Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

CAVAN GENERAL HOSPITAL DEPARTMENT OF CLINICAL & LABORATORY SCIENCES

EXTERNAL USER MANUAL

Cavan General Hospital
Telephone: +353 (49) 4376293
Fax: +353 (49) 4376993

Director:
Dr. Hala Rizkalla
E-mail: hala.rizkalla@hse.ie

Laboratory Manager
Mr. Brian O'Malley
E-mail: brianj.omalley@hse.ie

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CRITICAL VALUES (ADULTS)
DIVISION OF BIOCHEMISTRY

DIVISION OF BIOCHEMISTRY		
Analyte	**Outside Range**	
Sodium	< 120 mmol/L	> 150 mmol/L
Potassium	< 2.9 mmol/L	> 6.3 mmol/L
Urea	>30 mmol/L	
Creatinine	> 400 μmol/L	
Glucose	< 2.5 mmol/L	> 25 mmol/L
Adj calcium	< 1.8 mmol/L	> 3.5 mmol/L
Magnesium	< 0.4 mmol/L	
Phosphate	< 0.3 mmol/L	
AST	> 510 U/L	
ALT	> 825 U/L	
CK	> 5000 U/L (unless query MI)	
Amylase	> 450 U/L	
Lithium	> 1.5 mmol/L	
Triglyceride	> 20 mmol/L	
CRP	> 300 mg/L	
Troponin	Female 0-16 Male 0-34 nmol/L	

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 SURGICAL PATHOLOGY
1. Fat in endometrial curettings and endoscopic Biopsies
2. 1st Diagnosis of leukaemias/lymphomas
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 CSF microscopy results
3. Positive PCR result for any enteric pathogen
4. Positive Rotavirus
5. Positive Adenovirus
6. *Cryptosporidium* species
7. Positive *RSV*
8. Positive *Influenza*
9. All in-house positive test results for causative pathogens of notifiable diseases
10. First positive Carbapenemase Producing Enterobacteriaceae
11. First Group B Streptococcus in a maternity/laboratory ward or neonatal patient
12. First Group A Streptococcus in an in-patient
13. First positive urinary antigen test
14. Other results may be phoned at the discretion of the Medical Scientist.

1. GENERAL INFORMATION

1.1 LABORATORY STAFF & TELEPHONE NUMBERS

All numbers shown are for normal laboratory hours, i.e. Monday to Friday.

Department	Personnel	Telephone No.
Specimen Reception		6840
Consultant Histopathologist	Dr Hala Rizkalla	3108
Consultant Microbiologist	Dr. Cathal Collins Dr. Billie Caceda Dr. Elizabeth Trautt (V)	Request Consultant Microbiologist On Call at 049-4376000
Consultant Clinical Biochemist	Dr. Maria Fitzgibbon (V)	6298
Consultant Haematologists	Dr. Anne Fortune (V)	6054
	Dr. Barry MacDonagh (V)	6414
Laboratory Manager	Brian O'Malley	6292
Blood Transfusion	Eamon Hannick*	6271
Haematology & Coagulation	Anna Dowd*	6294/6296
Clinical Chemistry	Angelo Smith* Fiona Jennings* Elaine Fitzpatrick*	6297 6298 6298
Histopathology/Cytology	Imelda Gibson* Brigid Irvine*	6300
Microbiology	Larry O'Neill* Karen Smith * Fionnuala Gilmartin* Linda Crowe* Conor McPhillips*	6295 6295 6295 6295 6295
Histology Reports	Laboratory Secretaries	6293
Microbiology Reports	Laboratory Secretaries	6053
Haematology, Coagulation, Clinical Chemistry Reports	Laboratory Secretaries	6293/6357
Surveillance Scientist	Briain McDonald Aileen Reilly	6916

(V) = Visiting Consultant

* = Chief/Senior Scientists in these departments

All extension numbers are pre-fixed by (049) 437 from outside the hospital.

1.2 LOCATION

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

1.3 NORMAL LABORATORY HOURS

Monday - Friday	08.00 - 20.00 hours
Lunch	13.00 - 14.00 hours (reduced staff numbers)

1.4 ACCREDITATION

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

1.5 GENERAL NOTES

1.5.1 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?

1.5.2 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 and date of birth. It is highly desirable to include the date and time of specimen collection on the specimen also.

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.

1.5.3 Request Forms:

There are 4 Cavan General Hospital request forms for general use:

- General Form for Clinical Chemistry / Endocrinology / Haematology / Coagulation / Immunology
- Histopathology / Cytology - 1 General, 3 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)***
- Address
- Date of Birth
- General Practitioner
- Patient Gender

Requesting Details:

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

Specimen Details:

- Date and time collected
- Nature of sample requested
- Tests requested

Other Information:

- Full clinical details relevant to investigation
- For microbiology specimens please state any antibiotic used

1.5.4 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 main laboratory reception area

NOTE: A GP specimen collection service is available to GMS GPs. Information on this service is available from Primary Care on 041-6850700.

1.5.5 Receipt of Specimens

The daily cut off time for receipt of specimens in the laboratory is 5pm on Mondays to Thursdays and 3pm on a Friday.

1.5.6 Storage of Specimens

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. Where a delay in transportation is envisaged, specimens must be stored as follows:

Department Specimens	**Store At**	**Acceptable Time Delay Before Transportation**
Haematology	4°C	Same Day
Coagulation	Room Temperature	< 4 Hours /Same Day
Clinical Chemistry	Room Temperature	Same Day
Histopathology	Room Temperature	Same Day
Cytopathology	Room Temperature	Same Day
Microbiology	4°C	Same Day

1.5.7 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.

1.5.8 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 to a medical practitioner and willingly submits to the collecting procedure e.g. venepuncture. Patients 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.
The requirement for consent for individual tests performed is outlined in the relevant section of this laboratory manual.

1.5.9 Specimen Collection and Patient Preparation Prior to Specimen Collection

Hand hygiene must be performed prior to commencement.
Greet the patient and identify yourself and indicate the procedure that will take place. Positive patient identification is **MANDATORY.**
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.
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.
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.

1.5.9.1 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.

1.5.9.2 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
- Potassium
- Porphyria

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.

1.5.10 Specimen Containers

Refer to section 1.6 below and the inside of the back cover of this manual

1.5.11 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.

1.5.12 Results:

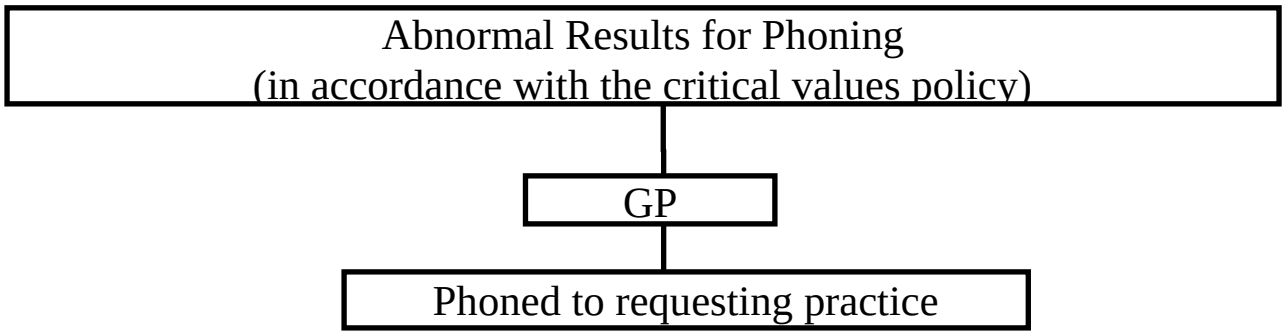
Printed reports are returned to all GP practices who opt for this service, on a daily basis. For many GP practices, results are also transmitted electronically via Healthlink. Transmission of results electronically is preferred to printed reports due to the decreased turnaround times and reduction of errors associated with paper systems.

Sample Turnaround Times (TATs)
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. GP samples that arrive in the afternoon may not be available until the following day. (See page 62 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.

1.5.13 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.



1.5.14 External Tests:

Specimens which need to be sent to external laboratories e.g. Eurofins Biomnis, NVRL etc must be accompanied by a separate request form. Please ensure all details have been included. Failure to adhere to the above instructions may result in the specimen being rejected for analysis.
Specific forms and containers are used for cervical cytology samples. Specific specimen collection containers are used for Chlamydia testing. Eurofins 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.

1.6 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	Acidified Urine	Outside Laboratory	24 hour Urine (see section 1.5.9.2)
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
AIDS	Clotted blood	Outside Laboratory	White 
Albumin	Serum	Biochemistry	Brown 
Albumin Creatinine Ratio	Urine - Random	Biochemistry	Plain 
Aldosterone	Serum	Outside Laboratory	Brown 
Alkaline Phosphatase	Serum	Biochemistry	Brown 
Alpha 1acid Glycoprotein	Serum	Outside Laboratory	Brown 
Alpha Fetoprotein	Serum	Biochemistry	Brown 

Test	Sample required	Department	Container
Alpha1 Antitrypsin	Serum	Outside Laboratory	Brown 
ALT	Serum	Biochemistry	Brown 
Aluminium	Plasma	Outside Laboratory	Contact phlebotomy
Amikacin	Serum	Outside Laboratory	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. Clotted blood 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 
Anti Streptolysin O titre (ASOT)	Serum	Outside Laboratory	Brown 

Test	Sample required	Department	Container
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	Clotted blood 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 
Bilirubin (Direct	Serum	Biochemistry	Brown 

Test	Sample required	Department	Container
Bilirubin (Total)	Serum	Biochemistry	Brown 
Blood film	EDTA Sample: 2.7ml (Adults), 1.2ml (Paeds)	Haematology	Red 
Blood Grouping	EDTA Sample: 2.7ml or EDTA Sample: 7.5ml	Blood Transfusion	Red 
Bone Profile	Serum	Biochemistry	Brown 
Brucella Infections	Blood culture. Clotted blood 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 
Caeruloplasmin	Serum	Outside Laboratory	Brown 
Calcium	Serum	Biochemistry	Brown 
Calcium	Plain24 Hour Container	Biochemistry	24 hour Urine (see section 1.5.9.2)

Test	Sample required	Department	Container
Candida Infections	Blood culture. Swab form suspected lesion. Clotted blood for precipitins in suspected systemic disease.	Microbiology	Blood Culture &  Blue Top  White
Carbamazapine	Serum	Outside Laboratory	 Brown
Catecholamines (see Note No.1)	PlainUrine	Outside Laboratory	24 hour Urine (see section 1.5.9.2)
Cathecholamines &VMA	Plain Urine	Referral Test	24 hour Urine (see section 1.5.9.2)
CEA	Serum	Biochemistry	 Brown
Chloride	Serum	Biochemistry	 Brown
Chloride (Urinary)	Urine	Biochemistry	 Plain
Cholera	Faecal sample	Microbiology	 Blue Top
Cholesterol (HDL)	Serum	Biochemistry	 Brown
Cholesterol (LDL)	Serum	Biochemistry	 Brown
Cholesterol (Total)	Serum	Biochemistry	 Brown
Clostridium difficile	Diarrhoea Sample See section **5.4.1** on page 64.	Microbiology	 Blue Top

Test	Sample required	Department	Container
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
Cortisol (timed samples)	Serum	Outside Laboratory	Brown 
Creatine Kinase (CK)	Serum	Biochemistry	Brown 
Creatinine	Serum	Biochemistry	Brown 
Creatinine (Urinary)	Urine	Biochemistry	Plain 
Creatinine Clearance	Urine 24 hour collection + Serum (both samples to arrive together)	Biochemistry	24hr Collection + Brown 
CRP	Serum	Biochemistry	Brown 
Cryptosporidium	Faecal sample	Microbiology	Blue Top 
Cyclosporin	EDTA	Outside Laboratory	Red 
D-Dimers[6]	Sodium Citrate Sample: 3ml (Adults), 1.2ml (Paeds)	Coagulation	Green 

Test	Sample required	Department	Container
Diarrhoea	Faecal sample	Microbiology	Blue Top 
Digoxin	Serum	Outside Laboratory	Brown 
Diphtheria	Swab inflamed area/ membranes	Microbiology	Blue Top 
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 

Test	Sample required	Department	Container
Ferritin	Serum	Biochemistry	Brown 
Fetal Genetic RhD Screen	EDTA Sample: 9 ml	Blood Transfusion	Red 
Fibrinogen	Sodium Citrate Sample: 3 ml (Adults), 1.2ml (Paeds)	Coagulation	Green 
Folate	Serum	Biochemistry	Brown 
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 
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 

Test	Sample required	Department	Container
Giardiasis	Faeces examination for cysts or duodenal aspirate for trophozoites Clotted blood for IFAT	Microbiology	Blue Top  Brown 
Glucose	Fluoride Oxalate	Biochemistry	Yellow 
Gonorrhoea	Pus swab from cervix, urethra and rectum in transport medium	Microbiology	Sterile Universal Container
Gonorrhoea & Chlamydia PCR	Specimen Collection Devices (Swab & Urine)	Outside Laboratory	Contact Laboratory
Growth Hormone	Serum	Outside Laboratory	Brown 
Haemochromatosis Screen	EDTA	Outside Laboratory	Red 
HbA1C	Potassium EDTA – separate sample required	Biochemistry	Grey 
HCG	Serum	Biochemistry	Brown 
Hepatitis A	Serum	Outside Laboratory	Brown 
Hepatitis A, B & C	Clotted blood	Microbiology	Brown 
Hepatitis B	Serum	Outside Laboratory	Brown 
Hepatitis B PCR	Serum	Outside Laboratory	Brown 

Test	Sample required	Department	Container
Hepatitis BsAg	Serum	Outside Laboratory	Brown 
Hepatitis C	Serum	Outside Laboratory	Brown 
Hepatitis C PCR	Serum	Outside Laboratory	Brown 
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 
Lactate Dehydrogenase (LD)	Serum	Biochemistry	Brown 
LFT	Serum	Biochemistry	Brown 
LH	Serum	Biochemistry	Brown 

Test	Sample required	Department	Container
Lithium	Serum	Biochemistry	Brown 
Magnesium	Serum	Biochemistry	Brown 
Malaria Testing	EDTA Sample: 2.7ml (Adults), 1.2ml (Paeds)	Haematology	Red 
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. Clotted blood	Microbiology	Sterile Universal Container, Blue Top  Brown 
Microalbumin	Urine	Biochemistry	Plain 
Mycoplasma infections	Paired sera for atypical infections	Microbiology	Brown 
Oestradiol	Serum	Biochemistry	Brown 
Oligoclonal Bands	Serum & CSF	Outside Laboratory	Brown 

Test	Sample required	Department	Container
Ornithosis	Serum	Microbiology	Brown 
Paratyphoid B	Faecal sample	Microbiology	Blue Top 
Phenobarbitone	Serum	Outside Laboratory	Brown 
Phenytoin	Serum	Outside Laboratory	Brown 
Phosphate	Serum	Biochemistry	Brown 
Plague	Seek advice from lab	Microbiology	Seek advice from lab
Pneumocystis jiroveci ***(Previously carinii)***	Sputum sample	Histopathology	Sterile Universal Container
Pneumonia ***(atypical)***	Urine Sputum sample Serology	Microbiology	Plain  Sterile Universal Container Brown 
Potassium	Serum	Biochemistry	Brown 
Potassium	Urine	Biochemistry	Plain 
Progesterone	Serum	Biochemistry	Brown 

Test	Sample required	Department	Container
Prolactin	Serum	Referral Test	Brown 
Protein (Total)	Serum	Biochemistry	Brown 
Protein (Urinary)	Plain Urine or 24 Hour Collection	Biochemistry	Plain  or 24 Hr Container
PSA (Free)	Serum	Biochemistry	Brown 
PSA (Total)	Serum	Biochemistry	Brown 
PT/INR	Sodium Citrate Sample: 3ml (Adults), 1.2ml (Paeds)	Coagulation	Green 
PTH	Serum	Biochemistry	Brown 
Quantiferon	Specific containers available from Laboratory	Outside Laboratory	Contact Laboratory
Rabies	Seek advice from lab	Microbiology	Seek advice from lab
Rast	Serum	Outside Laboratory	Brown 
Renin	Plasma	Outside Laboratory	Red 
Reticulocytes	EDTA Sample: 2.7ml (Adults), 1.2ml (Paeds)	Haematology	Red 

Test	Sample required	Department	Container
Rheumatoid Factor	Serum	Biochemistry	Brown 
RSV	NPA	Microbiology	Nasopharyngeal Swab See page 72
Rubella	Clotted blood	Microbiology	Brown 
Salicylate	Serum	Biochemistry	Brown 
Sickle Cell Screen	EDTA Sample: 2.7ml (Adults), 1.2ml (Paeds)	Haematology	Red 
Sodium (Serum)	Serum	Biochemistry	Brown 
Sodium (Urinary)	Plain	Biochemistry	Plain 
Syphilis	Clotted blood	Microbiology	Brown 
Tegretol	Serum	Outside Laboratory	Brown 
Testosterone	Serum	Outside Laboratory	Brown 
Theophylline	Serum	Outside Laboratory	Brown 
Thyroglobulin antibodies	Serum	Outside Laboratory	Brown 

Test	Sample required	Department	Container
Thyroid antibodies	Serum	Outside Laboratory	Brown 
TIBC	Serum	Outside Laboratory	Brown 
TORCH Screen	Serum	Outside Laboratory	Brown 
Toxicology (Blood)	Serum	Outside Laboratory	Brown 
Toxicology (Urine)	Urine	Outside Laboratory	Plain 
Toxoplasmosis	Clotted blood	Microbiology	Brown 
Transferrin	Serum	Biochemistry	Brown 
Triglyceride	Serum	Biochemistry	Brown 
Troponin I	Lithium Heparin	Biochemistry	Orange 
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

Test	Sample required	Department	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 
Urea	Serum	Biochemistry	Brown 
Valproate	Serum	Outside Laboratory	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	

Test	Sample required	Department	Container
Yersinia enterocolitica	Faecal sample. Clotted sample for serology	Microbiology	Blue Top  Brown 
Zinc	Plasma	Outside Laboratory	Contact phlebotomy

2. BLOOD TRANSFUSION DEPARTMENT

The Blood Transfusion department may be contacted at 049 437 6410. 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.

2.1 ASSAYS AVAILABLE IN CAVAN GENERAL HOSPITAL

Assay	Specimen	Bottle Colour	Sample Requirements	TAT
Blood Grouping For Termination of Pregnancy	EDTA (2.7mls) or EDTA (7.5mls) – if available	RED	Same Day Preferable	Same Day

2.2 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	Blood group and/or antibodies (if known)
Date of birth	
Address	
Gender	
Signature of the requester & bleep number (if applicable)	
Test required	
Date and time of request	
Signature of phlebotomist/ sampler (Blood Track 'Collect' Label)	
Date and time of specimen collection	

3. 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. This section must be completed manually by the sampler. (Ref: Haemovigilance Procedure CP-HV-0002 Procedure for Labelling Blood Transfusion Samples)

2.3 BLOOD TRANSFUSION SAMPLE TUBES

1. All Blood Transfusion samples **MUST be labelled immediately after sampling**. The sample bottles must never be pre-labelled prior to sampling.
2. **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?"

3 All samples **MUST** be handwritten with the following information:

- Patient's full name (i.e. first name and surname)
- Date of BirthDate & 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.

3. HAEMATOLOGY/COAGULATION DEPARTMENT

The Haematology/Coagulation department may be contacted at 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 ASSAYS AVAILABLE IN CAVAN GENERAL HOSPITAL

Assay	Specimen	Bottle Colour	Sample Requirements	TAT[5]	Reference Range
Full Blood Count	EDTA (2.7mls) – Adult EDTA (1.2mls) – Paediatrics	Red Red	Same Day Preferable[1]	Same Day	See table below
Blood film	EDTA (2.7mls) – Adult EDTA (1.2mls) – Paediatrics	Red Red	Same Day Necessary	Same Day	Interpretative report
Reticulocytes	EDTA (2.7mls) – Adult EDTA (1.2mls) – Paediatrics	Red Red	Same Day Necessary	Same Day	0.5-2.5%
ESR	Sodium Citrate (3.5 mls) – Adult Sodium Citrate (2.0 mls) – Paediatrics	Purple Purple	Same Day Preferable[2]	Same Day	**Age** / **mms/hr** (**Male** / **Female**) 0-50 yrs: 0 – 10 / 0 – 12 50-60 yrs: 0 – 12 / 0 – 19 60-70 yrs: 0 – 14 / 0 – 20 70-120 yrs: 0 – 30 / 0 – 35
Infectious Mononucleosis	EDTA (2.7mls) – Adult EDTA (1.2mls) – Paediatrics	Red	Same Day Necessary[3]	Same Day	Positive/Negative
Sickle Cell Screen	EDTA (2.7mls) – Adult EDTA (1.2mls) – Paediatrics	Red	Same Day Preferable	Same Day	Positive/Negative
Malaria Testing [6]	EDTA (2.7mls) – Adult EDTA (1.2mls) – Paediatrics	Red	Same Day Necessary	Same Day[6]	Positive/Negative
PT/INR	Sodium Citrate (3mls) – Adult[4] Sodium Citrate (1.2mls) - Paediatrics[4]	Green Green	Same Day Necessary	Same Day	PT 10.2 – 12.1 s male/female Refer to 'CMH Warfarin Guidelines'

Assay	Specimen	Bottle Colour	Sample Requirements	TAT[5]	Reference Range
APTT	Sodium Citrate (3mls) – Adult [4] 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[6]	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 hours. 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. Infectious mononucleosis (Monospot) requests must be received in the laboratory before 17.30 hours.

(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 (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 a.s.a.p. 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.

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 – 0.43	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 – 500	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 049 437 6298.
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.

4.1 ASSAYS AVAILABLE IN CAVAN GENERAL HOSPITAL

Assays Performed in Cavan General Hospital					
Assay	**Reference Range**		**Sample Type**	**Additional Information**	**TAT**
Albumin g/L	0 – 4 days 28 – 44 4d – 14y 38 – 54 Adult 14- 59y 35 – 50 60 – 90y 32 – 46 90+y 29 – 45		Serum	Reference Range from Abbott	72 hrs
Albumin Creatinine Ratio	Normal	<2.5 mg/mmol male	10ml yellow topped	Reference Range from Abbott	72 hrs
		<3.5 mg/mmol female			
	Microalbuminuria	2.5 – 29 mg/mmol male			
		3.0 – 29 mg/mmol female			
	Macroalbuminuria	>30mg/mmol (both sexes)			
Alkaline Phosphatase	Age	IU/L	Serum	Reference Range from Pathology Harmony	72 hrs
	0 – 14 day	70–380			
	14 day – 16yr	60–425			
	Adult	30–130			
ALT		0 – 55 U/L	Serum	Reference Range from Abbott	72 hrs
Alpha Fetoprotein	0.75 7.4 IU/ml		Serum	Reference Range from Abbott	72 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	72 hrs
AST	5 – 34 U/L	Serum	Reference Range from Abbott	72 hrs
Bilirubin (Direct	0–8.6 µmol/ L	Serum	Reference Range from Abbott	72 hrs
Bilirubin (Total)	0 – 7 day 0–171 µmol/L Adult 3–21 µmol/L	Serum	Reference Range from Abbott	72 hrs
CA125	0 – 35 IU/ml	Serum	Reference Range from Abbott	72 hrs
CA15.3	0 – 31 IU/ml	Serum	Reference Range from Abbott	72 hrs
CA19.9	0 – 37 IU/ml	Serum	Reference Range from Abbott	72 hrs
Calcium	Total Calcium 0 -10d 1.9 – 2.6 mmol/L 10d – 2y 2.25 – 2.75 mmol/L 2y – 12y 2.20 – 2.7 mmol/L Adult 2.1 – 2.55 mmol/L	Serum	Reference Range from Abbott	72 hrs
Calcium Adjusted (Calculation)	2.2 – 2.6 mmol/L		Source of evidence Path Harmonisation	72 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	72 hrs
Cholesterol (HDL)	> 1.0 mmol/L		Serum	ESC Dyslipidaemia Guidelines 2019	72 hrs
Cholesterol (LDL)	< 3.0 mmol/L		Serum	ESC Dyslipidaemia Guidelines 2019	72 hrs
Cholesterol (Total)	0 – 5.0mmol/L		Serum	ESC Dyslipidaemia Guidelines 2019	72 hrs
Creatine Kinase (CK)	30 – 200 U/L Male 29-168 U/L Female		Serum	Reference range from Abbott	72 hrs
Creatinine	0 – 2 weeks	27 – 81 µmol/ L	Serum	Reference range from Abbott	72 hrs
	2w – 5year	14 – 37 µmol/ L			
	5 – 9 years	25 – 48 µmol/ L			
	9 –15 years	30 – 72 µmol/ L			
	Adult	64 – 104 µmol/ L Male 49 -90 µmol/L Female			
Creatinine Clearance	80 – 120 ml/min		24 hour urine collection	Serum sample to be taken within collection period and arrive with the urine sample.	72 hrs

Assays Performed in Cavan General Hospital					
Assay	**Reference Range**		**Sample Type**	**Additional Information**	**TAT**
CRP	<5 mg/L		Serum	Reference range from Abbott	72 hrs
Electrolytes (Na, K, Cl) (Serum, All in mmol/L)	Sodium	133 – 146	Serum	Reference range from Pathology Harmony (K^+&Na^+)	72 hrs
	Potassium	0–14 day 3.4–6.0 mmol/L 15d–1yr 3.5–5.7 mmol/L 1yr–16yr 3.5–5.0 mmol/L Adult 3.5–5.3 mmol/L			
	Chloride	98– 107		Reference range from Abbott	
Ethanol	Up to 100 mg/dL: euphoric changes, some impairment expected. 100-300 mg/dL: drowsiness, confusion >300 mg/dL: impaired consciousness,		Serum		72 hrs
Ferritin	22-275 µg/L Male	5 – 205 µg/L Female	Serum	Reference range from Abbott	72 hrs
Folate	7 – 46.4 nmol/L		Serum	Reference range from Abbott	72 hrs
FSH		IU/L	Serum	Reference range from Abbott	72 hrs
	Follicular	3.0 – 8.1			
	Mid Cycle	2.5 – 16.7			
	Luteal	1.4 – 5.5			

Assays Performed in Cavan General Hospital				
Assay	**Reference Range**	**Sample Type**	**Additional Information**	**TAT**
	Male 0.95–11.95			
fT3	2.42– 6.00 pmol/L	Serum	Reference range from Abbott	72 hrs
fT4	9.0–19.0 pmol/L	Serum	Reference range from Abbott	72 hrs
Gamma GT	Male 0–55 IU/L Female 0–38 IU/L	Serum	Reference range from Abbott	72 hrs
Glucose	Fasting 3.9 – 5.6 mmol/L Post prandial 3.9 – 7.8 mmol/L	Serum	Reference range source from WHO OGTT Diabetic diagnosis range: Fasting >7.0 mmol/L 2hrs glucose ≥11.1 mmol/L	72 hrs
HbA1C	< 42 mmol/mol	Serum	National Reference Range	72 hrs
HCG	0–5.0 IU/L	Serum	Reference range from Abbott Refers to non pregnant females Post-menopausal HCG may be higher (<10u/l)	72 hrs
Iron	11 – 31 µmol/L male	Serum	Subject to diurnal	72 hrs

Assays Performed in Cavan General Hospital					
Assay	**Reference Range**		**Sample Type**	**Additional Information**	**TAT**
	9 – 30 µmol/L female			variation	
Lactate Dehydrogenase (LD)	125-220 U/L		Serum	Reference Range from Abbott	72 hrs
LH IU/L		IU/L	Serum	Reference range derived from Abbott	72 hrs
	Follicular	1.8 -11.8			
	Mid Cycle	7.6– 89.1			
	Luteal	0.6 – 14.0			
	Male	0.6– 12.1			
Lithium	0.5 –1.0 mmol/L		Serum	Tuesdays & Fridays Reference range from Nolen et al.2019	72 hrs
Magnesium	0.7– 1.0 mmol/L		Serum	Reference range derived from Pathology Harmony	72 hrs
Microalbumin	0–30 mg/L		Urine – random	See also ACR	72 hrs
Non HDL Cholesterol (Calculation)	<3.4 mmol/L		NA	Reference range derived from ESC guide 2019	72 hrs

Assays Performed in Cavan General Hospital					
Assay	**Reference Range**		**Sample Type**	**Additional Information**	**TAT**
NT Pro BNP	<75yr <125 pg/ml >75yr <450 pg/ml		Serum	Reference range derived from Abbott NT Pro BNP increases with age	72 hrs
Osmolality Serum	275-295 mOsm/Kg		Serum		SD
Osmolality Urine	No range - depends on fluid intake and balance		Urine		SD
Oestradiol		pmol/L	Serum	Reference range derived from Abbott	72 hrs
	Follicular	77 –921			
	Mid Cycle	139–2381			
	Luteal	77 –1140			
	Male	40–161			
Phosphate	0.8–1.5 mmol/L		Serum	Reference range derived from Pathology Harmony	72 hrs
Potassium urine	25 - 125 mmol/L		Urine	Interpret with respect to both serum and intake	72 hrs
Progesterone	Luteal 4–50 nmol/L		Serum	Reference range derived from Abbott	72 hrs

Assays Performed in Cavan General Hospital					
Assay	**Reference Range**		**Sample Type**	**Additional Information**	**TAT**
Protein (Total)	60 – 80 g/L		Serum	Reference range derived from Pathology Harmony	72 hrs
PSA (Free)* µg/L	Not Indicated		Serum	**Can only be processed on samples less than two hours old**.	72 hrs
PSA (Total) µg/L	Age (years)	Range µg/L	Serum	NPCRG Must be analysed within 24 hours of venepuncture National Guideline	72 hrs
	– <49yr	< 2.0			
	– 50 – 59yr	< 3.0			
	– 60 – 69yr	< 4.0			
	>70yr	< 5.0			
Procalcitonin	0 – 0.25 µg/L < 0.1 Bacterial inf. Very unlikely 0.1 – 0.25 Bacterial inf. Unlikely 0.1 – 0.5 Bacterial inf. Likely >0.5 Bacterial inf. Very likely		Serum	Reference range from Abbott	
Protein/Creatinine Ratio	See table -1 below				
Rheumatoid Factor	<30 IU/ml		Serum	Reference range derived from Abbott	72 hrs
Salicylate	Toxic levels >300 mg/L Lethal >700 mg/l		Serum	Therapeutic range 150 – 300mg/L	72 hrs

Assays Performed in Cavan General Hospital				
Assay	**Reference Range**	**Sample Type**	**Additional Information**	**TAT**
Sodium urine spot	40 – 220 mmol/L Interpret with respect to both serum and intake	Urine	Reference range derived from Abbott	72 hrs
Triglyceride	0 – 1.7 mmol/L	Serum	ESC Dyslipidaemia Guidelines 2019	72 hrs
Troponin I	< 16 ng/L Female < 34 ng/L Male	Serum	Reference Range from Abbott	72 hrs
Transferrin	0-14 years Male 1.86-3.88 g/L Female 1.80-3.91 g/L	Serum		72 hrs
	15-60yr Male 1.74-3.64 g/L Female 1.80-3.82 g/L			
	61-120yr Male 1.63-3.44 g/L Female 1.73-3.60 g/L			
Transferrin Saturation	Male / Female	Serum	Reference range source Abbott	72 hrs
	<1y: 4.1-59%			
	1-14y: 6.5-39%			
	14-19y: 9.6-58% / 5.2-44%			
	>19y: 19-55% / 10-50%			

Assays Performed in Cavan General Hospital				
Assay	**Reference Range**	**Sample Type**	**Additional Information**	**TAT**
TSH	0.35 – 4.94 mU/L	Serum	Reference Range from Abbott	72 hrs
Urate	Male 210 – 430 µmol/L Female 140–360 µmol/L	Serum	Reference Range from Abbott	72 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	72 hrs
Urinary Calcium	2.5–7.5 mmol/day (24hr)	Urine	Reference Range from Abbott	72 hrs
Urinary Creatinine	Male 5100–14200 µmol/L Female 3900–9400 µmol/L	Urine	Reference Range from Abbott	72 hrs
Urinary Protein 24h	<0.3 g/24h		Reference Range from Abbott	72 hrs
Urinary Urate	1500–4500 µmol/L (24hr),normal diet		Reference Range from Pathology Harmony	72 hrs
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	72 hrs

Assays Performed in Cavan General Hospital				
Assay	**Reference Range**	**Sample Type**	**Additional Information**	**TAT**
Vitamin B12	139 – 651 pmol/L	Serum		72 hrs
Vitamin D	> 50 nmol/L	Serum	Reference Range from National Osteoporosis Society	72 hrs

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

**: Reference ranges are derived by manufacturers except where otherwise stated.

Table-1 shows the PCR Reference Range

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 macroproteinuria	1+	2 or more PCR results >45, in the absence of UTI, indicates proteinuria
>100	Clinical Proteinuria or macroproteinuria	2+	Marked proteinuria
>450	Nephrotic range proteinuria	3+	Nephrotic range proteinuria

Source: UK Kidney Association.

Adult reference range: <50 mg/mmol

Paediatric reference range (<18 years of age): <20 mg/mmol

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 pmol/L	0.3 – 3.5
fT_4	10 - 19 pmol/L	10 – 16 mU/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.

Table -3 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
Fasting Lipids	Chol., Trig., HDL,LDL

Table-4 Urinary Assays available in Cavan

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

* See section 1.5.9.2

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, available at https://www.eurofins.ie/biomnis/test-information/test-guide/.

Test name	Specimen Type	Bottle Colour	Laboratory
Aldosterone (See Note 1)	Serum	Brown	Eurofins Biomnis
Alpha 1acid Glycoprotein	Serum	Brown	Eurofins Biomnis
Alpha1 Antitrypsin	Serum	Brown	Beaumont.
Aluminium	Plasma	Contact phlebotomy	Eurofins Biomnis
Amikacin	Serum	Brown	Eurofins Biomnis
Amino Acids	Lithium Heparin	Brown	Temple St.
Amino Acids	Urine	Plain- No Boric Acid	Temple St.
Ammonia (see note No. 1)	Plasma	EDTA Plasma	Eurofins Biomnis
Angiotensin Converting Enzyme (ACE)	Serum	Brown	Eurofins Biomnis
Anti Nuclear antibody Screen	Serum	Brown	Eurofins Biomnis
Anti Streptolysin O titre (ASOT)	Serum	Brown	Eurofins Biomnis
Anti Thyroid Antibodies	Serum	Brown	Eurofins Biomnis
Anti-Hepatitis B titre	Serum	Brown	NVRL
Atypical pneumonia screen	Serum	Brown	NVRL
Autoantibody Screen(AAS)	Serum	Brown	Eurofins Biomnis
Beta 2 Microglobulin	Serum	Brown	Eurofins Biomnis

Test name	Specimen Type	Bottle Colour	Laboratory
C3/C4	Serum	Brown	Eurofins Biomnis
Caeruloplasmin	Serum	Brown	Eurofins Biomnis
Carbamazapine	Serum	Brown	Eurofins Biomnis
Catecholamines (see Note No.1)	Urine	24 hour acidified (see section 1.5.9.2)	Eurofins Biomnis
Copper	Plasma	Contact phlebotomy	Eurofins Biomnis
Cortisol (timed samples)	Serum	Brown	Eurofins Biomnis
Cyclosporin	EDTA	Red	Eurofins Biomnis
Digoxin	Serum	Brown	Eurofins Biomnis
Electrophoresis	Serum	Brown	Eurofins Biomnis
Endomysial Antibodies	Serum	Brown	Eurofins Biomnis
Epanutin	Serum	Brown	Eurofins Biomnis
Epilim	Serum	Brown	Eurofins Biomnis
Growth Hormone	Serum	Brown	Eurofins Biomnis
Haemochromatosis Screen (Note 2)	EDTA	Red	Eurofins Biomnis
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

Test name	Specimen Type	Bottle Colour	Laboratory
IgE	Serum	Brown	Eurofins Biomnis
Oligoclonal Bands	Serum & CSF	Brown	Eurofins Biomnis
Osmolality (Serum)	Serum	Brown	Eurofins Biomnis
Osmolality (Urine)	Urine	Plain	Eurofins Biomnis
Phenobarbitone	Serum	Brown	Eurofins Biomnis
Phenytoin	Serum	Brown	Eurofins Biomnis
Prolactin	Serum	Brown	Eurofins Biomnis
PTH	EDTA Plasma	Red	MMUH
Rast	Serum	Brown	Eurofins Biomnis
Renin (see Note No. 1)	Plasma	Purple	Eurofins Biomnis
Tegretol	Serum	Brown	Eurofins Biomnis
Testosterone	Serum	Brown	Eurofins Biomnis
Theophylline	Serum	Brown	Eurofins Biomnis
Thyroglobulin antibodies	Serum	Brown	Eurofins Biomnis
Thyroid antibodies	Serum	Brown	Eurofins Biomnis
TIBC	Serum	Brown	Eurofins Biomnis
Tissue transglutaminase (tTg)	Serum	Brown	Eurofins Biomnis
TORCH Screen	Serum	Brown	NVRL
Toxicology (Blood)	Serum	Brown	National

Test name	Specimen Type	Bottle Colour	Laboratory
Toxicology (Urine)	Urine	Plain – no boric acid	Poisons Centre
TSH Receptor Antibodies	Serum	Brown	Eurofins Biomnis
Valproate	Serum	Brown	Eurofins Biomnis
Zinc	Plasma	Contact phlebotomy	Eurofins Biomnis
Urine assays	**Specimen type**	**Bottle**	**Dept**
Bence Jones Protein.	Urine (Early morning)	Plain- No Boric Acid	Eurofins Biomnis
Cathecholamines &VMA	Urine	24 hour acidified (see section 1.5.9.2)	Eurofins Biomnis
Drugs Of Abuse	Urine	Plain- No Boric Acid	Beaumont
5' HIAA	Urine	24 hour acidified (see section 1.5.9.2)	Eurofins Biomnis

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 Cavan General Hospital Website, under 'Useful Links' (http://www.hse.ie/eng/services/list/3/acutehospitals/hospitals/CavanMonaghan/Pathology_Department.html)
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 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 be 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:-

Tumour 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
- GP requests on patients with known malignancy or previously elevated levels.
- 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.

4.4 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).

4.5 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. Patients of Afro-Caribbean origin have a higher muscle mass so the eGFR should be multiplied by 1.21 for these patients. 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.***

4.6 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. Consult section 11 page 81 for time limits for requesting additional examinations.

4.7 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.

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 contaminating 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.

5.2 REPORTS

Telephone requests must be kept to an essential minimum in the interest of safety, as verbal reports may lead to transcription errors. If requested to do so or if the request form is marked "please phone", 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. 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.

To comply with the recently released document 'Communicating Critical Results for Patients in the Community ' GP-based faecal specimens will not be tested on Fridays or Saturdays (or indeed Sundays on bank holiday weekends).
Samples received on Friday and Saturday will be tested on the Sunday.(On bank holiday weekends Friday,Saturday and Sundays samples will be tested on BH Monday).

Nursing home samples are unaffected by the above.

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. Insufficient quantity of specimen, depending on specimen
5. Labelling of form and/or specimen does not meet our acceptance criteria as detailed on page 7
6. Prolonged specimen transport time - specimen dependant.
7. Sample where Gram Stain indicates poor quality e.g. sputum.
8. Samples requiring prior booking with the laboratory that arrive without arrangement
9. Samples not meeting the testing criteria e.g. samples for *C. difficile*, nasal swabs and Ova and Parasites testing
10. 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 Mater Misericordiae TB Laboratory. Where routine culture and TB analysis are both required, two samples and two forms must be sent.
Mycology: are sent to Eurofins Biomnis Laboratories or Public Health England Mycology Reference Laboratory, as appropriate
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 or at http://nvrl.ucd.ie/usermanual). Specific Aptima specimen collection containers are used for Chlamydia testing.

5.4 METHOD FOR COLLECTION OF SPECIMENS

5.4.1 Faeces

Samples are routinely tested for Salmonellae, Shigellae, Campylobacters, VTEC , C. difficile (on samples that take the shape of the container and patients that are over 2 years old) using molecular methods. Samples are also examined for Cryptosporidium. Samples are routinely examined for Rotavirus and Adenovirus in children under 5 years. Cultures for Yersinia and Vibrios are available on request.

5.4.2 Testing for Clostridium difficile using Real-Time PCR.

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.
The Microbiology laboratory test all appropriately submitted specimens by PCR alone using a real-time PCR assay. This means:

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

Do not send samples for 'test of cure'. These samples will be rejected.

5.4.2.1 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, labeled, 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.**

5.4.2.2 Results and Interpretation

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. diff 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).

5.4.3 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 defecation 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 7 for details.

Submit one stool sample if:

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

5.4.4 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.

5.4.5 Ear Swab

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

5.4.6 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.

5.4.7 IV Catheter Tip

Clean the insertion site with 25 Chlorhexidine 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.

5.4.8 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.

5.4.9 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.

5.4.10 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 Our Lady's Children Hospital, Crumlin. See section 7.

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

5.4.11 HVS for Culture.

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.17 Swab the external os 360 degrees if os stenosed.

5.4.12 Urethral Swab (for N. gonorrhoea and C. trachomatis)

Specific specimen collection containers are used for Chlamydia and *N. gonorrhoea* testing

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)**.

5.4.13 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."'*

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).

5.4.14 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.

5.4.15 Legionella

Collect urine samples for Legionella Urinary Antigen in a sterile universal container 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 with no preservative and send to Laboratory.

5.4.16 R.S.V.

A rapid assay is available for detection of RSV fusion protein antigen in nasal wash specimens. Collect fresh nasal wash samples and send to the laboratory as soon as possible.

5.4.17 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 6054).
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.
To comply with the recently released document 'Communicating Critical Results for Patients in the Community ‘ GP-based faecal specimens will not be tested on Fridays or Saturdays (or indeed Sundays on bank holiday weekends).
Samples received on Friday and Saturday will be tested on the Sunday.(On bank holiday weekends Friday,Saturday and Sundays samples will be tested on BH Monday).

Nursing home samples are unaffected by the above.

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 1.6 above and the last page of this manual

6. HISTOPATHOLOGY & CYTOPATHOLOGY DEPARTMENT

6.1 SURGICAL SPECIMENS:

6.1.1 Request Forms:

LF-HIST-0052 Histology/Cytology Request Forms available from laboratory or hospital stores must contain the following details.

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

Please fill in the request form with as much detail as possible. Use an addressograph label if available. To allow correct matching of previous specimens from a patient, give all identification details, including previous MRN if available. It is mandatory to give sufficient clinical details and to indicate if other specimens have been sent from the present operation ***(e.g. wider excision scar from melanoma)*** so that all material can be studied together. Otherwise, the specimen will be returned.

6.1.2 Specimen Containers

Place specimens for histopathological examination in an appropriately sized container (available from histopathology laboratory) which allows complete immersion in formalin and which allows the specimen to move freely. 10% formalin is the fixative used for most histopathological specimens

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

Patient's name
Patient's Hospital Number if available
Date of Birth
Specimen type and number (if more than 1 specimen from same patient)
Address
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 will NOT be processed and may be returned to their source

6.1.3 Reports/Turnaround Times

A written report is issued on most biopsies within 5 working days of receipt of a specimen in the laboratory. Larger, more complex specimens may take longer. 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.

6.1.4 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.

6.2 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. Request Forms::
LF-HIST-0052 /Cytology /Histology Request Forms available from laboratory or hospital stores must contain the following details. and indicate clearly that the specimen is for cytological examination.

- Patients name.
- 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).

6.2.1 Specimens Containers::

Almost all specimens except cervical smears should be submitted in a container of Cytolyte **(available from the Histology Laboratory** (Extension 6300). Rinse needle and syringe in cytolyte fluid and inject into container

Cytolyte Container

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
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.

6.2.2 Turnaround Times

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

6.2.3 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 Eurofins Biomnis Laboratories. See Section 7.

7. 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:** Eurofins Biomnis Laboratories Ltd **01 2958545**
Toxicology	National Poisons Centre, Beaumont Hospital, Dublin **(01) 8379963/8379966**
Meningococcal and GroupB strep PCR *	Meningococcal PCR Lab, Children's University Hospital, Temple St., Dublin **(01) 8784432** * 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**
Chromosomal Analyses	Eurofins Biomnis Laboratories, see page 13

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 https://www.eurofins.ie/biomnis, under Test Information

For result enquiries phone **1800 252966.**

On Call service for technical analysis &/or result enquiry telephone **01 2003825** Main reception number **(01) 2958545.**

For access to the Eurofins results portal, contact client services in Eurofins via email clientservices@eurofins-biomnis.ie or telephone 1800 252 966

8. 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 Rizkalla	3108	049 4373108
Consultant Microbiologist	Contact Consultant Microbiologist on Call Through Switch (049 4376000)		
Consultant Haematologists*	Dr. Anne Fortune	6054	049 4376054
Consultant Chemical Pathologist	Dr. Maria Fitzgibbon	Routine working hours	086 2499427
Deputy Consultant	Dr. Graham Lee		018032000
Laboratory Manager	Brian O'Malley	6292	049 4376292

- The Consultant Haematologists provide advice on all clinical and laboratory aspects of Haematology 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. 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. Fortune attends once weekly alternating Mondays & Wednesdays. On call Haematology advice is available by contacting the Haematology Registrar in the Mater Misericordiae Hospital.

9. 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 in the laboratory. We welcome all submissions.

10. 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

11. TIME LIMITS FOR REQUESTING ADDITIONAL EXAMINATIONS

<table>
<tr><th>Department</th><th colspan="2">Time Limit</th></tr>
<tr><td>Haematology/ Coagulation</td><td colspan="2">Blood film and Infectious Mononucleosis requests must be made within 24 hours of sample collection.
Additional requests on Coagulation samples must be made within 4 hours of sample collection.</td></tr>
<tr><td>Biochemistry/ Endocrinology</td><td colspan="2">Samples are held in the department for 7 days.</td></tr>
<tr><td></td><td>Analyte</td><td>Time Limit Following Specimen Collection</td></tr>
<tr><td></td><td>NT Pro BNP</td><td>6 days</td></tr>
<tr><td></td><td>Hba_1c</td><td>5 days</td></tr>
<tr><td></td><td>Glucose</td><td>7 days</td></tr>
<tr><td></td><td>CRP</td><td>7 days</td></tr>
<tr><td></td><td>TSH</td><td>7 days</td></tr>
<tr><td></td><td>fT_4</td><td>6 days</td></tr>
<tr><td></td><td>fT_3</td><td>6 days</td></tr>
<tr><td></td><td>PSA (Total)</td><td>24 hours</td></tr>
<tr><td></td><td>Iron</td><td>7 days</td></tr>
<tr><td></td><td>Urea/creatinine</td><td>7 days</td></tr>
<tr><td></td><td>Sodium/Potassium</td><td>36 hours (once separated)</td></tr>
<tr><td></td><td>Vitamin B12</td><td>7 days</td></tr>
<tr><td>Microbiology</td><td colspan="2">Additional requests on specimens must be made within 48 hours of sample collection. Specimens are held for 7 days but may not be suitable for analysis. Contact the Microbiology laboratory for advice.</td></tr>
<tr><td>Histology/ Cytology</td><td colspan="2">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.</td></tr>
</table>

12. 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
BNP (Clinical Chemistry)	Potassium EDTA	Red 	4
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	Plain: 
Sample for Flu/RSV	Nasopharyngeal Collection Kit