Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

CAVAN GENERAL HOSPITAL DEPARTMENT OF CLINICAL & LABORATORY SCIENCES

HOSPITAL USER MANUAL

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CRITICAL VALUES (ADULTS)

DIVISION OF BIOCHEMISTRY

Analyte	Outside Range	
Sodium	<120mmol/L	>160 mmol/L
Potassium	<2.5 mmol/L	>6.5 mmol/L
Glucose	<2.5 mmol/L	>20.0 mmol/L
Calcium (corrected)	<1.8 mmol/L	>3.5 mmol/L
Carbon Dioxide	<10 mmol/l	
Paracetamol		>50 mg/l
Lithium		>1.5 mmol/L
Salicylate		> 300 mg/l
Amylase		>500IU/L
Troponin I		Male > 34 ng/L first instance Female > 16 ng/L first instance
eGFR		<15 mls/min (first instance)
Free T4	<8.0 pmol/L	>40.00 pmol/L
CRP		>300 mg/l
Magnesium	<0.4mmol/L	
Phosphate	<0.3mmol/L	
Total Bilirubin	>300µmol/L (neonates only)	
Urate (obstetric)	>400 µmol/L (Obstetrics)	
Direct Bilirubin	>25 µmol/l (neonates only)	
AST/ALT	> 510/825 IU/L	
Albumin	<20 g/l (Paediatrics only)	
Triglycerides	> 20 mmol/L	
Urea	>30 mmol/l (first instance)	
Creatinine	>354 µmol/l (first instance)	
Cortisol	<50mmol/l	
Ethanol	> 400 mg/dl	
HBA1c	>100 mmol/mol	
CK	>5000 U/L (Unless query MI)	

DIVISION OF HAEMATOLOGY	
WBC	>30.0 x 10^9xl
HGB	<8.5g/l
PLT	<80, >1,000 x 10^9xl
APTT	>120 sec
INR	>4
Absolute Neutrophil Count	<0.5 x 10^9xl
Sickle Screen	Positive in pre-op emergency screen
Fibrinogen	< 1.0 g/L
Malaria	Positive
Infectious Mononucleosis	Positive

DIVISION OF BLOOD TRANSFUSION

1. Positive DCT
2. Antibodies where a crossmatch is requested
3. Kleihauer > 4ml bleed

DIVISION OF SURGICAL PATHOLOGY

1. Fat in endometrial curettings and endoscopic Biopsies
2. 1st Diagnosis of leukaemias/lymphomas and any unexpected, clinically significant pathology result
3. Funisitis
4. Necrotizing Fasciitis
5. Invasive Organisms in an immunocompromised patient
6. Large Vessels in Lung Core Biopsy
7. Major disagreement between primary pathologist and external Pathology opinion.
8. Acid Fast organisms in any patient
9. Pneumocystis in BAL/Washings
10. Any organism in CSF

DIVISION OF MICROBIOLOGY

1. Gram stains on all positive blood cultures
2. All positive CSF microscopy results
3. Positive PCR result for any enteric pathogen
4. Positive Rotavirus
5. Positive Adenovirus
6. *Cryptosporidium* species
7. Positive Respiratory Pathogen e.g. Influenza, SARS CoV2, RSV
8. All in-house positive test results for causative pathogens of notifiable diseases
9. First positive Carbapenemase Producing Enterobacteriaceae
10. First Group B Streptococcus in a maternity/labour ward or neonatal patient
11. First Group A Streptococcus in an in-patient
12. First positive urinary antigen test
13. Other results may be phoned at the discretion of the Medical Scientist.

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1 GENERAL INFORMATION

1.1 LOCATION

The laboratory is located on the first floor of Cavan General Hospital.

1.2 LABORATORY STAFF & TELEPHONE NUMBERS

All numbers shown are for normal laboratory hours service, i.e. Monday to Friday. For information on contacting staff out of hours see section 0.

Department	**Personnel**	**Telephone No.**
Specimen Reception		6840
Consultant Histopathologist Consultant Histopathologist	Dr. Hala Rizkalla Dr. Megan Finan	3108 **(Bleep 911)** 6407 **(Bleep 912)**
Consultant Microbiologist	Dr. Cathal Collins Dr. Elizabeth Trautt	Request Consultant Microbiologist On Call Through Switch
Consultant Chemical Pathologist	Dr. Maria Fitzgibbon (V)	086-2499427
Consultant Haematologists	Dr. Barry MacDonagh (V) Dr. Anne Fortune (V)	6296 6054
Laboratory Manager	Brian O'Malley	6292
Blood Transfusion	Eamon Hannick*	6271
Haematology & Coagulation	Anna Dowd*	6294/6296
Clinical Chemistry	Aileen Reilly* Fiona Jennings* Elaine Fitzpatrick*	6297 6298 6298
Histopathology/Cytology	Imelda Gibson* Brigid Irvine*	6300 6300
Microbiology	Larry O'Neill* Karen Smith* Fionnuala Gilmartin* Linda Crowe* Conor McPhillips*	6295 6405 6053 6053 6053
Histology Reports	Laboratory Secretaries	6293
Microbiology Reports	Microbiology Secretary	6053
Haematology, Coagulation, Clinical Chemistry Reports	Laboratory Secretaries	6293/6357
Surveillance Scientist	Briain McDonald	6916 **(Bleep 215)**
Point of Care Co-ordinator	Cathal McLoughlin	6298
Transfusion Surveillance Officer	Siobhan Smith	6414 **(Bleep 913)**

(V) = Visiting Consultant * = Chief/Senior Scientists in Department

1.3 ACCREDITATION

The Laboratory is accredited to ISO15189 through the Irish National Accreditation Boar. The current scope of accreditation is available at https://www.inab.ie/fileupload/medical-testing/cavan-general-hospital-231mt.pdf

1.4 GENERAL NOTES

1.4.1 Use of Laboratory

The annual workload of the Laboratory has been increasing. All medical staff are requested to consider carefully the reasons for which they are requesting an investigation before initiating a request. The need for clinical justification applies particularly to emergency investigation requests, especially outside normal working hours. Asher's Catechism ***(BMJ, 2:260; 1954)*** is still relevant today and its regular application is urged, i.e.

1. Why do I request this test?
2. What will I look for in the results?
3. If I find what I am looking for, will it affect my diagnosis?
4. How will this investigation affect my management of the patient?
5. Will this investigation ultimately benefit the patient?

1.4.2 Routine Service

A routine laboratory service is available Monday to Friday during the following hours:

Monday - Friday	08.00 - 20.00 hrs.
Lunch	13.00 - 14.00 hrs. (reduced staff nos.)

There is a limited 'routine' service provided on Saturday, Sunday & Bank Holiday mornings in Microbiology ONLY.

1.4.3 On Call Service

1.4.3.1 Blood Sciences

An on call laboratory service is available from 20.00 hrs to 08.00 hrs. Monday to Friday and all day Saturday, Sunday and Public/Bank holidays. From 20.00 hrs to 00.00 hrs two scientists are present in the laboratory at all times, and there is no need to make direct contact, **except for emergencies**.

After 00.00 hours until 08.00 hours a scientist may not be in the laboratory all the time so the medical officer **must contact him/her by mobile phone to arrange testing**. The number to phone is **087 2944882** (Speed Dial 7484) for blood sciences (i.e. transfusion, haematology and biochemistry)

1.4.3.2 Microbiology

An on call Microbiology service is available from 20.00 hrs to 08.00 hrs. Monday to Friday. On Saturdays, Sundays and Public/Bank holidays, a routine service is available from 08:00 to 16:00. From 16.00 hrs to 08.00 the on call service is available.

The medical officer **must contact the Microbiology On Call Medical Scientist by mobile phone to arrange testing**. The number to phone is **086 0229204** for Microbiology (Speed Dial 7351)

1.4.4 Emergency Service:

A service for emergencies is available on a 24-hour basis. All critical values will be phoned as per the lists available inside the front cover of this manual. Refer to section 1.4.14 on page 18.

1.4.5 Specimens:

The primary responsibility for sample collection lies with the requesting physician. It is imperative that the collector can positively identify the patient from whom a specimen is collected. All specimens must be adequately labelled with the patient's full name, medical record number and date of birth. It is highly desirable to include the date and time of specimen collection on the specimen also. *There are specific requirements for labelling Blood Transfusion specimens – refer to specimen labelling in the Blood Transfusion section (section 2.6 of this manual).*

If a sample is not taken correctly, the test results may be seriously distorted.

Please ensure that specimen collection containers have not passed their expiry date before use.

1.4.6 Request Forms:

There are 9 Cavan General Hospital request forms for general use:

- Blood Transfusion - Blood Grouping, Antibody screening, DCT & Cord Bloods, Product Crossmatch/Issue requests (refer to section 2.5 for details on completion)
- General Form for Clinical Chemistry / Endocrinology / Haematology / Coagulation / Immunology. Multiple departmental requests may be documented on a single form and sent with the appropriate number of specimens to the laboratory.
- Histopathology / Cytology - 1 General, 5 anatomical site related
- Microbiology
- Samples for referral to outside laboratories e.g. external test requests

Addressograph labels may be used on all request forms, please affix an addressograph Label to each back copy of the request form.

The request form must contain*:

Patient Details:

- Patient name/identity
  (surname & forename)
- Date of Birth
- Patient medical record number
- Consultant
- Patient Location

Requesting Details:

- Name of requestor
- Address/Ward to send results
- Mode of contact e.g. bleep/ telephone number

Specimen Details:

- Date and time collected (excluding Histology/Cytology)
- Nature of sample requested
- Tests requested
- Patient medical record number

Other Information:

- Full clinical details relevant to investigation
- For microbiology specimens please state the antibiotic used
- Patient Gender (this may be essential for assays where reference ranges are gender specific)

Where multiple specimens are submitted with a single request form, all specimens must be labelled correctly, and where appropriate, with the site/source of the specimen.

**For Blood Transfusion request form and specimen requirements please refer to the Blood Transfusion section (section 2.5 of this manual).*

1.4.7 Transportation of Specimens:

Please seal labelled samples in either the request form with plastic sleeve or in a biohazard plastic bag with the accompanying appropriate request form in the side pocket. Samples may then be sent to the laboratory via the pneumatic tube system **except** for:

(1) Blood Cultures and CSF
(2) Samples packed on ice
(3) Histology/Cytology samples
(4) Blood/Blood Component Packs for transfusion
(5) Samples requiring special transport arrangements

Deliver category 1 to 4 by hand to the laboratory specimen reception.

Deliver category 6 samples to the main laboratory reception area and hand to a clerical officer for dispatch (normal working hours). Out of hours i.e. on call - send samples to the clerical officer in the Emergency Department who will document, package and arrange transportation.

Use of the Pneumatic Tube System within Cavan General Hospital

Instructions for Use:

1. Ensure that all samples and accompanying forms are sealed in transparent plastic bags. Place the sealed bag(s) containing sample and form in a pod having checked that the lid is properly closed and that the pod is in good condition (no cracks or breaks).
2. Input the four-digit address of the target destination onto the keypad.
3. Enter the carrier bottle into the sending funnel.

Pneumatic Tube Numbers/Addresses

AMAU	6927	New SCBU	2623
CCU	2608	Oncology	6112
Delivery Ward	2612	Onc. /Infusion Rom	6112
Dialysis	2620	Paediatrics	2616
Emergency (A&E)	2607	PAU	2624
Endoscopy	2006	PDU	2621
Dayward	6514	Pharmacy	2611
ICU	2622	Phlebotomy	2609
Laboratory	2601	Psychiatry	2610
Maternity	2613	Renal Dialysis	2620
Medical 1	2605	SSU	2621
Medical 2	2604	Surgical 1	2618
Medical 3	2606	Medical 5	2617
MLU/Labour Ward	2612	Medical 6	2621
		Theatre	2615

All faults/breakdowns must be logged by the affected area on the Maintenance Request System. Out-of-hours, dial 7266 for remote assistance.

NOTE: It is the policy of the laboratory to return empty pods to their point of origin ASAP i.e. empty pods are **not** stored in the laboratory.

1.4.7.1 Timeframe for Transport

It is imperative that specimens are transported to the laboratory as soon as possible after collection to ensure that they are stored under optimal conditions.

1.4.8 Rejection of Specimens -

Specimens will be rejected for analysis for the following reasons:

- Inadequate/incorrect labelling of specimen or request form
- Inadequate information on the request form or specimen to allow positive patient identification.
- Where specimens have leaked or the container has been damaged during transport.
- Haemolysed blood.
- Where there is obvious inadequacy of specimen.
- Wrong specimen bottle or correct procedure not followed e.g. specimen arrives routinely but should have been sent on ice.
- Specimens requiring prior booking with the laboratory that arrive without arrangement.
- Specimens not meeting the testing criteria e.g. samples for *C. difficile* and Ova and Parasites testing.

N.B.: The rejection of samples from the ICU, RDU, CCU, ED, SCBU, MAU, PAU, Oncology, SDW, Anticoagulation Clinic, EPU, Paediatric, Haematology Clinic, Transit Lounge and Microbiology samples are notified to the requesting clinician/ward

1.4.9 Consent

All procedures carried out on a patient need the informed consent of the patient. For most routine procedures, consent can be inferred when the patient presents himself or herself with a request form and willingly submits to the collecting procedure e.g. venepuncture. Patients in a hospital bed should normally be given the opportunity to refuse.
Special procedures, including more invasive procedure, 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.
The requirement for consent for individual tests performed is outlined in the relevant section of this laboratory manual.

1.4.10 Specimen Collection and Patient Preparation Prior to Specimen Collection

1.4.10.1 Venepuncture

Hand hygiene must be performed prior to commencement.
Greet the patient and identify yourself and indicate the procedure that will take place. Proper patient identification is **MANDATORY.**
If an inpatient is able to respond, ask for a full name and date of birth and always check the armband for confirmation. **DO NOT DRAW BLOOD IF THE ARMBAND IS MISSING**.
Verify that the patient meets and requirements for the testing to be undertaken e.g. fasting status, medication status, predetermined time for specimen collection, etc.

1. Standard precautions must be observed when taking blood.
2. Disposable non-sterile latex free gloves must be worn by the phlebotomist when taking blood in all circumstances.
3. Change gloves between patients
4. Wash hands or apply an antimicrobial gel before and after each procedure and on removal of gloves.
5. When sampling blood from any patient extreme care must be taken and every patient must be considered as potentially high risk.
6. When taking blood ensure the limb is well supported, and the patient is aware to keep it still. The limb may need to be supported by an assistant to achieve this.
7. When removing a blunted needle from a limb, ensure that the vacuum bottle has been disconnected from the multi sampler area. Leaving this in situ may cause blood droplets to spray.
8. Cover the puncture site with a sterile swab or cotton wool when removing the needle to reduce the risk of blood droplets spraying into the air.
9. To remove a blunted needle from the needle holder, press lever on top of vacuette holder, pointing downwards over a sharps bin. Drop into sharps container provided.
10. Avoid spillage of blood. If spillage occurs, clean spillage immediately.
11. If a sample bottle breaks, never attempt to pick it up. Avail of the nearest spillage kit and use accordingly to clean the hazardous material.

12. The user of 'sharps' is responsible for their safe and appropriate use and disposal. 'Sharps' must never be left for a colleague to tidy up.
13. Label the specimen with the appropriate patient details (refer to section 1.4.5 or 2.6 for blood transfusion samples)
14. Place the specimen in the bag attached to the request form.
15. Take care to prevent needle stick injuries when using and disposing of needles.
16. The Pathology Laboratory handles and processes the specimen according to the relevant laboratory method.

Note:
NEVER pour blood from one tube to another since the tubes can have different additives or coatings. Submit the collected specimen, in its entirety to the laboratory. There is no requirement for separation or division of samples.
For positive patient identification refer to Blood Transfusion section (section 2.6 of this manual).

1.4.10.2 24-Hour Urine Collection

General Information for Patients:
You will receive

- A large plastic container in which to store urine.
- A request form with your details on it.
- A plastic bag in which to return your collection and request form.

1. You may need more than one storage container to contain all of your urine for the 24-hour period.
2. Make sure each storage container is labelled with your full name and that your hospital number is written on it. **If your container is not labelled properly you may be asked to repeat the 24-hour collection.**
3. Keep your storage container cool throughout the 24-hour collection period until you bring it back
4. For certain collections, a blood sample may need to be taken within the 24 hour collection period; you will be informed if this is the case.

Procedure: How to collect your sample.
1. Start the 24-hour urine test by urinating directly into the toilet. Do not save this urine.
2. After you urinate, write the date and time on your storage container, **this is the start of your test.** Write this time & date on the container.

3. For the next 24 hours, collect all your urine into your storage container.
4. Exactly 24 hours after you started the test, urinate one last time and place the urine in your storage container. **This is the end of your test.** Write the date and time the test ended on your storage container.
5. If you need to use more than one container during the 24-hour period, use one container at a time. When it is full, collect your urine in the next container.
6. Please bring the urine to the hospital as soon as possible. To prevent leaks, make sure the lid is on tightly, and that the container is transported upright inside a plastic bag.
7. If you are an inpatient, your nurse will tell you what time to begin and end the collection and will set up more containers, as needed. If you have questions about the procedure, please ask.

1.4.10.3 24-Hour Urine Collection (Acidified)

In the interest of safety we are no longer issuing pre acidified 24 hour urine containers. Therefore if you require 24 hr urinary evaluation of any of the following analytes:

- Urinary Calcium
- VMA
- Cathecholamines

Please collect the sample in the plain 24 hour collection bottle.
Mark the container clearly 'Acid Required'.
Return to the laboratory as per normal and the sample will then be acidified upon receipt of the sample in Specimen Reception.

1.4.11 Specimen Containers

Refer to section 1.5 below and the inside of the back cover of this manual

1.4.12 Disposal of Sharps:

Please dispose of any sharps in the correct manner, i.e. a SHARPS disposal box. Remember - health and safety is imperative for all. See Safe Use and Disposal of Sharps Policy (NE Area)

1.4.13 Results:

Within the hospital, validated results are also available via ward look-up for Coagulation, Haematology, Microbiology and Clinical Chemistry. Histology/ Cytology are sent directly to the requesting clinician. Instructions for the use of ward look-up, which requires an individual password, are available on the next page. Further assistance is available from the laboratory.
NOTE: It is the responsibility of the laboratory to ensure that tests are performed to the highest possible standard and reported in the time specified within this User Manual. It is the responsibility of the requesting clinician to follow up on the test results.

Sample Turnaround Times (TATs)
Please note that we have a policy to fast-track samples from the Emergency Department, ICU, RDU, CCU, SCBU, MAU, PAU, Oncology, SDW, Anticoagulation Clinic, EPU, Paediatric, Transit Lounge and Haematology Clinic. Those samples whose TAT is usually one working day will be reported within 2 hours of the receipt of sample. Please note that instrument and computer breakdowns may result in delays and TATs may not be attainable for the duration. (See page 91 for Microbiology TAT).

Please keep telephone requests for results to a minimum - remember verbal results may lead to transcription errors. Interpretation of results is not always straightforward. Consultations and queries on the interpretation and selection of tests are encouraged. If the validity of a test is doubted it is most important that you contact the Laboratory as soon as possible to repeat the analysis on the stored specimen.

1.4.14 Ward Based Laboratory Result Lookup

The ward based laboratory lookup system (known as ward enquiry) is a module of the Laboratory Information System. It is designed to allow approved staff access to validated laboratory results for patients in their care. The module is access protected by individual passwords. Passwords and training is available from Ken Gregg, Carmel Maguire, Deidre Lambe (Extension 6416) in the laboratory. Help is available by clicking on the user manual icon on the main screen. All activity is logged against the name of the individual logged in at that time.
1. To use the system, log on by entering your individual password.

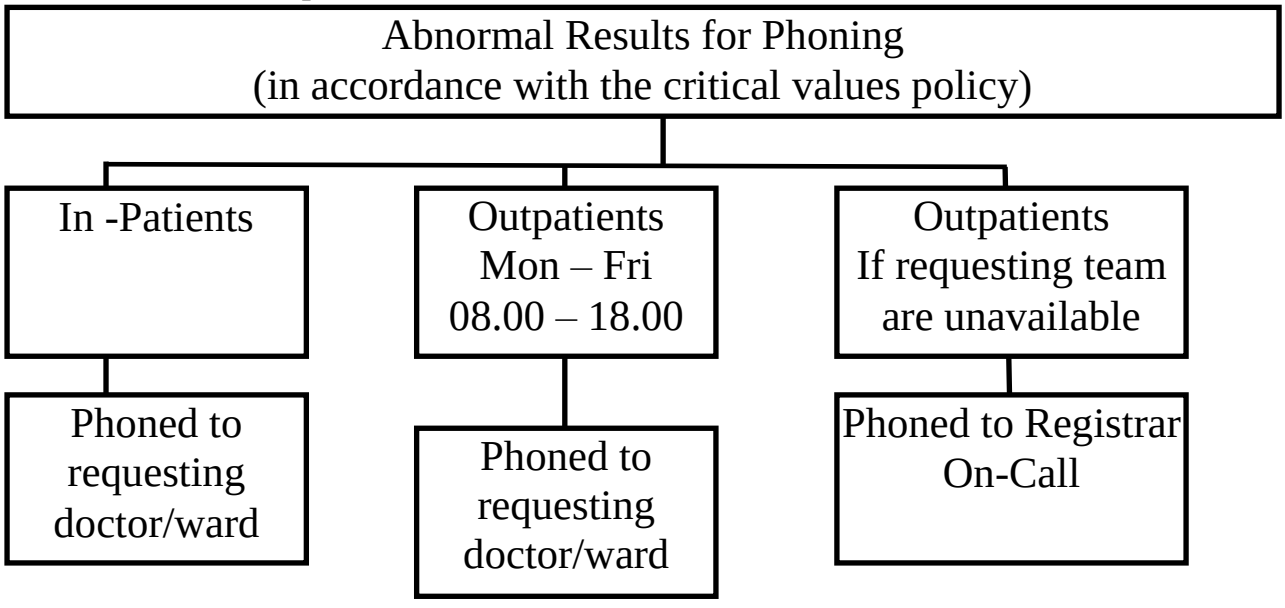
2. Enter the MRN of the individual patient. This may bring up a list of more than one patient due to different spelling of the patient name or a different DOB. Select the appropriate entry and the latest results for Haematology, Coagulation and Biochemistry will appear on the screen.
   NOTE: Where results are expected but not displayed, return to the search screen and amend the lookback timeframe from 35 days to the appropriate timeframe to incorporate the results required.
3. To see previous results scroll back through the screens.
4. To see trends click on the cumulative icon for each department
5. Click on individual parameters to graph the trend – use the 'From' and 'To' date options to view a specific time period.
6. To view microbiology click on the green icon on the results screen (only available if microbiology results are available). Select the specific results sought by clicking on the appropriate line in the upper box on the screen and the result will appear in the lower box. Additional antibiotic sensitivities may be available by contacting the Laboratory (Extension 6053).
7. To view a list of tests sent to other laboratories click on the yellow icon. At present no results are available on screen for these tests.
8. To view the blood group of a patient click on the white icon. This is only available if there is a blood group available for the patient. No detail of prepared blood or blood products is available at present.
9. To view unsigned results:
   a. Click on File and then View Unsigned Samples
   b. Under Ward select the appropriate location e.g. Emergency.
   c. Click on Search .
      The search returns all results within the last week which have yet to be reviewed and/or signed.
   d. To view results prior to the last week, change the dates in the Between Dates section appropriately.
   e. Results can be further viewed by clinician by selecting the appropriate clinician name from the Clinician drop-down list and clicking on Search .
   f. Click on any sample number to be brought to the individual results.

Results of specimens referred to Eurofin Biomnis, Mater Misericordaie University Hospital and NVRL are also available at ward level on Ward Lookup:

1. First log on to the Laboratory Lookup Module.
2. Enter Patient MRN and click on Search.
3. If necessary pick the correct patient by double clicking on their name. The results screen appears.
4. If External tests have been requested on this patient, a yellow 'Ext. Rept' icon will appear
5. To view results of external tests, click on the yellow icon. An External Tests window appears.
6. For each sample referred the following information is shown:
   - Sample ID
   - Sample Date
   - Request Detail
   - Status.
7. Two variations of status are possible:
   - Results not ready – electronic report not available
   - Results available – electronic report available
8. To see the result of the other variation click on the appropriate row and wait 3 – 5 seconds for the result to appear.

1.4.15 Phoning of Results/Critical Values

Significantly abnormal results i.e. results falling outside defined limits (alert values) will be telephoned, as outlined in the following protocol. These limits are quoted inside the front cover of this manual.



1.4.16 External Tests:

Specimens which need to be sent to external laboratories e.g. Eurofins Biomnis, NVRL, PCR samples for Children's Health Ireland at Temple Street etc. must be accompanied by a separate request form. Please ensure all details have been included. Failure to adhere to the above instructions will result in the specimen being returned to the originating area until such time as a correct request form, etc. is submitted.
Specific forms and containers are used for cervical cytology samples.
Specific specimen collection containers are used for Chlamydia testing.
Biomnis Laboratories perform chromosomal analyses on specimens with the exception of:
Peripheral Blood Samples:

1. Newborns & infants of less than 5 years of age for chromosomal analysis
2. FISH studies for Microdeletion Syndromes (no age restrictions)
3. On-going Family studies
4. Solid tissue – post natal only

A completed Informed Consent Form for Genetic Testing and a Constitutional Karyotype Information Form is required for all genetic testing. Samples received without these 2 forms cannot be processed.
NOTE: The Genetics Laboratory GSTS Pathology 5th Floor Tower Wing Guy's Hospital Great Maze Pond London SE1 9RT analyse specimens for numbers 1 to 4 above.

1.5 SPECIMEN CONTAINERS

This table contains an alphabetical test list of the most common tests requested from the laboratory. Please refer to individual department sections for further test information

Test	Sample required	Department	Container
5' HIAA	Urine	Outside Laboratory	24 hr. Urine – (See section 1.4.10.3)
Actinomycosis	Pus with "sulphur granules" if present	Microbiology	Sterile Universal Container
Acute anterior poliomyelitis	See NVRL User Manual	Microbiology	See NVRL User Manual
Acute encephalitis	See NVRL User Manual	Microbiology	See NVRL User Manual
Albumin	Serum	Biochemistry	Brown 
Albumin Creatinine Ratio	Urine - Random	Biochemistry	Plain 
Aldosterone	Serum or Plasma	Outside Laboratory	Brown  / Red 
Alkaline Phosphatase	Serum	Biochemistry	Brown 
Alpha 1acid Glycoprotein	Serum	Outside Laboratory	Brown 

Test	Sample required	Department	Container
Alpha Fetoprotein	Serum	Biochemistry	Brown 
Alpha1 Antitrypsin	Serum	Outside Laboratory	Brown 
ALT	Serum	Biochemistry	Brown 
Aluminium	Plasma	Outside Laboratory	Contact phlebotomy
Amikacin	Serum	Biochemistry	Brown 
Amino Acids	Lithium Heparin	Outside Laboratory	Orange 
Amino Acids (Urinary)	Plain- No Boric Acid	Outside Laboratory	Plain 
Ammonia	Plasma	Outside Laboratory	EDTA Plasma
Amoebiasis	Warm specimen of faeces (<1hour) for microscopy. Serum for serology	Microbiology	Blue Top  White 
Amylase	Serum	Biochemistry	Brown 
Angiotensin Converting Enzyme (ACE)	Serum	Outside Laboratory	Brown 
Anthrax	Seek advice from lab	Microbiology	Seek advice from lab
Anti Nuclear Antigen	Serum	Outside Laboratory	Brown 

Test	Sample required	Department	Container
Anti Streptolysin O titre (ASOT)	Serum	Outside Laboratory	Brown 
Anti Thyroid Antibodies	Serum	Outside Laboratory	Brown 
Anti Tissue Transglutaminase	Serum	Outside Laboratory	Brown 
Anti-Hepatitis B titre	Serum	Outside Laboratory	Brown 
APTT	Sodium Citrate Sample: 3ml (Adults), 1.2ml (Paeds)	Coagulation	Green 
Aspergillosis	Serum for precipitin test against *A. fumigatus*	Microbiology	White 
AST	Serum	Biochemistry	Brown 
Atypical pneumonia screen	Serum	Outside Laboratory	Brown 
Autoantibody Screen(AAS)	Serum	Outside Laboratory	Brown 
Bacillary dysentery	Faeces	Microbiology	Blue Top 
Bence Jones Protein.	Urine (Early morning)	Outside Laboratory	Plain 
Beta 2 Microglobulin	Serum	Outside Laboratory	Brown 

Test	Sample required	Department	Container
Bilirubin (Direct	Serum	Biochemistry	Brown 
Bilirubin (Total)	Serum	Biochemistry	Brown 
Blood film	EDTA Sample: 2.7ml (Adults), 1.2ml (Paeds)	Haematology	Red 
Blood Group and Antibody screen	Blood Transfusion EDTA-KE Sample: 7.5ml (Adults), EDTA-KE 2.7ml (Paeds/neonates) *Label on bottle states 'EDTA-KE for Blood Transfusion'*	Blood Transfusion	BTS Red (KE) 
NT-Pro BNP	Serum	Biochemistry	Brown 
Bone Profile	Serum	Biochemistry	Brown 
Brucella Infections	Blood culture. Serum for serology	Microbiology	Blood Culture & White 
C3/C4	Serum	Outside Laboratory	Brown 
CA125	Serum	Biochemistry	Brown 
CA15.3	Serum	Biochemistry	Brown 
CA19.9	Serum	Biochemistry	Brown 

Test	Sample required	Department	Container
Caeruloplasmin	Serum	Outside Laboratory	Brown 
Calcium	Serum	Biochemistry	Brown 
Calcium	24 Hour Container	Biochemistry	24hr Container (See section 1.4.10.3)
Candida Infections	Blood culture. Swab form suspected lesion. Serum for precipitins in suspected systemic disease.	Microbiology	Blood Culture & Blue Top  White 
Carbamazapine	Serum	Outside Laboratory	Brown 
Catecholamines (see Note No.1)	Urine	Outside Laboratory	24 hour (See section 1.4.10.3)
Cathecholamines &VMA	Urine	Outside Laboratory	24 hr. Urine – (See section 1.4.10.3)
CEA	Serum	Biochemistry	Brown 
Chloride	Serum	Biochemistry	Brown 
Chloride (Urinary)	Urine	Biochemistry	Plain 
Cholera	Faecal sample	Microbiology	Blue Top 

Test	Sample required	Department	Container
Cholesterol (HDL)	Serum	Biochemistry	Brown 
Cholesterol (LDL)	Serum	Biochemistry	Brown 
Cholesterol (Total)	Serum	Biochemistry	Brown 
Clostridium difficile	Diarrhoea Sample See section **5.4.5** on page 97.	Microbiology	Blue Top 
Coagulation Screen	Sodium Citrate Sample: 3ml (Adults), 1.2ml (Paeds)	Coagulation	Green 
Conjunctivitis *(bacterial)*	Eye swab for bacterial culture	Microbiology	Blue Top 
Conjunctivitis *(viral)*	Eye swab in viral transport medium	Microbiology	Pink Top 
Copper	Plasma	Outside Laboratory	Contact phlebotomy
Cord blood group and Direct Coombs	Blood Transfusion EDTA-KE Sample: 2.7ml (Paeds)	Blood Transfusion	BTS Red (KE) 
Cortisol (timed samples)	Serum	Biochemistry	Brown 
Creatine Kinase (CK)	Serum	Biochemistry	Brown 
Creatinine	Serum	Biochemistry	Brown 
Creatinine (Urinary)	Urine	Biochemistry	Plain 

Test	Sample required	Department	Container
Creatinine Clearance	Urine 24 hour collection + Serum (both to arrive in the laboratory together)	Biochemistry	24hr Collection + Brown 
Crossmatch	Blood Transfusion EDTA-KE Sample: 7.5ml (Adults), EDTA-KE 2.7ml (Paeds/neonates) *Label on bottle states 'EDTA-KE for Blood Transfusion'*	Blood Transfusion	BTS Red (KE) 
CRP	Serum	Biochemistry	Brown 
Cryptosporidium	Faecal sample	Microbiology	Blue Top 
Cyclosporin	EDTA	Referral Test	Red 
Cytology	Appropriate to nature of investigation as per section 6.4	Histopathology	Cytolyte container 
D-Dimers[6]	Sodium Citrate Sample: 3ml (Adults), 1.2ml (Paeds)	Coagulation	Green 
Diarrhoea	Faecal sample	Microbiology	Blue Top 
Digoxin	Serum	Outside Laboratory	Brown 
Diphtheria	Swab inflamed area/ membranes	Microbiology	Blue Top 

Test	Sample required	Department	Container
Drugs Of Abuse	Urine	Outside Laboratory	Plain 
Electrolytes (Na, K, Cl)	Serum	Biochemistry	Brown 
Electrophoresis	Serum	Outside Laboratory	Brown 
Endocarditis	Take 3 sets of blood cultures within 2-4 hour period before starting antibiotic therapy	Microbiology	Blood Cultures
Endomysial Antibodies	Serum	Outside Laboratory	Brown 
Epanutin (Phenobarbitone)	Serum	Outside Laboratory	Brown 
Epilim	Serum	Outside Laboratory	Brown 
ESR	Sodium Citrate Sample: 3.5ml (Adults), 2.0ml (Paeds)	Haematology	Mauve 
Ethanol	Serum	Biochemistry	Brown 
Fasting Lipids	Serum	Biochemistry	Brown 
Ferritin	Serum	Biochemistry	Brown 
Fibrinogen	Sodium Citrate Sample: 3ml (Adults), 1.2ml (Paeds)	Coagulation	Green 
Folate	Serum	Biochemistry	Brown 

Test	Sample required	Department	Container
Food poisoning	Seek advice from lab	Microbiology	Seek advice from lab
FSH	Serum	Biochemistry	Brown 
fT3	Serum	Biochemistry	Brown 
fT4	Serum	Biochemistry	Brown 
Full Blood Count	EDTA Sample: 2.7ml (Adults), 1.2ml (Paeds)	Haematology	Red 
Fetal Genetic RhD Screen	EDTA Sample: 9ml	Blood Transfusion	Red 
Fungus infections of skin, hair and nails	Skin scrapings in universal container or portions of nail /hair stump for fungal examination	Microbiology	Sterile universal container
Gamma GT	Serum	Biochemistry	Brown 
Gastro-enteritis	Faecal sample	Microbiology	Blue Top 
Gentamicin	Serum	Biochemistry	Brown 
Giardiasis	Faeces examination for cysts or duodenal aspirate for trophozoites Serum for IFAT	Microbiology	Blue Top  Brown 
Glucose	Fluoride Oxalate	Biochemistry	Yellow 

Test	Sample required	Department	Container
Gonorrhoea	Pus swab from cervix, urethra and rectum in transport medium	Microbiology	Transport swab or Chlamydia SCD
Gonorrhoea & Chlamydia PCR	Specimen Collection Devices (Swab & Urine)	Outside Laboratory	Contact Laboratory
Group & Antibody Screen/ Crossmatch/ Direct Coombs Neonate/Infant	Minimum 1.0 mls in EDTA-KE Blood Transfusion Sample (2.7ml) *Label on bottle states 'EDTA-KE for Blood Transfusion'*	Blood Transfusion	BTS Red (KE) 
Growth Hormone	Serum	Outside Laboratory	Brown 
Haemochromatosis Screen	EDTA	Outside Laboratory	Red 
HbA1C	Potassium EDTA	Biochemistry	Grey 
HCG	Serum	Biochemistry	Brown 
Hepatitis A	Serum	Outside Laboratory	Brown 
Hepatitis A, B & C	Serum	Microbiology	Brown 
Hepatitis B	Serum	Outside Laboratory	Brown 
Hepatitis B PCR	Serum	Outside Laboratory	Brown 
Hepatitis BsAg	Serum	Outside Laboratory	Brown 
Hepatitis C	Serum	Outside Laboratory	Brown 

Test	Sample required	Department	Container
Hepatitis C PCR	Serum	Outside Laboratory	Brown 
Histopathology	Appropriate to nature of investigation and with appropriate fixative as per section 6.1	Histopathology	Appropriately sized container
HIV	Serum	Outside Laboratory	Brown 
IBTS Antibody Quantitation/Titration	Blood Transfusion 7.5ml EDTA-KE *Label on bottle states 'EDTA-KE for Blood Transfusion'*	Blood Transfusion	BTS Red (KE) 
IgE	Serum	Outside Laboratory	Brown 
Immunoglobulin A (IgA) g/L	Serum	Biochemistry	Brown 
Immunoglobulin G (IgG) g/L	Serum	Biochemistry	Brown 
Immunoglobulin M (IgM) g/L	Serum	Biochemistry	Brown 
Infectious Mononucleosis (Monospot)	EDTA Sample: 2.7ml (Adults), 1.2ml (Paeds)	Haematology	Red 
Iron	Serum	Biochemistry	Brown 
Kleihauer Test	EDTA Sample (2.7ml)	Blood Transfusion	Red 
Lactate Dehydrogenase (LD)	Serum	Biochemistry	Brown 

Test	Sample required	Department	Container
LFT	Serum	Biochemistry	Brown 
LH	Serum	Biochemistry	Brown 
Lithium	Serum	Biochemistry	Brown 
Magnesium	Serum	Biochemistry	Brown 
Malaria Testing	EDTA Sample: 2.7ml (Adults), 1.2ml (Paeds)	Haematology	Red 
Materno/Foetal ABO incompatibility	7.5 mls mother's blood in EDTA-KE & minimum 1ml of baby's blood in EDTA-KE BTS (2.7ml) *Label on bottle states 'EDTA-KE for Blood Transfusion'*	Blood Transfusion	BTS Red (KE) 
Measles	Seek advice from lab	Microbiology	Seek advice from lab
Meningitis ***(bacterial)***	CSF for culture & PCR for ***N. meningitidis.*** Blood culture. Throat or pernasal swab. Tissue fluid aspirate from skin for culture of ***N. meningitidis / microscopy***	Microbiology	Sterile Universal Container Blue Top 
Meningitis (viral)	CSF and faeces for virology. Serum	Microbiology	Sterile Universal Container, Blue Top  Brown 
Metabolic Screen	Urine	Outside Laboratory	Plain 

Test	Sample required	Department	Container
Microalbumin	Urine	Biochemistry	Plain 
Mycoplasma infections	Paired sera for atypical infections	Microbiology	Brown 
Oestradiol	Serum	Biochemistry	Brown 
Oligoclonal Bands	Serum & CSF	Outside Laboratory	Brown 
Organic Acids	Urine	Outside Laboratory	Plain- No Boric Acid
Ornithosis	Serum	Microbiology	Brown 
Osmolality (serum)	Serum	Biochemistry	Brown 
Osmolality (urine)	Urine	Biochemistry	Plain 
Paracetamol	Serum	Biochemistry	Brown 
Paratyphoid B	Faecal sample	Microbiology	Blue Top 
Phenobarbitone	Serum	Outside Laboratory	Brown 
Phenytoin	Serum	Outside Laboratory	Brown 
Phosphate	Serum	Biochemistry	Brown 

Test	Sample required	Department	Container
Procalcitonin	Serum	Biochemistry	Brown 
Plague	Seek advice from lab	Microbiology	Seek advice from lab
Pneumocystis jiroveci ***(Previously carinii)***	Sputum sample	Histopathology	Cytolyt 30ml Contact Ext 6300
Pneumonia ***(atypical)***	Urine Sputum sample Serology	Microbiology	Plain  Sterile Universal Container Brown 
Potassium	Serum	Biochemistry	Brown 
Potassium	Urine	Biochemistry	Plain 
Progesterone	Serum	Biochemistry	Brown 
Prolactin	Serum	Outside Laboratory	Brown 
Protein (Total)	Serum	Biochemistry	Brown 
Protein (Urinary)	Plain Urine or 24 Hour Collection	Biochemistry	Plain  or 24 Hr Container

Test	Sample required	Department	Container
PSA (Free)	Serum	Biochemistry	Brown 
PSA (Total)	Serum	Biochemistry	Brown 
PT/INR	Sodium Citrate Sample: 3ml (Adults), 1.2ml (Paeds)	Coagulation	Green 
PTH	EDTA Sample: 2.7ml (Adults), 1.2ml (Paeds)	Biochemistry	Red 
Quantiferon	Specific containers available from Laboratory	Outside Laboratory	Contact Laboratory
Rabies	Seek advice from lab	Microbiology	Seek advice from lab
Rast	Serum	Referral Test	Brown 
Renin	Plasma	Referral Test	Red 
Reticulocytes	EDTA Sample: 2.7ml (Adults), 1.2ml (Paeds)	Haematology	Red 
Rheumatoid Factor	Serum	Biochemistry	Brown 
RSV	NPA	Microbiology	Nasopharyngeal Swab See page 107
Rubella	Serum	Microbiology	Brown 
Salicylate	Serum	Biochemistry	Brown 

Test	Sample required	Department	Container
Sickle Cell Screen	EDTA Sample: 2.7ml (Adults), 1.2ml (Paeds)	Haematology	Red 
Sodium (Serum)	Serum	Biochemistry	Brown 
Sodium (Urinary)	Plain	Biochemistry	Plain 
Syphilis	Serum	Microbiology	Brown 
Tegretol	Serum	Outside Laboratory	Brown 
Testosterone	Serum	Outside Laboratory	Brown 
Theophylline	Serum	Outside Laboratory	Brown 
Thyroglobulin antibodies	Serum	Outside Laboratory	Brown 
Thyroid antibodies	Serum	Outside Laboratory	Brown 
TIBC	Serum	Outside Laboratory	Brown 
Tobramycin	Serum	Biochemistry	Brown 
TORCH Screen	Serum	Outside Laboratory	Brown 
Toxicology (Blood)	Serum	Outside Laboratory	Brown 

Test	Sample required	Department	Container
Toxicology (Urine)	Urine	Outside Laboratory	Plain 
Toxoplasmosis	Serum	Microbiology	Brown 
Transferrin	Serum	Biochemistry	Brown 
Transferrin Saturation	Serum	Biochemistry	Brown 
Triglyceride	Serum	Biochemistry	Brown 
Troponin I	Serum	Biochemistry	Brown 
TSH	Serum	Biochemistry	Brown 
TSH Receptor Antibodies	Serum	Outside Laboratory	Brown 
Tuberculosis ***(non-pulmonary)***	Lymph node and other biopsy for culture in a sterile container with **no fixative**.	Microbiology	Sterile Universal Container
Tuberculosis ***(pulmonary)***	3 (minimum) early morning sputum samples. Pleural fluid for AFB and culture.	Microbiology	Sterile Universal Container
Tuberculosis (urinary)	3 (minimum) consecutive early morning urine samples for AFB and culture. Min. of 50 mls each collection	Microbiology	50ml Red Top 
U&E	Serum	Biochemistry	Brown 
Urate	Serum	Biochemistry	Brown 

Test	Sample required	Department	Container
Urea	Serum	Biochemistry	Brown 
Urine for C&S	Urine Monovette tube only (with boric acid where possible)	Microbiology	Urine Monovette 
Valproate	Serum	Referral Test	Brown 
Vancomycin	Serum	Biochemistry	Brown 
Vitamin B12	Serum	Biochemistry	Brown 
Vitamin D	Serum	Biochemistry	Brown 
Whooping cough	NPA or pernasal swab	Microbiology	Specific Wire Swab Available from Microbiology
Worms	Faeces for ova, cysts & parasites. Whole worm or segment of tapeworm can be sent to laboratory for identification.	Outside Laboratory	Blue Top 
Yellow fever	Contact laboratory	Microbiology	Contact laboratory
Yersinia enterocolitica	Faecal sample. Serum sample for serology	Microbiology	Blue Top  Brown 
Zinc	Plasma	Outside Laboratory	Contact phlebotomy

2 BLOOD TRANSFUSION DEPARTMENT

2.1 BLOOD AND BLOOD PRODUCTS STOCKED IN CAVAN GENERAL HOSPITAL

- Red Cell Concentrate *(leucocyte depleted)* - **adult packs only**
- Plasma - LG-Octaplas – frozen
- Emergency Pool of Platelets (1 Pool)
- Coagulation factor replacement products:
    - Fibrinogen (Fibryga)
    - Octaplex® *(Prothrombin Concentrate Complex – used for reversal of warfarin)*
    - Factor 7a (Novo Seven)
    - Factor 8 (Elocta)
    - Factor 9 (Alprolix)
    - Von Willebrand Factor (Wilate)
    - Rhophylac

2.2 BLOOD COMPONENTS/PRODUCTS WHICH MUST BE ORDERED FROM IBTS, DUBLIN (VIA BLOOD TRANSFUSION)

- Platelets (pooled/apheresis)
- CMV Negative and/or Irradiated products
- Pedi-packs – red cells or platelets
- Washed products

1. All blood and blood components are ordered by completing the blood transfusion request form, (LF-BT-0015/16) which is sent to the Blood Transfusion laboratory.
2. Urgent Requests for blood and blood components must be telephoned to the Blood Transfusion laboratory (Ext 6271) or the on-call Medical Scientist, (Speed dial 7484, as applicable)

2.3 BLOOD TRANSFUSION TEST & SPECIMEN REQUIREMENTS

Test and Specimen Required			
Test	**Sample required**	**Notes**	**TAT**
Blood Group and Antibody screen Adults Neonates/Paediatrics excluding Antenatal Requests	Blood Transfusion Sample: 7.5ml EDTA-KE 2.7ml EDTA-KE	Sample available for use for 72 hours	8 Hours*
Antenatal Blood Group and Antibody screen	Blood Transfusion Sample: 7.5ml EDTA-KE 2.7ml EDTA-KE	Sample available for use for 72 hours	Same Day¥
Crossmatch Adults Neonates/Paediatrics	Blood Transfusion Sample: 7.5ml EDTA-KE 2.7ml EDTA-KE		8 Hours**
Cord blood group and Direct Coombs	EDTA-KE Blood Transfusion Sample (2.7mls)		Within 24 hours
Investigation of Materno/foetal ABO incompatibility	7.5 mls mother's blood in EDTA-KE & minimum 1ml of baby's blood in EDTA –KE Blood Transfusion sample (2.7mls)	Notify laboratory to arrange investigation	8 Hours*
Infant Groups & Screen/Crossmatch/ Direct Coombs other than newborn	Minimum 1.0 mls in EDTA-KE Blood Transfusion sample (2.7mls)		8 Hours*
Kleihauer Test	EDTA Sample (2.7ml)	For RhD negative mothers only***	72 Hrs (Max)
Fetal Genetic RhD Screen	EDTA Sample (9ml)	For RhD negative mothers only. Referred to IBTS	7 – 10 days
Quantitation/Titration	7.5ml EDTA	Referred to IBTS	

Test and Specimen Required			
Test	**Sample required**	**Notes**	**TAT**
Suspected transfusion reaction investigation	Inform the Laboratory and Transfusion Surveillance Officer. Refer to Blood Transfusion SOP's and Investigation of Suspected Transfusion Reaction form on the Transfusion Record.		8 Hours*

TAT = Turn Around Time

***NOTE**: From time of receipt

**: From time of receipt unless component is required in advance of 8 hours.

¥: These specimens are processed and reported on the same day, Monday to Friday, if received before 7pm.

*** Post delivery, a Kleihauer test is only performed when it has been confirmed that the woman has delivered a RhD positive baby.

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

2.4 INFORMATION/INSTRUCTIONS PROVIDED TO PATIENTS

An information leaflet for patients is available on each ward within the Hospital. Additional leaflets may be obtained from the Transfusion Surveillance Officer (extension 6414).

For information about donations contact

The Irish Blood Transfusion Service: Tel: 1850 73 11 37, Website: www.giveblood.ie

2.5 REQUEST FORMS (PINK LF-BT-0015/16)

1. Addressograph labels are permitted on Blood Transfusion Request forms.
2. It is essential that all sections of the request form are fully and accurately completed with the **essential** information listed below

Essential Information **(minimum data required to perform transfusion requests)**	**Additional Important Information**
Patient's: First name	Patient's diagnosis
Surname	Reason for transfusion
Date of birth	Blood group and/or antibodies (if known)
Medical Record Number	Previous: Transfusion history (*including previous transfusion reactions*) Obstetric history
Gender	Product required
Signature of the requester & bleep number (if applicable)	Number of product required
Test required	Date & time product/s required Special requirements e.g. irradiated, CMV negative *Refer to section 2.12 for further details*
Signature of phlebotomist/ sampler (Blood Track 'Collect' Label)	
Date and time of request	
Date and time of specimen collection (Blood Track 'Collect' Label)	Indicate if Anti D has been given in last 4 months (if known)
	Location of patient (indicate if MGH)
	Routine or urgent request –***For urgent requests ring Blood Transfusion Lab***

3. Request forms for Group and Antibody screens and DAT - Direct Antiglobulin Test (Coombs) can be completed by the following:
   - Doctors
   - Midwives in the following locations: - Ante Natal Clinics
     - Midwifery Led Unit (MLU)
     - Delivery Ward
   - Nurses in the Surgical Pre-Assessment Clinics & Oncology Unit

4. Requests for crossmatching/issuance of blood products/components **MUST be completed by a doctor**.
   The section on the request form which states, "***Sample taken and patient identification checked by:"*** is reserved for the sampler to complete once the blood sample has been obtained. The signature of the sampler and the date and time of sampling must be entered onto the form once the patient's identification has been positively confirmed and the sample has been obtained. If the sample has been taken using the Blood Track system, then a 'Collect' label is placed in this section which states the sampling information. Otherwise this section must be completed manually by the sampler. (Ref: Haemovigilance Procedure CP-HV-0002 Procedure for Labelling Blood Transfusion Samples)
   NOTE: Failure to complete this section will result in the sample being rejected in the laboratory.
   (For details of how to complete the request form in the event of an unidentified patient or in an emergency situation refer to the Haemovigilance SOP CP-HV-0001 Completion of Blood Transfusion Request Form).

2.6 BLOOD TRANSFUSION SAMPLE TUBES

1. All Blood Transfusion samples **MUST be labelled immediately after sampling** using the Blood Track System. The sample bottles must never be pre-labelled prior to sampling.
2. Blood Track involves the use of a Personal Digital Assistant (PDA) at the patient bedside for recording sample collection. To use the system, the staff member must be registered on Blood Track with their employee number and the patient must be wearing a 2D barcode wristband containing five unique patient identifiers. This process enhances patient safety when sampling.
3. For details on how to operate the Blood Track System refer to Haemovigilance SOP CP-HV-0002 Procedure for Labelling Blood Transfusion Samples.
4. **Positive Patient Identification** must be confirmed by the sampler prior to sampling by:
   - Asking the patient/person to identify themselves by stating their name and date of birth, (if able), by asking, "What is your name and date of birth?"

- Confirm that the details are correct by checking the patient's ID band and request form.
- If any of the details are incorrect or the patient does not have an ID band insitu then **DO NOT** take the sample until the omission/error has been resolved.
    - All day case patients and in-patients **MUST** have a valid ID band insitu prior to sampling. If the ID band is not insitu it must be placed on the patient's wrist/limb prior to sampling.

    Wristband Policy.

    Patient wristband should be printed on demand only. If the wristband is removed for any reason, it must be reprinted and placed on patient's wrist immediately. Extra copies of wristbands **should not** be printed and filed in patient's charts.

5. In the event that the Blood Track system is not operational all group and antibody or crossmatch samples **MUST** be handwritten with the following information:
    - Patient's full name (i.e. first name and surname)
    - Date of Birth
    - MRN
    - Date & time of sample collection
    - Location of patient
    - Signature/initials of sampler

    The **sample tubes must be hand written and signed** by the sampler. Any omissions or errors in sample labelling will result in the sample being rejected by the laboratory.

    (For details of how to label the sample in the event of an unidentified patient or an emergency situation please refer to the Haemovigilance SOP CP-HV-0002 Procedure for Labelling Transfusion Samples)

    Only order blood when there is a clear indication for transfusion. Otherwise a group and antibody screen is sufficient and the sample is available for crossmatching purposes for up to 72 hours after sampling.

2.7 EMERGENCY BLOOD (UNCROSSMATCHED O NEGATIVE)

1. A minimum of two units of emergency use, uncrossmatched O Rhesus negative blood are available in the Blood Transfusion Laboratory HemoBank electronic issue fridge.

2. The units can only be removed from the HemoBank electronic issue fridge by a medical scientist.
3. The person collecting the units should bring a completed blood component slip with all of the patient's details recorded on the slip, (if an unknown patient then the unknown identifiers issued must be used).

The units are issued to the patient by the medical scientist and are logged on LIS that they have been removed from the laboratory pending transfusion.

In the event that there is a shortage of O Rhesus negative blood, emergency O Rhesus positive blood can be issued to male patients and women of non-bearing child age.

2.8 EMERGENCY PLATELETS

1. One Pool or Apheresis Platelets are available for emergency use. These platelets are available in the Blood Transfusion Laboratory
2. The Pool or Apheresis Platelets can only be released from the Blood Transfusion by a medical scientist.
3. The person collecting the Pool or Apheresis Platelets, should bring a completed blood component slip with all of the patient's details recorded on the slip, (if an unknown patient then the unknown identifiers issued must be used).
4. The Pool or Apheresis Platelets are electronically signed out of the laboratory using the Blood Track kiosk. In the event that the Blood Track kiosk is not operational platelets are signed out on LF-BT-0006 Blood Transfusion register by the collector.

2.9 ELECTIVE SURGERY:

1. Where possible, take blood at the Surgical Pre-Assessment Clinics or in the Out-Patent clinics so that it can be grouped and screened for atypical antibodies. Then, where necessary, the patient should have a repeat group and antibody screen or crossmatch sample taken on admission prior to surgery.
2. **Requests for crossmatched blood should be received in the laboratory by at least lunchtime the day prior to surgery.**
3. In most low blood usage surgical procedures, a group and antibody screen is adequate (i.e. serum is processed and saved for 72hrs), as it only takes 35 minutes to provide blood in the absence of any atypical antibodies.

4. For a guide on transfusion requirements for elective surgery, refer to the Maximum Blood Order Schedule (MBOS) in section 2.12 of this manual.

2.10 BLOOD COMPONENTS

2.10.1 Platelets:

1. Platelets are ordered from the Blood Transfusion Laboratory using the pink Blood Transfusion request form (LF-BT-15/16).
2. The standard dose for patients in almost all circumstances is one pack.
3. Orders for more than one pack of platelets must be discussed by the clinical team with the Consultant Haematologist or Haematology Registrar (Mater Hospital Haematology Dept provide cover out-of-hours – contact via the switchboard).
4. Once the request form is received the Medical Scientist will order directly from IBTS where platelets are not available on site (see section 2.8 above).
   NOTE: Delivery of platelets for non-emergency situations takes approximately 2½ hours.
5. If platelets are required urgently then ensure that verbal contact is made either with the Blood Transfusion Medical Scientist or the on-call medical scientist, (as applicable) and that they are informed that the platelets are required urgently and arrangements will be made to transport them as urgently as possible from the IBTS.
6. Once the platelets have arrived from the IBTS they can be stored on the platelet agitator in the Blood Transfusion laboratory until they are required or have expired.
7. Once the platelets have been removed from the platelet agitator they must either be transfused to the patient within 6 hrs of removal or returned to the platelet agitator for further storage.
8. Platelets should only be ordered if there is an intention to transfuse them.
9. Platelets must be prescribed on the Blood Transfusion Record and the pack numbers must be recorded on the Transfusion Record

THE FOLLOWING TWO PRODUCTS MUST NOT BE CONFUSED WITH ONE ANOTHER

2.10.2 PLASMA–LG-Octaplas

Used for :

- Haemostatic failure associated with massive blood loss
- Replacement of single coagulation factor deficiencies where a specific or combined factor concentrate is unavailable, e.g Factor V or Factor XI.
- Liver disease (in the presence of haemorrhage or prior to an elective procedure where coagulopathy is present)
- Thrombotic Thrombocytopenic Purpura (TTP) in conjunction with plasma exchange.
- Immediate reversal of warfarin in a patient who is bleeding and/or requires emergency surgery - use **only when Prothrombin Complex Concentrates is not available or contraindicated.**
- Acute Disseminated Intravascular Coagulopathy, (DIC)

1. Plasma is ordered from the Blood Transfusion laboratory using the pink Blood Transfusion request form, (LF-BT-0015/16)
2. Dosage is 12 – 15ml/kg and each pack contains 200mls.
3. Preparation / thawing of plasma takes approximately 35 minutes ***(this is dependent on the number of units requested)***.
4. Once thawed the plasma should be used immediately, but if a delay is anticipated the packs can be stored in the Blood Transfusion Issue fridge for up to 24 hours.
5. Once thawed the product cannot be refrozen. Therefore, only request when there is an intention to use. In general it is recommended that only 2 units are thawed at a time.

Plasma must be prescribed on the Blood Transfusion Record and the batch numbers of the products administered must be recorded on the Transfusion Record.

2.10.3 PROTHROMBIN COMPLEX CONCENTRATE (PCC) – Octaplex®

Used for:

- **Emergency reversal of Warfarin** in:
    - life threatening/major haemorrhage
    - prior to emergency surgery when surgery cannot be delayed for >6 hours to allow Vitamin K to take effect.
- Bleeding and peri-operative prophylaxis in congenital deficiency of any of the Vitamin K dependant coagulation factors II, VII, IX, X, when purified specific coagulation products are not available.
- Prothrombin Complex Concentrate should **NOT** be used for reversal of warfarin in non-emergency situations.

1. PCC/Octaplex® is ordered from the Blood Transfusion laboratory using the pink Blood Transfusion request form, (LF-BT-0015/16) Note: No sample requirement - product is issued immediately in an emergency situation
2. **Dosage** – *see 2.13 for the National Centre for Hereditary Coagulation Disorders Guidelines for recommended uses and doses* or contact the Consultant Haematologist for further advice.
3. **Maximum single dose of PCC/Octaplex® is 2000IU**
4. PCC/Octaplex® must be reconstituted as soon as possible after removal from the Blood Transfusion Issue fridge or returned to the Issue fridge within 30 mins of removal.
5. **Preparation:** prepare as per instructions contained within product box. The ampoules should be at room temperature prior to reconstitution to ensure rapid reconstitution of the powder in the diluent.
6. Wipe the top of the ampoules with the alcohol swabs provided and allow to dry
7. Add the 40mls water for injection using the transfer needle to the vial of powder, - insert the short end of the needle into the water and the long end into the powder (the vacuum in the vial will draw the water into the vial)
8. Do not shake the ampoules once the water for injection has been added to the powder, (this creates a froth which makes drawing up into a syringe difficult).
9. Draw the reconstituted solution into 50ml syringes* ensuring that the filter supplied is attached to the syringe during this procedure. Once the

solution has been drawn up into the syringe the filter should be removed prior to administration.

10. *Ampoules with different batch numbers should not be mixed together in the same 50ml syringe, but must be drawn up in different syringes.
11. **Administration Rates** - Administer using a syringe driver at a rate of:
    - 1ml/min (for first 5 minutes)
    - 2-3ml/min (until infusion complete)
12. PCC/Octaplex® must be prescribed on the Blood Transfusion Record and the batch numbers of the product administered must be recorded on the Transfusion Record.

2.11 GENERAL INSTRUCTIONS:

1. All Blood Transfusion request forms must be completed fully (refer to 2.5) and signed by the requesting doctor, (or in the case of group and antibody screens those nurses/midwives listed in section 2.5).
2. For **urgent requests** for blood/blood components /products, the doctor must speak personally to the Blood Transfusion Department/Medical Scientist on-call and ensure that the sample is dealt with immediately.
3. Crossmatches for patients with atypical antibodies can take a considerable amount of time. The Blood Transfusion Department will inform the appropriate medical staff if the situation should arise.
4. **Collection of Blood and Blood Products from the Blood Transfusion Lab/Traceability –**
   - All personnel must be trained to collect blood and blood components from the Blood Transfusion Lab. Untrained personnel will not be able to access crossmatched red cells from their storage location in the HemoSafe® blood issue fridge.
   - Any member of staff who requires training should contact Ext 6271 to arrange same.
   - A completed Blood Collection slip, (containing the patient's full name, MRN and DOB) must accompany the collector when they come to the lab to collect any blood or blood components.
     Please refer to *CP-HV-0004 Collection of Blood Components and Products from the Blood Transfusion Laboratory and Delivery to the Clinical Area*
   - **Blood must not be taken and stored in any other fridge, i.e. drug, ward or theatre fridges.**

5. **If the blood is not collected within 24 hours of the requested time, it will be returned to the main blood stock unless the doctor contacts the Laboratory, i.e. in the case of postponed/delayed theatre cases.**

   Full details of all Blood Transfusion practice can be found in the Blood Transfusion Standard Operating Procedures, (SOP's) which are available in each wards/departments in the red Haemovigilance Procedure folder.

2.12 CAVAN/MONAGHAN HOSPITAL CMV/IRRADIATED GUIDELINES

Conditions Requiring Irradiated and/or CMV Negative Blood & Blood Products

Condition	Requirements
All Shared care Paediatric patients (Shared between Crumlin)	Irradiated
Haematological Malignancies	
Newly diagnosed patients and/or on intensive chemotherapy for: Hodgkin's Disease Non Hodgkin's Lymphoma (Only in the context for stem cell harvesting) Aplastic Anaemia	Irradiated
Leukaemia/Lymphoma patients on purine analogues • Fludarabine • Cladrabine • Bendamustine • Alemtuzumab	Irradiated
• Bone marrow transplant recipients (from start of conditioning) • Hematopoietic stem cell transplant recipients (from start of conditioning) • Chronic Graft Versus Host Disease • Lung transplant recipients Renal transplant recipients	Irradiated
Granulocyte infusions	Irradiated
HLA matched platelet transfusions	Irradiated
Bone marrow or hematopoietic stem cell **donors** requiring allogeneic transfusions (from 7 days prior to harvest)	Irradiated
Obstetric/Neonatal	
Intrauterine transfusions	Irradiated and CMV negative
All pregnant mothers[1]	CMV negative
Neonatal exchange transfusions (with or without previous intrauterine transfusion)	Irradiated and CMV negative
Neonatal Population (up to 40 weeks corrected age + 28 days)	CMV negative
Neonatal small volume 'top up' transfusion[2] – only if previous intrauterine transfusions or co-existing immunodeficiency states.	Irradiated
Transfusion from first or second degree family members	Irradiated
Acquired Immunodeficiency States	
Human Immunodeficiency Virus (HIV)	Irradiated

1.*.Women who are pregnant are presumed to be CMV seronegative unless tested and reported to be positive.* ***NB*** *A woman who contracts CMV infection from whatever source during the first two trimesters of pregnancy has a high chance of vertically transmitting CMV infection*
2. It is not necessary to irradiate blood for routine small volume 'top-up' RBC transfusions of pre-term infants unless there have been previous intrauterine transfusion or a co-existing immunodeficiency state is suspected or confirmed or the donor is a first or second degree relative

Table 2 Congenital Immunodeficiency states with predominate defect of cell mediated immunity

Conditions	Requirements
Severe Combined Immunodeficiency, (SCID) not otherwise classified	Irradiated
SCID with dwarfism	Irradiated
3rd and 4th arch/pouch syndrome (Di George's)	Irradiated
Wiskott-|Aldrich Syndrome	Irradiated
Cell-mediated immunodeficiency, not otherwise classified	Irradiated
Reticular dysgenesis	Irradiated
Conditions in which TA-GVHD has not been reported	**Requirements**
Adenosine deaminase deficiency	Irradiated
MHC Class I deficiency	Irradiated
MHC Class II deficiency	Irradiated
Leucocyte adhesion deficiency	Irradiated
Immunodeficiency with eosinophilia (Omenn's Syndrome)	Irradiated
Ataxia telangiectasia	Irradiated

**** TA-GVHD*** *– Transfusion Associated Graft Versus Host Disease*
Once the diagnosis of immunodeficiency has been suspected in an infant, irradiated products should be given while awaiting results of diagnostic tests.

2.13 MAXIMUM BLOOD ORDERING SCHEDULE (MBOS)

NSR = No Specimen Required G&S = Group & Screen
Number stated = order crossmatch of red cells pre-operatively for stated amount

GENERAL AND VASCULAR SURGERY

GENERAL			
Amputation of limb (A/K OR B/K)	G&S	Nissen Fundoplication (lap)	G&S
Appendicectomy	NSR	Pilonidal cyst or sinus resection	NSR
Cholecystectomy (all types)	G&S	Skin graft	NSR
Embolectomy	G&S	Splenectomy (open)	G&S
Gastrectomy	2	Sympathectomy	G&S
Haemorrhoidectomy	NSR	Tracheostomy	G&S
Hernia repair (Open)	NSR	Vagotomy and pyloroplasty	G&S
Hernia repair (lap)	G&S	Varicose vein stripping	NSR
Laparotomy, exploratory	G&S		
COLECTOMIES			
Colectomy (segmental)	G&S	Colostomy (revision or closure)	G&S
Colectomy (total)	2		
VASCULAR ACCESS			
Open Vascular Access (Vascath)	NSR	Open Vascular Access (Portacath)	NSR

UROLOGY

Cystoscopy	NSR	Ureterovaginal or vesico-vaginal fistula repair	G&S
		Orchidectomy	NSR

MGH

All procedures performed in MGH are NSR

OBSTETRICS

CAESAREAN SECTION	
Elective/Uncomplicated	G&S
Emergency	2
Known or suspected placenta previa Gd I-II	2
Placenta previa (Major III-IV) for LSCS	4
After trial of forceps	G&S
DELIVERIES	
Deliveries, multiple	G&S
Delivery – with anaemia (Hb <10g/DL)	G&S
Deliveries, multiple	G&S
High risk labour	G&S
PLACENTA PREVIA	
Placenta previa (minor I-II) no bleeding	G&S
Placenta previa (minor I-II) bleed under obs	2
Placenta previa (Major III-IV) under obs	2
Placenta previa (Major III-IV) for LSCS	4

GYNAECOLOGY

Abortion, spontaneous	NSR
Cervical conization	NSR
D&C	NSR
Ectopic pregnancy	2
Endometrial ablation	NSR
Hysteroscopy	NSR
Laparoscopy	NSR
Oophorectomy /Biopsy	NSR
Salpingo-oophorectomy	NSR
Tubal ligation	NSR
HYSTERECTOMY	
Abdominal	G&S
Abdominal with BSO	G&S
Vaginal	G&S
Vaginal with pelvic floor repair	G&S

N.B. BLOOD ORDERS WHICH EXCEED THE SCHEDULE MUST BE DISCUSSED WITH THE TRANSFUSION LABORATORY

2.14 PCC/OCTAPLEX® USAGE/DOSAGE GUIDELINES

National Centre for Hereditary Coagulation Disorders, St James's Hospital, Dublin

WARFARIN REVERSAL

NO BLEEDING OR MINOR BLEED

PATIENT'S INR	ACTION
3.0 < INR < 6.0 (target INR 2.5) 4.0 < INR < 6.0 (target INR 3.5)	1. Reduce warfarin dose or stop 2. Restart warfarin when INR < 5.0
6.0 <INR < 8.0, no bleeding or minor bleeding	1. Stop warfarin 2. Restart when INR < 5.0 3. If other risk factors for bleeding consider 1mg of Vitamin K(Oral)
INR > 8.0, no bleeding or minor bleeding	1. Stop warfarin 2. Restart when INR < 5.0 3. Give 1 – 2mg of Vitamin K(Oral) 4. Recheck INR between 12 & 24hrs

MAJOR OR LIFE-THREATENING BLEEDS

Life Threatening/ Major Haemorrhage • Intracranial bleed • Retroperitoneal bleed • Intraocular bleed • Muscle bleed with compartment syndrome • Pericardial bleed • Active bleed with hypotension or 2g fall in Hb	1 Stop warfarin 2 Consult Haematologist immediately 3 Vitamin K 10mg IV slowly 4 Give **PCC** (e.g. **Octaplex®**)

Patient's INR	Dose of PCC
INR 2.0 – 3.9	25 IU/Kg
INR 4.0 – 6.0	35 IU/Kg
INR > 6.0	50 IU/Kg

NB: Any single dose of Octaplex should not exceed 3000iu. (i.e. 6 ampoules)

See section 2.10.3 for further details on PCC/Octaplex® reconstitution and administration

3 HAEMATOLOGY/COAGULATION DEPARTMENT

The Haematology/Coagulation department may be contacted at extension 6296/6294. (From outside the hospital 049 437 6296/6294)
Same day reporting on samples which arrive in the Department after 17.30hrs cannot be guaranteed. Therefore, it is essential to contact the laboratory about samples arriving after this time if the report is required that evening.

3.1 REPORTS

When results have been validated they are available through the ward look-up facility.

3.2 ASSAYS AVAILABLE IN CAVAN GENERAL HOSPITAL

<table>
<tr><th>Assay</th><th>Specimen</th><th>Bottle Colour</th><th>Sample Requirements</th><th>TAT</th><th>Reference Range</th></tr>
<tr><td>Full Blood Count</td><td>EDTA (2.7mls) - Adult
EDTA (1.2mls) – Paediatrics</td><td>Red
Red</td><td>Same Day Preferable(1)</td><td>Same Day</td><td>See table below</td></tr>
<tr><td>Blood film</td><td>EDTA (2.7mls) - Adult
EDTA (1.2mls) – Paediatrics</td><td>Red
Red</td><td>Same Day Necessary</td><td>Same Day</td><td>Interpretative report</td></tr>
<tr><td>Reticulocytes</td><td>EDTA (2.7mls) - Adult
EDTA (1.2mls) – Paediatrics</td><td>Red
Red</td><td>Same Day Necessary</td><td>Same Day</td><td>0.5-2.5%</td></tr>
<tr><td>ESR</td><td>Sodium Citrate (3.5 mls) - Adult
Sodium Citrate (2.0 mls) – Paediatrics</td><td>Purple
Purple</td><td>Same Day Preferable(2)</td><td>Same Day</td><td>
<table>
<tr><th>Age</th><th colspan="2">mms/hr</th></tr>
<tr><th></th><th>Male</th><th>Female</th></tr>
<tr><td>0-50 yrs</td><td>0 – 10</td><td>0 – 12</td></tr>
<tr><td>50-60 yrs</td><td>0 – 12</td><td>0 – 19</td></tr>
<tr><td>60-70 yrs</td><td>0 – 14</td><td>0 – 20</td></tr>
<tr><td>70-120 yrs</td><td>0 – 30</td><td>0 – 35</td></tr>
</table>
</td></tr>
<tr><td>Infectious Mononucleosis</td><td>EDTA (2.7mls) - Adult
EDTA (1.2mls) – Paediatrics</td><td>Red</td><td>Same Day Necessary(3)</td><td>Same Day</td><td>Positive/Negative</td></tr>
<tr><td>Sickle Cell Screen</td><td>EDTA (2.7mls) - Adult
EDTA (1.2mls) – Paediatrics</td><td>Red</td><td>Same Day Preferable</td><td>Same Day</td><td>Positive/Negative</td></tr>
<tr><td>Malaria Testing(6)</td><td>EDTA (2.7mls) - Adult
EDTA (1.2mls) – Paediatrics</td><td>Red</td><td>Same Day Necessary</td><td>Same Day(6)</td><td>Positive/Negative</td></tr>
<tr><td>PT/INR</td><td>Sodium Citrate (3mls) – Adult (4)
Sodium Citrate (1.2mls) - Paediatrics(4)</td><td>Green
Green</td><td>Same Day Necessary</td><td>Same Day</td><td>PT 10.2 - 12.1 s male/female
Refer to CMH Warfarin Guidelines’ for INR Target Values</td></tr>
</table>

Assay	Specimen	Bottle Colour	Sample Requirements	TAT	Reference Range
APTT	Sodium Citrate (3mls) – Adult [4][7] Sodium Citrate (1.2mls) - Paediatrics[4]	Green Green	Same Day Necessary	Same Day	APTT: 22.9 – 28.6 s, male/female
Coagulation Screen	Sodium Citrate (3mls) – Adult [4] Sodium Citrate (1.2mls) - Paediatrics[4]	Green Green	Same Day Necessary	Same Day	See individual components
Fibrinogen	Sodium Citrate (3mls) – Adult [4] Sodium Citrate (1.2mls) - Paediatrics[4]	Green Green	Same Day Necessary	Same Day	1.5 - 4.0 g/L
D-Dimers[5]	Sodium Citrate (3mls) – Adult [4] Sodium Citrate (1.2mls) - Paediatrics[4]	Green Green	Same Day Necessary	Same Day	< 0.5 mg/L FEU considered Negative ≥ 0.5 mg/L FEU considered Positive

(1) **FBC:** If it is not possible to send the sample to the Laboratory on the day of venepuncture preferably within 4 hours of collection, store it in a refrigerator at 2 to 8°C until it can be sent.

(2) **ESR:** Will be done if sample is received before 17.30 hrs. The test takes one hour. Samples stored >4 hours can lead to a false lowering of ESR values.

(3) **Infectious Mononucleosis (Monospot):** Infectious Mononucleosis (Monospot) tests are carried out on same day EDTA samples. Requests must be received in the laboratory before17.30 hrs.

(4) **Coagulation Samples** : It is imperative that coagulation samples are filled to the mark indicated on the container. Coagulation samples must be tested on the day of venepuncture, preferably within 4 hours of collection.

(5) **D-Dimers**: Due to the introduction of a new D-Dimer assay results will be reported as mg/l FEU (milligram per litre, Fibrinogen Equivalent Units) according to the international norm.

(6) **Malaria Testing:** Samples requested for Malaria Testing are processed in Cavan General Laboratory with 2 Malaria Rapid Detection Test (RDT) kits. A Malaria RDT kit result will be reported as Positive

or Negative.
If the Malaria RDT kit is positive, samples are referred to Mater Hospital (MMUH) for Malaria Microscopy ASAP and a telephoned result will be phoned to the Clinical team as soon as it becomes available.
If the Malaria RDT is Negative, samples are referred to Eurofins Biomnis Laboratories for testing on the next working day.
All Positive Malaria Microscopy results from the MMUH are referred to PHE Malaria Reference Laboratory, London for confirmatory testing.

(7) It is recommended that coagulation samples from patients on **unfractionated Heparin** are centrifuged within 1 hour of collection, stored at room temperature and tested within 4 hours. Therefore, please send such samples to Laboratory as soon as possible after collection.

Full Blood Count Specified Ranges

Parameter	0 – 3 days	3 day – 1 month	1 – 2 months	2 – 3 months	3 – 6 months	6 months – 2 years	2 – 6 years	6 – 12 years	Adult Male	Adult Female
RBC (x 10^{12}/L)	5.0 – 7.0	4.0 – 6.6	3.0 – 5.4	3.1 – 4.3	4.1 – 5.3	3.9 – 5.1	4.0 – 5.2	4.0 – 5.2	4.5 – 5.5	3.8 – 4.8
Haemoglobin (g/L)	14.0 – 22.0	15.0 – 21.0	11.5 – 16.5	9.4 – 13.0	11.1 – 14.1	11.1 – 14.1	11.0 – 14.0	11.5 – 15.5	13.0 – 17.0	12.0 – 15.0
Hct (l/l)	0.45 – 0.75	0.45 – 0.67	0.33 – 0.53	0.28 – 0.42	0.30 – 0.40	0.30 – 0.38	0.34 – 0.40	0.35 – 0.45	0.40 – 0.50	0.36 – 0.46
MCV (Fl)	100 - 120	92 – 118	92 – 116	87 – 103	68 – 84	72 – 84	75 – 87	77 – 95	83 – 101	83 – 101
MCH (pg)	31 – 37	31 – 37	30 – 36	27 – 33	24 – 30	25 - 29	24 – 30	25 – 33	27 – 32	27 – 32
MCHC (g/L)	30.0 – 36.0	29.0 – 37.0	29 – 37	28.5 – 35.5	30 - 36	32 – 36	31 – 37	31 – 37	31.5 – 34.5	31.5 – 34.5
WBC (X 10^9/L)	10.0 – 26.0	7.0 – 23.0	5 – 19	5 – 15	6 – 18	6 – 16	5 – 15	5- 13	4.0 – 11.0	4.0 – 11.0
Neuts (X 10^9/L)	4.0 – 14.0	3.0 – 5.0	3 – 9	1 – 5	1 – 6	1 – 7	1.5 – 8	2 – 8	2 – 7	2 – 7
Lymphs (X 10^9/L)	3.0 – 8.0	2.0 – 8.0	3 – 16	4 -10	4 – 12	3.5 – 11	6 – 9	1 – 5	1 – 3	1 – 3
Monocytes (X 10^9/L)	0.5 – 2.0	0.5 – 1.0	0.3 – 1.0	0.4 – 1.2	0.2 – 1.2	0.2 – 1.0	0.2 – 1.0	0.2 – 1.0	0.2 – 1.0	0.2 – 1.0
Eosinophils (X 10^9/L)	0.1 – 1.0	0.1 – 2.0	0.2 – 1.0	0.1 – 1.0	0.1 – 1.0	0.1 – 1.0	0.1 – 1.0	0.1 – 1.0	0.02 – 0.5	0.02 – 0.5
Platelets (X 10^9/L)	150-450	210 - 500	210 – 500	210-650	200 – 550	200 – 550	200 - 450	180 - 400	150 – 400	150 – 400
RDW (%)									11.6 – 14.0	11.6 – 14.0
Basophils (X 10^9/L)									0.02 – 0.1	0.02 – 0.1

Pregnancy Reference Ranges

Parameter	Units	1st Trimester	2nd Trimester	3rd Trimester
WBC	X 109/L	5.7-13.6	6.2-14.8	5.9-16.9
Haemoglobin	g/L	11.0-14.3	10.0-13.7	9.8-13.7

Reference: Haematological Values during Pregnancy (Blood Cells. A Practical Guide. Barbara J. Bain; 3rd Edition)

4 CLINICAL CHEMISTRY DEPARTMENT

This section attempts to summarise our services and answer the most common questions about testing requirements.

The department may be contacted at extension 6298. (From outside the hospital 049 437 6298)
Same day reporting on samples which arrive in the Department after 15:30 cannot be guaranteed. Therefore, it is essential to contact the laboratory about samples arriving after this time if the report is required that evening.

4.1 ASSAYS AVAILABLE IN CAVAN GENERAL HOSPITAL

Assays Performed in Cavan General Hospital					
Assay	**Reference Range**		**Sample Type**	**Additional Information**	**TAT**
Albumin	0-4 days 28- 44 g/L 4 days-14yr 38-54 g/L Adult : 14-59yr 35-50 g/L 60-90yr 32-46 g/L >90yr 29-45 g/L		Serum	Reference Range from Abbott	12 hrs
Albumin Creatinine Ratio (ACR)	Normal	<2.5 mg/mmol male	Urine	Reference Range from Abbott	12 hrs
		<3.5 mg/mmol female			
	Microalbuminuria	2.5 – 29 mg/mmol male			
		3.5 – 29 mg/mmol female			
	Macroalbuminuria	>30mg/mmol (both sexes)			
Alkaline Phosphatase	Age	IU/L	Serum	Reference Range from Pathology Harmony	12 hrs
	0–14 day	70–380			
	14d – 16yr	60–425			
	Adult	30 – 130			
ALT	0– 55 U/L		Serum	Reference Range from Abbott	12 hrs
Alpha Fetoprotein	0.75–7.4 U/ml		Serum	Reference Range from Abbott	12 hrs
Amikacin	<5 mg/L		Serum	CGH AM guide	12 hrs

Assays Performed in Cavan General Hospital				
Assay	**Reference Range**	**Sample Type**	**Additional Information**	**TAT**
Amylase	28–100 IU/L	Serum	Reference Range from Abbott	12 hrs
AST	5– 34 IU/L	Serum	Reference Range from Abbott	12 hrs
Bilirubin (Direct)	0 – 8.6 µmol/ L	Serum	Reference Range from Abbott	12 hrs
Bilirubin (Total)	0–7d 26-205 µmol/ L Adult < 21 µmol/ L	Serum	Reference range derived from Abbott	12 hrs
CA125	0 – 35 IU/ml	Serum	Reference range derived from Abbott	12 hrs
CA15.3	0 – 31 IU/ml	Serum	Reference range derived from Abbott	12 hrs
CA19.9	0 – 37 IU/ml	Serum	Reference range derived from Abbott	12 hrs
Calcium	Total calcium : 0–10 day 1.9–2.6 mmol/L 10 day–2yr 2.25–2.75 mmol/L 2 yr–12 yr 2.20–2.7 mmol/L Adult 2.1–2.55 mmol/L Adjusted calcium (calculation): 2.2–2.6 mmol/L	Serum		12 hrs

Assays Performed in Cavan General Hospital					
Assay	**Reference Range**		**Sample Type**	**Additional Information**	**TAT**
CEA	0 – 5 ug/L		Serum	Reference range derived from Abbott	12 hrs
Cholesterol (HDL)	> 1.0 mmol/L		Serum	ESC Dyslipidaemia Guidelines 2019	12 hrs
Cholesterol (LDL)	< 3 mmol/L		Serum	ESC Dyslipidaemia Guidelines 2019	12 hrs
Cholesterol (Total)	0 – 5.0 mmol/L		Serum	ESC Dyslipidaemia Guidelines 2019	12 hrs
CO2 (Bicarbonate)	Adult 22-29 mmol/L		Serum	Path Harmony	12 hours
Cortisol	150-455 nmol/L For short SynACTHen test, expect an increment of >150 nmol/l after 30 minutes		Serum	Mater Misericordiae In-house study	12 hours
Creatine Kinase (CK)	Male Female	30–200 IU/L 29– 168 IU/L	Serum	Reference range from Abbott	12 hrs
Creatinine	<2 weeks	27 – 81µmol/ L	Serum	Reference range from Abbott	12 hrs
	2 weeks – 5yr	14 - 37µmol/ L			
	5–9 year	25 – 48µmol/ L			
	9–15year	30 –72µmol/ L			
	Adult Male	64– 104 µmol/L			
	Adult Female	49– 90 µmol/ L			

Assays Performed in Cavan General Hospital					
Assay	**Reference Range**		**Sample Type**	**Additional Information**	**TAT**
Creatinine Clearance (Calculation)	80 – 120 ml/min		24 hour urine collection	Serum sample to be taken within collection period and arrive with the urine sample.	12 hrs
CRP	<5 mg/L		Serum	Reference range from Abbott	12 hrs
CSF Glucose	<16yr 3.3–4.5mmol/L >16yr 2.2–3.9mmol/L (Interpret with regard to plasma glucose)		CSF	Reference range from Abbott	
Electrolytes (Na, K, Cl) (Serum, All in mmol/L)	Sodium	133 – 146	Serum	Reference range from Pathology Harmony (K^+&Na^+)	12 hrs
	Potassium	0–14day 3.4–6.0 15d–1yr 3.5–5.7 1yr–16yr 3.5–5.0 Adult 3.5–5.3		Reference range from Abbott	
	Chloride	98– 107		Reference range from Abbott	

Assays Performed in Cavan General Hospital					
Assay	**Reference Range**		**Sample Type**	**Additional Information**	**TAT**
Ethanol	Up to 100 mg/dL: euphoric changes, some impairment expected. 100-300 mg/dL: drowsiness, confusion >300 mg/dL: impaired consciousness,		Serum	NA	12 hrs
Ferritin	Male 22 – 275µg/L Female 5–205 µg/L		Serum	Reference range from Abbott	12 hrs
Folate	7.0 – 46.4 nmol/L		Serum	Reference range from Abbott	12 hrs
FSH		IU/L	Serum	Reference range from Abbott	12 hrs
	Follicular	3.0 – 8.1			
	Mid Cycle	2.5 – 16.7			
	Luteal	1.4 – 5.5			
	Male	0.95–11.95			
fT3	2.42– 6.00 pmol/L		Serum	Reference range from Abbott	12 hrs
fT4	9.0–19.0 pmol/L		Serum	Reference range from Abbott	12 hrs
Gamma GT	Male Female	0–55 IU/L 0–38 IU/L	Serum	Reference range from Abbott	12 hrs

Assays Performed in Cavan General Hospital					
Assay	**Reference Range**		**Sample Type**	**Additional Information**	**TAT**
Gentamicin (Single daily dose)	<1 mg/L		Serum	Sample immediately prior to dose. Repeat every 3 days or 24 hours following change in dose. Assuming normal renal function. CGH Antimicrobial Guidelines	12 hrs
Gentamicin (Multiple daily dose)	Contact Consultant Microbiologist for interpretation of results		Serum	Repeat every 3 days. Assuming normal renal function. Reference range derived by CGH Therapeutic Committee Policy	
Glucose	Fasting	3.9 – 5.6 mmol/L	Fluoride EDTA	Reference range source from WHO	12 hrs
	Post prandial	3.9 – 7.8 mmol/L			
OGTT	Diabetic diagnosis range: Fasting >7.0 mmol/L 2hrs glucose ≥11.1 mmol/L				
HbA1C	< 42 mmol/mol		EDTA	National Reference Range	24 hrs
HCG	0–5.0 IU/L		Serum	Reference range from Abbott Post-menopausal HCG may be higher (<10µ/l)	12 hrs

Assays Performed in Cavan General Hospital				
Assay	**Reference Range**	**Sample Type**	**Additional Information**	**TAT**
Iron	Male 11 – 31 µmol/L Female 9 – 30 µmol/L	Serum	Reference range from Abbott Subject to diurnal variation	12 hrs
Lactate Dehydrogenase LD	125–220 u/L	Serum	Reference Range from Abbott	12 hrs
LH	mIU/ml Follicular 1.8 -11.8 Mid Cycle 7.6– 89.1 Luteal 0.6 – 14.0 Male 0.6– 12.1	Serum	Reference range derived from Abbott	12 hrs
Lithium	0.5 –1.0 mmol/L		Reference range from Nolen et al. 2019	12 hrs
Magnesium	0.7– 1.0 mmol/L	Serum	Reference range derived from Pathology Harmony	12 hrs
Micro protein CSF	0–1 month 0.2–0.8g/L Thereafter 0.15–0.45g/L	CSF	Reference range derived from Abbott	12 hrs
Micro protein Urine	0.00–0.14 g/L 0.3 g/24h	Urine	Reference range derived from Abbott	12 hrs
Microalbumin	0–30 mg/L	Urine – random	See also ACR	12 hrs

Assays Performed in Cavan General Hospital					
Assay	**Reference Range**		**Sample Type**	**Additional Information**	**TAT**
Non HDL Cholesterol (Calculation)	<3.4 mmol/L		NA	Reference range derived from ESC guide 2019	
NT Pro BNP	<75yr <125 pg/ml >75yr <450 pg/ml		Serum	Reference range derived from Abbott NT Pro BNP increases with age	12 hrs
Oestradiol		pmol/L		Reference range derived from Abbott	12 hrs
	Follicular	77 –921			
	Mid Cycle	139–2381			
	Luteal	77 –1140			
	Male	40–161			
Osmolality (serum)	275 – 295 mOsm/KG		Serum		24 hrs
Osmolality (urine)	No range exists - depends on fluid intake and balance		Urine		24 hrs
Paracetamol mg/L	Interpret with NPIS nomogram		Serum	See the nomogram figure below (Figure1)	12 hrs
Phosphate	0.8–1.5 mmol/L		Serum	Reference range derived from Pathology Harmony	12 hrs

Assays Performed in Cavan General Hospital				
Assay	**Reference Range**	**Sample Type**	**Additional Information**	**TAT**
Potassium urine	25–125 mmol/L	Urine	Reference range derived from Abbott Interpret relative to intake/serum	12 hrs
Procalcitonin	0 – 0.25 µg/L	Serum	< 0.1 Bacterial inf. Very unlikely 0.1 – 0.25 Bacterial inf. Unlikely 0.2 – 0.5 Bacterial inf. Likely 0.3 >0.5 Bacterial inf. Very likely 0.4 Reference range from Abbott	12 hrs
Progesterone	Luteal 4–50 nmol/L	Serum	Mid Luteal Day 21 – 24 Reference range derived from Abbott	12 hrs
Protein/Creatinine Ratio	<22.6 mg/mmol	Urine	Ref. Range source from Abbott See the Table-1 below for Interpretation	24 hrs
Protein (Total)	60 – 80 g/L	Serum	Reference range derived from Pathology Harmony	12 hrs

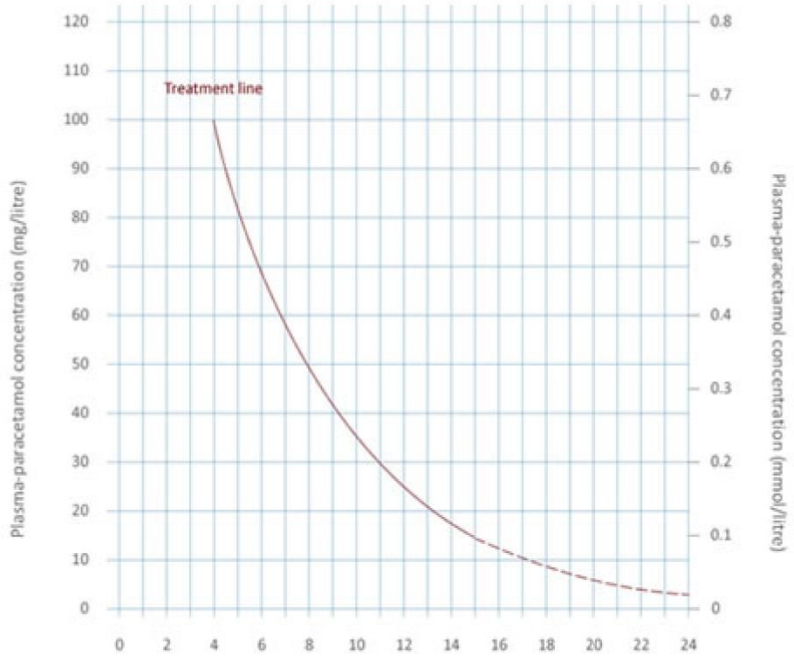
Assays Performed in Cavan General Hospital					
Assay	**Reference Range**		**Sample Type**	**Additional Information**	**TAT**
PSA (Total) µg/L	Age (years)	Range	Serum	National Guideline	12 hrs
	<49yr	< 2.0 µg/L			
	50 – 59yr	< 3.0 µg/L			
	60 – 69yr	< 4.0 µg/L			
	>70yr	< 5.0 µg/L			
Rheumatoid Factor	<30 IU/ml		Serum	Reference range derived from Abbott	12 hrs
Salicylate	Toxic levels >300 mg/L Lethal >700 mg/l		Serum	Therapeutic range 150 – 300mg/L	12 hrs
Sodium urine	40 – 220 mmol/L Interpret relative to intake/serum		Urine	Reference range source Abbott	12 hrs
Tobramycin	<1 mg/l		Serum	CGH AM Guideline	12 hrs
Transferrin	0 –14y:	Male 1.86 –3.88 g/L Female 1.80 –3.91g/L	Serum	Reference range source Abbott	12 hrs
	15 –60yr:	Male 1.74 –3.64g/L Female 1.80 –3.82g/L			
	61 –120yr:	Male 1.63 –3.44g/L Female 1.73 –3.60g/L			
Transferrin saturation		Male / Female	Serum	CALIPER Study	12 hrs
	< 1y	4.1 – 59%			
	1 – 14y	6.5 – 39%			
	14-19y	9.6 – 58% / 5.2 – 44%			
	>19 y	19 – 55% / 10 – 50%			

Assays Performed in Cavan General Hospital				
Assay	**Reference Range**	**Sample Type**	**Additional Information**	**TAT**
Triglyceride	0 – 1.7 mmol/L	Serum	ESC Dyslipidaemia Guidelines 2019	12 hrs
Troponin I	Male: 0 – 34 ng/L Female: 0 – 16 ng/L	Serum	Reference Range from Abbott	12 hrs
TSH	0.35 – 4.94 mU/L	Serum	Reference Range from Abbott	12 hrs
Urate	Male 210 – 430 µmol/L Female 140–360 µmol/L	Serum	Reference Range from Abbott	12 hrs
Urea	0 –14d 0.8–5.5 mmol/L 15d–1yr 1.0–5.5 mmol/L 2y–16yr 2.5–6.5 mmol/L Adult 2.5–7.8 mmol/L	Serum	Reference Range from Pathology Harmony	12 hrs
Urinary Calcium	2.5–7.5 mmol/day (24hr)	Urine	Reference Range from Abbott	12hrs
Urinary Creatinine	Male 5100–14200 µmol/L Female 3900–9400 µmol/L	Urine	Reference Range from Abbott	12hrs
Urinary Protein 24h	<0.3 g/24h		Reference Range from Abbott	12hrs
Urinary Urate	1500–4500 µmol/L (24hr),normal diet	Urine	Reference Range from Pathology Harmony	12hrs

Assays Performed in Cavan General Hospital				
Assay	**Reference Range**	**Sample Type**	**Additional Information**	**TAT**
Urate/Creatinine ratio (Calculation)	0 –6wk 0.2 –3.0 mmol/mmol 6wk –2yr 0.2 –2 mmol/mmol 2–6y 0.2 –1.5 mmol/mmol 6 –14yr 0.2 –1.0 mmol/mmol Adult 0.15 –0.6 mmol/mmol	Urine	Reference RangeVademecum Metabolicum	12hrs
Vancomycin	15 - 20 mg/L	Serum	CGH AM Guideline	12 hrs
Vitamin B12	139 – 651 pmol/L	Serum	Reference Range from Abbott	12 hrs
Vitamin D	> 50 nmol/L	Serum	Reference Range from National Osteoporosis Society	12 hrs

*: Serum must be separated from cells within 2 hours of venepuncture

Figure 1: New treatment nomogram for paracetamol overdose



***Health Products Regulatory Authority, 2021**

Table 1 shows PCR Interpretation

PCR mg/mmol	UK CKD Interpretation	Approximate dipstick equivalent	Comment
<15	Normal	Negative	Normal
16 - 44	Trace Protein	Trace	Trace Proteinuria
45 - 100	Clinical Proteinuria or	1+	2 or more PCR results >45, in the absence of UTI, indicates protrinuria
>100	Macroproteinuria	2+	Marked proteinuria
>450	Nephrotic range proteinuria	3+	Nephrotic range proteinuria

Source: UK Kidney Association.

PCR in Pregnancy.

If using protein:creatinine ratio to quantify proteinuria in pregnant women:

- use 30 mg/mmol as a threshold for significant proteinuria
- if the result is 30 mg/mmol or above and there is still uncertainty about the diagnosis of pre-eclampsia, consider re-testing on a new sample, alongside clinical review.
- Source NICE Guideline: Hypertension in Pregnancy, diagnosis & management NG133 . [2019]

Table -2 Thyroid Function Reference Ranges in Pregnancy

Analyte	First Trimester	Second Trimester	Third Trimester
TSH	0.1 – 3.1	0.2 – 3.3 mU/L	0.3 – 3.5
fT_4	10 - 19 pmol/L	10 – 16 pmol/L	9.0 – 15.0
fT_3	3.0 – 3.6 pmol/L	3.8 – 5.4	3.5 – 5.5
Sample Type is serum in all cases			

Ref: Schneider, H.G. AACB 2019.

Profiles Available in Cavan.

Profile	Tests
U&E	Na, K, Cl, Urea, Creatinine
LFT	Tot Protein, Albumin, ALP, ALT, AST, Total bilirubin GGT
Bone	Ca, Po4, ALP, Corrected Ca
Lipids	Chol., Trig., HDL,LDL

Urinary Assays available in Cavan

Urine Assays	Sample	Turnaround time
Albumin/Creatinine Ratio (ACR)	Random Urine	2 Days
Calcium	Plain	2 Days
Creatinine	Plain	2 Days
Sodium	Plain	2 Days
Potassium	Plain	2 Days
Chloride	Plain	2 Days
Microalbumin	Plain	2 Days
Protein	Plain	2 Days

4.2 ASSAYS CARRIED OUT AT OTHER SITES

This is an alphabetical list of the commonly requested external tests. For a more comprehensive list please consult the Eurofins Biomnis Laboratories Test Guide, which has been distributed to all the wards.

Test name	Specimen Type	Bottle colour	Laboratory
Aldosterone (See Note 1)	Serum	Brown	Eurofins
Alpha 1acid Glycoprotein	Serum	Brown	Eurofins
Alpha1 Antitrypsin	Serum	Brown	Beaumont
Aluminium	Plasma	Contact phlebotomy	Eurofins
Amino Acids	Lithium Heparin	Brown	CHI at Temple St.
Amino Acids	Urine	Plain- No Boric Acid	CHI at Temple St.
Ammonia (see note No. 1)	Plasma	EDTA Plasma	Eurofins
Angiotensin Converting Enzyme (ACE)	Serum	Brown	Eurofins

Test name	Specimen Type	Bottle colour	Laboratory
Anti Nuclear Antigen	Serum	Brown	Eurofins
Anti Streptolysin O titre (ASOT)	Serum	Brown	Eurofins
Anti Thyroid Antibodies	Serum	Brown	Eurofins
Anti Tissue transglutaminase	Serum	Brown	Eurofins
Anti-Hepatitis B titre	Serum	Brown	NVRL
Atypical pneumonia screen	Serum	Brown	NVRL
Autoantibody Screen(AAS)	Serum	Brown	Eurofins
Beta 2 Microglobulin	Serum	Brown	Eurofins
C3/C4	Serum	Brown	Eurofins
Caeruloplasmin	Serum	Brown	Eurofins
Carbamazapine	Serum	Brown	Eurofins
Catecholamines (see Note No.1)	Urine	24 hour (See section 1.4.10.3)	Eurofins
Copper	Plasma	Contact phlebotomy	Eurofins
Cyclosporin	EDTA	Red	Eurofins
Digoxin	Serum	Brown	Eurofins
Electrophoresis	Serum	Brown	Eurofins
Endomysial Antibodies	Serum	Brown	Eurofins
Epanutin	Serum	Brown	Eurofins
Epilim	Serum	Brown	Eurofins
Growth Hormone	Serum	Brown	Eurofins
Haemochromatosis Screen (Note 2)	EDTA	Red	Eurofins
Hepatitis A	Serum	Brown	NVRL
Hepatitis B	Serum	Brown	NVRL
Hepatitis B PCR	Serum	Brown	NVRL
Hepatitis BsAg	Serum	Brown	NVRL
Hepatitis C	Serum	Brown	NVRL
Hepatitis C PCR	Serum	Brown	NVRL
IgE	Serum	Brown	Eurofins
Oligoclonal Bands	Serum & CSF	Brown	Eurofins
Phenobarbitone	Serum	Brown	Eurofins

Test name	Specimen Type	Bottle colour	Laboratory
Phenytoin	Serum	Brown	Eurofins
Prolactin	Serum	Brown	Eurofins
PTH	EDTA	Red	MMUH
Rast	Serum	Brown	Eurofins
Renin (see Note No. 1)	Plasma	Purple	Eurofins
Tegretol	Serum	Brown	Eurofins
Testosterone	Serum	Brown	Eurofins
Theophylline	Serum	Brown	Eurofins
Thyroglobulin antibodies	Serum	Brown	Eurofins
Thyroid antibodies	Serum	Brown	Eurofins
TIBC	Serum	Brown	Eurofins
TORCH Screen	Serum	Brown	NVRL
Toxicology (Blood)	Serum	Brown	National Poisons Centre
Toxicology (Urine)	Urine	Plain – no boric acid	
TSH Receptor Antibodies	Serum	Brown	Eurofins
Valproate	Serum	Brown	Eurofins
Zinc	Plasma	Contact phlebotomy	Eurofins
Urine assays	**Specimen Type**	**Bottle**	**Dept**
Bence Jones Protein.	Urine (Early morning)	Plain- No Boric Acid	Eurofins
Cathecholamines &VMA	Urine	24 hr. Urine – (See section 1.4.10.3)	Eurofins
Drugs Of Abuse	Urine	Plain- No Boric Acid	Beaumont
Metabolic Screen	Urine	Plain (& merthiolate)	CHI at Temple St.
5’ HIAA	Urine	24 hr. Urine – (See section 1.4.10.3)	Eurofins

Test name	Specimen Type	Bottle colour	Laboratory
Organic Acids (see Note 1)	Urine	Plain- No Boric Acid	CHI at Temple St.

Notes:

1. Frozen specimen, send directly to laboratory for separation.
2. For Haemochromatosis Screening, a completed consent form, available from Eurofins Biomnis., is required. This is downloadable from https://www.eurofins.ie/biomnis/, under Test Information and Test Request/Consent Forms. This form is also available on the Pathology Laboratory Intranet Page, under 'Useful Links'
3. A more comprehensive test guide is available from https://www.eurofins.ie/biomnis/, and follow the links to the online test guide.

4.3 ANTIBIOTIC ASSAYS

Amikacin, Gentamicin, Vancomycin and Tobramycin assays are performed in Biochemistry and are analysed during routine and out of hours service seven days a week.

4.4 TUMOUR MARKER REQUESTING – USER GUIDELINES

Tumour markers covered by this guideline:
CEA, CA-125, CA15-3, CA 19-9, AFP, HCG, PSA

Indications for measurement
All requests must be supported by adequate clinical details.

Medical Oncology, Gastroenterology and related teams	For the monitoring of established malignancy For the monitoring of cirrhosis, chronic liver disease, and certain premalignant conditions For the investigation of Cancers of Unknown Primary Origin (ESMO/NCCN suggested panel: hCG, AFP, PSA, CA 125, CA 15-3)
Gynaecology	CA-125 for Ovarian tumours
Surgical Oncology	For the investigation of pancreatic tumours and chronic pancreatitis

Clinically justified orders for tumour markers will be accepted from any clinical user where the clinical details meet the above criteria. Other requests need to be discussed on a case by case basis and will not be analysed where a clear indication is lacking.

NB: Any request which does not fulfil the agreed criteria for tumour marker analysis will not analysed on the day that it is received. These samples will be separated and stored appropriately, for up to 3 months so that they may be analysed at a future date, should the requesting team return with additional information which supports the agreed clinical indications.

Sample Requirements and Stability
Serum samples are required. Samples should be sent to the laboratory as soon as possible after phlebotomy. Samples left unseparated overnight will be unsuitable for analysis. Free PSA is unstable so Free:Total PSA ratio will only be available on samples received within 3 hours of blood taking.

Requesting Tumour Markers:

The following indications are generally recognised in the international literature:-

Marker	**Indication**		
***CEA**	Colorectal cancer: • Staging/Prognosis • Detecting recurrence • Monitoring therapy • Screening for Liver Mets	Breast cancer: • Prognosis • Monitoring therapy	Ovarian cancer: • If CA 125 is not elevated at diagnosis
CA 125	Ovarian cancer: • Staging/Prognosis • Detecting recurrence • Monitoring therapy		
CA 19.9	Pancreatic Cancer • Prognosis • Monitoring post surgery (may be useful in conjunction with diagnostic imaging)		Ovarian cancer: • If CA 125 is not elevated at diagnosis
CA 15.3	Breast cancer: • Monitoring therapy		
AFP	Germ Cell Tumour: • Diagnosis • Staging/prognosis • Detecting recurrence • Monitoring therapy	Liver tumour: • Monitoring high risk patient	
hCG	Germ Cell Tumour: • Diagnosis • Staging/prognosis • Detecting recurrence • Monitoring therapy		
PSA	Prostate cancer: • Screening • As an aid to DRE • Prognosis • Monitoring for recurrence		

NB: Other Criteria:

- *CEA may also be useful in selected Oncology patients with a diagnosis of prostate, lung and some non-colon malignancy.
- For the investigation of Cancers of Unknown Primary Origin ESMO/NCCN suggested panel: hCG, AFP, PSA, CA 125, CA 15-3
- hCG diagnosis and monitoring of molar disease
- All requests for a specific marker, where there is known or relevant pathology indicated by clinical details, e.g. HCG and AFP with clinical details "Testicular mass detected", should be analysed
- Any other requests, not fitting these criteria, need to be discussed on a case by case basis and will not be analysed where a clear indication is lacking.

4.5 REPRODUCTIVE ENDOCRINOLOGY

Follicle Stimulating Hormone (FSH), Luteinising Hormone (LH), Oestradiol (E2) and Progesterone (Prog)

Woman with a Menstrual Cycle:

Ideally LH, FSH and Oestradiol samples should be taken on day 3 or 4 of the cycle to obtain the best information about ovarian function. Follicular FSH levels tend to rise as a woman gets older and ovarian reserve diminishes and levels may be a little higher than the quoted reference range even in ovulatory cycles. In the early follicular phase of the cycle FSH should be slightly higher than LH. If LH is much higher than FSH at this stage it suggests the possibility of polycystic ovary disease particularly if there is oligoamenorrhoea.

Progesterone should only be measured in the mid-luteal phase to assess ovulation. In a 28 day cycle the mid-luteal time occurs around days 21 to 24 of the cycle. In women with a longer regular cycle, if ovulation occurs, it is later and can be estimated based on the fact that ovulation usually occurs approximately 14 days before the first day of the next cycle. In women with oligoamenorrhoea assessing ovulation is more difficult.

Amenorrhoea (non-pregnant):
LH, FSH and Oestradiol cannot be timed however, when interpreting the results, it is useful to check whether or not the woman has had a period since the blood test was taken when interpreting the results. There is no point in measuring a progesterone level as women with amenorrhoea are not ovulating.

Menopause:
The menopause is a clinical diagnosis and there is no diagnostic blood test. Menopause is defined clinically as 12 months of amenorrhea in a woman over age 45 in the absence of other biological or physiological causes. The average age at menopause is approximately 51 years. Serum FSH concentrations increase across the menopausal transition, but at times may be suppressed into the normal premenopausal range (after a recent ovulation).

4.6 CARDIAC INVESTIGATIONS

Cardiac Troponin (cTnI or cTnT) is the marker of choice for diagnosing myocardial infarction(MI). cTnI is available in the biochemistry department:

Rule-in MI:	Measure cTnI 4 - 6 hours post onset of symptoms (at presentation if time of symptom onset unknown). A repeat cTnI may be required after a further 4 to 6 hrs. While cTnI is cardiac specific it is not diagnostic so 2 to 3 measurements at timed intervals may be necessary to confirm an MI
Rule-out MI:	cTnI at 12 to 24 hrs. post event is advised

NB: CK, AST and LDH may be requested individually where appropriate. AST and LDH are most commonly requested in the investigation of haematological malignancies and CK for possible rhabdomyolysis or muscle disorders.

4.7 eGFR IN CHRONIC KIDNEY DISEASE

The Chronic Kidney Disease classification is as follows:

Stage	Description	
1	"Normal" GFR	**e**GFR >90 ml/min/1.73 m^2 with other evidence of chronic kidney damage*
2	Mild impairment	**e**GFR 60-89 ml/min/1.73 m^2 with other evidence of chronic kidney damage*
3A	Moderate impairment	**e**GFR 45-59 ml/min/1.73 m^2
3B	Moderate impairment	**e**GFR 30-44 ml/min/1.73 m^2
4	Severe impairment	**e**GFR 15-29 ml/min/1.73 m^2
5	Established renal failure	**e**GFR <15 ml/min/1.73 m^2 or on dialysis

*** "Other evidence of chronic kidney damage" may include:**

- Persistent microalbuminuria or persistent proteinuria (in absence of UTI)
- Persistent haematuria (after exclusion of other causes, e.g. Urological disease)
- Structural abnormalities of the kidneys demonstrated on ultrasound scanning or other radiological tests e.g. polycystic kidney disease, reflux nephropathy and/or Biopsy proven chronic glomerular nephritis

NB : Without other evidence, a GFR >90/ml/min **does not indicate CKD**.

Facts about the MDRD eGFR:

- eGFR will be reported in mL/min/1.73m^2. Since the MDRD formula underestimates GFR in patients with normal or near normal kidney function, eGFRs of ≥90 mL/min/1.73m^2 will be reported as >90 mL/min/1.73m^2.
- eGFR is not valid in patients with rapidly changing renal function e.g. acute renal failure. Plasma creatinine should be monitored in these patients.
- The MDRD eGFR calculation was validated in Caucasian and Afro-Caribbean patients with renal disease in the USA. Individuals of Afro-Caribbean origin have a higher muscle mass so the eGFR should be **multiplied by 1.21** for these cases. Although it has not been validated for all ethnic or population groups, the eGFR has been accepted for use in white and South Asian populations.
- MDRD eGFR has NOT been validated for calculating drug doses.

- Creatinine clearance with timed urine collections is still required for measuring GFR in certain circumstances:
    - Extremes of body size and age e.g. severe malnutrition or obesity, elderly, children < 18 years
    - Pregnancy, Vegan diet, Creatine supplements, Oedematous states
    - Skeletal muscle disease e.g. muscular dystrophy, paraplegia, quadriplegia, amputee
    - Prior to dosing with nephrotoxic/chemotherapy drugs
- Microalbuminuria is still the gold standard for detecting early renal disease in patients with diabetes mellitus.
- ***eGFR formula varies slightly depending on the method used to analyse creatinine.***

4.8 SHORT SYNACTHEN TEST

Indication:

- Diagnosis of primary adrenocortical insufficiency.
- Diagnosis of Congenital Adrenal Hyperplasia (CAH). (17 (OH)-progesterone is also measured in this case).

If the basal (i.e. 8am) cortisol is **>450 nmol/**L then adrenal insufficiency is **excluded.** If the basal (i.e. 8am) cortisol is **<80 nmol/L** then adrenal insufficiency exists and there is no need to do a Short Synacthen test in these settings.

Contraindications:

- Pregnancy: It is not advised to perform the Short Synacthen test (SST) during pregnancy. If patient is of child-bearing age, please confirm patient is not pregnant
- Hypersensitivity to Tetracosactide and / or ACTH or to any of the excipients
- Manufacturer states contraindicated in allergic disorders, e.g. asthma. See position statement of Society of Endocrinology Sept 2011
- Avoid in ICU and critically ill patients. Assessment of salivary cortisol may provide an alternative option but should be discussed in advance with the Consultant.

Adverse Effects:
Hypersensitivity reactions- tend to be more severe in patients susceptible to allergies and may include injection site reactions, dizziness, nausea, vomiting, utricaria, pruritis, flushing and dyspnoea.

What you need:

- Tetracosactide (SynACTHen®) 250 microgram vial (Order in advance through Pharmacy)
- One I.V. cannula and adhesive (if administering Tetracosactide (Synacthen®) intravenously, a second IV cannula is required)
- NaCl 0.9% 10ml ampoules (IV line flushes)
- Serum blood tubes x 3
- Serum blood tubes (white for 17 (OH)-progesterone, if applicable).
- One EDTA tube (pink) for ACTH. Must be taken in cold gel bag and transported to the Clinical Biochemistry Laboratory immediately
- Syringes

In the unlikely event of an adverse issue, ensure resuscitation equipment is available close by.

Pre-Procedure Notes:

- Discontinuation of OCP/HRT for 6 weeks prior to testing is recommended. If this is not possible discuss with Consultant Clinical Biochemist (contact through Cavan Hospital switchboard).
- Prednisolone and hydrocortisone will cross react in the assay and should be stopped for at least 24 hours before testing.
- Enquire about history of asthma or other allergic disorders (contraindications as per Society of Endocrinology Guidelines)
- Enquire if any previous untoward reaction to Synacthen and avoid in these patients.
- There is no requirement for fasting. Ideally, perform the test between 8 and 10 am and no later than 12 midday.
- Take samples for baseline ACTH (ETDA bottle, ***must go to lab in cool gel bag immediately***) and basal serum cortisol (time 0)
- Maintain patency of indwelling IV line by flushing with 2 ml NaCl 0.9% (from NaCl 0.9% ampoules) each time blood sample is taken. Prior to taking blood samples, withdraw 2 ml of blood and

discard this blood sample to ensure that the dead space is removed prior to obtaining blood samples

Procedure:

1. Wash hands
2. Take samples for basal ACTH and serum cortisol as outlined above
3. Administer 250 microgram Tetracosactide (Synacthen®) at time 0 (IM is preferred). If using the IV route, you will need separate IV access to the indwelling cannula for blood draws and flush with 2 ml of NaCl 0.9%
4. Take further samples for plasma Cortisol levels at 30 minutes and 60 minutes post Synacthen injection.
5. If Congenital Adrenal Hyperplasia (CAH) is suspected, request and take blood samples for 17(OH) progesterone at times 0 (baseline), 30 minutes and 60 minutes.

	Std SST	**Std SST**	**SST for Dx of CAH**
Time (minutes)	**Plasma Cortisol**	**ACTH**	**17 (OH) P**
0	X	X	X
Inject 250 microgram tetracosactide (SynACTHen®) IM/IV			
30	X		X
60	X		X
Total number of blood bottles	3 Serum tubes (for cortisol), +/- 3 white serum tubes for 17(OH) prog, 1 EDTA tube (for ACTH)		

Interpretation of results:

- Normal cortisol response following Synacthen stimulation is >450 nmol/L Abbott Alinity assay at 30 minutes, if test is performed in the morning. (Consider diurnal variation if test is performed later in the day). Interpretation based on stopping OCP/HRT 6weeks before testing
- An increment of >150 nmol/L is expected
- An abnormal response confirms adrenocortical failure but does not indicate whether the adrenal failure is primary or secondary

- Serum ACTH will be raised in primary adrenocortical insufficiency and low in secondary failure (normal ACTH <46ng/L)
- Interpretation of results of SST for the investigation of CAH – Refer to Consultant Clinical Biochemist

Assay methods:
Cortisol is measured by Abbott Alinity method which cross reacts as follows:

  - Prednisolone: 12.3 %at a concentration of 1 microgram/ml
  - Fludrocortisone: 36.6% at a concentration of 10 microgram/ml

ACTH is sent to Euofins for analysis.

If you have any queries, please contact the Clinical Biochemistry Laboratory or the Consultant Clinical Biochemist through the Cavan Hospital switchboard.

4.9 REPORTS

When results have been validated they are available through the ward look-up facility.

- Note: Calcium level may be reported when not requested in the event of a high Potassium result. This occurs as we measure Calcium as a check for EDTA contamination on all samples with Potassium results > 6.8 mmol/L.

4.10 SAMPLING TIMES FOR THERAPEUTIC DRUG MONITORING (TDM)

Trough levels are preferable for TDM, that is, sample immediately prior to the next dose. Samples for Lithium measurement should be taken 12 hours post dose.

Gentamicin:

Dose	**When to do levels**	**Target level**	**How often to repeat levels**
Once daily dosing	Prior to 2nd dose	<1mg/L	Every 3 days (if renal function is normal) or 24 hours after any dose change
Multiple Daily Dosing	Trough and peak at 3rd or 4th dose Trough immediately before dose and peak 60 minutes post infusion/bolus	**Trough**:<2mg/L (<1 mg/L for endocarditis) **Peak**: 5-10mg/L (3-5 mg/L for endocarditis)	Every 3 days (if renal function is normal) or 3 doses after any dose change

4.11 SAMPLE STORAGE

Samples are stored for a of maximum 7 days, (3 days for Hba1c) We try to facilitate add on requests as far as possible within the constraints of sample volume, sample type and the in vitro stability of individual analytes. Please reference section 12.3 on page number 136 for details of time limits for requesting additional examinations.

4.12 EXTERNAL QUALITY ASSESSMENT

The department participates in relevant, third party quality assessment schemes. This includes schemes operated by:

- WEQAS (Welsh External Quality Assessment Scheme)
- NEQAS (National External Quality Assessment Scheme, UK)
- IEQAS (Irish External Quality Assessment Scheme)
- RIQAS (Randox External Quality Assessment Scheme)

The Department is committed to ensuring comprehensive external assessment of the test repertoire.

4.13 POINT OF CARE TESTING.

The laboratory offers support for the following point of care devices in Cavan General Hospital.

- Siemens Rapid Point 500e Blood Gas Analysers.
- Roche Accu chek Inform II glucometers
- Roche Urisys Urinalysis Meters.
- Abbott Optimum Neo Ketone Meters

The POCT coordinator manages the EQA schemes, instrument access password provision and troubleshooting for these instruments. Training for the glucometers is provided by the supplier on a regular basis. Training in the use of the blood gas instruments is provided by the Siemens Training Co-ordinators and POCT coordinator at the bi-annual induction days for medical staff, and on an ad hoc basis by appointment.

The post of POCT co-ordinator is a single handed position. The biochemistry staff will advise on problems with POCT instruments in the absence of the POCT co-ordinator, however some problems may have to be deferred until the co-ordinator's return.
Anyone requiring a password to allow for usage of Ward based Glucometers can contact Coker Adediran, Deidre Lambe or Cathal McLoughlin in the Laboratory EXT 6357/6416/6357, Monday to Wednesday 9AM – 1PM only.
The Point of Care service is currently available 9am to 5pm, Monday to Friday.

4.13.1 Reference Limits Including Their Origin

Parameter	Arterial [1]	Venous [2]	Neonatal Capillary[2]
pH	7.320–7.450	7.32 -7.450	7.32 – 7.450
H^+	47.9–35.5	47.9–35.5	47.9–35.5
pCO_2 (kPa)	4.27–6.40	5.5 – 6.8	3.79 – 6.49
pO_2 (kPa)	11.07–14.40	4.0 – 5.33	4.37 -8.15
Na^+ (mmol/L)	136 – 145	136 – 145	
K^+ (mmol/L)	3.4 – 5.1	3.4 – 5.1	
Cl^- (mmol/L)	98 - 107	98 - 107	
iCa^{++} (mmol/L)	1.15 - 1.33	1.15 - 1.33	1.06 – 1.34
Glu (mmol/L)	4.1 - 5.6	4.1 - 5.6	2.1 – 5.3
Lac (mmol/L)	0.36 -1.39	0.36 -1.39	1.4 – 4.1
Bicarb (mmol/L)	19-24[2]	22-26	
tHb (g/dL)	12.0- 17.5		14.5 – 23.4
$Hct_{(c)}$ (%)	35 - 51		
O_2Hb (%)	94.0 - 98.0		
COHb	0.5 - 1.5		
MetHb	0.0-1.5		
HHb (%)	0.0 - 5.0		
sO_2 (%)	95 - 98.0	~75	
$HCO_3^-(c)$(mmol/L)	22.0 - 26.0	23 - 29	22 - 26
BEecf (mmol/L)	-2.0 - 2.5	-3.0 - +3.0	
nBilirubin (umol/L)			102 -136.8 (Neonate <1 day)[1] 136.8 – 205 (Neonate 1-2 days)[1] 205 – 273.6 (Neonate 3-5 days)[1] 5.13 -34.2 (adult)[1]

1. Tietz NW, Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics, 7th Edition, C. Burtis and D. Bruns; Elsevier Saunders, 2015.
2. Tietz NW, Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics, 4th Edition, C. Burtis and D. Bruns; Elsevier Saunders, 1995

5 MICROBIOLOGY DEPARTMENT

5.1 GUIDELINES FOR PROPER SPECIMEN COLLECTION & TRANSPORT

- Collect specimen before administering antimicrobial agents when possible
- Use sterile containers and aseptic technique to collect specimens to prevent introduction of microorganisms during invasive procedures. Where present, submit pus for analysis, not swabs of pus.
- Collect an adequate amount of specimen, or the test may not be performed. Inadequate amounts of specimen may yield false-negative results.
- Transport specimens to the laboratory as soon as possible.
- Notify the laboratory in advance if special tests are requested or if unusual pathogens are suspected.

5.1.1 Microbiology Ward CPE Screening

When sending Microbiology ward CPE screens to the Microbiology laboratory use **ONLY** the **Microbiology Ward CPE Screening Template** (LF-MICRO-0104) and **MedDX specimen bags**, both of which can be supplied by the Microbiology laboratory.
Attach no more than six addressographs per sheet and enclose no more than six swabs per specimen per bag.
If a ward CPE screen is received in the Microbiology laboratory in any other format other than described above it will be returned to source for amendment before processing.

5.2 REPORTS

Telephone requests must be kept to an essential minimum in the interest of safety, as verbal reports may lead to transcription errors. CSF direct examinations and Blood culture Gram stain results will be phoned. If requested to do so or if the request form is marked ***please phone*** then urine direct examinations, gram stains and pregnancy tests will be phoned.

NOTE: Please note that microorganisms take some time to grow ***(from 18 hours to a few days)***, therefore "instant results" on cultures are not possible on the same day. However direct microscopic examination and Gram stain may be available on the same day, where appropriate.

Turnaround Times (TAT):
Turnaround times for microbiology samples will vary depending on site and organisms grown e.g. Blood Cultures are routinely kept for 5 days but in cases of suspected Bacterial Endocarditis (BE) samples are cultured for up to 3 weeks. For most routine specimens for C/S, results are usually available after 48-72 hours, but may take longer if slow growing organisms are isolated or mixtures are present. Interim reports will be issued once available. These will be clearly marked 'Interim Report' and will be superseded by the final report once issued.
The laboratory endeavours to communicate results of:

- CSF cell counts and stains immediately, within two hours of receiving the specimen.
- Blood Cultures gram stains within 2 hours on the sample becoming positive

For positive cultures, organisms identified by Maldi TOF will be available on the LIS ward enquiry system within 18 hours, or as soon as the organism has grown sufficiently to be identified.

The table below lists the maximum TAT for various microbiology tests, however in many instances the TAT is significantly less than stated.

Sample/Test	**Turnaround Time (TAT)**
Urine Microscopy	24 hours
Urine Culture	7 days
Swabs/Fluids/Tissue for C/S	7 days
Faeces	5 days
Blood Culture (Routine)	6 days
Blood Culture (BE)	22 days
Respiratory Samples	4 hours
CSF Culture	3 days
Urinary Antigens	24 hours
HIV Antibody/Antigen	24 hours

5.3 REASONS FOR REJECTING SPECIMENS FOR BACTERIOLOGICAL EXAMINATION

1. Specimens submitted in an unsterile container.
2. Tissue/specimen received in formalin or any fixative.
3. Specimens which have leaked or where the container has been damaged during transport to the laboratory.
4. Blood cultures that have been refrigerated.
5. Insufficient quantity of specimen, depending on specimen
6. Labelling of form and/or specimen does not meet our acceptance criteria as detailed on page 10
7. Prolonged specimen transport time - specimen dependant.
8. Sample where Gram Stain indicates poor quality e.g. sputum.
9. Samples requiring prior booking with the laboratory that arrive without arrangement
10. Samples not meeting the testing criteria e.g. samples for *C. difficile*, nasal swabs and Ova and Parasites testing
11. Urine samples not received in monovette containers.

This Department provides a routine diagnostic service for General Microbiology investigations except for:
T.B. Bacteriology: are sent to **St James Hospital** TB Laboratory. At least three consecutive samples are required, preferably early morning samples. Where routine culture and TB analysis are both required, two samples and two forms must be sent.
Mycology: are sent to Biomnis Laboratories or Public Health Mycology Reference Laboratory
Virology: The majority of molecular and serological tests for viral pathogens are referred to by the National Virus Reference Laboratory (NVRL) for analysis. While seasonal on-site testing includes influenza, norovirus, and HIV, all requests are subsequently referred to the NVRL for confirmation. Please contact the laboratory for the specific transport media. For serological diagnosis, paired sera are required. See NVRL user manual for more details (available in laboratory, at ward desk or at https://nvrl.ucd.ie/usermanual)
Specific Aptima specimen collection containers are used for Chlamydia testing.

Surveillance:
The Microbiology Laboratory participates in a number of local, regional and national surveillance initiatives including EARSS, CIDR and service-specific audits of clinically significant organisms. The Cavan and Monaghan Hospital Surveillance Program is co-ordinated by the Surveillance Scientist.
Laboratory screening of patients for resistant bacteria is a vital part of infection control e.g. MRSA,CPE,VRE etc. A schedule of such screening and advice on who to screen and how is available from the Infection Prevention and Control Team (IPCT) at extension 6916.

5.4 METHOD FOR COLLECTION OF SPECIMENS

5.4.1 Blood Cultures

Collect three sets of blood cultures per febrile episode; separate each set by at least 1 hour from the previous specimen, if bacterial endocarditis is suspected. This provides maximum recovery of organisms in patients with intermittent bacteraemia. In all other cases of suspected sepsis, a minimum of 2 sets of blood cultures is indicated.
Adults: 2 bottle system: 10mls of blood is added to both the aerobic and anaerobic bottles.
Paediatric: A single bottle paediatric version is available (minimum volume 0.5 mls) 1 - 5mls of blood is added to this bottle.
Please include all relevant clinical information particularly current or intended antibiotic therapy. All positive Gram stains are telephoned to wards and to the Consultant Microbiologist, and documented in the lab. Cultures are incubated for 5 days but suspected BE or Brucellosis cultures are kept for 21 days. Both systems are capable of supporting the growth of pathogenic bacteria, yeasts and fungi. Please indicate if prolonged incubation is required as above.

Note: Cultures are continuously monitored for signs of positivity once loaded onto the Bactec system. It is imperative, therefore, that bottles be taken directly to Microbiology and put immediately onto the machine. Significant delays (more than 4 hours) between collection of blood cultures and initiation of incubation will prolong detection times. Bottles must not be sent in the pneumatic chute system. Instructions on loading bottles onto the machine are available in the laboratory

5.4.2 C.S.F. Samples

The single most important factor in the prognosis of meningitis is the rapidity with which the diagnosis is made. It is advisable, therefore, that the Microbiology Dept is notified **in advance**, and that samples are handed directly to a member of the Microbiology staff.
Samples are routinely cultured and checked for:

- Appearance,
- WCC, RBC, (and a WCC differential if indicated)
- Protein, Glucose,
- Xanthochromia, and
- Organisms on Gram stain.

Where molecular testing is requested on any CSF with a raised white cell count, the request will be screened by the Consultant Microbiologist for suitability prior to processing in the laboratory.
Supplementary testing may be carried out on the FilmArray Multiplex PCR Machine if testing criteria are met or by advice of the Consultant Microbiologist.
In order to optimise the chances of obtaining an isolate for antibiotic sensitivity testing, grouping and typing, take a throat swab (a full sweep of the pharyngeal wall and tonsils) in all patients where *N. meningitidis* is suspected, and an EDTA blood specimen for PCR and send to Children's Health Ireland at Temple Street accompanied by a Temple Street Request form. These are examined Mon - Fri at 11.00 hrs. Specimens may be sent at any time, and will be refrigerated until the next run.
NOTE: Samples for PCR that are marked 'hold in Lab' will be kept for 48 hours after which the sample will be discarded.
Samples for PCR will be sent to the reference laboratory with next available routine transport.

Please note that where additional testing of CSF samples is requested, the following minimum volume must be sent: TB culture – 2 x 0.5 ml; TB PCR – 2 x 0.5 ml; Viral PCR - 1ml; Oligoclonal bands - 1.0 mls and a simultaneous serum blood sample. Please ensure relevant forms are submitted also.

In a patient with a petechial or haemorrhagic rash, skin scrapings/needle aspiration may be taken for microscopic examination.

Normal CSF values:

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

These values represent the approximate upper and lower limits of normality and are for guidance only

5.4.3 Non-culture Methods of Diagnosis in meningitis/encephalitis/ neonatal sepsis.

CSF and Blood for PCR, paired serum specimens for serology, Viral culture and TB Culture are sent to Dublin and must be accompanied by the appropriate forms.

Note: only CSF samples with an elevated WCC will be sent for TB Culture
If cytology for malignant cells is required, please submit a specific cytology request form.

PCR for the detection of Group B streptococcal DNA with suspected sepsis and/or meningitis: Group B Streptococcal PCR and PCR for *E. coli* from CSF may be requested handwritten on current IMMRL request forms. EDTA and CSF are the acceptable samples and the cut-off time for receipt of samples in Chidren's Health Ireland at Temple St is 11.00am Monday to Friday.
NOTE :PCR for E. *coli* from EDTA blood samples is available by special request only.

5.4.4 CSF Samples for CJD

Always notify the Microbiology Dept. (Ext 6053) when a CSF sample is to be sent for 14.3.3 protein analysis for the diagnosis of suspect CJD. CSF samples for 14.3.3 are referred to Beaumont and should be frozen down to -70°C within 30 minutes of aspiration of the sample, so it is essential to hand deliver the sample to the Laboratory so arrangements can be made. NOTE: Specimens will not be processed by Neuropathology in Beaumont Hospital without a fully completed questionnaire (LF-NCJD-CSF Questions- available form Microbiology).

5.4.5 Faeces

Samples that take the shape of the container are routinely examined for Salmonellae, Shigellae, Campylobacters, *VTEC*, Cryptosporidium spp., *Giardia lamblia* and *C. difficile* (on samples that take the shape of the container and patients that are over 2 years old) using the Enteric Bio platform. Samples are routinely examined for Rotavirus and Adenovirus in children under 5 years. Cultures for Yersinia and Vibrios are available on request.

Please note: Clostridium difficile is associated with a history of antibiotic use and significant diarrhoea. Please indicate antibiotic used and its duration of use on the request form.

Patients with symptomatic *C. difficile* infection (CDI) almost always have **diarrhoea**, defined as at least **3 unformed or watery stools** in a 24-hour period. Most patients have more than 3 episodes of watery, foul-smelling, stools per day. Other clinical features consistent with CDI include abdominal cramps, fever, leukocytosis, and hypoalbuminemia.

- Specimens that do not take the shape of the container are rejected
- Testing is restricted to one specimen in 3 days.
- Test of cure specimens will be rejected.
- Tests on patients < 2 years will be rejected.

5.4.5.1 Specimen Collection and Transport

Only patients with diarrhoea should be tested for CDI. Stool specimens should be collected in a clean container with a secure lid, labelled , and sent to the laboratory as soon as possible after collection. Specimens that are **liquid or soft**, that is, take the shape of the container are acceptable. **Specimens that are formed or hard ("moon rocks") will be rejected.** Patients may be colonized with toxin-producing *C. difficile* strains that are not causing active disease; therefore it is not recommended that formed stool be tested or that positive results on formed stool be treated. Such treatment has not been demonstrated to prevent subsequent CDI and may even lead to the development of CDI as therapy with both metronidazole and oral vancomycin have been associated with CDI. **Rectal swabs and fluid obtained at colonoscopy are not acceptable.**

5.4.5.2 Results and Interpretation of C. difficile results by PCR

The PCR assay detects the toxin B gene. Therefore the reports will refer to whether the toxin B gene has or has not been detected. It is important to recognize that detection of *C. difficile* DNA by NAAT does not confirm that toxin is being produced and therefore positive tests may occur in patients who do not have CDI. In this instance interpretation of positive NAAT test results should be correlated with the clinical presentation (i.e. the presence or absence of symptoms in the patients).

5.4.6 Ova and Parasites

A full parasitology screen is available on request. However, ova and parasite investigations are difficult and time consuming. Very few samples show positive results. Therefore, only request these when there is a clear indication and state clinical details on the request form. Please include all relevant epidemiological details including history of foreign travel.

Send stool for ova, cyst and parasites. For Enterobious vermicularis ova ***(Pinworm infection)*** a "sellotape slide preparation" is required. ***(Detailed instructions available from Microbiology Dept)***. The specimen is best obtained between 22.00hr and midnight or early in the morning, before defaecation or bathing. Wear gloves during the

procedure and wash hands and nails thoroughly. Transport specimens for processing as soon as possible.
Ova and parasites should be requested when there is a high index of suspicion. The following are the guidelines for requesting Ova and Parasites:
Please note that these samples are not processed within Cavan General Hospital but are referred to Eurofins Biomnis for analysis. See section 8 for details.
Submit one stool sample if:

Persistent diarrhoea > 7 days;
OR patient is immunocompromised
OR patient has visited a developing country.

5.4.7 Faecal Occult Blood (FOB) test.

Before and during sampling: Even if there are no dietary restrictions necessary it is recommended to eat foods rich in roughage (e.g. vegetables, salads, whole grain bread, nuts)before and on the day(s)of sample collection, in order to reveal possible hidden bleeding sources. Please place a portion of the stool sample into each labelled sterile container (blue topped) and return the samples after collecting the last stool sample ,together with the fully completed request form promptly to the laboratory for testing.

5.4.8 Ear Swab

Aspirate (tympanocentesis) may be taken for otitis media; moist swab for otitis externa.

5.4.9 Eye Swab

Collect the specimen by swabbing; pass swab (two times) over lower inferior tarsal conjunctival fornix. Avoid eye lid and lashes. If purulent material is seen collect this on a sterile cotton swab and deliver immediately to the laboratory.

5.4.10 IV Catheter Tip

Clean the insertion site with Chlorhexidine 2% or an iodophor and aseptically remove the cannula after the alcohol has dried. If purulent material presents at the exit site, swab and send for culture. Send the tip of the cannula, approximately 2 inches or 5cm to Microbiology in a sterile container.

5.4.11 Nasal Swabs

It has been shown that nasal swabs are indicated in very few clinical conditions and are only appropriate in the following scenarios:

1. Suspicion of (a) Nasal Diphtheria
   (b) Rhinoscleroma
   (c) Chronic atrophic rhinitis (ozaenia)
2. Investigation of carriage of Group A Streptococci and MRSA
3. Surveillance screening of neonates.

When submitting nasal swabs please complete the clinical details fully on the request form. Only those associated with the clinical conditions mentioned above will be processed. Those not complying with this protocol will be rejected with the comment:
Nasal swabs are indicated in very few clinical conditions. Unable to process sample without adequate clinical details.
Note: In exceptional cases samples may still be cultured following discussion between the requesting clinician with the Consultant Microbiologist.
Insert a sterile swab into the nose until resistance is met at the level of the turbinates approximately 1 inch into the nose. Rotate the swab against the nasal mucosa and repeat the process on the other side.

5.4.12 Neonatal Screening Swabs

The following bacteriological investigations are recommended.

Early-onset sepsis (<48 hours after birth)

"Surface" cultures:	Nasopharyngeal aspirate for RSV detection. Deep ear swab using a swab passed through a sterile speculum. Take this as soon as possible and no later than 6 hours after birth. Umbilical swab Swabs from any focal site of inflammation e.g. septic spots etc. Swabs for MRSA if transferred from other hospital
Systemic cultures:	Blood Culture CSF ***(if clinically indicated)*** ***(Gastric aspirates are potentially misleading)***

The above "surface" cultures also apply to babies with maternal risk e.g. prolonged rupture of membranes in delivery suite. It is useful to refer maternal cultures i.e. high vaginal swabs, blood cultures, amniotic fluid and placental culture, if possible. Placental swabs are generally of limited value and placental tissue is preferred if chorioamnionitis is suspected.

Late-onset sepsis (>48 hours after birth)

"Surface" cultures:	Endotracheal aspirate/secretion ***(in ventilated babies)*** for culture.
	Surface swabs from sites of inflammation e.g. pus from septic spot, umbilical swab if omphalitis, etc.
Systemic cultures:	Blood culture
	CSF (if clinically indicated)
	Urine Suprapubic aspirates (SPA) or clean catch urine (do not delay antibiotic therapy). Please telephone the laboratory if sending a SPA.

5.4.13 Sputum

Instruct the patient to remove dentures, rinse mouth and gargle with tap water and not with antiseptic mouthwash. Instruct the patient to expectorate saliva or postnasal discharge and discard, before expectorating a deep lung sputum sample into a specimen container. Specimens must be submitted in a wide-mouthed container and sent to the laboratory without delay. A first morning specimen is preferred.

Note: Please indicate on form if patient has cystic fibrosis as these specimens require prolonged incubation on selective agars.
Where testing for Legionella is desired, ensure adequate clinical details are provided with the specimen.

5.4.14 Throat Swab

Take a cotton wool swab and, depressing the tongue with a spatula, direct the swab to the back of the throat with the other hand and swab the tonsillar pillars and the oropharynx, rotating the swab as this is done. If pseudo membrane is present, take the swab beneath the membrane or culture a part of the membrane if possible. Place the swab in appropriate transport medium.

Please indicate on form or phone laboratory if *C. diphtheriae* is suspected as selective media must be used for culture. For *Bordetella pertussis* (whooping cough) investigation, a peri-nasal swab is required.

PCR-based assays have become the test of choice for diagnosis of *Bordetella pertussis* due to their exquisite sensitivity and specificity – available from Children's Heath Ireland at Crumlin. See section 8.

Note: Do not take throat samples if epiglottis is inflamed as sampling may cause serious respiratory obstruction.

5.4.15 HVS for culture /Urethral Swab (for N. gonorrhoea and C. trachomatis)

Submitted HVS samples should include the following clinical information to guide laboratory testing: nature of the vaginal discharge, any risk or suspicion of sexually transmitted disease, and associated symptoms.
HVS for culture: After introduction of speculum, roll swab anywhere on vaginal wall to obtain discharge.

Endocervical swab for GC culture: Clean the cervical os with a large sterile swab and discard. Insert a new swab into the endocervix and rotate 360 degrees. Swab the external os 360 degrees if os stenosed.

Specific (Aptima) specimen collection containers are routinely used for Chlamydia and *N. gonorrhoea* testing in Cavan General Hospital and are available from the Laboratory.

Collect the specimen at least 2 hours after the patient has urinated. Insert a thin urogenital swab 2-4cm into the end of the urethra and gently rotate. Leave in place for a few seconds before withdrawing. Throat and rectal swabs may be taken. Chlamydia needs special swabs **(available from Microbiology laboratory)**.

5.4.16 Urine

The Microbiology Department uses an automated urine sediment analyser (Sedimax) to examine urines for the presence of cells and microscopic particles. This platform accepts only monovette type tubes and consequently the Laboratory can only accept monovettes as the primary sample container. Two types of monovettes are available from the Laboratory – those with and those without boric acid as stabiliser. Note: It is vital when taking samples with these tubes that the plunger is withdrawn completely and then snapped off.

The first sample of the day is the best because bacteria will have had an opportunity to grow in the bladder overnight and it is much more likely that significant numbers will be detected in this sample than one collected later in the day. **Paediatric Urines:** The most reliable specimen is suprapubic aspiration. If non-invasive collection is required and mid-stream urine cannot be taken, a Uribag specimen may be submitted after careful preparation of the perineum (see method for mid-stream urine collection below). Urine collected directly from a napkin is not a suitable specimen for microbiological examination. Please indicate on request form if Uribag is used.

The introduction of the Sedimax has permitted 'Negative Screening' of submitted urine samples, as follows:
Samples that have a white cell count ≤40 per cmm and a bacterial cell count ≤150 per cmm will not be cultured and will be reported with the following comment:

> *'This urine specimen has not met the automated CGH laboratory criteria for culture as the WCC is < 40/cmm and bacterial count is < 150 organisms/cmm (or equivalent).*
> *Consultant Comment: Please note that pyuria is defined as WCC >/= 10/cmm. If culture of this specimen is still considered clinically indicated, please contact the laboratory within 48 hours of this report and request culture and sensitivity testing.'*

Note: The Negative Screening procedure will not apply to the following wards: ICU, Paediatrics (including PAU), Maternity/ANC, SCBU, RDU and Oncology. In addition it will not apply to repeat samples which must be clearly marked as 'Repeat'.

Urine samples are most commonly collected by sampling the **midstream** flow by the clean-catch technique i.e. the MSU. Patients seen in a clinician's office or in a clinic are frequently asked to obtain their own urine sample. This practice is acceptable if the patient is given precise instructions for properly collecting the specimen. Remember if not mid-stream the sample may easily be contaminated and make interpretation of results difficult.

1. Complete the request form fully giving all relevant clinical and antibiotic details.
2. Submit samples in boric acid containers (green topped monovettes). It is important to fill these bottles up to the mark indicated.

Mid-stream urine (MSU) specimens are collected as follows:

Male: The glans penis cleaned with soap and water. Micturition is commenced and when a few ml of urine have been passed, a wide-mouthed container is introduced into the stream and from this the monovette container is filled.

Females: If the patient is able to collect urine without assistance from the nursing staff, instruct them as follows:

1. Separate the labia and with cotton wool or a sponge moistened with water, wipe the vulva from the front to the back. Disinfectants must not be used.
2. With the labia still separated allow some urine to pass into the toilet, and then, without stopping, allow some to pass into a sterile container.
3. Pass the remaining urine into the toilet.

In elderly or very ill patients nursing assistance is required.
Preferably collect the urine in a sterile plastic urine container with Boric Acid preservative (green top monovette) and deliver to the laboratory within one hour of collection. Where this is not possible the specimen can be preserved in a refrigerator at 4°C ***(never frozen)***.

Obtain urine specimens from catheterized ***(CSU)*** patients from a sampling port or sleeve. This must first be disinfected by wiping with a 70% isopropyl alcohol impregnated swab. Allow the area to dry before sampling. Do not take urine sample from the drainage bag as these samples reflect the bacterial count in the bag and not the patient's urinary tract. The person obtaining the specimen must wear gloves and wash hands before donning gloves and after their removal.

Reminder: For TB, early morning urine on 3 consecutive days; minimum of 50 ml of each collection (Containers not filled to the 50ml mark will not be processed .Containers available in the Laboratory).

5.4.17 Wound swabs and samples of pus

If there is any volume of pus present collect it with a syringe into a sterile container rather than onto a swab. The site of origin of the material must be stated. Anaerobes and fastidious organisms die if subjected to delay or dehydration. Use swabs with transport medium.

5.4.18 Legionella

Collect urine samples for Legionella Urinary Antigen in a sterile universal container or yellow monovette with no preservative and send to Laboratory.
Strep pneumoniae antigen test from urine samples is available in Microbiology. Collect urine samples in a sterile universal container or yellow monovette with no preservative and send to Laboratory.

5.4.19 R.S.V.

A rapid assay is available for detection of RSV fusion protein antigen in nasal wash specimens. Collect a nasophayngeal sample using the Nasopharyngeal Sample Collection Kit for viruses (available in Laboratory) and send to the laboratory as soon as possible.

5.4.20 Rapid HIV (Needlestick Injuries)

An on-site, rapid HIV test is available for needlestick injuries only and these specimens (serum or plasma only) must be submitted as soon as possible after exposure. A separate specimen must be submitted for confirmatory testing in the NVRL. Results from tests carried out in the laboratory in Cavan General Hospital will be phoned to the requesting clinician once available.

5.4.21 Norovirus & Influenza

These tests are available on-site during the flu and norovirus season or during hospital outbreaks.
CMH microbiology laboratory will provide an on-site service for the detection of norovirus, influenza and RSV pathogens in relevant clinical specimens from CMH patients (adult and paediatric) which meet certain criteria (see below). Testing will be performed using real-time reverse-transcriptase PCR-based assays.

The provision of this on-site service should result in faster result turnaround times (same day / within 24 hours) thereby enabling timelier clinical and infection control management decisions.

The service will be continued during the relevant 'seasons' only, taking into consideration local needs and national data. The service will not be provided 'out-of-season'.

The laboratory will perform batch testing runs on a daily basis, including weekends. No additional testing will be performed outside of these daily batched runs. Specimens received after 2pm (Monday-Friday) and 12pm (Saturday, Sunday) will not be tested until the following day.

The assays are CE-marked for in vitro diagnostic use and are considered to have excellent performance. Although there have been no issues with local validation, these assays have not been subjected to an accreditation inspection and are not accredited to relevant ISO standards.

<u>Norovirus testing:</u>

During the 'norovirus season', faecal specimens received for pathogen testing that meet the following criteria will routinely be tested for norovirus in the CMH microbiology laboratory:

- Any specimen from ED, MAU, or PAU regardless of specific test requests
- Any specimen from an in-patient ward where enteric viral pathogen testing has been specifically requested
- Any specimen from an in-patient when the hospital is in the midst of a norovirus outbreak (suspected or confirmed), regardless of specific test requests

As per previous, all faecal specimens received where enteric viral pathogen testing has been specifically requested, including those from out-patients, the community and long-term care facilities, will be referred to the NVRL for result confirmation and/or additional pathogen testing. Any specimen where norovirus testing has been performed in CMH will also be referred.

Influenza and RSV testing:

This assay allows for detection of influenza A, influenza B and/or RSV from nasopharyngeal swab specimens from patients with signs and symptoms of respiratory infection.

The nasopharyngeal swab should be collected using the *Nasopharyngeal Sample Collection Kit for Viruses* which can be requested from the CMH microbiology laboratory. **Please note these are different than the 'pink swabs' (*Copan Transystem™ sterile transport swab*) or the *Copan UTM Kit for the Collection and Preservation of Influenza Viruses* that have been previously used in CMH.**

During the 'influenza season', respiratory tract specimens received for viral pathogen testing that meet the following criteria will routinely be tested for influenza and RSV in CMH:

- Any nasopharyngeal swab (*Nasopharyngeal Sample Collection Kit for Viruses* only) OR nasopharyngeal aspirate OR nasal/throat swab (*Nasopharyngeal Sample Collection Kit for Viruses* only) received from ED, MAU, PAU, or in-patient ward
- Any nasopharyngeal swab (*Nasopharyngeal Sample Collection Kit for Viruses* only) OR nasopharyngeal aspirate OR nasal/throat swab (*Nasopharyngeal Sample Collection Kit for Viruses only*) OR tracheal aspirate OR BAL received from an ICU patient where viral studies have been requested

As per previous, all respiratory tract specimens received for viral pathogen testing, including those from out-patients, the community and long-term care facilities, and those taken with viral swabs that were not collected with the *Nasopharyngeal Sample Collection Kit for Viruses*, will be referred to the NVRL.

Individual cases can be discussed with the consultant microbiologist and/or infection prevention and control team where on-site testing for norovirus and/or influenza is considered indicated but the above criteria are not met.

5.4.22 COVID-19/SARS-CoV-2

Send samples for testing to the microbiology laboratory directly, without waiting to batch with other samples. Please note that specimens for testing HAVE TO be packaged separately and not with other samples.
NOTE: Samples being hand-delivered to the laboratory must be placed in the designated, labelled, receptacle at specimen reception.
Sample types accepted for testing (see sampling guidance below):

- Nasopharyngeal **and** Oropharyngeal swabs (two swabs combined or separately) in ambulatory patients **OR**
- Bronchoalveolar lavage (BAL) **OR** Nasopharyngeal aspirate (NPA) **OR** Sputum (if produced) **OR** Endotracheal aspirate is preferred in cases of severe illness

Guidelines for correct specimen collection, as well as indications for testing, are available on the HSE Health Protection Surveillance Centre (www.hpsc.ie)

5.4.23 Other Tests

In addition to microbiological analysis, the following tests are available:
Faecal occult blood
Nasopharyngeal Aspirate (NPA) for RSV

5.5 REPORTING PROCEDURE:

Results of primary cultures are usually available after 24 hours incubation, sensitivities after 48 hours. Sterile cultures are re-incubated for a further 24 hours, and should these be positive, sensitivities will be available 3 days after the first incubation i.e. an additional 24 hours later. Supplementary reports are sometimes issued when extended incubation yields anaerobic organisms.
NOTE: In most cases only a selection of available antibiotic sensitivities are reported by the Lab .Additional sensitivities can be released by contacting the Microbiology Laboratory (Ext 6053) or on discussion with the Consultant Microbiologist (Ext 3146).
For wound/ulcer/skin swabs, sensitivity testing is not performed for particular organisms isolated but the specimen will be held for 5 working days in the laboratory to allow the requester to discuss the requirement for sensitivity testing with the Consultant Microbiologist. Interim reports will be issued once available. These will be clearly marked 'Interim Report' and will be superseded by the final report once issued.

5.6 INSTRUCTIONS FOR SEMEN ANALYSIS (SPERM TEST) FOR INFERTILITY/POST VASECTOMY.

These tests are now performed in the Rotunda Hospital. Arrangements and appointments can be made by contacting the Rotunda Laboratory at 01-8171739.

5.7 MICROBIOLOGY SPECIFIC SPECIMEN CONTAINERS

Refer to section 1.5 above and on the last page this manual

6 HISTOPATHOLOGY & CYTOPATHOLOGY DEPARTMENT

6.1 REQUEST FORMS:

LF-HIST-0051- LF-HIST-0054, LF-HIST-0078 Histology Request Forms must contain the following details.

- Patients name.
- _Address
- Patients Hospital Number.
- Patient's date of birth.
- Consultant's name.
- Examination required
- Date specimen was taken.
- Specimen type(s).
- Ward
- Clinical details.
- Details of where reports (and copy of report) are to go.
- Date/number of previous histology (if relevant).

6.2 SPECIMENS CONTAINERS:

Ensure that the specimens are correctly labelled with the following information:

Necessary: Patients name
Patients Hospital Number
Date of Birth
Specimen type and suffix number (if more than 1 specimen from same patient)

Desirable: Date of procedure on container

When several specimens are obtained at one procedure, list them on one single request form and number them to correlate with the relevant specimen container.

Unlabelled containers or insufficiently completed request forms will NOT be processed and will be returned to their source or retained in the laboratory until completed by the team.

6.3 SURGICAL BIOPSIES:

Fixatives: 10% formalin. - The jar/bucket should be ⅔ filled
In the case of very large specimens, e.g. ovarian tumours, limbs, contact the histopathology laboratory to source a suitable container to ensure the specimen is adequately fixed .
Reports: A written report is issued on 80% of biopsies within 5 working days of receipt of a specimen in the laboratory. 80% of larger, more complex specimens, e.g. appendices, gall bladders, etc. are reported within 7 working days of receipt, as per the national quality assurance benchmark. If there are any queries regarding a specimen, either before or after receiving the histopathology report, please ring the secretaries' office ***(ext. 6293)*** and you will be referred to the appropriate pathologist.
(A) Urgent Biopsies: If an urgent result is required, please indicate this on the request form, with a contact phone number. It is also helpful to telephone one of the pathologists when sending the specimen. Ensure that the specimen reaches the laboratory without delay.

.**(B) Biopsies and surgical resections:**
Ordinarily submit these to the Laboratory in 10% Formalin ***(see below for exceptions)***. Small biopsies will be processed as soon as possible. However, large specimens and some others will be delayed 24 hours to ensure optimal fixation. Tissue blocks are processed overnight and then sectioned and stained the following day so that slides are available for reading about 36-48 hours after receipt.

(C) Bone marrow aspirate & biopsy:
All bone marrow specimens will be sent to the histology department in the Mater Misericordiae Hospital for processing.

(D) Gastro-intestinal biopsy:
Individually label multiple biopsies from the same examination, each in a separate container, each container separately labelled ***(e.g. colon @ 60cm, etc.)***. Clearly list the site of origin of each individual biopsy on a single request form. Number the specimen jars and state these on the request form ***(Do not use multiple request forms)***.

(E) Lymph nodes:
Distinguishing between benign and lymphomatous lymph nodes can be extremely difficult unless the tissue is optimally processed. When lymphoma is suspected, the laboratory must be contacted on the day before the planned procedure. Flow cytometry is carried out in an external laboratory and must be booked with 24 hours notice.

(1) Inform the laboratory/pathologist the day before the lymph node biopsy.
(2) Remove the lymph node intact (not piecemeal).
(3) Submit the lymph node fresh and send by special messenger (as for frozen section) so that touch preparation and optimal fixation can be arranged. Immediate diagnosis on frozen section is not possible.
(4) The sample should arrive by midday, Monday to Thursday.
(5) Handle suspected lymphomatous involvement of spleen and extra nodal tissue similarly.
(6) If metastatic tumour in lymph nodes is suspected, routine histology is appropriate, i.e. fixation in 10% Formalin.
(7) **Should the procedure occur out of hours, the lymph node can be placed in Formalin fixative.**

(F) Specimens for T.B. culture:

(1) Should tuberculosis be suspected, perform the procedure at the end of the theatre list. Inform all personnel involved (medical, anaesthetic, nursing, etc.) of the possible risk. Post-operative decontamination of the theatre equipment will be required.
(2) Should the occasion arise out of hours, the Surgeon may take separate samples placing the sample for histology in Formalin fixative, and the sample for culture in a dry container. It is preferable that discussion with the Pathologist should take place prior to the procedure even if it is out of hours.

(G) Unusual disease and tumours:
Material from rare tumours or unusual diseases is often not optimally studied by routine Formalin fixation and special fixatives or freezing of fresh tissue may be superior, e.g. gout (Uric Acid), glycogen storage disease, mucopolysaccharidoses etc. Discussion with the Pathologist before obtaining tissue from such tumours or diseases is encouraged.

(H) Temporal artery biopsy:
Treat these as other biopsies, i.e. place in 10% Formalin.

(I) Muscle biopsy:
Procedure required for the histopathological examination of muscle biopsies including histochemistry and/or electron microscopy is.

(i) The examination of these specimens is performed by Dr Jane Cryan/Dr. Francesca Brett, Neuropathologists, Beaumont Hospital, Dublin 9.
(ii) Before undertaking muscle biopsy specimens, notify the Neuropathologist and Neuropathology Laboratory in Beaumont Hospital of the planned date and reason for biopsy - phone Beaumont Extn. 2633.
(iii) The biopsy, usually taken by the Surgeons in theatre, should be of adequate size, e.g. 2x1x1cms, children $1cm^2$.
(iv) Place the specimen in a specimen jar on filter paper moistened, not saturated, with normal Saline solution. Please orientate and identify the distal and proximal margins.
(v) Arrange immediate transportation of specimen with an accompanying letter giving full clinical history and examination and reasons for biopsy. The specimen should arrive at the Neuropathology Department, Beaumont Hospital, Dublin within 2 hours of taking and preferably sooner. The specimen should be taken in the morning such that its arrival in Beaumont is not at lunchtime or out of hours.
(vi) Notify the Neuropathology Laboratory in Beaumont Hospital of the pending arrival and contact later, checking that the specimen actually did arrive.

Selection of Muscles:

(1) In general, dystrophic myopathic diseases principally affect the proximal muscles, whereas denervation affects the more distal muscles.
(2) Do not take biopsy from the site of previous electromyography.
(3) Severely atrophic muscle is useless for accurate diagnosis.

(J) Nerve biopsies

(1) The examination of these specimens is performed by the Neuropathologists in Beaumont Hospital, who must be contacted before the procedure is done.
(2) Usually the samples are submitted in formalin after having stretched the nerve over a piece of cardboard (by tying the ends to two pieces of the cardboard).

(K) Referral tests sent from the Histology Laboratory:

Referral tests originate within the Histopathology Laboratory, and the results of these are incorporated into Cavan Pathology Laboratory reports. The list of referral centres is as follows:

Requested Analysis	**Referral Laboratory**
Colorectal Cancer Mutation Panel	Beaumont Histopathology
Lung Cancer Mutation Panel	Beaumont Histopathology
MSI	Beaumont Histopathology
MLH1 Methylation	Beaumont Histopathology
Melanoma Mutation Panel	Beaumont Histopathology
BRAF Mutation	Beaumont Histopathology
Her2 ISH	Poundbury Cancer Institute
PDL1 (Lung and Melanoma)	Beaumont Histopathology
PDL1 (Breast, Gastric and other)	Poundbury Cancer Institute
PDL1 (Gastric)	Poundbury Cancer Institute
Muscle Biopsy	Beaumont Histopathology
Cobas Pic 3a	Beaumont Histopathology
NTRK Fusion	St. James's Hospital
Flow Cytometry	St. James's Hospital
MTHFR Mutation c677T	Eurofins Biomnis
Prothrombin Mutation G20210A	Eurofins Biomnis
SNP Microarray	Eurofins Biomnis
Chromosome Analysis	Eurofins Biomnis

Requested Analysis	Referral Laboratory
Chromosome Y Microdeletions	Eurofins Biomnis
CGH Array	Eurofins Biomnis (Viapath)
Cystic Fibrosis Screen	Eurofins Biomnis
JAK2 Mutation	Eurofins Biomnis

(L) Tissue for cytogenetics (Intra-Uterine Deaths/Neo-Natal Deaths/POCs).

(1) The examination of these specimens is performed by Eurofins Biomnis.
(2) If an infant with a possible congenital abnormality is delivered, it is advisable that samples are taken for cytogenetics.
(3) If the infant is liveborn, take a 5ml ***(or more if possible)*** fresh sample of **heparinised blood.**
(4) If the infant is stillborn, then obtain fresh samples of placental and skin tissue. If this is the case then adhere to **the following procedure**
(5) Written consent from the parents must be obtained for all cytogenetic tests and sent with the sample and request form.

CYTOGENETICS - SAMPLES AND MEDIUM.

A. Medium for cytogenetics studies.

Ham's F10 medium and streptomycin is provided as a storage medium for all solid tissue samples. Store it at 2-6°C **(not frozen)** prior to use. The medium is available in Maternity or alternatively in the Histopathology fridge in the Laboratory. **It is very important that the Maternity ward communicates with the Histology Laboratory. If their supply of medium runs out or if the expiry date on the Medium is reached.** The tubes of medium supplied are sterile, no other additives are required. Please check the expiry date on the medium before using it.

B. Taking the solid tissue samples.

Carry out this procedure using aseptic techniques where possible. Wear gloves, a mask **(if possible)** and use sterile forceps.

Placenta.
Extract the opaque membrane which is combined with the fibrous spongy membrane. Pieces of this opaque membrane should be approximately 1cm in diameter, shaken slightly to displace maternal red blood cells and should then be placed directly into the Ham's F10 medium to prevent them drying out. If in doubt about which pieces of placenta to take, extract a membrane 1cm in diameter and put directly into the medium.

Intact Foetuses.
Following a spontaneous abortion, take skin, muscle, placenta and cardiac or cord blood samples. The skin and muscle samples should be approximately 1mm in depth and at least 5mm in diameter.

Do not swab the area with alcohol prior to taking the samples.

Take at least 1ml of cardiac or cord blood into a **lithium heparin tube.**

Products of Conception.
Unfixed foetal sac and membranes yield good growth. Use a sterile forceps to take samples and place directly into a tube of Ham's F10 medium to prevent them drying out. The foetal sac and other membranes taken should be approx. 1cm in diameter.

(1) Complete the appropriate forms, including a consent form, copies of which should be present in the Maternity Unit. The more clinical information given, the easier it is to interpret abnormal karyotypes.
(2) Adequately wrap and post specimens as soon as possible to Eurofins Biomnis Laboratories. If in doubt contact the pathologist or the Histology Laboratory. Samples must reach the laboratory by 10am for despatch (MONDAY to FRIDAY). There is no service available at weekends and bank holidays.
(3) If the baby is for Post Mortem and this cannot be done quickly, it is advantageous that specimens for Cytogenetic Studies are taken as soon as possible after delivery, in particular, with reference to intra-uterine deaths.
(4) Results may not be available for 6 weeks, awaiting growth and specific karyotypes.

Should foetal tissue or foetuses be identified within the POCs by the pathologist, the specimen will be retained in the laboratory for one year should the parents wish the foetus to be returned for burial. The ward will be notified of the presence of foetal tissue and this will also be documented on the Histology Report.

X-Ray examination intra-uterine deaths/neonatal deaths:
All intra-uterine or neonatal deaths must be x-rayed prior to post mortem examination. Please furnish full clinical information on x-ray request form and liaise directly with radiographers to arrange a suitable time.

6.4 CYTOPATHOLOGY

All Cytology specimens except cervical smears are processed in the Histology Laboratory. A semi-automated liquid-based processor, the Thin Prep processor is used.

6.4.1 Submission

Cytology request forms must contain the following details.

- Patients name.
- Address
- Patients Hospital Number.
- Patient's date of birth.
- Consultant's name.
- Examination required
- Date specimen was taken.
- Specimen type(s).
- Ward
- Clinical details.
- Details of where reports (and copy of report) are to go.
- Date/number of previous cytology (if relevant).

Ensure that the specimens are correctly labelled with the following information:

Necessary:
- Patients name
- Patients Hospital Number
-Date of Birth
- Specimen type and suffix number (if more than 1 specimen from same patient)
- Address

Desirable
- Date of procedure on container

Almost all specimens should be submitted in a container of CytoLyt ***(available from the Histology Laboratory)***. Rinse needle and syringe in CytoLyt fluid and inject into container.



CytoLyt Container

Submit small volumes of fluid in CytoLyt

Turnaround Times
80% of cytology are reported within 5 days as per national Quality Assurance benchmark.

Cervical Smears
If in the screening programme (Cervical Check) the specimen is sent to Quest Diagnostics. Specific request forms are to be used. If the patient is outside the limits of the screening programme the specimen is sent to Biomnis Laboratories. See Section 8. Cervical smear specimens are logged onto the LIS on the external menu.

6.5 AUTOPSIES

The post-mortem room is closed and all autopsies are performed off site. Coroner's cases will be organised by the Coroner. For non-Coronor's cases, contact Administration in Cavan General Hospital.

6.5.1 Coroner's Autopsies:

When asked to pronounce a patient dead, a Physician must ensure that notification of the next-of-kin is undertaken. If the cause of death is known and is due to natural causes, a death certificate may be signed and permission for post mortem obtained from the next-of-kin. However, if the cause of death is unknown or although known is not due to natural causes, the County Coroner's Office must be informed at the soonest opportunity. It is preferable that devices e.g. drains, ETT, urinary catheter, etc., should be left in situ.

CORONER for CAVAN & MONAGHAN SOUTH
DR MARY FLANAGAN, MAIN ST., CASTLEBLANEY, CO MONAGHAN
Work 042-974 6557 Home 042-9749268
Mobile 087-2427668

The doctor must complete a Cavan & Monaghan Coroners Post Mortem Acknowledgement of Information Received document with the next of kin/family and send to the Coroner, ensuring the family have been given a copy.

Deaths reportable to the Coroner pursuant to rules of law include:

- If the cause of death is unknown or if no doctor is willing to sign a death certificate.
- Sudden unexpected or unexplained deaths
- Where a death was directly or indirectly due to unnatural causes, **regardless of the interval between injury and death** - road traffic accident; any accident in the home, workplace or elsewhere; suicide, homicide; burns or carbon monoxide poisoning; physical injuries; drug overdoses or drug abuse; exposure and hypothermia; neglect, including self neglect; starvation ***(including anorexia nervosa)***, poisoning - from any cause; drowning; hanging;

firearm injuries; abuse - irrespective of the duration between injury and death.

- Death resulting from an industrial or occupational disease or accident
- Deaths which are directly or indirectly the result of any surgical or medical treatment or any procedure
- Where there is any allegation of medical negligence, misconduct or malpractice on the part of any doctor, nurse or any other person.
- Where death may be due to homicide or occurred in suspicious circumstances
- A death which may be due to CJD
- Deaths occurring in the Accident & Emergency Department
- Certain deaths which occur in a department of a hospital e.g. radiology department, out-patients, physiotherapy, ECG, EEG etc.
- A death in any public or private institution for the care of elderly or infirm persons
- Any death involving a healthcare associated infection
- Septicaemia which may be caused by an injury
- Death occurring during a surgical operation or anaesthesia
- Abortions ***(other than natural and those outside of the provisions of the Health (Regulation of Termination of Pregnancy) Act 2018)*** and certain stillbirths
- Acute alcoholism/alcohol poisoning
- Deaths connected with crime or suspected crime i.e. suspicious circumstances
- All cases brought in dead or dying within 24 hours of admission.
- All death directly due to medical or surgical treatment or within 24 hours of anaesthesia, surgical procedure or any procedure.
- Death of people referred from institutions such as nursing homes, mental hospitals or prisons.
- Death of a person receiving a disability pension - where death is or may be connected with a pensionable disability
- When the body is to be removed from the state.
- Maternal death.
- Death of a child in care or detention.
- All sudden infant deaths - please follow Emergency Department protocol.

In these cases or when in doubt, inform the Coroner's office and enter a note to this effect in the chart. The Coroner then determines if there is a possibility of unnatural death and has the power to order and autopsy to assist this determination ***(irrespective of the wishes of the next-of-kin)***. **Should the Coroner order a post mortem, permission from the next-of-kin is not necessary and should not be requested.** However, the next of kin should be informed by the clinician that a post mortem is taking place, and what that entails.

6.5.2 Hospital Autopsies

Patients who die in hospital:
It is imperative that the Medical Consultant in charge of the patient's care is consulted before arranging a hospital autopsy. Also inform the consultant before any notification to the Coroner.

Prior to seeking permission for the performance of post mortems in hospital deaths, it must be first determined if there is any reason why the Coroner should be notified. If not or if the Coroner has declined to take the case, obtain written informed consent to perform an autopsy from the next-of-kin using the Consent Forms which are available from Matrons office.
If the deceased had no living relative, consent may be given by the Chief Executive of the hospital or his/her deputy.
Please remember that relatives should not be asked for consent if the death is or has been referred to the Coroner. If the Coroner orders an autopsy to be carried out, relatives are not legally permitted to withhold consent.

Contact Administration to arrange the post mortem.

Produce a detailed Clinical Summary of the patients' history, investigations and suspected diagnosis. Please notify any risks to mortuary and laboratory staff from potentially dangerous infectious disease. If there is thought to be a risk, e.g. jaundice of unknown origin, TB, HIV, the pathologist must be informed directly. In patients with jaundice of unknown origin, where there is a suspicion of infectious hepatitis, it may be possible to carry out a tru-cut biopsy of the liver to

exclude infection before proceeding with the post mortem examination. This will, of necessity, entail a delay.

If a patient has died from a suspected or known potentially dangerous infection, regardless of whether or not a post mortem examination is to be carried out, make this information available to any personnel involved in removal of the body to the Mortuary and to the Mortuary Technicians. Under these circumstances, embalming procedures may be contra-indicated. Consult ***The Guidelines for the Control of Infection in Hospitalised Patients***.

Please do not give the relatives a time for release of the body from the mortuary without first knowing when the post-mortem will be performed .

Foetuses, stillbirths and neonatal deaths: Submit the placentas from all foetuses, stillborn infants and neonatal deaths for examination along with the foetus/infant. Take microbiological swabs before placing the placenta in formalin.

If the foetus/infant exhibits dysmorphic features take samples for cytogenetic studies - see pages 67-68. Do this as soon as possible ***before*** the post mortem examination.

The foetus/infant is kept in the refrigerator in the Quiet Room (Maternity Ward) before and after the post mortem. If any examination requiring dissection and/or histopathological examination is to be carried out on a formed foetus, regardless of its gestational age or how small it is, written consent (using the PM consent form) must be obtained from one of the parents. A full clinical history must also be submitted with the signed consent form and the Pathologist must be contacted.

Important

The post-mortem examination will not be started before the Pathologist has received all the relevant forms which include the signed consent form and clinical summary.

Reports:
A final anatomical diagnosis incorporating information from clinical history, gross and microscopic examination and special studies is produced usually within 6 weeks of autopsy. Should special examinations ***(e.g. Neuropathology, Toxicology, Cytogenetics, etc.)*** be required, this interval may be longer.

CAVAN/MONAGHAN HOSPITAL (NON-CORONER) POST MORTEM CONSENT FORM

Please read carefully and tick the appropriate boxes before signing to document your consent to a hospital post mortem examination on:

Name of Deceased: _____Date of Birth: ____/___/_____ HcRN*:_____

Primary Consultant: _____Date of Death: ____/____/_____ Time of Death:

* HcRN: Healthcare Record Number

Please tick √

I confirm that through a process of discussion, I have been provided with information regarding what is entailed in a hospital post mortem examination; I have also been provided with written information.	☐
I confirm that any questions I had about the hospital post mortem examination have been answered to my satisfaction and understanding.	☐
I understand that a hospital post mortem examination includes the retention of small samples of tissue as histological blocks and slides.	☐
I understand this is not a mandatory procedure and that I may give consent for a full or limited hospital post mortem examination.	☐

Please select one of the following options regarding the hospital post mortem examination:

Option One: I consent to a **full** hospital post mortem examination. ☐

OR

Option Two: I consent to a **limited** post mortem examination. ☐

I understand that this may limit the information obtained. I wish to limit the examination to (please specify):

……

Retention of organs for more detailed examination:

As part of a full or limited hospital post mortem examination, it may be necessary to retain organ(s) for detailed laboratory examination for investigative purposes. Please indicate whether you consent to this.

I consent to the retention of organ(s) for detailed examination. ☐

Comments……

Ultimate disposition of organs retained at hospital post mortem examination:

Following completion of detailed laboratory examination of retained organ(s), there are a number of options in relation to the ultimate disposition of the organ(s). **An immediate decision is not required**.

Please tick √ to indicate your decisions

I do not wish to make decisions regarding ultimate disposition at this time. I understand I will be contacted to discuss this at a later stage.	☐
Further retention*:*	
I consent to retained organs being made available for medical education and training.	☐
I consent to retained organs being made available for medical research.	☐
Sensitive disposal of retained organs*:*	
I wish to make my own arrangements for the burial or cremation of retained organ(s). I understand a member of the hospital team will offer assistance.	☐
I wish the hospital to arrange for the burial or cremation of retained organs in accordance with my instructions.	☐
I wish the hospital to arrange for the burial or cremation of retained organs without my further involvement.	☐

Name of Deceased: _____ Date of Birth:_____/____/____
HcRN:_____

Communication following completion of the hospital post mortem examination
There are a number of options in relation to the communication of information regarding the retention of organs and the hospital post mortem examination results.

Wishes for communication regarding organ retention: I do not wish to be contacted with information regarding any organ retention. *By ticking this box, you are indicating that you do not wish to receive notification regarding the retention of organs*.	☐
Wishes for communication regarding the hospital post mortem examination results: I do not wish to be given details of the hospital post mortem examination results. I wish to meet with hospital staff to discuss the hospital post mortem examination results, when available. Please send the hospital post mortem examination results to the general practitioner of the deceased. *Note*: *A copy of the hospital mortem examination results may be requested in writing and will be made available to you when it is completed*.	☐ ☐ ☐

Consent given by:

Signature: _____ Date: _____ Time (24 hour clock): ____
Printed Name: _____Relationship to the Deceased: _____
Contact Details: _____

Registered Medical Practitioner obtaining consent:

I confirm that I have spoken with _____ (*Insert name of person giving consent*) and I have explained to them the content of this form. This consent to a hospital post mortem examination has been freely given on an informed basis.

Signature: _____ Date: _____ Time (24 hour clock):

Printed Name: _____Contact Number (bleep or phone)

Job Title: _____Medical Council Number: _____

In the case of verbal consent:
Reason why consent was obtained verbally:
…….

Witness to verbal consent (Verbal consent must be witnessed by another member of the multidisciplinary team):

Signature: _____Date: _____ Time (24 hour clock):

Printed Name: _____Contact Number (bleep or phone): ____

Job Title (including Medical Council Number, if applicable): _____

Pathology Department:
The consent form has been reviewed before undertaking the hospital post mortem examination by:

Signature: _____Date: _____Time (24 hour clock):_____:

Printed Name: _____Contact Number (bleep or phone):_____

Job Title (Including Medical Council Number if Applicable):_____

6.6 INDICATIONS FOR PLACENTA EXAMINATION

The majority of placentas do not require pathological examination. Placentas are a normal part of childbirth, not pathology. These placentas are stored in the fridge in the maternity unit for seven days and can be examined pathologically should the clinical progress of the baby indicate same.

Referral for examination in NOT indicated in the following conditions as pathological examination is unlikely to provide useful information

- Cholestasis of pregnancy
- Pruritis of pregnancy
- Covid 19 during pregnancy (excluding the previous 4 weeks)
- Hepatitis B, HIV etc.
- Other maternal disease with normal pregnancy outcome
- Placenta praevia
- Post partum haemorrhage
- Polyhydraminous
- Normal pregnancy

Indications for referral of placentas for pathological examination (to Rotunda Hospital for expert opinion) :

- Stillbirth
- Late miscarriage
- Foetal growth restriction birth weight below 3rd centile
- Prematurity (under 32 weeks)
- Foetal hydrops
- Severe foetal distress requiring admission to neonatal intensive care.

Referral of placentas for examination (Local examination in Cavan General Hospital)

- Maternal pyrexia (>38°C)
- Prematurity (32-34 weeks)
- Foetal growth restrictions (3-10th centile), Pre-eclampsia/maternal hypertension

- Prolonged rupture of membranes (>36 hours)
- Other conditions, clinically indicated, where examination may give clinically relevant information.

Occasionally it may be desirable to refer placenta for histological examination:

- Morbidly adherent placenta (if clinically relevant)
- Placental abruption
- Abnormal placenta shape (if clinically relevant)
- Cord and membrane abnormalities e.g. 2 vessel cord, true knot etc..
- Maternal group B streptococcus
- Rhesus (and other) isommunisation
- Twins or multiples
- Maternal coagulopathy
- Maternal substance use

(Placentas in this category may be examined macroscopically and given a description only with a report stating that microscopic examination will be undertaken if there are further relevant clinical indications)

7 ON-CALL SERVICE

The on-call service is available outside the Laboratory normal working hours as outlined in section 1.4.3 on page 9 above. The range of tests available is limited **(see below)**.

Blood science samples may be sent without prior notification. However samples from

- patients requiring urgent blood transfusion need prior notification.
- Microbiology samples require prior notification to the Microbiology On Call Medical Scientist by mobile phone to arrange testing

This is essential to ensure that the specimen is processed and it remains the responsibility of the Medical Officer to contact the scientist. The completed request form ***(including brief clinical details outlining reasons for request)*** must be signed by the responsible doctor. This task must not, for medico-legal reasons, be delegated. Critical values are phoned to the doctor on call.

7.1 ON CALL TESTS

7.1.1 Microbiology

- CSF examination
- Positive Blood cultures
- Paediatric Urines
- SARS Cov2 Testing
- Respiratory Viral Testing

7.1.2 Haematology & Blood Transfusion

- Full Blood Count
- Prothrombin Time (INR)
- Activated Partial Thromboplastin Time (APTT)
- Fibrinogen
- D-Dimers
- Blood Grouping/Cross-matching
- Issue of blood & blood products
- Direct Coombs Test
- Antibody screen and/or phenotyping as required

- Malaria Antigen Detection see note below
- Sickledex for HbS see below 7.1.4
- ESR are analysed for temporal arteritis and childhood osteomyelitis only on call. Any other ESR's will not be analysed

7.1.3 Chemical Pathology

- Renal Profile
- Bone Profile
- Cardiac Profile
- Liver Profile
- Glucose (serum)
- Glucose & protein (CSF)
- Magnesium
- Bilirubin
- Alcohol
- Paracetamol
- Salicylate
- Lithium (overdoses only)
- Troponin
- ßHCG
- Gentamicin (time limited)
- Tobramycin (time limited)
- CRP.

7.1.4 On call tests performed if requested by a <u>Consultant</u>

- Malaria Screen is performed using the screening kits in haematology.
- Samples testing positive with screening kit are referred to Mater Misericordiae University Hospital for confirmation of species via blood film examination.
- Sickle Cell Screens - Only request on call when the presence of HbS affects the immediate clinical management of the patient
- **Urinary biochemistry** e.g. urinary potassium/sodium for ICU, urinary protein for maternity.

7.1.5 Overdose - Toxicology

Urinary dipsticks are available in the Emergency Department for toxicology screening. On the next working day, send blood and urine for confirmatory toxicological screening on patients who have or are suspected of having overdosed to the National Poison Centre, Beaumont Hospital, Dublin.

7.1.6 Samples for Referral

Samples requiring out of hours dispatch to outside laboratories e.g. Eurofins Biomnis Laboratories, National Poisons Centre etc., should be sent to the clerical officer in the Emergency Department who will arrange their packaging and dispatch.

For samples referred to Biomnis Laboratories for urgent analysis and/or result enquiry between 17.30 hrs and 09.00 hrs please phone 01 2003825. This is a bleeper, and the caller will be asked to leave their contact number for a call back.

Tests/Samples not analysed on call

- Tests not included in the on-call lists, endocrinology requests, tumour markers, virology and all other referral tests etc.
- PSA and PTH are not separated or frozen.

8 EXTERNAL TESTS

These are tests not performed on site in Cavan General Hospital and charges for each test are applied. Route all specimens through the Laboratory with the correct completed forms which will ensure that the sample is sent to the correct location in the correct manner. The following samples are at present dispatched to:

Cervical Cytology	Contact Cervical Check **Samples outside National Screening Programme:** Biomnis Laboratories Ltd **01 2958545**
Toxicology	National Poisons Centre, Beaumont Hospital, Dublin **(01) 8379963/8379966 Speedcode 7041**
Meningococcal and GroupB strep PCR *	Meningococcal PCR Lab, Children's University Children's Health Ireland at Temple St., Dublin **(01) 8784432 Speedcode 7049**

	* Sun-Thurs - please contact the Medical Scientist on call who will arrange to have the sample included in the next morning's transport. Fri. & Sat. - leave samples in lab sample reception for the attention of the Medical Scientist.
***Pertussis* screening**	Children's Health Ireland at Crumlin
Virology	National Virus Reference Laboratory, U.C.D., Belfield, Dublin 4. **(01) 7161323 Speedcode 7082**
Chromosomal	Eurofins Biomnis Laboratories, see page 12 **Analyses**

Eurofins Biomnis Laboratories analyse the majority of the samples referred. Some tests are performed in Dublin, others in France. A full list of tests and specimen requirements for tests analysed by Eurofins Biomnis Laboratories is available at www.biomnis.ie, under Test Information

For result enquiries phone **1800 252966.**
On Call service for technical analysis &/or result enquiry phone **01 2003825** Main reception number **(01) 2958545.**

9 ADVICE

Scientific and medical advice on issues within the laboratory's range of interest and competence is available. Key contact staff are listed below.

Position	Name	Ext.	Direct Line
Director of Laboratory Consultant Histopathologist	Dr. Hala Rizkala	3108	049 4373108
Consultant Microbiologist	Request Consultant Microbiologist On Call Through Switch		
Consultant Haematologists*	Dr. Barry Mac Donagh	6296	049-4376296
	Dr. Anne Fortune	6294	049 4376294
Consultant Clinical Biochemist	Dr. Fitzgibbon		049-4376297
Deputy Consultant	Dr. Graham Lee	(Leave name and contact number with MMUH Switch)	01-803 2000

- The Consultant Haematologists provide advice on all clinical and laboratory aspects of Blood Transfusion including interpretation of tests and of clinical findings, and recommendations for further clinical, laboratory or therapeutic actions either for specific patients or more generically for development of guidelines and protocols. This specifically includes transfusion medicine advice in relation to adverse effects of transfusion and in relation to blood component traceability. Advice is given as required to clinicians and patients, management and administrative staff, scientific or nursing staff.
- Access to advice from the consultant haematologist is available on-site in CGH according to an agreed schedule of attendance at the hospital. Dr. MacDonagh attends once monthly and Dr. Fortune once weekly alternating Mondays & Wednesdays. On call Haematology advice is available by contacting the Haematology Registrar in the Mater Hospital.
- Specific Transfusion advice is available from the IBTS at the National Blood Centre, Dublin. Speed Dial 7066. (01 432 2861). Full access to transfusion medicine advice is provided through the IBTS.

- Specific Microbiology advice is available from the Consultant Microbiologist on-call. Details of the on-call service cover are emailed to all clinical areas on a weekly basis but should there be any confusion, the Consultant Microbiologist on call is contactable through the Hospital Switchboard.

10 PROBLEMS / COMPLAINTS

Minor: Contact the Laboratory Manager
Major: Contact the Director of the Laboratory

Please do not hesitate to call Cavan General Hospital Pathology Laboratory if further assistance is required.

A complaints/comments form is available from the laboratory. We welcome all submissions. All such complaints/comments are logged within the quality management system in place, thoroughly investigated and feedback provided to the complainant.

11 DATA PROTECTION POLICY

The Pathology Laboratory complies with the policy of the HSE regarding the legislation pertaining to the rights of the patient and staff and to act in an ethical and responsible manner in maintaining the security and integrity of all personal information
The pathology laboratory retains the following information in relation to each test request received, for a minimum of 30 years, in order to ensure patient history is maintained and that sufficient information is available to staff responsible for the interpretation and reporting of results from the laboratory:

- Patient full name
- Patient medical record number
- Patient date of birth
- For each specimen: date/time of collection, date/time of receipt in the laboratory and date/time of report, specimen type, priority.
- Clinical information provided by clinicians
- The results and where appropriate, interpretation of each test requested.
- Requesting clinician and address

12 TIME LIMITS FOR REQUESTING ADDITIONAL EXAMINATIONS

Please note that verbal requests for any examinations must by followed by a fully completed request form in order for results to be issued. Request forms must be received within the timeframe outlined for each department below:

12.1 BLOOD TRANSFUSION

Additional requests on samples received in the department must be made on the appropriate request form within 48 hours of sample collection.

12.2 HAEMATOLOGY/COAGULATION

Blood film and Infectious Mononucleosis (Monospot) requests must be made within 24 hours of sample collection. Additional requests on Coagulation samples must be made within 4 hours of sample collection.

12.3 BIOCHEMISTRY/ENDOCRINOLOGY

Samples are held in the department for 7 days. The following time limits for addition of requests apply:

Analyte	*Time Limit Following Specimen Collection*
NT Pro BNP	6 days
Hba_1c	5 days
Glucose	7 days
CRP	7 days
TSH	7 days
fT_4	6 days
fT_3	6 days
PSA (Total)	24 hours
Iron	7 days
Urea/creatinine	7 days
Sodium/Potassium	36 hours (once separated)
Vitamin B12	7 days

12.4 MICROBIOLOGY

Contact the Microbiology laboratory for advice.

12.5 HISTOLOGY/CYTOLOGY

Additional requests on specimens submitted for Cytology must be made within 4 weeks of specimen collection. Specimens submitted for Histology are retained in the department for 6 weeks. In addition, blocks and slides are retained indefinitely on all specimens processed. Contact the Histology laboratory for advice regarding additional examinations required. Products of Conception containing recognisable foetal tissue are retained for one year should parents wish to arrange collection for burial. After this time, the Hospital will arrange burial.

13 REPEAT EXAMINATION DUE TO ANALYTICAL FAILURE OR FURTHER EXAMINATION OF SPECIMENS

Where repeat examinations are required due to analytic failure, every effort will be made to reduce specimen deterioration in the interim, and analyses will be repeated as soon as possible. Where further examinations of specimens are required, where requested by a clinician, these will be carried out provided specimen stability is acceptable. Where deemed necessary, through scientific professional judgement, in the interests of patient care, further tests may be carried out on specimens where results derived initially would warrant further examination.

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BLOOD COLLECTION TUBES (SARSTEDT)

Application	Contents	Cap	Order of Draw
Virology, Bacteriology	Serum	White 	1
Clinical Chemistry	Serum-Gel	Brown 	2
Coagulation	Trisodium Citrate 1:9	Green 	3
HbA_1c (Clinical Chemistry)	Potassium EDTA	Grey 	4
Haematology (except ESR)	Potassium EDTA	Red 	4
Blood Transfusion	Potassium EDTA (BTS)	Red 	5
Glucose (Clinical Chemistry)	Fluoride	Yellow 	6
ESR (Haematology)	Trisodium Citrate 1:4	Mauve 	7

MICROBIOLOGY SPECIFIC SPECIMEN CONTAINERS

Specimen Type	Swab Required	Comment
Routine Culture	Blue Top 	Amies Transport Media
Chlamydia	Special collection devices available	
Viral	Pink Top 	Viral Transport Media
Pertussis	Blue top with wire swab 	No Media

Appropriate Specimen	Universal Container Lid Colour
MSU C&S	Acidified (Boric Acid): Green 
	Plain: 
Faeces C&S, etc.	Blue Top 
Sputum/fluids	White Top
Urine for TB	At least 50 ml early morning urine samples on 3 consecutive mornings
Sample for Flu/RSV	Nasopharyngeal swab in Nasopharyngeal Sample Collection kits (available from Laboratory)