeks
D-Dimers	Na citrate (green)*	1 x 3.0 ml	1 x 1.4ml	Haematology, SJH	1 hr from receipt in SJH.	8 hrs (verbal report) 48 Hours *(hardcopy)*
Factor Xa Assay ***Anticoagulation history required***	Na citrate (green)* *(Sample must be taken within 3 hours of LMWH administration)*	2 x 3.0ml		NCL, SJH	NA	72 Hours
Specific Factor Assays e.g. factor VIII	Na citrate (green)*	2 x 3.0 ml *(per factor)*	2 x 1.4ml *(per factor)*	Adult – NCL, SJH Neonate – Haematology, CHIC	Must be arranged with haematology lab and/or Consultant haematologist.	1 week

Test	Specimen	Volume Adult/Cord	Volume Paed	Lab/Hospital	Turn Around Time URGENT	Turn Around Time ROUTINE
Complement	Clotted (white)	1 x 7.5ml		Immunology, SJH	Ring Lab if urgent.	3 weeks
Suspected Factor Deficiencies Investigations. ***(Full Profile)***	Na citrate (green)* (If no previous history or unknown)	6 x 3.0 ml	1 x 3.0 ml	Adult – NCL, SJH Neonate – Haematology, CHIC	Must be arranged with haematology lab and/or Consultant haematologist	1 week 3 weeks
Factor V Leiden Only ***(see Thrombophilia screen also)***	Na citrate (green)* EDTA	2 x 3.0 ml 1 x 2.7 ml	2 x 1.4ml 1 x 1.4ml	Adult – NCL, SJH Neonate – Haematology, CHIC	As Above	1 Month
Von Willebrands Screen	Na citrate (green)*	2 x 3.0 ml	2 x 1.4ml	Adult – NCL, SJH Neonate – Haematology, CHIC	As Above	3 - weeks 6-8weeks
Prothrombin Gene G20210A Mutation	EDTA (red)	1x 2.7 ml	1 x 1.6ml	Adult – NCL, SJH Neonate – Haematology, CHIC	As above	1 Month
Auto – Antibodies: Anti-cardiolipin (ACL) Anti-nuclear factor (ANA) Anti-phospholipid ß-2- Glycoprotein 1	Clotted (white)	1 x 7.5 mL	N/A	Immunology, SJH	48 – 72 hrs	3 weeks

*All coagulation specimens must be filled to the green mark on the sample bottle. Under, Overfilled, Clotted or Haemolysed specimens **are unsuitable for analysis.** Coagulation samples must be received within 2 hrs of venepuncture to allow time for dispatch to another site.

16 Microbiology

The Microbiology Department provides an extensive service. All antibiotic susceptibility testing in the Microbiology Department is carried out to EUCAST standards.

Due to the nature of specimens and examinations in Microbiology reference ranges are limited and apply to CSF cell counts only – see below. Non-conforming samples are rejected. Samples that cannot be repeated e.g. CSF, or Blood Cultures taken prior to the administration of antibiotics may be amended by the by filling in a correction / nonconforming sample form and signing it when the amendment is made in the laboratory. In some instances, patients collect their own sample.

Instructions for semen collection for analysis are printed on the reverse of the request form. Details of the collection of urine samples and vulvovaginal samples are provided verbally by midwives and clinical staff.

Clinical consultation is provided by Consultant Microbiologist, Dr Niamh O'Sullivan (speed dial 4228).

Sample, Container and important collection, transport and storage details

Prior to sample collection consideration should be given to the following:

1. Appropriate sterile containers are available. Occasionally a specialised container is required. Contact the Microbiology laboratory to request same (ext. 5278).
2. Timing of sample collection to facilitate economic processing, e.g. if sample requires referral to an external laboratory collect during routine hours (8am -6pm Mon-Fri).
3. Samples should be transported to the laboratory via the chute, or left for collection during routine hours. Otherwise store in designated sample storage fridge prior to collection on the next routine working day.
   Exceptions: Blood Cultures, CSF samples, samples taken for *Neisseria gonorrhoeae* culture (see details below).

16.1 Test Repertoire

Test	Specimen Required	Form	Turnaround time from receipt
Blood Culture	Optimal time of specimen collection: Prior to antimicrobial therapy where possible. As soon as possible after a spike of fever, except in endocarditis where timing is less important. Disinfect the septum of the blood culture bottle with ethanol, methanol or isopropyl alcohol and allow to dry. Paediatric patients: BacTALERT paediatric blood culture bottle. Ideally add 4ml blood (minimum 0.5mL, max 4mL). Adult patients: BacTALERT aerobic and anaerobic blood culture bottles. Add a volume of 5-10 mL blood to each bottle. Withdraw blood from a peripheral vein and divide the sample equally among blood culture bottles. Samples should not be taken through an intravenous catheter or other access device unless no other access is available **NOTE: Do not exceed the manufacturer's recommended maximum volume for each bottle as this may lead to false positives.** Take two sets during any 24h period for each septic episode (a single set is adequate for neonates).	Microbiology	Final Report - 5 to 7 Days Continuous Monitoring. Lab will notify a positive Result. If culture is negative at 36hours after the time of receipt in the lab (not time of sample collection) the comment Neg @ 36 hrs will be automatically added into the LIS report. Film Array test processed on the first Positive Blood Culture for each patient. Organism identification will be yielded on most Positive Blood Cultures within two hours of Blood Culture positivity. A valid result may not be available if more than one organism is present, or if there is scanty growth. A “Not Detected”, or “Inconclusive” result from the Film Array does not exclude the presence of a pathogen.

Test	Specimen Required	Form	Turnaround time from receipt
	SEND TO LABORATORY IMMEDIATELY **DO NOT REFRIGERATE**		
Swabs for C&S	Swab type: Amies charcoal transport swabs. Ear swab for C&S: 9.2 Collect prior to antimicrobial therapy where possible. 9.3 Obtain sample by rotating swab once gently at the entry to auditory meatus. 9.4 Swab any pus or exudate Eye swab for C&S: 1. Collect prior to antimicrobial therapy where possible and preferably, before application of local anaesthetic. 2. Any available pus should be sampled, plus a swab sample of the area of interest. 3. Use one swab per eye 4. Hold the swab parallel to the cornea and gently rub the conjunctiva in the lower eyelid from nasal side outwards 5. If both eyes are to be swabbed label both sides 'right' or 'left' accordingly 6. The laboratory must be consulted if *Neisseria. gonorrhoeae* culture is required. Ideally, the inoculation of a specimen querying *Neisseria gonorrhoeae* should be made directly onto	Microbiology	Final Report (No significant isolates) – up to 5 working days (Monday – Friday) if no significant orgs up to 5 working days to account for anaerobic cultures If significant isolate is detected additional 5 working days may be required- thus a 10-working day TAT

Test	Specimen Required	Form	Turnaround time from receipt
	culture media at the patient's side without delay. Otherwise, transport immediately to the lab. See section of Gonococcal culture below. 7. Separate samples must be collected for the detection of viruses and the molecular detection of *Neisseria gonorrhoeae* and *Chlamydia.* See Section 9.5.3 below. Nasal swab for C&S: 1. Optimal time for specimen collection is prior to antimicrobial therapy where possible. 2. Moisten swab prior to collection with 0.9% NaCl 3. Place the swab into the anterior nose and direct it slightly upwards gently rotating as you go 4. Sample purulent discharge if present Oral swab for C&S: 1. Optimal time for specimen collection is prior to antimicrobial therapy where possible. 2. Specimen pus if present, otherwise swab any lesions or inflamed areas of tongue and mouth. 3. A tongue depressor or spatula may be helpful to aid vision and avoid contamination from other parts of the mouth. Perineal swab / Groin swab for C&S: 1. Optimal time of specimen collection: prior to antimicrobial therapy where possible.		

Test	Specimen Required	Form	Turnaround time from receipt
	2. Moisten swab prior to collection with 0.9% NaCl 3. Rotate swab over perineal/groin area along the inside of the thighs and closest to the genitalia Placenta swab for C&S: 1. Expose foetal side of placenta 2. Swab between two membranes (chorion and amnion) at the base of the umbilical cord Throat swab for C&S: 1. Optimal time of specimen collection: prior to antimicrobial therapy where possible. 2. Gently swab the tonsillar area and/or posterior pharynx. 3. Avoid touching any other part of the mouth, tongue and uvula with the swab. Umbilical swab for C&S: 1. Optimal time of specimen collection: prior to antimicrobial therapy where possible. 2. Swab the umbilical area around the base of the cord stump. Genital swab, abscess, pus, fluid, Bartholin's gland for C&S: 1. Optimal time of specimen collection: prior to antimicrobial therapy where possible.		

Test	Specimen Required	Form	Turnaround time from receipt
	2. Fresh pus is the sample of choice. This can be obtained either using a swab or a syringe. If using the syringe method, it must be capped with a red bung prior to sending to the lab. 3. Any fluids or pus removed from a genital abscess should be sent to the laboratory in a sterile container, or capped syringe. If pus is present remove with a syringe, cap and send to Microbiology. 4. Alert Microbiology/on call staff to expedite culture in certain circumstances e.g. high-risk patient admitted or at request of Consultant Microbiologist Vaginal swabs HVS for C&S: 1. Optimal time of specimen collection: prior to antimicrobial therapy where possible. 2. A speculum **MUST** be used 3. Sample as high as possible from the posterior fornix. The swab should be rolled firmly over the surface of the vaginal vault. 4. It is important to avoid vulval contamination of the swab. 5. If pelvic infection, including *Neisseria gonorrhoeae*, is suspected the cervix should be swabbed. See section of Gonococcal culture below. 6. Separate samples must be collected for the detection of viruses and the molecular detection of *Neisseria gonorrhoeae* and *Chlamydia.* LVS for C&S:		

Test	Specimen Required	Form	Turnaround time from receipt
	1. Optimal time of specimen collection: prior to antimicrobial therapy where possible. 2. As for HVS without the use of a speculum. 3. Insert swab into lower part of vagina and rotate firmly. Cervical swab for C&S: 1. Optimal time of specimen collection: prior to antimicrobial therapy where possible. 2. After introduction of the speculum into the vagina the swab should be rotated inside the endocervix. Urethral swab for C&S: 1. Optimal time of specimen collection: prior to antimicrobial therapy where possible. 2. Contamination with microorganisms from the vulva should be avoided. 3. The patient should not have passed urine for at least one hour. Wound swab (skin, septic spot, abscess, pus, fluid) for C&S: 1. Optimal time for specimen collection is prior to antimicrobial therapy where possible. 2. Fresh pus is the sample of choice (preferable to swabs). This can be obtained either using a swab or a syringe. If using the		

Test	Specimen Required	Form	Turnaround time from receipt
	syringe method, it must be capped with a red bung prior to sending to the lab 3. A swab sample should be obtained using a zigzag motion on the upper surface of the wound 4. If the wound is deep, consider a deep swab where the swab is placed into the wound to avoid superficial microflora 5. Be careful to differentiate both swabs 6. Identify wound swab site on the laboratory form 7. Alert Microbiology/on call staff to expedite culture in certain circumstances e.g. high-risk patient admitted or at request of Consultant Microbiologist 8. Swab of any pus or exudates present. 9. Sample a representative part of the lesion. The swabbing of dry crusted areas is unlikely to be helpful. 10. If only a minute amount of pus exudate is available, it may be preferable to send a pus or exudate swab in Amies transport medium to minimise the risk of desiccation during transport. 11. The swab should be well soaked in any pus or exudates.		
Miscellaneous specimens	Tissue for C&S: 1. Place in sterile urine container – refrigerate if not sent immediately. Expressed Breast Milk for C&S:	Microbiology	For Tissues: Final Report (No significant isolates) – up to 5 working days (Monday – Friday) if no significant orgs up to 5 working days to account for anaerobic cultures If significant isolate is detected additional 5 working days may be required- thus a 10 working day TAT

Test	Specimen Required	Form	Turnaround time from receipt
	1. Optimal time of specimen collection: prior to antimicrobial therapy where possible. 2. Freshly expressed breast milk is the sample of choice for the investigation of mastitis 3. Decant immediately into a sterile universal container Cannulae for C&S: PICC: Peripherally inserted central catheter. UAC: Umbilical arterial catheter. UVC: Umbilical venous catheter. 1. Optimal time of specimen collection: prior to antimicrobial therapy where possible. 2. Disinfect the skin around the cannula entry site, remove cannulae using aseptic technique, and cut off 4cm of the tip into a sterile container using sterile scissors 3. Swabs: Sample the inflamed area around the catheter insertion site using a swab		Final Report (no sensitivities required) – two working days (Monday – Friday). Final Report + sensitivities – five working days.
IUCD for C&S	Place in sterile urine container: 1. Optimal time of specimen collection: prior to antimicrobial therapy where possible. 2. IUCDs should only be sent if clinical suspicion of infection exists. 3. Place the entire IUCD, including any exudate, in a clean, sterile, leak-proof container and transport ASAP.	Microbiology	Final report – 14 days

Test	Specimen Required	Form	Turnaround time from receipt
	4. Specimen should be delivered to the laboratory as soon as possible. 5. Refrigerate if not sent immediately		
Swabs for screening e.g. GBS, surveillance, MRSA, VRE, CRE, ESBL, environmental.	Amies charcoal transport swab. Refrigerate if not sent immediately. Environmental swabs only accepted through infection control. LVS/Perineal swab for GBS: 1. A swab inserted 2cm into vagina first and then the same swab inserted 1cm into rectum MSU for GBS: 1. Urine should be in bladder for 2-3 hours prior to collection 2. Container should be labelled prior to collection 3. Ensure patient understands instructions and has read leaflet 4. The first part of voided urine is discarded and without interrupting the flow, approximately 10ml is collected into a sterile container. Throat swab for Gentamicin Resistant GNB: 1. Gently swab the tonsillar area and/or posterior pharynx. 2. Avoid touching any other part of the mouth, tongue and uvula with the swab.	Surveillance/ Infection control	Negative culture – up to five working days. Positive culture – five working days

Test	Specimen Required	Form	Turnaround time from receipt
	MRSA Screens: Nasal swab: 1. **Moisten** swab prior to collection with 0.9% NaCl 2. Place the swab into the anterior nose and direct it slightly upwards gently rotating as you go Throat swab: 1. Gently swab the tonsillar area and/or posterior pharynx. 2. Avoid touching any other part of the mouth, tongue and uvula with the swab. Perineal/Groin swab: 1. **Moisten** swab prior to collection with 0.9% NaCl 2. Rotate swab over perineal/groin area along the inside of the thighs and closest to the genitalia Umbilical swab (baby only): 1 **Moisten** swab prior to collection with 0.9% NaCl 2 Rotate swab over base of umbilicus and place into sleeve Consider other sites for screening as appropriate e.g. CSU if catheter in-situ, IV site if IV in-situ, etc. Extended Spectrum Beta Lactamase (ESBL), Vancomycin Resistant Enterococcus (VRE), Carbapenem Resistant Enterococcus (CRE):		

Test	Specimen Required	Form	Turnaround time from receipt
	Stool: 1. Container should be labelled prior to collection 2. Ask patient to pass a sample into a clean, dry, disposable bed pan, similar container, or alternatively to place a disposable kidney dish in the toilet. A disposable kidney dish can be placed horizontally into the toilet. 3. Either method will facilitate sample collection and choice of method depends on location. 4. Faecal matter can be scooped on the integral sample scoop and placed into the leakproof stool container. 5. The specimen is unsatisfactory if there is any residual soap, detergent or disinfectant in the pan. 1-2g of sample is sufficient for C&S. Rectal swab (If a stool sample is not forthcoming): 1. Insert swab 1cm into rectum and rotate.		

Test	Specimen Required	Form	Turnaround time from receipt
ETT/Paediatric Sputum	1. All specimens should be fresh and taken prior to antimicrobial treatment is started. 2. Secretions - tip in sterile urine container – refrigerate if not sent immediately. 3. Specimens produced via endotracheal tube (ETT). Ideally a minimum volume of 1mL is required.	Microbiology	Final Report (No significant isolates) – up to 5 working days (Monday – Friday) if additional testing required. Final Report + sensitivities – five working days.
Stool (Faecal sample) for C&S	Faeces in sterile stool container with integral sample scoop or sterile urine container– refrigerate if not sent immediately. 1. Collect sample as soon as possible after onset of symptoms. 2. Container should be labelled prior to collection 3. Ask patient to pass a sample into a clean, dry, disposable bed pan, similar container, or alternatively to place a disposable kidney dish in the toilet. A disposable kidney dish can be placed horizontally into the toilet. 4. Either method will facilitate sample collection and choice of method depends on location. 5. Faecal matter can be scooped on the integral sample scoop and placed into the leakproof stool container. 6. The specimen is unsatisfactory if there is any residual soap, detergent or disinfectant in the pan. 7. 1-2g of sample is sufficient for C&S.	Microbiology	Four working days

Test	Specimen Required	Form	Turnaround time from receipt
CSF	Optimal time of specimen collection: preferably prior to antimicrobial therapy is started. However, therapy must not be delayed unnecessarily pending lumbar puncture. CSF in three sterile universal containers and an additional fluoride EDTA tube for glucose estimation in Biochemistry (yellow top) is also required. 1. 1 ml of CSF for adult CSF analysis in each container 2. 1 ml required for neonatal CSF analysis in each container 3. Samples labelled 1, 2 and 3 are required. 4. Send to laboratory immediately 5. Phone Microbiology on ext. 5278 to inform staff of sample being sent **DO NOT REFRIGERATE**	Microbiology	Microscopy, Biochemistry, Gram stain - 2 Hours Negative culture – up to five working days Positive culture – five working days
Urine for Culture	Collect sample prior to antimicrobial therapy where possible. Use sterile urine containers. Collect a minimum of 1mL sample for C&S. Refrigerate if not sent immediately. CSU for C&S: 1. May be obtained either from a transient ("in and out") catheterisation or from an indwelling catheter. In the latter, the specimen is obtained aseptically from a sample port in the catheter tubing or by aseptic aspiration of the tubing. The specimen should not be obtained from the collection bag.	Microbiology	Urgent microscopy - 1 - 2 Hours Negative culture – two working days Organism + sensitivity – up to five working days.

Test	Specimen Required	Form	Turnaround time from receipt
	2. Collect sample of 10mls urine. 3. Transfer urine into a sterile urine container immediately. MSU for C&S: 1. Recommended method for routine testing 2. Urine should be in bladder for 2-3 hours prior to collection 3. Container should be labelled prior to collection 4. Ensure patient understands instructions and has read leaflet 5. The first part of voided urine is discarded and without interrupting the flow, approximately 10mL is collected into a sterile urine container. CCU for C&S: 1. A reasonable alternative to MSU. 2. Thorough periurethral cleaning is recommended. 3. The whole specimen is collected into a sterile container and then an aliquot sent for examination. Bag Urine for C&S: 1. Used for paediatric patients. 2. The sterile bags are taped over the genitalia and the collected urine is transferred to a sterile leak-proof container. There are frequent problems of contamination with this method of collection.		

Test	Specimen Required	Form	Turnaround time from receipt
Urine for pregnancy test	Urine in sterile urine container - Refrigerate if not sent immediately 1. Ensure patient understands instructions and has read leaflet 2. Take a sample while the urine is being voided	Microbiology	One working day or one hour (for Urgent or specifically requested).
Gonococcal Culture	Contact lab 30 minutes prior to taking specimen. Direct Plating by Lab onto "Pre-warmed Plates"	Microbiology	Negative culture- up to five working days Positive culture 3 working days: Clinician informed and sensitivities referred to St. James Hospital.
Semen Analysis	1. Patients must receive their semen sample collection container, instructions (PATH-MAND-INS-3) and laboratory request form from their referring doctor/nurse. 2. Appointments for semen analysis must be booked via the Pathology laboratory office on 01 408 5326 3. The whole semen sample must be collected in the specific container, as per instructions.	Andrology	3 working days
Mycoplasma / Ureaplasma.	Cervicovaginal, urethral, sperm, urine, gastric secretions – refrigerate if not sent immediately	Microbiology	Negative: two working days Positive: four working days
SARS-CoV-2, RSV and Influenza A/B	Nasopharyngeal swab: 1. See PATH-MICRO-INS-90 "Specimen Collection – Nasopharyngeal Swab" and 2. IPC document: "Testing of laboratory specimens for SARS-CoV-2 for sample collection instructions." - Available on Intranet	Virology	TAT: Urgent: Two hours, Routine: Up to two working days- if sent to CHI Crumlin for batch testing

16.2 Critical phoning limits

Referral samples	All results phoned from a referral laboratory to the Microbiology Department
Blood cultures	Gram stain result on all positive blood cultures
CSF	Cell count, Gram stain and cultures yielding growth of a pathogen
Urine samples	Requested urgent microscopies Pre-operative pregnancy tests – all positive pregnancy tests are phoned. Negative tests are ideally phoned, but if unable to contact someone result will be validated immediately. Paediatric urines with >10 white cells Paediatric urines with Candida present Candida isolated from sterile sites, plus paediatric urines Paediatric positive cultures and sensitivity results Group B strep (in-patients) Swabs / Surveillance: Group A streptococcus Group B strep (in-patients) Listeria monocytogenes Any multidrug resistant isolates (MRSA, VRE, ESBL & CRE)
SARS-CoV-2	Urgent SARS-CoV-2 "Detected" results (samples tested in-house) will be phoned during routine hours only, i.e. Monday to Friday: 8am to 6pm. For out-of-hours results check the Laboratory Information System. If there are further queries out-of-hours contact Laboratory on-call staff on-call mobile. Please Note: Non-urgent SARS-CoV-2 test results (samples tested off-site) will be available on the Laboratory Information System within 24 – 36 hours. "Detected" results will be phoned.

16.3 Microbiology requests sent to National Virus Reference Laboratory and other referral laboratories

Specimens must be in the laboratory by 12.00 pm for same day dispatch or before 10 am for microbial PCR.
Specimens sent after this time will be dispatched on the next working day, unless urgent referral is requested by the clinician.

National Virus Reference Laboratory (NVRL) Out-of hours service

An out of hours service is available for emergency testing at the NVRL for a limited range of tests. Due to the limited availability and high cost, this service must be requested by a consultant at the Coombe in agreement with the Clinical Virologist on duty in the NVRL. All approved requests must be sent to the laboratory for dispatch to NVRL.

The NVRL on-call service may be contacted by leaving a concise message:
Telephone NVRL to alert them re sample on 01 7164050.
This will connect to a call back service. The following information is required:

- Name of caller
- Contact number
- Hospital source
- Message

Clinician on call Tel: 087 9806448
The results will be telephoned to the requesting doctor, therefore the request form should indicate the requesting doctors name and bleep No./Phone No.
NVRL user manual has extensive detail of all services provided and sample requirements https://nvrl.ucd.ie/usermanual

NVRL Telephone Numbers (Daytime)	
Reception	01-7161260
Results	01-7161323 or 01-7161358
General Serology	01-7164406

NVRL telephones urgent results to the requesting clinician or to microbiology department
Hard copy reports are sent directly to wards/clinics

NVRL Results on LabCentre (LIS)

Results of specimens sent to the NVRL with a specimen date of 14/08/2007 or later are available on LIS, however there is restricted access to some results.

16.4 Referral specimen requirements and turnaround times

The Microbiology lab will supply Viral Transport swabs and Chlamydia / GC– APTIMA gene-probe collection systems during "routine hours of opening" on request. Guide turnaround times only as under constant review.
Consult www.nvrl.ucd.ie for up-to-date requirements and user manual.

Tests marked with * form part of the “booking bloods“

Pathogen	Investigation	Paediatric Specimen	Adult Specimen	Reference Laboratory	Turnaround Time
Bacterial PCR – Pneumococcal, Meningococcal and Haemophilus influenzae **Group B Strep PCR** **E coli PCR**	PCR	CSF (100ul-200ul) or EDT Blood sample	CSF (100ul-200ul) or EDTA Blood sample	Irish meningitis and sepsis reference laboratory (IMSRL) CHI Temple Street	Specimens processed 5 times a week (Mon to Fri) For same day results, specimen must be with Ref lab by 11.30 a.m. Do not send specimens over weekend. Refrigerate overnight or at weekend.
Chlamydia **Mycoplasma genitalium** **Neisseria gonorrhoeae**	Molecular analysis	Use APTIMA gene-probe collection systems Ensure in date Instructions for sample collection are detailed on the packaging of the device. Urine: 1. Urine should be in bladder for 2-3 hours prior to collection 2. Container should be labelled prior to collection 3. Ensure patient	As per Paediatric Specimen	National Virus Reference Lab (NVRL)	5 working days

Pathogen	Investigation	Paediatric Specimen	Adult Specimen	Reference Laboratory	Turnaround Time
		understands instructions and has read leaflet Endocervical swabs: 1. A speculum MUST be used 2. Break swab and place in viral transport medium Eye swab: As in Section 16.1 above with application of slightly more pressure than for regular eye swab. Send to laboratory immediately			
Clostridium difficile	C diff toxin C diff antigen Faeces sample	Collect sample as per Section 16.1	As per Paediatric Specimen	Public Health Laboratory, Cherry Orchard Hospital, Dublin	7 working days
CMV	Antibodies	Clotted blood 1.2 ml	Clotted blood 5 ml	National Virus Reference Lab	5 working days

Pathogen	Investigation	Paediatric Specimen	Adult Specimen	Reference Laboratory	Turnaround Time
CMV	Culture DEAFF test	Throat swab and washings Urine 10-20 ml Collect sample as per Section 16.1	As per Paediatric Specimen	National Virus Reference Lab	Culture: 21 days working days DEAFF test: 2 working days
CMV	PCR	EDTA Blood sample 1.2 ml	EDTA Blood sample 5 ml	National Virus Reference Lab	Up to 7 working days Tests performed twice weekly
Coxsackie A+B virus	PCR	Faeces CSF Throat swab Collect sample as per Section 16.1	As per Paediatric Specimen	National Virus Reference Lab	5 working days
EBV serology	Antibody	Clotted blood 1.2 ml	Clotted blood 5 ml		5 working days
E coli 0157 (or bloody faeces)	Culture			Public Health Laboratory, Cherry Orchard Hospital, Dublin	5 working days
Enterovirus screen	Antibodies	Clotted blood 1.2 ml	Clotted blood 5 ml	National Virus Reference Lab	5 working days
Hepatitis B	PCR Viral load	Clotted blood 1.2 ml	Clotted blood 5 ml	National Virus Reference Lab	5 working days
Hepatitis B * **Hepatitis C ***	Antibodies	Clotted blood 1.2 ml	Clotted blood 5 ml	National Virus Reference Lab	5 working days

Pathogen	Investigation	Paediatric Specimen	Adult Specimen	Reference Laboratory	Turnaround Time
Hepatitis C	PCR Viral load	Clotted blood 1.2 ml Send urgently to NVRL or separate and freeze if not urgent	Clotted blood 5 ml Send urgently to NVRL or separate and freeze if not urgent	National Virus Reference Lab	5 working days
Herpes simplex	Antibodies	Clotted blood 1.2 ml	Clotted blood 5 ml	National Virus Reference Lab	5 working days
Herpes simplex	PCR	EDTA Blood sample 1.2 ml	EDTA Blood sample 5 ml	National Virus Reference Lab	7 working days
Herpes simplex **HSV 1** **HSV 2**	Culture	Swab of lesion in pink viral transport swab	As per Paediatric Specimen	National Virus Reference Lab	14 working days
HIV *	Antibodies	Serum 1.2 ml	Serum 4ml	National Virus Reference Lab	3 working days
HIV	PCR Viral load	EDTA Blood sample 1.2 ml Send urgently to NVRL or separate and freeze if not urgent	EDTA Blood sample 5 ml Send urgently to NVRL or separate and freeze if not urgent	National Virus Reference Lab	8 working days
Influenza viral screen - **A, B, H3, H1N1**	PCR	Nasal /throat swabs must be sent on viral transport swabs Respiratory secretions Collect sample as per Section 16.1	As per Paediatric Specimen	National Virus Reference Lab	5 working days 36 hours if urgently required
Lyme disease- **Borrellia sp**	Antibodies	Clotted blood 1.2 ml	Clotted blood 5 ml	National Virus Reference Lab	5 working days

Pathogen	Investigation	Paediatric Specimen	Adult Specimen	Reference Laboratory	Turnaround Time
Legionella antigen	PCR	Urine Collect sample as per Section 16.1	As per Paediatric Specimen	Mater Hospital, Microbiology Department	14 working days
Measles	Antibodies	Clotted blood 1.2 ml	Clotted blood 5 ml	National Virus Reference Lab	5 working days
Mumps	Antibodies	Clotted blood 1.2 ml	Clotted blood 5 ml	National Virus Reference Lab	5 working days
Occult blood	Occult blood	Faeces Collect sample as per Section 16.1	As per Paediatric Specimen	CHI Crumlin, Microbiology Lab	2working days

Pathogen	Investigation	Paediatric Specimen	Adult Specimen	Reference Laboratory	Turnaround Time
Ova and parasites	Faecal parasites	Faeces Collect sample as per Section 16.1 - Do not refrigerate Ideally three stool specimens collected over no more than a 10-day period. It is usually recommended that specimens are collected every other day. Unless the patient has severe diarrhoea or dysentery, no more than one specimen should be examined within a single 24-hour period, as shedding of cysts and ova tends to be intermittent	As per Paediatric Specimen	CHI Crumlin, Microbiology Lab	5 working days
Parvovirus	Antibodies	Clotted blood 1.2 ml	Clotted blood 5 ml	National Virus Reference Lab	5 working days
Pertussis PCR and culture	PCR Culture	Nasopharyngeal/perinasal, soft-wire mounted swab in charcoal transport medium.	As per Paediatric Specimen	CHI Crumlin, Microbiology Lab	Culture: 7 working days PCR is done twice a week – specimens must be sent to

Pathogen	Investigation	Paediatric Specimen	Adult Specimen	Reference Laboratory	Turnaround Time
		Pass swab gently along the floor of the nasal cavity to the posterior wall of the nasopharynx			CHI CRUMLIN within 24 hours of sampling
Pertussis antibodies	Antibodies	200 ul serum	20 ul serum	CHI Crumlin, Microbiology Lab	Not suitable: infants under one or patients vaccinated in last 6 mths
Respiratory virus	PCR	Nasopharyngeal aspirate Sputum Collect sample as per Section 16.1	As per Paediatric Specimen	National Virus Reference Lab	5 working days
Rotavirus	Molecular detection	Faeces Collect sample as per Section 16.1	As per Paediatric Specimen	National Virus Reference Lab	5 working days
RSV	Culture	Nasopharyngeal aspirate Sputum Collect sample as per Section 16.1	As per Paediatric Specimen	National Virus Reference Lab	14 working days
RSV	Immunofluorescence	Nasopharyngeal aspirate Sputum Collect sample as per Section 16.1	As per Paediatric Specimen	National Virus Reference Lab	2 working days
Urgent RSV	Immunofluorescence	ETT Collect sample as per Section 9.5.1 above.	N/A	National Virus Reference Lab	For same day results, specimen must be in NVRL by 2.30 pm.

Pathogen	Investigation	Paediatric Specimen	Adult Specimen	Reference Laboratory	Turnaround Time
Rubella	Antibodies	Clotted blood 1.2 ml	Clotted blood 5 ml	National Virus Reference Lab	5 working days
Respiratory pathogens	Sputum Culture	N/A	Purulent/muco-purulent specimen Check specimen is of adequate quality as specimens of saliva and post nasal secretions are usually unsuitable Sample required is sputum from the lower respiratory tract expectorated by deep coughing. When the cough is dry, physiotherapy, postural drainage or inhalation of an aerosol before expectoration may be helpful. Collect Nasopharyngeal aspirate in a sterile container. Effort should be made to collect a liquid specimen.	CHI Crumlin, Microbiology Lab	4 working days for negative result. Up to five working days to include antibiotic susceptibilities.

Pathogen	Investigation	Paediatric Specimen	Adult Specimen	Reference Laboratory	Turnaround Time
			All specimens should be fresh and taken prior to antimicrobial treatment is started. Culture for Legionella species may still be successful after antimicrobial treatment has started. Ideally a minimum volume of 1mL.		
Syphilis ***T. pallidum**	Antibodies	Clotted blood 1.2 ml	Clotted blood 5 ml	National Virus Reference Lab	Between 3 and 7 working days
TB	ZN TBC	N/A	Sputum: Three early morning, freshly expectorate sputa samples on three consecutive mornings: A sample of expectorant obtained after a deep forced cough is sample of choice. Urine:	The Irish Mycobacteria Reference Laboratory (IMRL) St. James Hospital	ZN 2-3 working days Final culture up to 6 weeks for urine or sputum culture

Pathogen	Investigation	Paediatric Specimen	Adult Specimen	Reference Laboratory	Turnaround Time
			Three early morning urine on three consecutive morning, Urine should be in bladder for 2-3 hours prior to collection. Ensure patient understands instructions and has read leaflet. Quantiferon Test: Special kit available from the Microbiology Laboratory Please follow the manufacturer's instructions supplied with the kit. Before the QFT is conducted, confirm arrangements for testing with the Microbiology laboratory. Other samples as appropriate e.g. genital fluid, CSF:		

Pathogen	Investigation	Paediatric Specimen	Adult Specimen	Reference Laboratory	Turnaround Time
			Place fluid into universal container. CSFs: collect aseptically as much as possible (max. 20mL) Collect as detailed in Section 16.1		
TORCH	Antibodies	Clotted blood 1.2 ml	Clotted blood 5 ml	NVRL	5 working days
Toxoplasma screen	Antibodies	Clotted blood 1.2 ml	Clotted blood 5 ml	NVRL	5 working days
Toxoplasma Capture assay	Capture assay	Serum 1.2 ml	Serum 4ml	Toxoplasma Reference Unit Public Health Wales Microbiology Singleton Hospital Swansea SA2 8QA	Performed on Day of receipt
Varicella *	Antibodies	Clotted blood 1.2 ml	Clotted blood 5 ml	NVRL	5 working days

Pathogen	Investigation	Paediatric Specimen	Adult Specimen	Reference Laboratory	Turnaround Time
Viral meningitis – CMV (Cytomegalovirus), EBV (Epstein Barr virus), Enterovirus, HSV (Herpes simplex 1 and 2), HHV (Human herpes virus), Measles virus, Mumps virus, Poliomyelitis virus, VZV (Varicella zoster)	PCR	CSF (140ul-200ul) Collect sample as detailed in Section 16.1	As per Paediatric Specimen	NVRL	Specimens processed 4 times a week (Mon to Fri). For same-day results, specimen must be with lab by 10 a.m. Do not send specimens to NVRL over weekend. Freeze CSF overnight or over weekend.
Viral Studies	Viral Studies	Eye swab Nasal swab Oral swab Throat swab Skin swab Genital swabs Collect as detailed in Section 16.1 above. Use Viral Transport Swab	As per Paediatric Specimen	NVRL	5 working days

16.5 Cytogenetics/genetics specimens

The appropriate request form must be used for the the appropriate genetic service.

Genetic samples are referred to either CHI CRUMLIN or to TDL Genetics, The Doctors Laboratory, – Each has own request form.

Please fill out all details required. Specimen type must be specified.

Consent must be obtained and documented on the request forms.

The microbiology laboratory will supply transport media.

Investigation	Request	Specimen	Requirements
Cytogenetics	Chromosome analysis	Blood - Lithium Heparin tube	2mls of blood in lithium heparin, minimum required for analysis 1ml. For paediatric samples use specific screw cap 1.2 ml tube as provided
Cytogenetics	Chromosome analysis	Bone marrow	Place bone marrow aspirate directly into transport medium with heparin
Cytogenetics	Chromosome analysis	Placenta/skin	Collect specimen into sterile plastic container with 10 mL of Ham's medium
Cytogenetics	Chromosome analysis	Amniotic fluid	10-20 ml into screw cap sterile container
Cytogenetics	FISH / QFPCR	Amniotic fluid	10-20 ml into screw cap sterile container
Molecular Genetics	DNA analysis	5 ml venous blood in EDTA (down to 1ml volume can be used for infants)	Send at room temp courier. Refrigerate if there is a delay

Do NOT freeze specimens for cytogenetics

Gently invert specimens to avoid clotting of blood or marrow specimens

REFRIGERATE SPECIMENS IF NOT DISPATCHING IMMEDIATELY.

17 Histopathology

The Histopathology Department provides a full service during the Pathology Department working hours as described above.
It should be noted that NO ON-CALL service is not provided in histopathology.

Histopathology Contact Numbers

Histopathology Laboratory	01-4085701
Histopathology Office	01-4085326
Fax No.	01-4085608

Histopathology Hours of Service

Histopathology Department	Monday to Friday 8.00am – 6pm
Clerical Assistance	Monday to Friday 8.00am – 4.30pm
Cut off time for receipt of specimens	16.30 hrs
Cut off time for receipt of samples for **URGENT** processing	12.00 midday

All formalin fixed specimens should be stored at Room Temperature prior to processing.

Safety Note:

For the health and safety of the Histopathology staff all histology specimens, suspected to contain biological agents (TB, HIV or Hepatitis B or C infection) must be identified.
Specimens from such patients should not be sent for urgent analysis.

17.1 Histopathology Request Form/Specimen Labelling

For specimen labelling/ request form completion see **Section 6.4** of this document, the exception is placenta specimens, which are detailed here:

17.2 Minimum Criteria for Processing Placenta Specimens

At least one of the following Clinical details **MUST** be documented on the request form.

1. **Clinical condition**:
   - Case of intra-uterine death
   - Premature (Gestation < 32/40)
   - Dysmorpho-genetic foetal abnormality
   - Suspicion of placental infection
   - Low birth weight babies with suspected placental pathologies,
   - Any baby unexpectedly flat at delivery,
   - Single sex twins
   - Any Placenta that appears large for the weight of the infant

2. **Consultant Paediatrician requested placenta**
   Name of Requesting Consultant Paediatrician must be documented on the request form

If the placenta does not meet the above criteria, it will **NOT** be examined but will be held, the requestor will be contacted and so advised.

NOTE: Specimens held in this way will be returned to ward/clinic if the requestor does not contact the laboratory.

The requestor must go to the Histopathology Department and amend the request form, and sign for this amendment. The specimen will then be approved for processing

17.3 Histopathology Specimen Handling & Turnaround Times Tests performed

All Tissue Specimens must be placed in 10% Formalin Fixative except where other specific arrangements have been made with the Histopathology Department.

Histopathology Tests:

The Histopathology Department provides a comprehensive service to include routine histopathology, immunohistochemistry (IHC), molecular (DDISH), special stain testing on routinely processed tissue samples. Specialised tests are offered to other hospitals around the country.

The tables below outline:

a) Requirements per specimen type

b) The list of tests that may be used to determine diagnosis.

Tests not offered by the histopathology department are sent to external laboratories for testing.

NOTE: The Histopathology department **does not accept TOP or MTOP, or placentae from TOP/MTOP**.

If a specimen arises as a result of complications post TOP this will be accepted but it must be written on the form.

	Specimen Type	Fixation Requirements
Histopathological Diagnosis	**LLETZ Biopsies**	Pinned out on cork, Placed in 350ml container with 10% Formalin
	Uteri, Tubes, Ovaries	Placed in 2.5L container with 10% Formalin ***Uteri not to be opened in theatre***
	Biopsy Specimens	Placed in 60ml container with 10% Formalin
	Products of Conception *Please ensure that identifiable foetus or foetal parts are sent to the mortuary and not sent with the POC.*	Placed in 60ml or 350ml (as appropriate) container with 10% Formalin
	Placental tissue	Placed in 5 L container with 10% Formalin Must comply with Acceptance criteria – see 17.2
	All other specimens	Placed in an appropriately sized container so that the specimen can be submerged with 10% Formalin

	Specimen Type	Fixation Requirements
Non-gynae cytology specimens	All non-gynae cytology specimens received in the histopathology laboratory are forwarded to the Cytology Laboratory at St. James Hospital for preparation and reporting. The report issued by St James is returned & reviewed by the TCH pathologist who then issues the report to the clinician.	
Frozen Sections	Surgical Tissue	Fresh Tissue must be wrapped in saline moistened gauze and placed in a sealed specimen container
	Arrangements must be made in advance with a Consultant Histopathologist or Histopathology Chief or Senior Medical Scientist	
Urgent Specimens	Urgent biopsy specimens excluding biohazard specimens may be processed on a 24hr turn around basis if the specimen is received in the laboratory before 12 Mid-Day. Urgent cases may have a verbal provisional report on request by clinician to pathologist within 24 to 48 hours. At weekends & bank holiday weekends samples will not be processed until the next working day if received after 12MD on the Friday.	

Turnaround Times	
Urgent requests	Highest priority – depends on fixation Verbal report within 24-48 hrs of receipt upon request
Small samples e.g. biopsies, pipelles	7 working days from receipt
Large samples e.g. LLETZ, uteri, vulval resection	10 working days from receipt
Placenta	20 working days from receipt

Note: Any extra work requested by pathologists e.g. Levels, extra blocks, Immunohistochemistry, Molecular tests, etc., will have an effect on the final TAT's depending on the extra tests requested.

17.4 Histopathology Examinations performed on-site

		Test / Assay Name	
Histopathology Processing of 10% Formalin fixed tissue samples for histopathology examination.	Specimen Types: 10% Buffered Formalin fixed Tissue	Tissue Dissection, Processing, Embedding, Microtomy	
	Methodology: Routine Histopathology	Automated/Semi-Automated and Manual Haematoxylin & Eosin Staining methods.	
Processing of Fresh / Frozen tissue	Specimen Types: Fresh Tissue	Processing of fresh tissue samples: Dissection, Frozen Section Microtomy and Staining	
	Methodology: Processing Fresh/ Frozen tissue		
Histochemistry and Special Stains	Specimen Types: Glass slides cut from 10% Buffered Formalin fixed Tissue	Alcian Blue, Gram Twort, Martius Scarlet Blue, Millers Elastin, PAS, PASD, Perls Prussian Blue, Ziehl-Neelsen, Van Gieson, Oil Red "O'	
	Methodology: Manual Staining, Special Staining		
Immunohistochemical Investigations	Specimen Types: Glass slides cut from 10% Buffered Formalin fixed Tissue. Methodology: Automated Immuno-histochemical staining	Actin	AE1/AE3
		Bcl-2	BerEP4
		Calretinin	CAM5.2
		CD3	CD10
		CD15	CD20
		CD31	CD45
		CD61	CD68
		CD138	CEA
		Chromogranin A	CK5/6
		CK7	CK20
		CMV	Collagen IV
		D2-40	EMA
		ER	GFAP
		HNF1b	Ki67
		MCM3	Napsin A
		P16/Ki67 Dual	P16
		P53	P57
		P63	PAX 2
		PAX8	PR
		S100	Sars-Cov 2
		Vimentin	WT1

		Test / Assay Name
Molecular Techniques Chromogenic/Brightfield In Situ Hybridisation	Specimen Types: Glass slides cut from 10% Buffered Formalin fixed Tissue	DDISH: C17 Probe
	Methodology: Automated In Situ Hybridisation	
Histological Interpretation	Specimen Types: ALL Histopathology Tissue Samples	
	Methodology: Microscopy	

17.5 Histopathology Supplies

Pre-filled 10% Formalin placenta buckets will be delivered to the Delivery Suite upon request by the laboratory porter or the Histopathology department staff, if required. Weekend stock requirements should be given to the laboratory porter by Friday morning at the latest to ensure delivery before the weekend.

Theatre formalin requests are made directly to the Histopathology laboratory when required. The request must be made before 11.30am so that the stock can be delivered when the theatre samples are being collected at 12pm. Any theatre stock requests made after this time will be collected by theatre staff from the Histopathology laboratory.

All other departments throughout the hospital must order 10% formalin, cork etc through the laboratory porter using form Pathology Department Stores Order Form GG-Lab Stores-F.

17.6 Histopathology Reports

Histopathology reports will only be given verbally to a requesting clinician by a Consultant Histopathologist, a Specialist Registrar in Histopathology, or by a Pathology Clerical Officer if directed to do so by a Consultant Histopathologist.
Histopathology reports cannot be faxed.
Copies of reports can be requested by phoning the Pathology Office @ Ext. 5326 when a printed copy of the report will be made available for collection at the Pathology Office.

17.7 Hospital Instructions for handling Foetus / Foetal tissue detected at histological examination

17.7.1 Identifiable foetus or foetal parts are sent to the mortuary and not sent with the POC

17.7.2 Patients who have had a miscarriage or a threatened miscarriage, MUST BE provided with an AM-11-C form.

17.7.3 The AM-11-C form has two copies: a hospital copy and a laboratory copy.

17.7.4 The hospital copy is sent to patient records and the laboratory copy is sent either to the laboratory office or to the histopathology laboratory if attached to the request form.

17.7.5 In this form the patient is ask their preference as to whether she wants to arrange burial of the foetus/foetal tissue herself (if identified) or whether she prefers to allow the hospital to do so on her behalf.

17.7.6 On occasions where foetal parts or a complete foetus is identified in samples sent to the laboratory for histological assessment, the AM-11-C form will instruct the hospital on the patient's burial preference.

17.7.7 This procedure is designed to inform all staff of the documentation and legal requirements that must be adhered to in completing this task.

17.7.8 It is the responsibility of the requesting clinician to ensure the potential for identification of a foetus or foetal parts during histological examination, is discussed with their patient.

17.7.9 They must ensure Form AM-11-C (Foetus/ Foetal Tissue in Histopathology Samples) is completed and signed by the Patient / Next of Kin together with the Health Professional discussing arrangements with the patient.

17.7.10 The Hospital Copy of this form is filed in the patient's hospital chart and the Laboratory Copy is sent to the laboratory attached to the histopathology request form together with the tissue sample.

17.7.11 The AM-11-C Form is accessed from QPulse and printed onto carbonless paper.

17.7.12 If a foetus is identified during histological examination the laboratory contacts the Mortuary Technician who will transfer the foetus to the Mortuary.

17.7.13 When foetal parts are identified microscopically in processed tissue every attempt will be made by the histopathology staff to remove all residual chemicals that may be present in the tissue hence the tissue sample should be treated as chemically altered and buried according to legislation.

17.7.14 The histopathology staff will contact the Mortuary Technician, who will, transfer the tissue containing the foetal parts to the Mortuary for burial.

Arrangements for burial of the foetus/ foetal remains will be carried out as described above in 'Release and removal of remains from the Mortuary'.

17.8 Return of Current Histological Tissue or Archived Histological Tissue to Patients

17.8.1 On occasions patients may request the return of histological processed tissue or archived tissue samples, this must be authorised through the Consultant Histopathologist.

17.8.2 If a request is made for the return of histological tissue or archived tissue samples, every attempt will be made by the histopathology staff to remove all residual chemicals present in the tissue. The tissue sample should be treated as chemically altered and buried according to legislation.

17.8.3 The laboratory will complete AM-12-C (Checklist of documentation for Tissue returned to Patients/Next of Kin from the histology Department) when all tissue is ready for return. This is filed with the original histopathology report stored by the laboratory office.

17.8.4 On returning any tissue samples to patients an AM-14-C (Biological transfer form) must be completed. One copy is filed with the laboratory report and the other copy is given to the patient/next of kin.

17.8.5 The AM-14-C Form is accessed from QPulse and printed onto carbonless paper.

18 Mortuary

Mortuary Contact Numbers

Mortuary/PM Room	01-4085274
Histopathology Laboratory	01-4085701
Histopathology Office	01-4085326
Fax No.	01-4085608

Hours of Service

Monday to Friday 8.00 – 16.30

18.1 Transfer of Remains to Mortuary

18.1 When remains are to be transferred to the Mortuary it is vital that the patients parents/guardians or next of kin are aware that once removed to the Mortuary remains cannot be returned to the hospital- as there is an infection risk.

18.2 However, there is a dedicated body fridge in St Gerard's Ward that can accommodate both small foetal remains and up to a term baby remains.

18.3 Parents /guardian are encouraged to say their goodbyes with no time constraints as the remains can be stored in the fridge. Remains are brought to the Mortuary in a specially designated bassinette to minimise anxiety of the parents/ guardians and other patients/staff/visitors who may be in the hospital as the remains are being brought to the Mortuary.

18.4 All remains must have the following:

- Mortuary Card
- Baby Name Tag x 2

<u>The Mortuary Card</u> should be completed to provide the following information

1. Name (Surname and Forename)
2. Sex
3. Date of Birth
4. Date of Death
5. Date transferred to Mortuary
6. Name of staff member who transferred to Mortuary
7. Parents Notified of Death-Time and Date

In addition, a PAS sticker from the mothers' chart **MUST** be on the Mortuary Card.

<u>The Hospital Tag</u> MUST have the following information:

1. Baby's Name
2. Mother's Name
3. Baby's Date of Birth

NB. There are 2 tags in use in the hospital- Pink for a female and Blue for a Male infant.

18.5 The Mortuary fridge is checked every morning by the Mortuary Technician

18.6 The Mortuary Technician will check that the Mortuary card and baby tags correspond and are completed in full. The case will only be registered once this process is completed.

18.7 Each case is given a unique Mortuary registration number.

18.8 The case is registered on the Laboratory Information System.

18.9 A mortuary register printout is made and sent to the Patient Accounts Department. This printout contains details of all remains currently in the Mortuary. A second copy of the register is filed in the Mortuary printout folder.

18.10 Remains are released by one of the following methods however the Mortuary Removals Record MUST be completed for each case

- **For Private burials**

The Hospital Chaplin co-ordinates release of the remains with next of kin. The remains are in general released by the Hospital Chaplin or mortuary technician to the next of kin.

However, this may occur by the Histopathologist/Midwife/Nurse/Clinician or The Laboratory Manager if requested by the next of kin or due to staffing issues.

- **For Hospital burials**

The Mortuary Technician will be contacted by the undertakers to release the remains for burial

18.11 The Mortuary Removals Record can be located in the wall mounted file- holder facing the fridge.

18.2 Release and removal of Remains from the Mortuary

18.2.1 Remains may only be collected for burial by the parents/next of kin or by an undertaker.

18.2.2 Check mortuary fridge for remains required.

18.2.3 Remove remains from fridge.

18.2.4 Check name on mortuary card and baby tags.

18.2.5 Sign the Mortuary Removals Record (which can be found in the wall mounted bracket facing fridge.

- Date
- Name (Baby of)
- Taken by
- Witness

18.2.6 The Mortuary Technician will amend the Mortuary Register on the Laboratory Information System with the information on the Mortuary Removals Record.

18.3 Requesting a Post Mortem

Do not request a hospital autopsy unless the need for a coroner autopsy is excluded.

Please refer to AM-3 and ***The Role of the Coroner in Death Investigation*** Leaflet for clarification.

When a Hospital Post Mortem is required the requesting clinician **must ensure** all required documents are completed in full.

Consent must be obtained for a hospital post mortem

- AM-1 (hospital consent form) **must** be completed in full and signed
- The requesting clinician or designated staff member should contact the Laboratory Office or the Mortuary Technician to inform them of the request for Post Mortem.
- An agreed time is then established for the post mortem.
- The Chart containing a Clinical Summary and AM-1 form are sent to the Laboratory Office.
- The remains should then be transferred to the mortuary (if not already there) and all documentation as described above in 'Transfer of remains to Mortuary' must be present and completed.
- The Post Mortem is carried out.
- If required, tissue and specimens for laboratory testing are sent to the relevant departments in the laboratory.
- The requesting clinician or ward will be contacted and advised that the post mortem is completed and that the remains have been released.
- The Pathologist dictates preliminary findings and a Provisional Anatomical Diagnosis report is issued to the requesting clinician.
- If organs are retained for diagnostic purposes, AM-5 (Notice of Organs Retained at post mortem) and AM-7 (Notice of disposal of Autopsy Tissue) will be sent to the requesting

clinician. It is the responsibility of the requesting clinician to ensure these documents are discussed with the Parents/Next of Kin and completed.

- AM-7 **must be completed** and returned to the Laboratory Office.
- Once all laboratory testing is complete, the final report is issued to the requesting clinician.

18.4 Coroner's Autopsy (Post Mortem)

"Where a death occurs suddenly or unexpectedly or from a cause which is unknown or unclear or unnatural, the coroner must be informed"

Please refer to AM-3 and ***The Role of the Coroner in Death Investigation*** Leaflet for clarification

The Coroner's office is always available for advice

Dublin District Coroners Contact Information

Telephone Numbers	01- 874 6684
	01- 874 3006
Fax No.	01-874 2840
Email Address	coroners@dublincorp.ie

Hours of Service

Monday to Friday 09.00-17.00

Saturday 9.00 - 12.00

Consent is NOT required once the coroner has accepted jurisdiction

Once jurisdiction is accepted by the coroner, a coroner's consent form is faxed to the Laboratory Office.

However, it is important the Coroner's Autopsy is discussed with parents /next of kin, information is available in AM-2 (Frequently asked questions about Autopsy/post mortem).

Form AM-4 (Coroner's Autopsy/post mortem) **must** be completed and sent to the laboratory with the chart and clinical summary.

The remains are identified by a member of An Garda Siochána, and the coroner's autopsy then can proceed.

The procedure thereafter is the same as for a hospital post mortem.

19 Ordering Laboratory Supplies

List of supplies available from the Pathology Department – see Pathology Department Stores Requisition Form

How to order: all orders must be in the laboratory by Tuesday evening to ensure deliveries can be provided on a Wednesday.

Delivery schedule: stores will be delivered on a Wednesday and Friday by the Laboratory Aide, except in extreme emergency where the laboratory department should be contacted immediately. The laboratory aide will deliver Formalin Containers to D/S and to Theatre (on request) every Wednesday and Friday.

Please note: Stores cannot be guaranteed outside routine hours.