UNIVERSITI TEKNOLOGI MARA | Hospital UiTM

1ST EDITION

Clinical Laboratory Handbook

DEPARTMENT OF CLINICAL DIAGNOSTIC LABORATORIES
HOSPITAL UNIVERSITI TEKNOLOGI MARA

STANDARDS MALAYSIA
ACCREDITED LABORATORY

MS ISO 15189

TESTING

SAMM NO. 688

CLINICAL LABORATORY HANDBOOK

1ST EDITION

DEPARTMENT
OF
CLINICAL DIAGNOSTIC LABORATORIES

HOSPITAL UNIVERSITI TEKNOLOGI MARA

VISION

We will nurture the standard of pathology & medical microbiology practices and be the provider through the combination of transformational leadership supported by committed and high integrity talented people.

MISSION

We are a committed team providing efficient, reliable and quality services in pathology & medical microbiology testing, teaching and research towards achieving optimum patient healthcare.

CORE VALUES

Reliable in everything we do.
Act with respect and high integrity.
Passionate and enthusiastic in achieving our mission.
Commitment to all staffs and the community.

Hospital Universiti Teknologi MARA,
Selangor Darul Ehsan.

International Standard Book Number:

Clinical Laboratory Handbook.
First Edition, September 2021, Edited by A/P Dr Fadzilah Mohd Nor @ Ghazali & Dr Ruzi Hamimi Razali.

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FOREWORD

The Department of Clinical Diagnostic Laboratories began its operation in 2010 and was known then as the Centre for Pathology and Research Laboratories (CPDRL). In the last few years, the laboratory has witnessed organizational restructuring and effective from November 2020, the laboratory has been officially recognized as Department of Clinical Diagnostic Laboratories (CDL), or Jabatan Makmal Diagnostik Klinikal. The CDL is providing comprehensive, superior quality pathology & clinical microbiology service to the medical profession and is deeply committed to maintaining professional and technical excellence, personalised services and the highest ethical standards.

Our laboratory handbook has similarly been subjected to multiple revisions and various changes in its name. Currently titled Clinical Laboratory Handbook, this First Edition highlights new laboratory services offered by the CDL and revised procedures pertaining to the collection and handling of certain specimens.

I would like to express my sincere and deepest gratitude to all the CDL staff for rendering their best efforts in the provision of necessary information and updates in the content of the new edition of the Clinical Laboratory Handbook. It is hoped that the Clinical Laboratory Handbook is able to enhance the knowledge of users concerning the requirements and correct procedures of specimen collection and handling in the pre-analytical phase of laboratory testing, subsequently having favourable impacts on patients' management and quality research outputs.

Comments and suggestions for improving the Clinical Laboratory Handbook are welcome and encouraged. Please feel free to contact the laboratory with comments.

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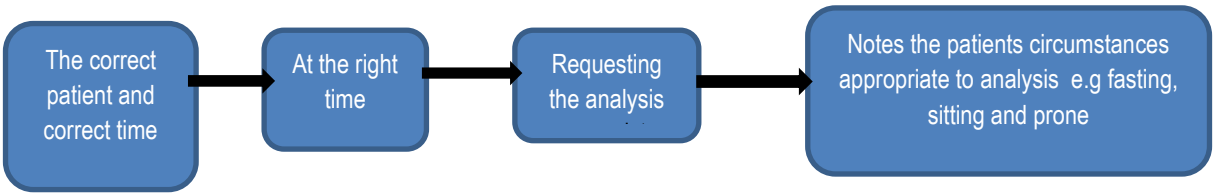
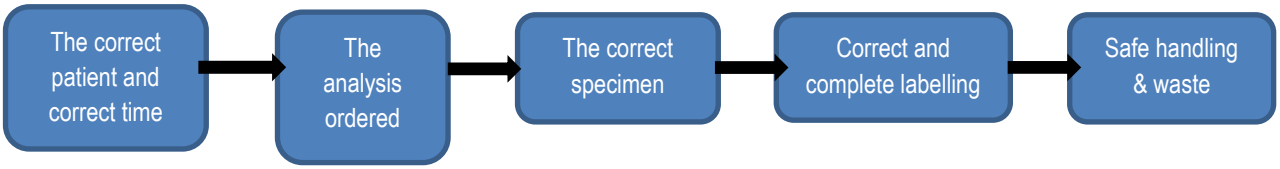
FLOW OF RESPONSIBILITIES

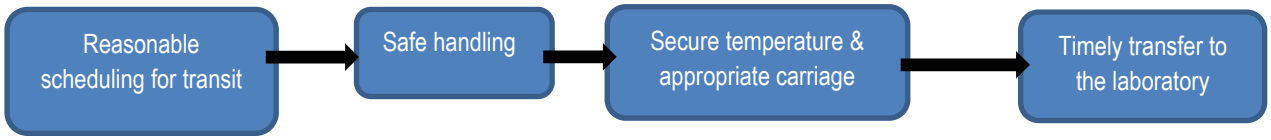
Step 1: The requesting clinician ensures:



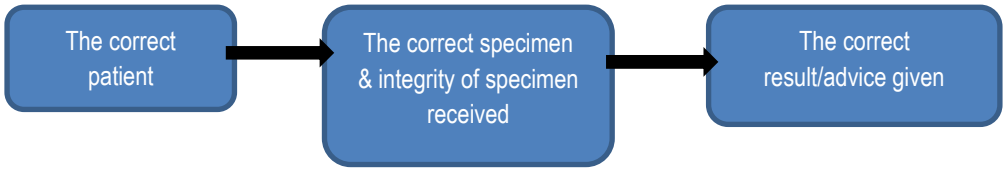
Step 2: The nurse, clinician and phlebotomist collecting specimen ensures:



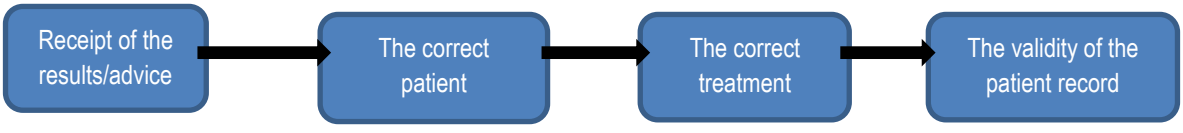
Step 3: The person undertaking the logistics stage ensures:



Step 4: The laboratory checks and ensures:

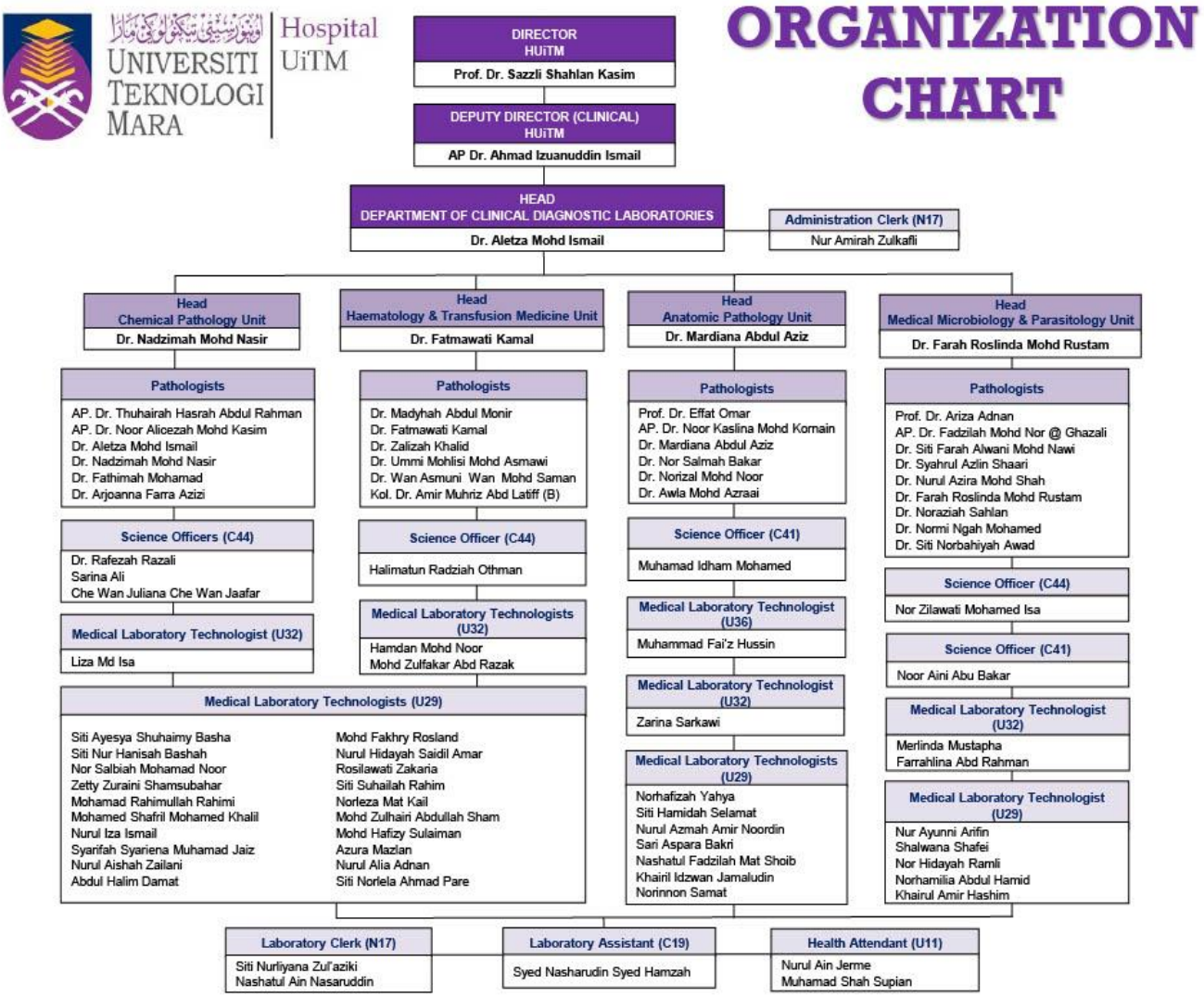


Step 5: The responsible clinician checks and ensures:

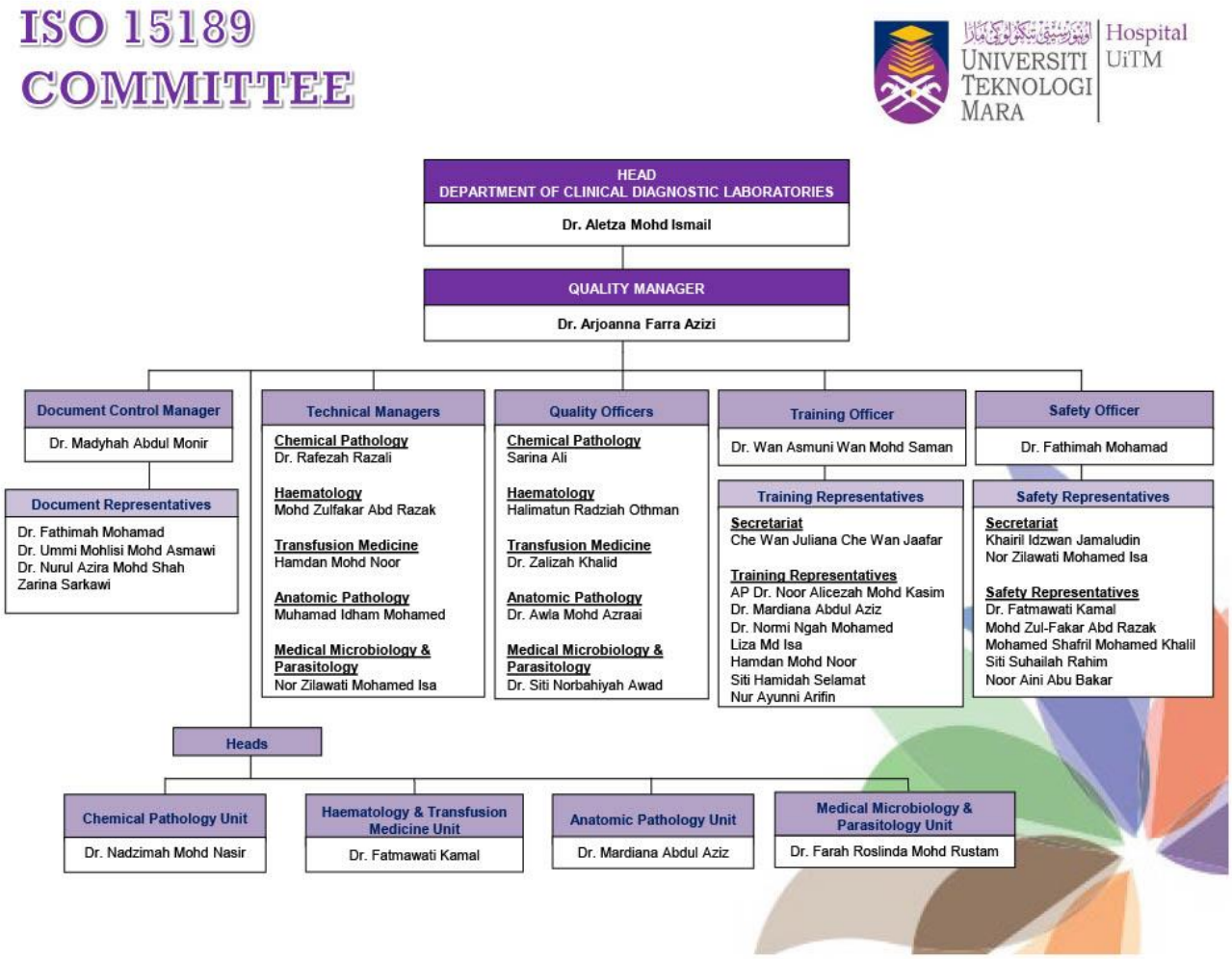


The flow of responsibilities, adopted and adapted from the National Health Service (NHS), Foundation Trust, UK.

ORGANIZATION CHART
DEPARTMENT OF CLINICAL DIAGNOSTIC LABORATORIES



ORGANIZATION CHART
INTERNATIONAL STANDARD ORGANIZATION (ISO) 15189
MEDICAL LABORATORIES COMMITTEE



DEFINITIONS

Phlebotomy

The removal of blood from a vein using a needle, also known as venepuncture. Phlebotomy may be used to obtain blood for diagnostic tests or as a treatment itself for certain conditions.

Urgent

Requiring immediate action or attention. The abuse or overuse of this status overloads the process and devalues the term when there is a truly urgent situation. It should not be used lightly.

Specimen & Sample

Specimen and sample are often used interchangeably. However;
Specimen refers to an item to be characterized biochemically or biologically.
Sample refers to a finite portion of that specimen that is taken for analysis.

Specimen Collection

Producing a specimen from a patient for laboratory analysis.

Specimen Handling

The process of handling, manipulating and storing collected patient's specimens or packaging before transportation.

Specimen transport

The process of transporting the collected, labelled, and packaged patient's specimen for laboratory analysis.

GENERAL OPERATING POLICIES

INTRODUCTION

The department started its operation in October 2010 as the Centre for Pathology Diagnostics and Research Laboratories (CPDRL) before Pathology and Medical Microbiology & Parasitology (MMP) became two separate departments. The laboratory was awarded the MS ISO 15189:2007 accreditation on the 31st of December 2014. It is continually upgrading test repertoire offered to reflect medical development. The laboratory comprises four (4) specialties including Chemical Pathology, Haematology & Transfusion Medicine, Anatomic Pathology, Medical Microbiology & Parasitology (MMP). In 2020, these two departments merged again as the Department of Clinical Diagnostic Laboratories to cater to the growing needs of the hospital.

LOCATION

The main laboratory is located at Level 1, Block A, Hospital Universiti Teknologi MARA (HUiTM), Bandar Puncak Alam. Two other locations are in Sg. Buloh and Selayang Campuses. In Sg Buloh Campus, the laboratory is located on the 1st floor of the UiTM Medical Specialist Centre (UiTMSC) whilst in Selayang Campus, the laboratory is located on the 5th floor of the Specialist Clinic Complex.

ORGANIZATIONAL STRUCTURE

Refer to pages iii and iv.

FUNCTIONS

- To provide diagnostic and consultancy services in the field of Chemical Pathology, Haematology & Transfusion Medicine, Anatomic Pathology, and MMP for Hospital Universiti Teknologi MARA (HUiTM).

- To conduct and facilitate research and development in Pathology, Medical Microbiology & Parasitology as well as other clinical disciplines.

OPERATION HOURS

The laboratory's operational hours are outlined in the table below:

Location	Unit	Operation Time
HUiTM, Bandar Puncak Alam	Chemical Pathology	TBA
	Haematology & Transfusion Medicine	
	Anatomic Pathology (Histopathology & Cytology)	
	Medical Microbiology & Parasitology	24 hours
Sg. Buloh Campus	Chemical Pathology	24 hours
	Haematology & Transfusion Medicine	
	Anatomic Pathology (Histopathology & Cytology)	8.00am - 5.00pm
Selayang Campus	Chemical Pathology	8.00am - 5.00pm
	Haematology & Transfusion Medicine	

The Pathologist and Clinical Microbiologist are available for consultation or assistance during and after office hours for all campuses (one pathologist for each specialty/call).

SCOPE OF SERVICE

The laboratory provides the following diagnostic and research services:

- Chemical Pathology
- Haematology & Transfusion Medicine
- Anatomic Pathology (Histopathology & Cytology)
- Medical Microbiology & Parasitology

The laboratory request form is made available on the hospital information system (HIS) known as UniMEDS. All test requests shall be ordered through the UniMEDS by authorized healthcare staff, accompanied by the properly collected specimens. In the event of HIS interruption, manual test ordering will be done using the following forms:

- *Chemical Pathology/Haematology: Pink*
- *Anatomic Pathology (Histopathological Examination /HPE, Fine Needle Aspiration Cytology/FNAC, & Non-Gynaecology): White*
- *Anatomic Pathology (Pap Smear): Blue*
- *Medical Microbiology/Parasitology: Green*

Standard request form KKM - PER PAT-301 and PDN format form should be used for outsourced tests where relevant.

Relevant clinical information with provisional diagnosis and treatment should be provided to ensure the acceptance of requests.

All personal and medical details are confidential thus, prior consent should be taken before disclosing any clinical information and family history to relevant healthcare professionals where referral is needed.

Please indicate any urgent requests by clicking the "STAT" option on the UniMEDS.

PATIENT IDENTIFICATION

Proper patient identification is crucial to ensure that specimen is being drawn from the individual designated on the online request form in HIS. In areas where a physician/medical officer/nurse/staff draws laboratory specimens, proper patient identification and specimen labelling will be the responsibility of the physician/nurse.

Compare information from the patient with the online request form and/or the patient's identification tag/bracelet.

In the event, the patient is unconscious, young, special needs, or unable to speak the language of the phlebotomist, a nurse, next of kin, or friend should be asked to identify the patient.

SPECIMEN COLLECTION

Collect blood using the accepted venepuncture technique. Draw whole blood in an amount of 2.5 folds of the required volume of serum so that an appropriate volume of serum can be obtained.

- **Procedure for venepuncture**

  - Verify the patient's diet restrictions.
  - Select a venepuncture site: median cubital is used most frequently
  - Apply the tourniquet and palpate the vein.
    NB: Prolongation of tourniquet application may produce erroneous test results. Do not leave the tourniquet on the patient's arm longer than 1 minute.

  - Wash hands prior to phlebotomy and between patients.
  - Wear gloves.
  - Cleanse the patient's skin with an alcohol swab using a circular motion from the centre to the periphery.
  - Allow the skin to air dry to avoid haemolysis of the blood and to prevent the patient from experiencing a burning sensation when the venepuncture is performed.
  - Hold the patient's arm firmly using the thumb to pull the skin taut to anchor the vein.
  - Puncture the vein with the needle at an angle of insertion of 30 degrees or less. Keeping the needle as stable as possible in the vein, push/connect the first tube onto the needle.
  - Fill the tube until blood flow ceases for correct volume of blood to anticoagulant ratios to ensure that the appropriate volume of specimen is available for analysis.
  - The acceptable order of draw for multiple samples is:
    • Blood culture bottle(s)
    • Coagulation tube (Blue-top, sodium citrate tube)
    • Serum tube with or without clot activator, with or without gel (i.e. Yellow/Red-top)
    • Heparin tube (Green-top)
    • EDTA tube (Lavender-top)
    • Glycolytic inhibitor (Grey-top, oxalate fluoride tube)
    • Other additive tubes
  - Mix the additive tubes immediately after collection by gentle inversion 8–10 times.
  - Place a cotton swab over the venepuncture site. Applying light pressure, remove the needle from the vein and activate the safety mechanism.
  - Dispose needles and syringes into the sharp-bin container.
  - Label appropriately all tubes.

The World Health Organization (WHO) provides guidelines that cover all the steps recommended for safe phlebotomy practises and reiterates the accepted principles for blood drawing and blood collection. Please click the link for further reading *https://apps.who.int/iris/handle/10665/44294

*World Health Organization. (2010). *WHO guidelines on drawing blood: best practices in phlebotomy*. World Health Organization.

SPECIMEN LABELING

Careful labelling is important to obtain accurate and reliable results. NEVER label tubes/containers prior to collection. All specimens must be labelled before leaving the patient's side.

Proper labelling includes computer-generated labels or hand-labelled tubes printed with the following information:

- Patient's Full Name
- National Registration Identification Card (NRIC) number
- Registration number (RN)
- Date and time of collection
- Specimen type

Urgent requests must be indicated and appropriately labelled.

Note: For blood bank specimens, refer to the Transfusion Medicine section.

SPECIMEN TRANSPORT

It is vital that specimens be maintained at the proper temperature to ensure specimen integrity. For tests in which no specific storage requirements are mentioned, specimens should be refrigerated until transport. The following definitions apply:

- room temperature 15 to 30^0C
- refrigerated 2 to 8^0C
- frozen -20 to 0^0C

All collected specimens/samples from the patients in the ward, operating theatre, and day care or clinic should be dispatched to the laboratory in the appropriate containers and thereafter put into a biohazard plastic bag. Refer to the specified test list of the individual specialty.

Urgent specimens/samples must be brought to the laboratory by the ward, operating theatre, daycare or clinic staff.

Frozen specimens must be transported in the frozen state. NEVER allow frozen specimens to be transported without dry ice. Specimens, when ready for transport, should be completely inserted into the dry ice. Frozen specimens that have been allowed to thaw cannot be refrozen and are unacceptable for analysis.

Place each blood bottle, leakproof aliquot tube, or primary specimen container in a double-layered, biohazard-labelled transport bag. The specimen should be placed in the sealable compartment and the completed requisition slip placed in the outer pouch to prevent contamination. Please ensure the containers and bags are properly sealed to avoid spills.

SPECIMEN RECEPTION COUNTER (SRC)

The SRC at HUiTM Puncak Alam, Sg Buloh Campus and Selayang Campus will receive specimens daily. However, after 5.00 pm., Saturday, Sunday, and public holidays, the SRC will also receive the specimen for related MMP (at HUiTM Puncak Alam) and Anatomic Pathology (cytology examination) (at Sg Buloh Campus).

Receipt of specimen for Anatomic Pathology (at Sg Buloh Campus) will take place at individual unit specimen reception area from Monday to Friday (8.00 a.m to 5.00 p.m.)

The time of specimens received at the counter must be acknowledged by the laboratory personnel. The specimens/samples will be sent to the respective laboratory for the test to be performed.

RESULTS

All the results of in-house tests from various specialties in the laboratory will be validated by the Pathologist & Clinical Microbiologist on duty/Medical Officer/Science Officer/Senior MLT. Clinical advice on the interpretation of test results is available where necessary or upon request. Preliminary report / urgent results will be informed to the specialist / medical officer/ staff nurse in charge via phone call and documented. For Chemical Pathology tests, only Troponin T results and critical values will be notified via phone. Tracing and collecting other urgent results are the responsibility of the requester.

All the outsource test results will be acknowledged by the Pathologist/Clinical Microbiologist on duty/Medical Officer/Science Officer. The original results will be dispatched to the ward/clinic. A copy of the outsource test results will be kept in the laboratory for documentation.

SPECIMEN REJECTION

When test requests are received in the laboratory, they may be rejected for any one of the following reasons:

- Specimen received without a label or with improper identification
- Unlabelled/mislabelled
- Specimen of questionable integrity (depending on tests ordered)
- Incorrect transport container
- Insufficient volume
- Haemolysis (depending on tests ordered)
- Improper handling or storage of specimen
- Clotted specimen (depending on tests ordered)
- Lipaemic samples
- Icteric samples
- No specimen received (only request form received)
- Repetitive test order / double request
- The test is not clinically indicated
- The test is not offered

The client or customer will be notified as soon as possible should the test request be unacceptable for any of the above reasons.

SPECIMEN RETENTION / TEST ADDITIONS

Except for unstable specimens (e.g., those for cultures, CBCs, urinalysis), laboratories retain most specimens for several days. If a test is to be added to a specimen that is already in the laboratory or if a repeat assay is requested, these should be communicated to the laboratories via 03 - 61265209 / 5215 / 5214/ 5053. A representative can arrange for additional testing if adequate specimen volume remains after the initial tests have been completed and the stability of the analyte(s) requested are acceptable. The add-on test(s) should be ordered in the HIS and a new request form should be sent to the laboratory.

QUALITY MANAGEMENT

The laboratory is subjected to external accreditation by 'Skim Akreditasi Makmal Malaysia (SAMM), MS ISO 15189: 2014'. Each of the laboratories runs a comprehensive Quality Management System (QMS), participating in relevant proficiency testing and quality assessment schemes at the national, regional and / international level, and operates a scheduled internal quality audit, corrective action and quality improvement.

The following quality control and quality assurance programmes are carried out in the CDL:

- Reagent assessment
- Method validation to ensure the test method implemented meets the requirement for accuracy, recovery, precision and detection limits.
- Calibration Method
- Quality control Method
- Internal and external quality assurance programme
- Quality system review and audit
- Turnaround time (TAT)

The laboratories comply with safety procedures as specified in the '*Laboratory Safety Manual*'.

FUTURE DIRECTION

To make available appropriate skills and subspecialty services to meet the expanding clinical requirements.
To ensure the laboratory abides by standard MS ISO 15189:2014.

ENQUIRY, FEEDBACK, SUGGESTION, COMPLAINTS & CUSTOMER SATISFACTION SURVEY

To ensure that we are meeting the needs of our users/clients/customers, the laboratories are always keen to receive any enquiry, comments, and feedback regarding the service provided. We welcome any suggestions to improve the service.

Complaints can be submitted by printing and filling in the 'Complaint Form' available at the Clinical Diagnostic Laboratories website at https://medicine.uitm.edu.my/

The online 'Laboratory Customer Survey' or 'Kaji Selidik Pelanggan Makmal' is available for further feedback on laboratory services. Kindly click the links below to fill in the survey.
https://forms.gle/NWf8XSvugf56rs7n8 (English version)
https://forms.gle/vNEhurJJPAGeew8G7 (Bahasa Melayu version)

Please feel free to contact the individual specialty representatives:

- Chemical Pathology: Cik Sarina Ali (03-61265215/5213)
- Haematology & Transfusion Medicine: Cik Halimatun Radziah Othman (03-61265209/5215)

- Anatomic Pathology: En. Muhamad Idham Mohamed/En. Muhammad Fa'iz Hussin (03-61265242/5053)

- Medical Microbiology & Parasitology: Pn. Norzilawati Mohd Isa (03-339610823)

- Selayang Campus laboratory: Pn. Che Wan Juliana (03-61264813/4814)

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Head of the Department

Clerk..... 6126 7663

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Consultant Pathologist

Dr. Fathimah Muhammad…… 6126 7646
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Senior Pathologist

Dr. Normi Ngah Muhamed…… 61267649
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Pathologist

Science Officer

Pn. Norzilawati Mohd. Isa…… 339610823

Cik Noor Aini Abu Bakar …… 339610822

CHEMICAL PATHOLOGY

1. INTRODUCTION

The Chemical Pathology Unit is an accredited clinical laboratory that provides comprehensive clinical biochemistry and advisory services including interpretation of results, advice on the appropriate selection of the laboratory tests, investigation and monitoring strategies for individual patients and specific diseases.

2. SERVICES

The Chemical Pathology Unit provides laboratory and consultative services in the areas of diagnostic and research as follows:

a) Urgent tests
b) 24-hour (on-call) tests
c) Routine tests
d) Specialised tests

2.1 Definition

a) Urgent tests
- Urgent tests which require stat analysis
- Turnaround time: 45 minutes (arterial and venous blood gases)
  : 1 hour (other urgent biochemistry tests)

b) 24-hour (on-call) tests
- Tests are offered over 24 hours.
- List of tests offered:
  - Renal Profile
  - Blood Gases
  - Liver Function Test
  - Bone Profile
  - Amylase
  - Aspartate aminotransferase (AST)
  - Calcium
  - Corrected Calcium
  - Creatine Kinase
  - C-reactive protein
  - Glucose
  - Magnesium
  - Phosphate
  - hs Troponin T
  - Body Fluids Biochemistry

- Bilirubin (total/direct)
- Urine FEME (dipstick only)
- Urine Pregnancy Test
- Vancomycin

c) Routine tests

- Tests that are offered during office hours.
- Turnaround time – 4 hours (inpatient) to 5 working days (outpatient)

d) Specialised tests

- Tests that are run in batches (e.g., endocrine tests, dynamic function tests and anaemia profile).
- Turnaround time – 5 working days.

3. REQUEST FORMS

All Chemical Pathology tests should be requested using an online ordering system via the HIS. In the event when the HIS is offline, the request should be done manually. The PER PAT-301 form or other specified forms must be filled when ordering any outsourced tests.

Additional tests: Additional tests to primary samples can be requested but subjected to sample integrity and sufficiency. Please contact 5215 prior to a request.

4. SPECIAL COLLECTION PROCEDURES

4.1 24-hour Urine Collection

Most quantitative assays are performed on urine specimen collected over 24-hour. The 24-hour timing allows for circadian rhythmic changes in excretion at a certain time of day.

- Procedure of Collection
  - Request for the 24-hour urine container from the laboratory.
  - On the day of collection, discard the first urine voided. The time of first urine voided is the start of the timing for the 24-hour collection.
  - Collect the second and subsequent voided urine for 24 hours from the timed start into the 24-hour urine container.
  - At the end of 24 hours, collect the last urine voided. Refrigeration of the sample during the collection period is advisable. Label the urine container as directed and send it immediately to the laboratory.

- Ensure patient information on the specimen urine container is complete before they are returned to the laboratory.
- Avoid direct urination into the 24-hour urine container to prevent skin contact with the preservatives contained in the bottle, which may cause burns or irritation.

4.2 Oral Glucose Tolerance Test (OGTT)

- Procedure of Collection
  - Check that the patient has fasted for a minimum of 8 hours.
  - Perform venepuncture and collect blood sample into fluoride oxalate tube and label with patient identification and "**fasting**" on the sample. Send the sample with the request form immediately to the laboratory.
  - Collect another blood sample in a fluoride oxalate tube for glucose measurement two hours after the glucose solution has been given.
  - The second blood sample must be labelled with patient details and "**2HPP**"; indicating 2 Hours Post Prandial.
  - Send the second sample immediately to the laboratory.

5. RECEIPT OF SPECIMEN

All specimens will be received at the Specimen Reception Counter. Specimens should arrive within the stipulated time given in the table "List of Tests".

6. REPORTING OF RESULTS

All results will be verified by the Medical Laboratory Technologists (MLTs) and validated by the Science Officer and/Medical Officer/ Pathologist on duty. Critical results listed in Table 1 will be informed via phone and documented.

Table 1. CRITICAL LIMITS FOR CHEMICAL PATHOLOGY

LOWER CRITICAL LIMIT	ANALYTE	HIGHER CRITICAL LIMIT
	ADULT	
2.8 mmol/L	Potassium	6.0 mmol/L
125 mmol/L	Sodium	155 mmol/L
2.8 mmol/L	Glucose	20 mmol/L
1.5 mmol/L	Calcium	3.0 mmol/L
0.41 mmol/L	Magnesium	2.0 mmol/L
0.32 mmol/L	Phosphate	2.87 mmol/L
7.2	pH	7.55
58.65 mmHg	pO2 (arterial)	-
19 mmHg	pCO2 (arterial)	67 mmHg
-	Creatine Kinase	1000 U/L
	PAEDIATRIC	
2.8 mmol/L	Potassium	6.0 mmol/L
125 mmol/L	Sodium	155 mmol/L
1.6 mmol/L	CSF-Glucose	-
1.7 mmol/L	Calcium	3.1 mmol/:
0.5 mmol/L	Magnesium	1.8 mmol/L
0.4 mmol/L	Phosphate	2.8 mmol/L
-	pH	7.6
43.98 mmHg	pO2 (arterial)	121.8 mmHg
19.55 mmHg	pCO2 (arterial)	68.42 mmHg
-	Creatinine	330 umol/L
-	Bilirubin	300 µmol/L
-	CSF-Protein	1.87 g/L
-	Urea	19.0 mmol/L
-	Uric Acid	500 µmol/L

References

a) *Critical Limit for Chemical Pathology, Quick Guide for Improving Notification of Critical Laboratory Results in MOH Hospitals, February 2010.*
b) *Critical Limits of Laboratory Results for Urgent Clinician Notification, eJIFCC vol 14 no 1: https://www.ifcc.org/media/477036/ejifcc2003vol14no1pp011-018.pdf*
c) Performance Indicators Malaysian Society for Quality in Health (MSQH) Hospital Accreditation Standards 5th Edition 2017.

LIST OF TESTS (Refer to Clinical Indications and Reference Ranges: App. 1 & 2)

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
1	17-hydroxy progesterone	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	UMMC
2	5-HIAA urine (24 hours)	Urine 24 hours	24 hours collection	24 hours bottle container	Complete PER PAT.301 form and send it along with the sample to CDL immediately.	UMMC
3	Acetaminophen (PCM)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	Hosp. Sg Buloh
4	Adreno corticotropic Hormone (ACTH)	Plasma	3 ml	K2-EDTA tube in ice (4°C)	**BY APPOINTMENT with the lab** (at least 3 days before collection). i) Pre-chill the tube & syringe overnight before use. ii) After collection, send immediately to lab.	UMMC
5	Alanine Transaminase (ALT)	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
6	Albumin	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
7	Albumin (CSF)	CSF	3 ml	Bijou bottle	Send to the CDL immediately.	CDL
8	Albumin (Peritoneal Fluid)	Peritoneal fluid	at least 15 ml	Bijou bottle	Send to the CDL immediately.	CDL
9	Alcohol Level	Serum	3 ml	Plain tube (without gel)	Complete PER PAT.301 form and send it along with the sample to CDL immediately. **MANDATORY TO USE A PLAIN TUBE WITHOUT GEL.**	HKL
10	Aldosterone	Plasma	4 ml	EDTA tube	**BY APPOINTMENT with the lab** (at least 3 days before collection). i) Complete PER PAT.301 form. ii) Sample volume must be at least 4 ml. Sample must be **sent immediately WITHOUT ice.** iii) **Please DO NOT pre-chill tube and syringe before blood taking.** iv) Record patient's posture whether supine or upright in column 'clinical history' on the request form. v) Blood should be taken between 8 am -10 am.	UMMC

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
11	Alkaline Phosphatase	Serum	3 ml	Plain tube	Send to CDL within 2-4 hours.	CDL
12	Alpha-1 antitrypsin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send to CDL within 2-4 hours.	UMMC
13	Alpha-Fetoprotein	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send to CDL within 2-4 hours.	Hosp. Sg Buloh
14	Aluminium	Serum	6 ml	Royal blue (plain) tube	**BY APPOINTMENT with the lab** (within 2 weeks before blood taking).	UMMC
15	Amino-levulinicacid (Delta-ALA)	Random urine	at least 15 ml	Urine container	i) Get IEM Request form at CDL Specimen Reception Counter. ii) After sample collection, send to CDL immediately.	IMR
16	Aminophylline	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send to CDL within 2-4 hours.	UMMC
17	Ammonia	Plasma	3 ml	EDTA tube in ice (4°C)	Sample must be kept on ice after collection. Complete PER PAT.301 form and send it along with the sample to CDL immediately.	Hosp. Sg Buloh
18	Amylase	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
19	Amylase (Other Fluids)	Other fluids	10 ml	Plain tube	Send to the CDL immediately	CDL
20	Amylase (Urine)	Random urine	30 ml	Urine container	Send to the Chemical Pathology Lab within 2-4 hours.	CDL
21	Androstenedione	Serum	10 ml	Plain tube	**BY APPOINTMENT with the lab** (at least 1 day before blood taking). i) Get Gribbles Request Form at the CDL Specimen Reception Counter. ii) Transportation to Australia is on Thursday. Advisable to send the sample on Tuesday or Wednesday.	Gribbles

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
22	Angiotensin-Converting Enzyme (ACE)	Serum	8 ml or 2 plain tubes	Plain tube	**BY APPOINTMENT with the lab** (at least 1 day before blood taking). i) Requires 2 plain gel tubes. ii) Get the Gribbles Request Form at the CDL Specimen Reception Counter and complete the form. iii) Send the form and samples to the CDL. iii) Transportation to the USA is on every Thursday. Samples should reach on Tuesday or Wednesday.	Gribbles
23	Anti-Acetylcholine Receptor Antibody	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	UMMC
24	Anti-Mullerian Hormone	Serum	3 ml	Plain tube	**BY APPOINTMENT with the lab** (at least 1 day before blood taking). i) Get the Gribbles Request Form at CDL Specimen Reception Counter. Ii) Send the sample with completed Gribbles Request Form to CDL immediately.	Gribbles
25	Apolipoprotein (a)	Serum	3 ml	Plain tube	**BY APPOINTMENT with the lab** (at least 1 day before blood taking). i) Get the Gribbles Request Form at the CDL Specimen Reception Counter. Ii) Send the sample with completed Gribbles Request Form to CDL immediately.	Gribbles
26	Apolipoprotein (b)	Serum	3 ml	Plain tube	**BY APPOINTMENT with the lab** (at least 1 day before blood taking). i) Get the Gribbles Request Form at the CDL Specimen Reception Counter. ii) Send the sample with completed Gribbles Request Form to CDL immediately.	Gribbles
27	Aspartate Transaminase	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
28	Bence Jones Protein	Random urine	20 ml	Urine container	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	UMMC
29	Benzodiazepine	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	Hosp. Sg Buloh
30	Beta Human Chorionic Gonado-trophin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	Hosp. Sg Buloh
31	Beta-2-Microglobulin	Serum	6 ml	Plain tube	i) Requires 2 plain gel tubes. ii) Get IMR Request Form at Laboratory Specimen Reception Counter. iii) Sent samples with completed IMR Request Form to the laboratory immediately.	IMR
32	Brain-Type Natriuretic Peptide	Plasma	3 ml	EDTA tube	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	UMMC
33	C- Peptide	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
34	Caeruloplasmin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	HKL
35	Calcitonin	Serum	3 ml	Plain tube	Complete the Gribbles Request Form, get it at the CDL Reception Counter. Send the sample within 2-4 hours.	Gribbles
36	Calcium	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
37	Calcium urine (24 hours)	Urine 24 hours	24 hours collection	24 hours bottle container	Send to the CDL immediately.	CDL
38	Calcium urine (random)	Random urine	20 ml	Urine container	Send to the CDL immediately.	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
39	Cancer 15-3 (CA 15-3)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	HKL
40	Cancer AG 125(CA 125)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	Hosp. Sg Buloh
41	Cancer AG19-9 (CA 19-9)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	Hosp. Sg Buloh
42	Carbamazepine	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	UMMC
43	Carcino-embryonic AG (CEA)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	Hosp. Sg Buloh
44	Chloride	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
45	Chloride urine (24 hours)	Urine 24 hours	24 hours collection	24 hours bottle container	Send to the CDL immediately.	CDL
46	Chloride urine (random)	Random urine	3 ml	Urine container	Send to the CDL immediately.	CDL
47	Chromogranin A	Serum	8 ml	Plain tube	**BY APPOINTMENT with the lab** (at least 1 day before sample collection). i) To contact the Chemical Pathologist on duty to justify the need. ii) Please send the sample in 3 plain tubes (3ml each) to the CDL. iii) Complete the Gribbles Request Form (get it at the CDL Reception Counter). iv) Send the form along with the sample to the CDL immediately.	Gribbles
48	Complement 3	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	Hosp. Sg Buloh
49	Complement 4	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	Hosp. Sg Buloh

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
50	Copper	Serum	3 ml	Royal blue trace (plain) tube	**BY APPOINTMENT with the lab** (at least 2 weeks before sample collection). i) Get royal blue (plain) tube at the CDL Specimen Reception Counter. ii) Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
51	Copper urine (24 hours)	Urine 24 hours	24 hours urine collection	24 hours bottle container	**BY APPOINTMENT with the lab** (at least 2 weeks before sample collection). i) Get the 24 hrs bottle (acid wash bottle) from the laboratory 1 week after booking. ii) Complete PER PAT.301 form and send it along with the sample to the laboratory immediately.	UMMC
52	Corrected Calcium	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
53	Cortisol (0 hour)	Serum	3 ml	Plain tube	Notify the laboratory at least 2 days before the dynamic function test. Once blood is taken, please send it to the laboratory immediately. The assay is unaffected by biotin (<= 123 nmol/L OR <= 30 ng/mL).	CDL
54	Cortisol urine (24 hours)	Urine 24 hours	at least 750 ml	24 hours bottle container	Complete PER PAT.301 form and send it along with the sample to the CDL immediately. Urine volume must be > 750 ml.	UMMC
55	Cortisol, 120 min	Serum	3 ml	Plain tube	Notify the laboratory at least 2 days before the dynamic function test. Once blood is taken, please send it to the laboratory immediately. The assay is unaffected by biotin (<= 123 nmol/L OR <= 30 ng/mL).	CDL
56	Cortisol, 30 min	Serum	3 ml	Plain tube	Notify the laboratory at least 2 days before the dynamic function test. Once blood is taken, please send it to the laboratory immediately. The assay is unaffected by biotin (<= 123 nmol/L OR <= 30 ng/mL).	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
57	Cortisol, 60 min	Serum	3 ml	Plain tube	Notify the laboratory at least 2 days before the dynamic function test. Once blood is taken, please send it to the laboratory immediately. The assay is unaffected by biotin (<= 123 nmol/L OR <= 30 ng/mL).	CDL
58	Cortisol, 90 min	Serum	3 ml	Plain tube	Notify the laboratory at least 2 days before the dynamic function test. Once blood is taken, please send it to the laboratory immediately. The assay is unaffected by biotin (<= 123 nmol/L OR <= 30 ng/mL).	CDL
59	Cortisol, Midnight	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 123 nmol/L OR <= 30 ng/mL).	CDL
60	Cortisol, Morning	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 123 nmol/L OR <= 30 ng/mL).	CDL
61	Cortisol, Serum	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 123 nmol/L OR <= 30 ng/mL).	CDL
62	C-Reactive Protein	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
63	Creatine Kinase	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
64	Creatinine	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
65	Creatinine PD Fluid (24 hours)	Peritoneal Dialysate	Timed collection	24 hours bottle container	Send to the CDL immediately.	CDL
66	Creatinine PD Fluid (0 hour)	Peritoneal Dialysate	Timed collection	24 hours bottle container	Send to the CDL immediately.	CDL
67	Creatinine PD Fluid (2 hours)	Peritoneal Dialysate	Timed collection	Sterile bottle container	Send to the CDL immediately.	CDL
68	Creatinine PD Fluid (4 hours)	Peritoneal Dialysate	Timed collection	Sterile bottle container	Send to the CDL immediately.	CDL
69	Creatinine PD Fluid (Overnight)	Peritoneal Dialysate	Timed collection	Sterile bottle container	Send to the CDL immediately.	CDL
70	Creatinine urine (24 hours)	Urine 24 hours	24 hours collection	24 hours bottle container	Send to the CDL immediately.	CDL
71	Creatinine urine (random)	Random urine	3 ml	Urine container	Send to the CDL immediately.	CDL
72	Cyclosporin	Whole blood	4 ml	EDTA tube	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	UMMC
73	Dihydro-testosterone	Serum	10 ml	Plain tube	**BY APPOINTMENT with the lab** (at least 1 day before blood taking). i) Get the Gribbles Request Form at the CDL Specimen Reception Counter. ii) Transportation to Australia is on Thursday. Advisable to send the sample on Tuesday or Wednesday	Gribbles
74	DHEAS	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
75	Digoxin level	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	UMMC
76	Direct Bilirubin	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
77	Estradiol	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 147 nmol/L OR <= 36 ng/mL).	CDL
78	Everolimus	Whole blood	3 ml	EDTA tube	**BY APPOINTMENT with the lab** (at least 1 day before blood taking). Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	UMMC
79	Faecal Occult Blood (FOB)	Stool	NA	Stool container	Send to the CDL immediately.	CDL
80	Fasting Plasma Glucose	Plasma	3 ml	Fluoride tube	A fasting sample is required (at least 8 hours fasted). Send to the CDL within 2-4 hours.	CDL
81	Fat globules	Stool	NA	Stool container	**BY APPOINTMENT with the lab** (at least 1 day before blood taking). The sample must be freshly collected. Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	UMMC

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
82	Ferritin	Serum	3 ml	Plain tube	The test will be analysed by batch (every Wednesday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 205 nmol/L OR <= 50 ng/mL).	CDL
83	Folate	Serum	3 ml	Plain tube	The test will be analysed by batch (every Wednesday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 86.1 nmol/L OR <= 21 ng/mL).	CDL
84	Free Light Chain	Serum	4 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
85	Free Prostate Specific Antigen	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours. Total PSA must have been analysed before the request is made. The total PSA result must be between 2.5 - 10 ng/ml.	HKL
86	Free T3	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
87	Free T4	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 409 nmol/L OR <= 100 ng/mL).	CDL
88	Fructosamine	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
89	FSH	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 246 nmol/L OR <= 60 ng/mL).	CDL
90	FSH, 0 min	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 246 nmol/L OR <= 60 ng/mL).	CDL
91	FSH, 30 min	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 246 nmol/L OR <= 60 ng/mL).	CDL
92	FSH, 60 min	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 246 nmol/L OR <= 60 ng/mL).	CDL
93	Gamma glutamyl transferase (GGT)	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
94	Gastrin	Serum	3 ml	Plain tube	**BY APPOINTMENT with the lab** (at least 1 week before blood taking). i) Get the Gribbles Request Form at the lab Specimen Reception Counter. ii) Fasting sample. iii) Transportation to Australia is on Thursday, Advisable to send the sample to the lab on Tuesday or Wednesday.	Gribbles

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
95	Gentamicin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to the CDL immediately.	Hosp. Sg Buloh
96	Glucose PD Fluid (2 hours)	Peritoneal Dialysate	Timed collection	24 hours container	Send to the CDL immediately.	CDL
97	Glucose (1HPP)	Plasma	3 ml	Fluoride tube	Send to the CDL within 2-4 hours.	CDL
98	Glucose (2HPP)	Plasma	3 ml	Fluoride tube	Send to the CDL within 2-4 hours.	CDL
99	Glucose (CSF)	CSF	at least 15 ml	Bijou bottle	Send to the CDL immediately.	CDL
100	Glucose (Pleural Fluid)	Pleural Fluid	at least 15 ml	Bijou bottle	Send to the CDL immediately.	CDL
101	Glucose PD (4 hours)	Peritoneal Dialysate	Timed collection	24 hours container	Send to the CDL immediately.	CDL
102	Glucose PD Fluid (0 hour)	Peritoneal Dialysate	Timed collection	24 hours bottle container	Send to the CDL immediately.	CDL
103	Glucose PD, overnight	Peritoneal Dialysate	Timed collection	24 hours bottle container	Send to the CDL immediately.	CDL
104	Glucose Random	Plasma	3 ml	Fluoride tube	Send to the CDL within 2-4 hours.	CDL
105	Growth Hormone	Serum	3 ml	Plain tube	**BY APPOINTMENT with the lab**.Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
106	Haptoglobin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
107	HDL-cholesterol	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
108	Homocysteine	Plasma	4 ml	EDTA tube	Complete PER PAT.301 form and send it along with the sample to the Chemical Pathology Lab within 2-4 hours after blood collection.	UMMC
109	Hs Troponin T	Serum	3 ml	Plain tube	Send to the CDL immediately. The assay is unaffected by biotin (< 82 nmol/L OR < 20 ng/mL).	CDL
110	IGF-1	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
111	Intrinsic Factor Antibody	Serum	3 ml	Plain tube	**BY APPOINTMENT with the lab** (at least 1 day before sample collection). i) Complete the Gribbles Request Form (get it at the CDL Reception Counter). ii) Send the samples within 2-4 hours.	Gribbles
112	Insulin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
113	Iron (Total)	Serum	3 ml	Plain tube	The test will be analysed by batch (every Wednesday). Send sample to the CDL within 2-4 hours.	CDL
114	Lactate	Plasma	3 ml	Fluoride In Ice (4°C)	i) Sample must be kept on ice after collection. ii) Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	Hosp. Sg Buloh
115	LDH	Serum	3 ml	Plain tube	Send to the CDL immediately.	CDL
116	LDH (Pericardial fluid)	Pericardial Fluid	at least 15 ml	Bijou bottle	Send to the CDL immediately.	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
117	LDH (Pleural fluid)	Pleural Fluid	at least 15 ml	Bijou bottle	Send to the CDL immediately.	CDL
118	LH	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 205 nmol/L OR <= 50 ng/mL).	CDL
119	LH, 0 min	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 205 nmol/L OR <= 50 ng/mL).	CDL
120	LH, 30 min	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 205 nmol/L OR <= 50 ng/mL).	CDL
121	LH, 60 min	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 205 nmol/L OR <= 50 ng/mL).	CDL
122	Lipase	Serum	3 ml	Plain tube	**BY APPOINTMENT with the lab.** Get the Gribbles Request form from the lab. Complete the Gribbles request form and send it along with the sample to the Chemical Pathology lab immediately.	Gribbles

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
123	Lipoprotein (a)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	IMR
124	Lithium	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	UMMC
125	Magnesium	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
126	Magnesium urine (24 hours)	Urine 24 hours	24 hours collection	24 hours bottle container	Send to the CDL immediately.	CDL
127	Magnesium urine (random)	Random urine	3 ml	Urine container	Send to the CDL immediately.	CDL
128	Mercury (Blood)	Whole blood	6 ml	Royal blue trace EDTA tube	**BY APPOINTMENT with the lab** (within 2 weeks before blood taking). i) Get a royal blue (EDTA) tube at the CDL Specimen Reception Counter. ii) Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
129	Mercury urine	Random urine	50 ml	Urine container	**BY APPOINTMENT with the lab** (within 1 week before sample collection). i) Contact the CDL ONE (1) week before sample collection. ii) Get the Gribbles request form from the CDL. iii) Send the form along with the sample to the CDL immediately.	Gribbles
130	Metanephrine urine (24 hours)	Urine 24 hours	24 hours collection	24 hours bottle container	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	UMMC

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
131	Myoglobin	Random urine	20 ml	Urine container	**BY APPOINTMENT with the lab** (at least 1 day before sample collection). i) Get the IEM Request form at the CDL Specimen Reception Counter. ii) Sample must be freshly collected. iii) After collection, send to the CDL immediately.	IMR
132	Oligoclonal band	Serum & CSF	Serum (3ml) & CSF (≥7drops)	Plain tube & bijou bottle	**BY APPOINTMENT with the lab** (at least 1 day before sample collection). i) 1-3mL of non-haemolysed serum and at least 0.5mL of CSF in a bijou bottle or sterile container. ii) It is recommended to collect serum and CSF at the same time. iii) Serum must be refrigerated immediately after collection. iv) CSF must be frozen immediately after collection. v) No haemolysis.	IMR
133	Osmolality (serum)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	Hosp. Sg Buloh
134	Osmolality urine (random)	Random urine	20 ml	Urine container	Send to the CDL immediately.	Hosp. Sg Buloh
135	Parathyroid (intact)-iPTH	Plasma	3 ml	EDTA tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
136	pH (Pericardial Fluid)	Pericardial Fluid	at least 15 ml	Bijou bottle	Send to the CDL immediately.	CDL
137	pH (Peritoneal Fluid)	Peritoneal fluid	at least 15 ml	Bijou bottle	Send to the CDL immediately.	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
138	Phenobarbitone	Serum	3 ml	Plain tube	Complete the TDM form and send it along with the sample to the CDL immediately.	HKL
139	Phenytoin (Dilantin)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	Hosp. Sg Buloh
140	Porphobilinogen urine (random)	Random urine	20 ml	Urine container	**BY APPOINTMENT with the lab** (at least 1 day before sample collection). i) Complete PER PAT.301 form. ii) Requires at least 5 ml of fresh urine and protects it from light (wrap the bottle with aluminium foil before sending it to the lab). iii) Send the sample to the lab immediately.	UMMC
141	Phosphate urine (24 hours)	Urine 24 hours	24 hours collection	24 hours bottle container	Send to the CDL immediately.	CDL
142	Phosphate urine (random)	Random urine	20 ml	URINE	Send to the CDL immediately.	CDL
143	Phosphate urine (random)	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
144	Porphyrin urine (random)	Random urine	20 ml	Urine container	**BY APPOINTMENT with the lab** (at least 1 day before sample collection). i) Complete PER PAT.301 form. ii) Requires at least 5 ml of fresh urine and protects it from light (wrap the bottle with aluminium foil before sending it to the lab). iii) Send the sample to the lab immediately.	UMMC
145	Potassium	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
146	Potassium urine (24 hours)	Urine 24 hours	24 hours collection	24 hours bottle container	Send to the CDL immediately.	CDL
147	Potassium urine (random)	Random urine	20 ml	URINE	Send to the CDL immediately.	CDL
148	Procalcitonin	Whole blood	3 ml	Lithium heparin	i) Get a lithium heparin tube at the CDL Specimen Reception Counter. ii) Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
149	Progesterone	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 123 nmol/L OR <= 30 ng/mL).	CDL
150	Prolactin	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 164 nmol/L OR <= 40 ng/mL).	CDL
151	Prostate Specific Antigen (Total)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	Hosp. Sg Buloh
152	Protein Electro-phoresis (urine random)	Random urine	20 ml	Urine container	Complete PER PAT.301 form and send it along with the sample to the CDL immediately. The test must be requested with Serum Protein Electrophoresis.	HKL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
153	Protein Electro-phoresis (serum)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL immediately. The test must be requested with Urine Protein Electrophoresis.	HKL
154	Renin	Plasma	4 ml	EDTA tube	**BY APPOINTMENT with the lab** (at least 3 days before blood taking) i) Complete PER PAT.301 form. ii) Sample volume must be at least 4ml. iii) Sample must be **sent immediately WITHOUT ice.** iv) **Please DO NOT pre-chill tube and syringe before blood taking.** v) Record patient's posture whether supine or upright in column 'clinical history' on the request form. vii) Blood should be taken between 8 am -10 am.	UMMC
155	Salicylate Acid	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	Hosp. Sg Buloh
156	Sex Hormone Binding Globulin	Serum	3 ml	Plain tube	**BY APPOINTMENT with the lab** (at least 1 day before blood taking) i) Get the Gribbles Request Form at the CDL Reception Counter. ii) Complete the form. iii) Send the sample within 2-4 hours.	Gribbles
157	Sirolimus	Whole blood	4 ml	EDTA tube	Make an appointment with the lab. Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	UMMC

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
158	Sodium	Serum	3 ml	Plain tube	Send to CDL within 2-4 hours.	CDL
159	Sodium urine (24 hours)	Urine 24 hours	24 hours collection	24 hours bottle container	Send to the CDL immediately.	CDL
160	Sodium urine (random)	Random urine	20 ml	Urine container	Send to the CDL immediately.	CDL
161	Sodium Valproate	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	Hosp. Sg Buloh
162	Stone Analysis	Stone	NA	Urine container	i) Please make sure only stone specimens are in the container. NO URINE (air-dry calculi). ii) Complete PER PAT.301 form and send it along with the sample to the laboratory within 2-4 hours. iii) Transportation to India is on Tuesday.	LABLINK
163	Stool Reducing Sugar	Stool	3 ml	Stool container	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	UMMC
164	Tacrolimus	Whole blood	3 ml	EDTA tube	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	UMMC
165	Thyroglobulin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
166	Thyroglobulin Ab	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
167	Thyroid Stimulating Immunoglobulin (TSI)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL immediately.	UMMC

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
168	Thyroperoxidase Antibody (TPO ab)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
169	Total Bilirubin	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
170	Total Bilirubin (CSF)	CSF	at least 15 ml	Bijou bottle	Send to the CDL immediately.	CDL
171	Total Cholesterol (Pleural Fluid)	Pleural Fluid	3 ml	Bijou bottle	Send to the CDL immediately.	CDL
172	Total Iron Binding Capacity (UiBC)	Serum	3 ml	Plain tube	The test will be analysed by batch (every Wednesday). Send the sample to the CDL within 2-4 hours.	CDL
173	Total Protein	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
174	Total Protein (CSF)	CSF	at least 15 ml	Bijou bottle	Send to the CDL immediately.	CDL
175	Total Protein (Pericardial Fluid)	Pericardial Fluid	at least 15 ml	Bijou bottle	Send to the CDL immediately.	CDL
176	Total Protein (Peritoneal Fluid)	Peritoneal fluid	at least 15 ml	Bijou bottle	Send to the CDL immediately.	CDL
177	Total Protein (Pleural Fluid)	Pleural Fluid	at least 15 ml	Bijou bottle	Send to the CDL immediately.	CDL
178	Total Protein urine (24 hours)	Urine 24 hours	24 hours collection	24 hours bottle container	Send to the CDL immediately.	CDL
179	Total Protein urine (random)	Random urine	20 ml	Urine container	Send to the CDL immediately.	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
180	Total Testosterone	Serum	3 ml	Plain tube	The test will be analysed by batch (every Thursday). Send the sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 123 nmol/L OR <= 30 ng/mL).	CDL
181	Triglycerides, Fasting	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
182	TSH (Cord Blood)	Cord blood	3 ml	Plain tube	Send to the lab immediately.	CDL
183	TSH Receptor Antibody	Serum	3 ml	Plain tube	**BY APPOINTMENT with the lab** (at least 1 day before blood taking). i) Get the Gribbles Request Form at the CDL Specimen Reception Counter. ii) Transportation to Australia is on Thursday. Advisable to send the sample on Tuesday or Wednesday.	Gribbles
184	TSH, 0 min	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 4912 nmol/L OR <= 1200 ng/mL).	CDL
185	TSH, 30 min	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 4912 nmol/L OR <= 1200 ng/mL).	CDL
186	TSH, 60 min	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 4912 nmol/L OR <= 1200 ng/mL).	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
187	TSH, 90 min	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 4912 nmol/L OR <= 1200 ng/mL).	CDL
188	UACR	Random urine	3 ml	Urine container	Send to the CDL immediately.	CDL
189	Unsaturated Iron Binding Capacity (UiBC)	Serum	3 ml	Plain tube	The test will be analysed by batch (every Wednesday). Send the sample to the CDL within 2-4 hours.	CDL
190	UPCR	Random urine	3 ml	Urine container	Send to the CDL immediately.	CDL
191	Urea	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
192	Urea PD Fluid (24 hours)	Peritoneal Dialysate	Timed collection	24 hours bottle container	Send to the CDL immediately.	CDL
193	Urea PD Fluid (Overnight)	Peritoneal dialysate	Timed collection	Universal Bottle container	Send to the CDL immediately.	CDL
194	Urea Post-Haemodialysis	Serum	Timed collection	Plain tube	Send to the CDL within 2-4 hours.	CDL
195	Urea Pre-Haemodialysis	Serum	Timed collection	Plain tube	Send to the CDL within 2-4 hours.	CDL
196	Urea urine (24 hours)	Urine 24 hours	24 hours collection	24 hours bottle container	**REFRIGERATE** during collection. Send to the lab in an ice box that contains an ice pack.	CDL
197	Urea urine (random)	Random urine	20 ml	Urine container	Send to the CDL immediately.	CDL
198	Uric Acid	Serum	3 ml	Plain tube	Send to the CDL within 2-4 hours.	CDL
199	Uric Acid urine (24 hours)	Urine 24 hours	24 hours collection	24 hours bottle container	**DO NOT REFRIGERATE.** Send the sample to CDL immediately.	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
200	Urine dipstick	Random urine	20 ml	Urine container	Send to the CDL immediately.	CDL
201	Urine Phase Contrast (urine random)	Random urine	30 ml	Urine container	**BY APPOINTMENT with the lab** (at least 1 day before collection). i) Get the Gribbles request form at CDL Specimen Reception Counter. Ii) Complete the form and send it along with the sample to the CDL immediately.	Gribbles
202	Urine Pregnancy Test (UPT)	Random urine	20 ml	Urine container	Send to the CDL immediately.	CDL
203	Vancomycin	Serum	3 ml	Plain tube	Send to the CDL immediately.	CDL
204	Vitamin B1 (Thiamine)	Whole blood	6 ml	Lithium heparin	**BY APPOINTMENT with the lab** (at least 1 day before blood taking). i) Get the Gribbles Request Form and lithium heparin tube (which has been wrapped with aluminium foil) at the CDL Specimen Reception Counter. ii) Transportation to Australia is on every Thursday. Samples should reach on Tuesday or Wednesday.	Gribbles
205	Vitamin B12	Serum	3 ml	Plain tube	The test will be analysed by batch (every Wednesday). Send sample to the CDL within 2-4 hours. The assay is unaffected by biotin (<= 205 nmol/L OR <= 50 ng/mL).	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
206	Vitamin D	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
207	Zinc (serum)	serum	6 ml	Royal blue trace (plain) tube	**BY APPOINTMENT with the lab** (within 2 weeks before blood taking). i) Get a royal blue (plain) tube at CDL Specimen Reception Counter. ii) Complete PER PAT.301 form and send it along with the sample to the CDL within 2-4 hours.	UMMC
208	Zinc urine (24 hours)	Urine 24 hours	24 hours collection	24 hours bottle container	**BY APPOINTMENT with the lab** (at least 2 weeks before sample collection). i) Get a 24 hrs bottle (acid wash bottle) at CDL Specimen Reception Counter 1 week after booking. ii) Complete PER PAT.301 form and send it along with the sample to the laboratory immediately.	UMMC

PROFILE						
No.	**Test**	**Specimen Type**	**Volume Required**	**Specimen container**	**Instruction**	**Destination**
1.	**Fasting serum lipids** 1. Total Cholesterol 2. Triglycerides 3. LDL-c 4. HDL-c	Serum	3 ml	Plain tube	A fasting sample is required (at least an 8-hour fast) Send to the Chemical Pathology lab within 2-4 hours.	CDL
2.	**Liver Function Test** 1. Total protein 2. Albumin 3. Total bilirubin 4. Direct bilirubin 5. ALT 6. ALP 7. GGT	Serum	3 ml	Plain tube	Send to the Chemical Pathology lab within 2-4 hours.	CDL
3.	**Renal Profile** 1. Urea 2. Creatinine 3. Sodium 4. Potassium 5. Chloride	Serum	3 ml	Plain tube	Send to the Chemical Pathology lab within 2-4 hours.	CDL
4.	**OGTT** 1. Fasting Glucose1. Fasting Plasma Glucose 2. Glucose-2HPP (2 hours postprandial)	Plasma	3 ml	Fluoride tube	Send to the Chemical Pathology lab within 2-4 hours.	CDL
5.	**BUSE** 1. Urea 2. Sodium 3. Potassium 4. Chloride	Serum	3 ml	Plain tube	Send to the Chemical Pathology lab within 2-4 hours.	CDL
6.	**Bone Profile** 1. Albumin 2. ALP 3. Total Calcium 4. Corrected Calcium 5. Phosphate	Serum	3 ml	Plain tube	Send to the Chemical Pathology lab within 2-4 hours.	CDL
7.	**Urine FEME** 1. Blood 2. Bilirubin 3. Urobilinogen 4. Ketone 5. Protein 6. Nitrite 7. Glucose 8. pH 9. Specific gravity 10. Leucocytes 11. Microscopy	Urine	20 ml	Urine collection container	Send to the Chemical Pathology lab within 2-4 hours.	CDL

No.	Test	Specimen Type	Volume Required	Specimen container	Instruction	Destination
8.	**Iron Profile** 1. Total Iron 2. TIBC 3. UIBC 4. Ferritin	Serum	3 ml	Plain tube	Send to the Chemical Pathology lab within 2-4 hours.	CDL
9.	**Female infertility studies** 1. FSH 2. LH 3. Estradiol 4. Progesterone	Serum	3 ml	Plain tube	Send to the Chemical Pathology lab within 2-4 hours.	CDL
10.	**Thyroid Function Test** 1. TSH 2. Free T4	Serum	3 ml	Plain tube	Send to the Chemical Pathology lab within 2-4 hours.	CDL
11.	**Amenorrhea studies** 1. FSH 2. LH 3. Estradiol	Serum	3 ml	Plain tube	Send to the Chemical Pathology lab within 2-4 hours.	CDL
12.	**Catecholamines** 1. Adrenaline 2. Noradrenaline 3. Dopamine	24-hour urine	24-hour urine collection (Urine volume must be > 750 ml).	Urine 24-hour container with 10 ml of 9 mol/L HCL acid	Complete PER PAT.301 form and send it along with the sample to the Chemical Pathology lab within 2-4 hours. Refrigerate during 24-hour urine collection.	UMMC
13.	**Blood Gases (Arterial or Venous)** 1. pH 2. PCO2 3. PO2 4. HCO3 5. Base Excess	Whole Blood	1ml	Heparin 1ml syringe	Send to the lab immediately in an ice-water bath	CDL
14.	**Urine Drug of Abuse** 1. Amphetamine 2. Cannabinoids 3. Morphine	Urine (random)	At least 1/2 of urine container.	Urine Container	1. Complete PER PAT.301 form (available at the Chemical Pathology lab). 2. Urine must be collected at least 1/2 of urine container. 3. Seal the urine container after collection. 4. Send to the Chemical Pathology lab within 2-4 hours.	UMMC

No.	Test	Specimen Type	Volume Required	Specimen container	Instruction	Destination
15.	**Urine Drug of Toxicology** 1. Amphetamine 2. Cannabinoids 3. Morphine Ketamine 4. Notes: HKL also reports 41 more types of drugs (including Ketum & Eramin 5).	Urine (random)	At least of urine container.	Urine Container	1. Complete the UPD form (available at the Chemical Pathology lab). 2. Urine must be collected at least ¾ of urine container. 3. Seal the urine container after collection. 4. Send to the Chemical Pathology lab within 2-4 hours.	HKL
16.	**Insulin Autoantibodies** 1. GAD 2. IA2 3. Islet Cell Antibodies 4. Anti-insulin	Serum	8 ml x 2 tubes	Plain tubes	**BY APPOINTMENT with the lab.** Complete the Gribbles Request Form (available at the Chemical Pathology lab) and send it along with the sample to the lab within 2-4 hours. Please send 2 separate plain tubes.	LABLINK
17.	**Aldosterone Renin Ratio (ARR)**	Plasma	4 ml	K2- EDTA	**BY APPOINTMENT with the lab** (at least 3 days before collection). i) Complete the PER PAT.301 form. ii) Sample volume must be at least 4 ml. Sample must be **sent immediately WITHOUT ice.** iii) **Please DO NOT pre-chill tube and syringe before blood taking.** iv) Record patient's posture whether supine or upright in column 'clinical history' on the request form. v) Blood should be taken between 8 am -10 am.	UMMC

ANATOMIC PATHOLOGY

INTRODUCTION

The Anatomic Pathology specialty provides two main services:

1) HISTOPATHOLOGY

Macroscopic and microscopic examination of tissues with interpretative diagnosis. This concerns assessment of biopsies or specimens removed at surgery. Intraoperative frozen section consultation is also provided. Inclusive within the service are ancillary services such as histochemical, immunohistochemical and immunofluorescent stains.

2) CYTOPATHOLOGY

Diagnostic and screening services based on the morphologic study of cells. It is divided into two categories:

i) Gynaenicological -based cytology
ii) Non-gynaenicological based cytology – Fine needle aspiration cytology (FNAC), brushings and body fluid cytology.

In addition to diagnostic interpretation, Anatomic Pathology specialty also conducts FNAC clinics, provides in-patient FNAC and rapid on-site (ROSE) evaluation services.

HISTOPATHOLOGY

1. ROUTINE SURGICAL AND BIOPSY SPECIMENS

1.1 SPECIMEN COLLECTION AND HANDLING

1.1.1 All specimens and the accompanying request forms must be sent to the CDL Specimen Reception Counter

1.1.2 If there are multiple specimens from the same patient, these must be completely collected before arrival at the counter.

1.1.3 All specimens must be labelled with the patient's name and at least one other unique identifier (e.g NRIC, MRN, etc). The type of specimen must be clearly labelled on the container.

1.1.4 Multiple specimens must be labelled accurately and this must be done by the medical officer/specialist. The staff must be responsible to re-check the details on the specimen containers prior to dispatch.

1.1.5 All specimens for routine histopathology examination should be fixed in 10% formalin in a suitable leak-proof container unless stated otherwise (e.g. frozen section or biopsy for immunofluorescence studies). The volume of formalin used should be at least 10 times the volume of the specimens to be fixed.

1.1.6 Do not put large specimens in small containers as this would prevent proper fixation of the tissue and it may cause distortion to the specimens.

1.1.7 Complex specimens which require orientation must be marked or tagged accordingly by sutures/staples. The orientation must be clearly indicated in the accompanying request form.

1.1.8 If a specimen is of utmost importance, or if there is uncertainty in the method of sampling/suitable fixation of the specimen, please communicate directly with the pathologist.

1.2 REQUEST FORM

1.2.1 All specimens must be accompanied by a request form.

1.2.2 **Internal (UiTM) requests:**

1.2.2.1 All requests shall be made via computerised order entry in UniMEDS. Please select the relevant test request according to the category and provide relevant clinical information, including any risk indicators (e.g. infectious risk, etc.).

1.2.2.2 For multiple specimens, please ensure that the request for each specimen is specified on the system. Requests for histopathology or cytology must be done separately.

1.2.2.3 Please indicate if an urgent result is required. In these cases, the requestor is advised to provide a contact number to ease communication.

1.2.2.4 Print the generated request form and the barcode sticker. Place the sticker onto the labelled specimen container.

1.2.3 **External requests (KKM hospitals / UPSC etc):**

1.2.3.1 Requests from KKM hospitals must be accompanied by a completed Per-PAT 301 form.

1.2.3.2 Requests from other institutions (e.g. UPSC) must be accompanied by completed relevant request forms.

1.2.4 **External request for a second opinion:**

1.2.4.1 Please communicate directly with the specific pathologist.

1.2.4.2 Please provide a cover letter with relevant clinical information and contact information along with the referral material and previous histopathology report, if any. The pathologist shall advise on the material to be provided.

1.3 CRITERIA FOR RECTIFICATION

1.3.1 For certain requests that do not fulfil the unit's requirements, the requestor shall be contacted to rectify the request by filling in the rectification form (to be provided by the laboratory staff). The specimen will only be processed following satisfactory corrective actions.

1.3.2 Examples of cases that will require rectification include (and are not limited to):

i) Specimens with no request form, inappropriate request form, damaged, or incompletely filled request forms.

ii) Incorrectly labelled specimen container.

iii) The discrepancy between details on the request form and specimen container.

iv) Inappropriate specimen container.

2.0 FROZEN SECTION

This service is **ONLY** offered during working hours (8 am - 4 pm), Monday – Friday (excluding public holidays).

2.1 SPECIMEN COLLECTION AND HANDLING

2.1.1 All frozen section requests must be discussed with the pathologist on-call at least 24-hour before the intended frozen section.

2.1.2 Please inform laboratory staff if a booked frozen section is cancelled.

2.1.3 All specimens for the frozen section must be sent fresh without any preservative in a closed container, accompanied by a completed request form along with the requestor's contact number.

2.1.4 The specimen should be sent immediately to the laboratory upon removal.

2.1.5 Interpretation will be verbally given to the requesting surgeon via phone call and documented.

2.1.6 High-risk infectious material will NOT be accepted for processing (e.g. tuberculosis).

2.1.7 All cases scheduled for a frozen section are best placed first in the operating list to ensure no disruption to the service.

2.2 REQUEST FORM

Refer to Histopathology section 1.2.

2.3 CRITERIA FOR RECTIFICATION

Refer to Histopathology section 1.3.

3.0 IMMUNOFLUORESCENCE (IF) STUDIES

3.1 SPECIMEN COLLECTION AND HANDLING

3.1.1 This service is provided for renal and skin biopsies.

3.1.2 All requests for IF studies must be discussed with the relevant pathologist on-call. For pre-planned biopsies, kindly inform lab staff at least three (3) days in advance.

3.1.3 ***Renal biopsy:***

3.1.3.1 Obtain at least a 3mm core of fresh tissue. Place sample in a clean air-tight container or phosphate buffer solution (PBS). Do not put fresh tissue on gauze.

3.1.3.2 Send specimen to the laboratory immediately. If a delay is anticipated, please transport in ice or gel ice.

3.1.3.3 Please send a separate biopsy fixed in formalin for ordinary light microscopic examination.

3.1.4 ***Skin biopsy:***

3.1.4.1 Place skin biopsy in saline or PBS, in a clean container.

3.1.4.2 Send specimen to the laboratory immediately. If a delay is anticipated, please transport in ice or gel ice.

3.1.4.3 Please send a separate biopsy fixed in formalin for ordinary light microscopic examination.

3.2 REQUEST FORM

Refer to Histopathology section 1.2.

3.3 CRITERIA FOR RECTIFICATION

Refer to Histopathology section 1.3.

CYTOLOGY

1.0 GYNAECOLOGICAL CYTOLOGY

1.1 SPECIMEN COLLECTION AND HANDLING

1.1.1. Conventional smears:

1.1.1.1 Label a clean glass slide with the patient's name and at least one other unique identifier (e.g. NRIC, MRN no.).

1.1.1.2 Avoid using a lubricant on the speculum.

1.1.1.3 Obtain an adequate sample from the cervix. Smear the material onto the labelled glass slide about as thick as a blood film.

1.1.1.4 Fix the slide immediately using a spray fixative.

1.1.1.5 Air-dry the fixed slide.

1.1.1.6 Place the slide in a slide mailer and despatch along with a completed request form to the CDL reception counter.

1.1.2. Liquid-based cytology:

1.1.2.1 Label a clean glass slide with the patient's name and at least one other unique identifier (e.g. NRIC, MRN no.).

1.1.2.2 Avoid using a lubricant on the speculum.

1.1.2.3 Obtain an adequate sample from the cervix using an appropriate broom-like sample collection device.

1.1.2.4 Rinse the broom in the vial containing a fixative solution. Discard the collection device.

1.1.2.5 Tighten the cap. Send the vial along with a completed request form to the CDL reception counter.

1.2 REQUEST FORM

Refer to Histopathology section 1.2.

1.3 CRITERIA FOR RECTIFICATION

Refer to Histopathology section 1.3.

2.0 NON-GYNAECOLOGICAL CYTOLOGY

2.1 SPECIMEN COLLECTION AND HANDLING

2.1.1 Fine needle aspiration cytology (FNAC) and brushings (e.g. during Endoscopic Bronchial Ultrasound - EBUS and Endoscopic Ultrasound – EUS procedures)

2.1.1.1 Call the lab to book an appointment for FNAC clinic/inpatient FNAC. This is much preferred than FNAC performed by a clinician to reduce the incidence of insufficient/suboptimal sampling. For EBUS or EUS, please contact the lab to book for ROSE service. Please see section 3.0 below.

2.1.1.2 After obtaining the sample, spread aspirated/brushing material onto a glass slide. Label the slide using a pencil with the patient's name and one other unique identifier (e.g NRIC, MRN no) on the frosted end of the slide.

2.1.1.3 For alcohol-fixed smears, immediately immerse slides in 95% alcohol for at least 30 minutes or use spray-fixative. The alcohol solution may be obtained from the laboratory (available during weekdays & office hours).

2.1.1.4 For air-dried smears, leave the slides to air-dry.

2.1.1.5 For cell block preparation, place the aspirated material and/or needle washings into a cytolyt-containing tube. Place the needle in the container as well. Label the container with patient details.

2.1.1.6 Send the slides/specimen along with the completed request form to the CDL reception counter. The specific requirements (minimum number of slides +/- need for needle washing) depend on the type of specimen. The requirements are outlined in the guidelines for specimen handling below (page 57).

2.1.2 Body fluid cytology

2.1.2.1 <u>Cerebrospinal fluid (CSF)</u>

2.1.2.1.1 Collect specimen in a sterile universal container. Label with patient details. Despatch immediately. Please call/inform the lab before sending the specimen. The specimen has to arrive at the laboratory before 4 pm for same-day processing. Clinicians are advised to plan the procedure to ensure immediate transport of the specimen to the laboratory.

2.1.2.1.2 If a delay is anticipated, please keep it refrigerated at 4°C and send it to the lab as soon as possible.

2.1.2.1.3 Ensure that specimens for microbiology/clinical chemistry are sent in separate containers. Refer to guidelines for specimen handling (page 57) for details.

2.1.2.2 Serous fluid (ascitic/peritoneal/pleural/pericardial fluid), bronchial washing and lavage, cyst fluid, synovial fluid.

2.1.2.2.1 Collect specimen in a sterile universal container. Label with patient details. Despatch immediately. If a delay is anticipated, please keep refrigerated at 4°C and send it to the lab as soon as possible.

2.1.2.2.2 Ensure that specimens for microbiology/clinical chemistry are sent in separate containers. Refer to guidelines for specimen handling (page 57) for details.

2.1.2.3 Sputum

2.1.2.3.1 The specimen should be obtained first thing in the morning, before the patient eats, drinks or cleans his/her teeth. Preferably the specimen should be collected on three consecutive days. The specimen is best obtained after chest physiotherapy.

2.1.2.3.2 Instruct the patient to cough deeply and collect the entire expectorated material in a sterile universal container and label it with patient details. Despatch immediately. If a delay is anticipated, please keep refrigerated at 4°C and send it to the lab as soon as possible. Refer to guidelines for specimen handling (page 57) for details.

2.1.2.4 Urine

2.1.2.4.1 Collect mid-stream urine sample in a sterile universal container. Avoid submitting the first-morning urine. Label with patient details. Despatch immediately. If a delay is anticipated, please keep it refrigerated at 4°C and send it to the lab as soon as possible.

2.1.2.4.2 Ensure that specimens for clinical chemistry / UFEME / microbiology are sent in separate containers. Refer to guidelines for specimen handling (page 57) for details.

2.2 REQUEST FORM

Refer to Histopathology section 1.2.

2.3 RECTIFICATION CRITERIA

Refer to Histopathology section 1.3.

3.0 FINE NEEDLE ASPIRATION CYTOLOGY (FNAC) SERVICES

Anatomic Pathology Unit provides three main FNAC services, which are:

i) FNAC Clinic
ii) Rapid On-Site Evaluation (ROSE) service.
iii) In-patient FNAC services.

FNAC services are provided in the FNAC clinic as well as in the wards. Direct involvement of the cytopathologist is much preferred compared to FNAC performed by clinicians to reduce the incidence of insufficient/suboptimal sampling.

These services are provided during working hours (please see specific sections below). If the FNAC procedure needs to be performed during the weekends or after office hours, please ensure that the person performing the procedure has been well trained in FNAC and slide smearing technique to ensure a good yield of cellularity.

3.1 FNAC Clinic

3.1.1 This is an appointment-based clinic, run by the cytopathologist and his/her team, to perform the FNAC procedure as well as to ensure the optimal amount of sample is taken for proper interpretation.
3.1.2 The FNAC clinic is held once a week in the Radiology Unit.
3.1.3 Book an appointment with the pathologist-in-charge at least 24-hours in advance.
3.1.4 All internal requests have to be made via UniMEDS. Print the generated form and barcode for the patient to bring along to the FNAC clinic.
3.1.5 Other external requests must be first referred to the in-house clinic, then subsequently arranged for an FNAC appointment.
3.1.6 UPSC requests must be accompanied by relevant request forms. Refer to Histopathology section 1.2.
3.1.7 Patients must be properly informed of the date/time and location of the FNAC clinic appointment.

3.2 Rapid On-Site Evaluation (ROSE) Service

3.2.1 This service is provided to ensure the optimal amount of sample has been taken by the radiologist/clinician.
3.2.2 This service covers the ultrasound-guided FNAC (breast/thyroid/lymph node, etc), Endoscopic Bronchial Ultrasound FNAC (EBUS-FNAC), Endoscopic Ultrasound FNAC (EUS-FNAC for liver, pancreas, etc) as well as Endoscopic Retrograde Cholangiopancreatography (ERCP) brushings.

3.2.3 The cytopathologist-in-charge must be informed at least 3 days before the planned procedure. The cytopathologist and cytotechnician will be on-site on the day of the procedure to provide feedback on sample cellularity to ensure adequate sampling.

3.2.4 All internal requests are to be made via UniMEDS. Other external requests (e.g. UPSC) must be accompanied by relevant request forms. Refer to Histopathology section 1.2.

3.3 In-patient FNAC Service

3.3.1 This is the FNAC service provided for inpatients.

3.3.2 The cytopathologist-in-charge must be informed at least 24- hours in advance.

3.3.2 All internal requests are to be made via UniMEDS. Other external requests (e.g. UPSC) must be accompanied by relevant request forms. Please refer to Histopathology section 1.2.

SPECIMEN REPORTING AND TURNAROUND TIME (TAT)

1.0 The histopathologist on duty will report all specimens and verify the reports before release.

2.0 All requests will be handled and reported according to the following categories:

2.1 *Urgent biopsies:* Biopsies marked as "urgent" by clinicians.

2.2 *Uncomplicated urgent biopsies:* Biopsies marked as "urgent" by clinicians which do not require any additional processes e.g. levels, special stains, immunohistochemistry, second opinion, etc.

2.3 *Complicated urgent biopsies:* Biopsies marked as "urgent" by clinicians require additional processes e.g. levels, special stains, immunohistochemistry, second opinion, etc.

2.4 *Routine surgical specimens:* All other biopsies (including excision biopsies) and excision/resection surgical specimens.

2.5 *Addendum reports:* Additional report issued after an initial histopathology report has been verified. These is also known as supplementary reports, typically containing additional information not yet available at the time of initial reporting.

2.6 *Turn Around Time* (TAT) is calculated from the date (or time) of arrival of the specimen to the laboratory to the date (or time) the report is verified and is as follows:

CATEGORIES	TAT
Uncomplicated urgent biopsies	5 working days
Complicated urgent biopsies and routine surgical specimen	14 working days
Frozen section	30 minutes (per specimen) from time of arrival to the lab to verbal reporting
Renal / Skin biopsy with immunofluorescence	14 working days
Gynaecological / Non - Gynaecological cytology:	14 working days

OTHER SERVICES

1.0 Interdepartmental Clinicopathological Conferences (CPC)

1.1. Anatomic Pathology Unit welcomes CPCs with the clinical departments.

1.2. Any enquiries regarding CPCs can be directed to the medical officer or pathologist-in-charge. Once confirmed, the list of patients to be discussed is to be submitted at least one week before the scheduled CPC date.

1.3. For cases reported in other institutions, the requestor is responsible to obtain all relevant material and histopathology/cytopathology reports for review

2.0 Faculty of Medicine, UiTM Clinicopathological Conferences (CPC)

2.1 If Anatomic Pathology Unit's participation is required for the weekly Faculty of Medicine's CPC, please liaise directly with the pathologist involved in the case to be discussed. Communicate the request at least one week prior to scheduled CPC date.

2.2 For cases reported in other institutions, please liaise with the rostered pathologist-on-call. The requestor is responsible to obtain all relevant material and histopathology/cytopathology reports for review.

3.0 Requests for diagnostic material / unstained sections / paraffin blocks

3.1 Valid requests for diagnostic material including paraffin blocks, or unstained sections (e.g. patient referral to another institution, etc) will be considered on a case-by-case basis.

3.2 The requesting clinician must communicate directly with the pathologist in charge of the case.

3.3 The requesting clinician must complete a request form (Request for Material from Anatomic Pathology Unit), which will be provided upon request. Please indicate the relevant details including the material required and the indication for the request made.

3.4 Upon approval of the request, the requestor must make the arrangements to collect the material.

3.5 All borrowed diagnostic material / stained sections/paraffin block must be returned as soon as the external review / additional tests have been completed.

4.0 Research

4.1 Anatomic Pathology Unit will facilitate research from both internal and external researchers.

4.2 Please enquire within the unit for further information.

Guidelines for Specimen Handling – Anatomic Pathology Unit

Histopathology			
Specimen type	**Container**	**Sample Volume / size**	**Remarks**
Routine HPE examination	Appropriate-sized, leak-proof container. Place in 10% formalin (at least 10x volume of sample).	-	This is to ensure proper fixation of the specimen.
Frozen section	Clean, empty air-tight container.	-	Despatch immediately.
Renal biopsy for IF	Clean, empty air-tight container or in Phosphate Buffer Solution (PBS).	At least 3mm core.	Despatch immediately. Otherwise, transport in ice/gel-ice. Please submit a separate piece of tissue in formalin for light microscopy.
Skin biopsy for IF	Tissue in saline or PBS in a clean, air-tight container.	-	
Cytopathology			
Gynae			
Specimen type	**Container**	**Sample Volume / size**	**Remarks**
Gynae smears (Conventional)	Smear onto labelled slides. Spray-fix immediately.	As collected.	Despatch immediately.
Gynae smears (liquid-based)	Collection vial containing fixative (can be collected from the lab).		
FNAC			
Specimen type	**Container**	**Sample Volume /size**	**Remarks**
FNAC of any site (smears)	Smear onto labelled slides. For alcohol fixation (wet-fixed), fix immediately by either immersing in 95% alcohol or spray-fix. For air-dried slide, leave to air-dry.	The minimum number of slides to be submitted depends on sample types; as outlined below.	Despatch immediately.
FNAC of any site – (for cell block)	Place aspirated material and needle washing in cytolyt-containing tube.	As collected.	Despatch immediately.

FNAC sample requirements	**Sample types**	**Needle washings to be provided?**	**Minimum number of slides/smears to be submitted**
	Breast	Yes	2 air-dried & 2 wet-fixed
	Thyroid	Yes	2 air-dried & 2 wet-fixed
	Nipple discharge	No	1 air-dried & 1 wet-fixed
	Cyst aspirates	No	1 air-dried & 1 wet-fixed
	Lung	Yes	2 air-dried & 2 wet-fixed
	Lymph node	Yes	2 air-dried & 2 wet-fixed
	Solid lump	Yes	2 air-dried & 2 wet-fixed
	Salivary gland	Yes	2 air-dried & 2 wet-fixed
	Liver/pancreas	Yes	2 air-dried & 2 wet-fixed

Body fluids			
Specimen type	**Container**	**Sample Volume / size**	**Remarks**
Bronchoalveolar lavage (BAL)	Sterile specimen container (in saline).	Minimum 5mls. The optimal volume is 20mls.	Keep fresh specimen in saline at 4°C. Despatch immediately (on the same day) with ice packing during transportation.
Brushing (e.g. EBUS, EUS) - smears	Smear onto labelled slides. For alcohol fixation, fix immediately by either immersing in 95% alcohol or spray-fix. For air-dried slide, leave to air-dry.	As collected.	ROSE service is provided for optimal sampling. Despatch immediately.
Brushing (e.g. EBUS, EUS) – for cellblock	Place in cytolyt-containing tube.	As collected.	Despatch immediately.
Cerebrospinal Fluid (CSF)	Sterile specimen container.	The optimal volume is 2ml.	Despatch immediately. Sample to arrive at the lab before 4 pm for same-day processing. Inform lab before sending the specimen. If a delay is anticipated, please keep it refrigerated at 4°C and send it to the lab as soon as possible.

			Please ensure specimens for microbiology/clinical chemistry are sent in separate containers.
Cyst fluid	Sterile specimen container.	As collected. The maximum volume is 25mls.	Refrigerate or add an equal volume of 50% ethanol to the fluid if more than a 24hours delay to the laboratory. Optional wet-fixed (95% ethanol) and/or air-dried direct smears may be made at the time of aspiration.
Nipple discharge	Smear onto labelled slides. For alcohol fixation, fix immediately by either immersing in 95% alcohol or spray-fix. For air-dried slide, leave to air-dry.	At least 1 air-dried and 1 alcohol-fixed slide.	-
Serous fluid (eg Pericardial, Peritoneal, Pleural)	Sterile specimen container.	The minimum volume of 75mls (for large volume collection and washings)	As much fluid as possible should be sent for evaluation.
Sputum	Sterile specimen container.	As collected. The entire amount of expectorated sample should be submitted. Multiple samples (x3) may be needed, but they should be taken on 3 separate days.	Should only be taken where patients are unfit for bronchoscopy. For best results obtain sputum following chest physiotherapy, with an early morning sample before the patient has eaten or brushed teeth.
Synovial fluid	Sterile specimen container.	The minimum volume of 5mls.	Despatch immediately. If a delay is anticipated, please keep refrigerated at 4°C and send it to the lab as soon as possible. Please ensure specimen for microbiology is sent in a separate container.
Urine	Sterile specimen container.	As collected. The maximum volume is 20mls.	Despatch immediately. If a delay is anticipated, please keep refrigerated at 4°C and send it to the lab as soon as possible. Avoid morning void samples. Please ensure specimens for clinical chemistry/UFEME/ microbiology are sent in separate containers.

HAEMATOLOGY AND TRANSFUSION MEDICINE

The Haematology and Transfusion Medicine specialty provides diagnostic and consultative services. It also receives specimens for research purposes. Two main services are operating in our unit are:

A. Haematology
B. Transfusion Medicine

Operating in both Sungai Buloh and Selayang campuses, the laboratory in Sungai Buloh performs both haematology and transfusion medicine services while the laboratory in Selayang only performs routine haematology service. The laboratory in Sungai Buloh operates 24 hours daily including weekends and public holidays while the laboratory in Selayang campus operates from 8 am to 5.00 pm excluding weekends and public holidays.

The laboratory shares Specimen Reception Counter with Chemical Pathology Unit. When specimens are received at the counter, the laboratory staff will stamp the reception time on the respective request form and acknowledge the receipt of the specimen through UniMEDS.

HAEMATOLOGY

1. Services

The diagnostic services are divided into:

a) Routine tests
These tests are offered during office hours (please refer to the test list in **Table 3**). The turnaround time (TAT) for routine in-patient and out-patient is 4 hours and 5 days, respectively.

b) Urgent tests
- These are short TAT tests for immediate patient management as indicated by the clinician on the request form. Urgent tests are offered 24 hours.

- The following list is urgent requests during and after office hours:
  1. Complete Blood Count (CBC) – TAT: 60 minutes
  2. Complete Blood Count + Differential Count (CBC+DIFF) – TAT: 60 minutes
     * For number 1 and 2, TAT may be delayed if a blood film review is required.
  3. Reticulocytes – TAT – 60 minutes
  4. Coagulation Screen – PT/INR & APTT – 60 minutes
  5. Peripheral Blood Film – TAT: urgent request is subjected to communication between pathologist and requesting clinician.

c) Specialised tests
These tests are run in batches (e.g., DNA Analysis) and outsourced to the referral laboratories (refer to **Table 4**). For the outsourced tests, the TAT depends on the complexity of the test.

2. Request forms

2.1 All haematology tests shall be requested through UniMEDS. The specimen shall arrive in the laboratory with UniMEDS form. The information in the form must be adequate, as it can significantly impact the quality of results and ultimately patient outcomes.

2.2 An additional test to the primary sample can be requested in a new request form. However, the request is subjected to the analyte's stability. Please contact the laboratory before request.

2.3 Specimen for haematology tests i.e., CBC or CBC+DIFF can **ONLY** be shared with HbA1c. The labelling must be done appropriately and separate forms for haematology and chemical pathology tests are needed. Failure to do so may lead to tests being missed out.

2.4 For tests that are run in outsourced laboratories, they shall be requested through UniMEDS. The specimen shall arrive in the laboratory with UniMEDS form together with the respective form of the outsourced laboratory.

3. Special Collection Procedures

In-house and outsourced tests require special collection procedures. Please refer to **Table 3** and **Table 4** for instructions. Failure to adhere to a specific procedure may cause rejection.

4. Receipt of Specimen

All specimens will be received at the Specimen Reception Counter either by a porter or pneumatic tube. The timely arrival of specimens in the right condition is vital as failure to keep to the appropriate arrival time may cause erroneous results and misinterpretation.

5. Rejection of Specimen

The common errors in specimen collection that can cause rejection are:

a) Incomplete request form
b) Misidentification of a patient.
c) Mislabelling of the specimen.
d) Inadequate specimen volume
   For e.g. Inadequate blood volume in citrate tube will result in the wrong ratio of blood: anticoagulant. This may affect test results.
e) Improper mixing that results in clotted sample.
f) Wrong tube/wrong anticoagulant.
g) Haemolysis/lipaemia
   - Common causes of haemolysed specimen include the needle being too large or too small), vigorous mixing of the filled collection tube, prolonged tourniquet pressure and difficult blood taking.
h) Exposure to light and/or extreme temperatures. This can affect the analyte's stability.
i) Improper time specimen/delayed delivery to the laboratory. This can affect the analyte's stability.
j) Improper storage prior to specimen despatch. This can affect the analyte's stability.
k) Improper collection of specimens
   - Heparin contaminated specimens may result in falsely prolonged APTT.
   - Specimens collected from the intravenous line may cause a dilutional effect leading to falsely low counts for HGB, WBC, RBC and PLT.

Several outsourced tests need to be despatched as soon as possible to the respective laboratory. Therefore, the requestor must make an appointment with the laboratory prior to specimen collection.

Rejection of specimen will be informed through a phone call by laboratory staff and must be acknowledged by ward/clinic staff.

6. Reporting of Results

Test results during office hours will be verified and/or validated by a Senior Medical Laboratory Technologist, Scientific Officer, Medical Officer and Pathologist. Results after office hours will be verified by a trained Medical Laboratory Technologist (MLT). If there is any uncertainty, the MLT will consult the pathologist on-call.

All haematology test reports are available in UniMEDS. Results reaching critical values will be informed via phone by laboratory staff (Refer to **Table 1**). The ward/clinic must acknowledge the notification of the result and laboratory action will be documented.

TABLE 1: ABNORMAL LIFE - THREATENING HAEMATOLOGY RESULTS

ADULT					
No	**Analyte**	**Unit**	**Low Critical Limit**	**Upper Critical Limit**	**Remark/Action**
1.	Haemoglobin	g/dL	6.0	19.0	Clotted specimen will be rejected.
2.	Haematocrit	%	20	60	
3.	Platelet	10^9/L	20	1000	
4.	Fibrinogen	mg/dL	100	-	
5.	Total WBC	10^9/L	1.0	-	
6.	INR		-	>5	
7.	PT	sec	-	>2.5 upper limit	
8.	APTT	sec	-	80 secs >2X upper reference range	
9.	Blast	%	First time or previous result no blast is reported.		
PAEDIATRIC					
No	**Analyte**	**Unit**	**Low Critical Limit**	**Upper Critical Limit**	**Remark/Action**
1.	Haemoglobin (Paeds)	g/dL	7.0	20.0	Clotted specimen will be rejected.
2.	Haemoglobin (Neonate)	g/dL	8.0	22.0	Clotted specimen will be rejected.
3.	Haematocrit (Paeds)	%	20	40	
4.	Haematocrit (Neonate)	%	25	70	
5.	Platelet	10^9/L	50	1000	
6.	Fibrinogen	mg/dL	70	-	
7.	Total WBC	10^9/L	2.0	50	

Reference: Quick Guide List Critical Result, Ministry of Health, Malaysia 2010

7. Enquiry for Laboratory Services

Enquiries regarding the laboratory services can be made via the following directories:

Enquiry	Extension No.
Specimen reception and Result	5215
Analytical issue	5209/5214
MLT and pathologist on-call	Refer to the monthly on-call roster for the contact numbers

TRANSFUSION MEDICINE

1. Services

The laboratory provides diagnostic tests related to the use of blood and blood products to all clinical departments in HUiTM. Apart from diagnostic tests, the laboratory also provides blood (packed cells, typed blood, etc.) and blood products for patients. All blood and blood products are obtained from the Pusat Darah Negara (PDN) periodically on case-to-case basis. This handbook outlines the blood request and transfusion procedures, storage, adverse transfusion reaction report and haemovigilance.

The following are the list of tests performed by the transfusion medicine unit:

1.1 Pre-transfusion testing

- ABO and Rh(D) Grouping
- Group, Screen & Hold (GSH) – tests include ABO and Rh(D) grouping and antibody screening/indirect Coombs test.
- Group & Crossmatch - tests include ABO and Rh(D) grouping, antibody screening/indirect Coombs test and the compatibility test.
- Crossmatching/Compatibility test
- Rh(D) Phenotyping for all Rhesus (D) negative patients

1.2 Post-transfusion testing

- Investigation of adverse transfusion reaction

1.3 Anti-Human Globulin (AHG) test/Coombs test

- Direct Coombs Test
- Extended Coombs Test
- Indirect Coombs Test / Antibody Screening

Some tests will be outsourced to the referral laboratories e.g. PDN and Institute for Medical Research (IMR). The PDN will perform extended antibody panels to identify new red cell antibody/antibodies following a positive antibody screening test. On the other hand, tests that are relevant to renal transplants will be outsourced to IMR.

Please refer to **Table 3** and **Table 4** for a list of tests that are offered in-house and outsourced. The appendices also contain details of test preparation and request forms needed for the respective tests.

2. Request forms

2.1 All diagnostic tests shall be requested through the UniMEDS and specimens shall arrive at the laboratory along with the UniMEDS form. Additional tests to the primary sample can be requested in a separate request form, however, the request is subjected to the analyte's stability. Please contact the laboratory before requesting an additional test.

2.2 All outsourced test requests shall be requested through the UniMEDS. The specimen shall arrive in the laboratory with the UniMEDS form and respective forms of the outsourced laboratory.

2.3 Prescription of blood and blood products should be made by the attending physician. The pathologist-on-call is available for consultation and advice on the appropriate type of blood products to be ordered, quantity, duration of transfusion, precautions and any other related issues if required.

2.4 All requests for blood and blood products (packed cells, platelet, fresh frozen plasma and cryoprecipitate) must be made using the PER-SS-BT 105 form (Refer to **Table 2**). The form shall be filled with legible handwriting, clear and complete by the attending doctor to avoid delay or rejection of blood or blood products request.

Table 2: Information for PER-SS-BT 105 form

	Information	Remarks
1.	Name	These three are **unique identifiers** in blood sampling/blood supply.
2.	Identity card/passport number	
3.	Registration number	
4.	Sex	
5.	Age	
6.	Blood Group	If known
7	Haemoglobin result	If known
8.	Reason for transfusion	Mandatory
9.	Time the blood/product required	Please tick the appropriate box available. Do not give vague statements e.g. "as soon as possible" or "PRN"- this would assist the laboratory staff in prioritising the blood request. The maximum time to hold cross-matched blood is within two days. However, the duration for keeping the crossmatched blood may be extended upon request. Please communicate with the laboratory staff for enquiry.
10.	Quantity of blood/product required	Number of bags or volume in mL
11.	Date and time of specimen collection	
12.	Name of person taking and labelling the sample	Must be clearly written or stamped and signed
13.	Name of requesting doctor	Must be clearly written or stamped and signed
14.	Other relevant information	Previous history of transfusion reaction

3. Specimen Collection

Refer to **Table 3** and **Table 4** for specimen collection.

A good practice during specimen collection is important for safe transfusion as most transfusion errors are due to taking samples from a wrong patient, labelling specimens using another patient's ID and administering blood to the wrong patient. Thus, practical precautions given in this section must be followed:

3.1 Patient identification and blood sampling for compatibility testing:
The process of taking and labelling specimens must be done in one process at the bedside, **one patient at one time**. The process shall be carried out by one person at the bedside. The doctor or ward staff (nurse) who performs this must ensure:

3.1.1 A patient must be correctly identified by checking the patient's wristband. If possible, ask the patient to state his/her name and IC number. The information must be checked against the case note or pre-printed patient identification label.

3.1.2 For an unconscious patient, the identification is done through the patient's wristband and confirmed by the patient's relative.

3.1.3 A wristband with a unique number is given for an unidentified patient with an emergency casualty. The number will be used to identify the patient until essential details of the patient are available.

3.2 Labelling of specimen

3.2.1 The person who withdraws the blood and the person who labels the specimen **must** be the same individual. The person must acknowledge his/her duty by signing the respective section in PER-SS-BT 105 form.

3.2.2 The specimen must be labeled clearly and accurately at the patient's bedside immediately after blood taking.

3.2.3 The label must contain three patient identifiers: name, RN and IC number.

3.2.4 The label should be preferably handwritten. However, pre-printed labels are acceptable.

3.2.5 The doctor's name, signature and stamp on the request form will indicate that the sample has been accurately identified.

3.2.6 **NEVER** label specimens from two or more patients at the same time.

3.3 Specimen requirement for elective surgery or correction of symptomatic anaemia.

3.3.1 The specimen should be sent to the laboratory at least 24 hours before the blood is required.

3.4 Specimens for patients with known RhD negative or red cell antibody (antibody-positive cases), must be sent to the laboratory **at least ONE WEEK** before the procedure. Ample time is needed for PDN to provide the appropriate blood and blood products such as platelet, fresh frozen plasma and cryoprecipitate

3.4.1 A new patient will require a fresh blood sample and a request form.

3.4.2 Each request for blood product requires a separate request form.

3.4.3 A new patient's sample is required for every new admission if blood products were to be requested.

4. Special Collection Procedures

4.1 The GXM for an infant less than 4 months of age **MUST** be accompanied by the mother's blood sample. Both samples **MUST** be distinctively labelled and sent together using one request form.

4.2 Request for antibody identification must be done during office hours. Please refer to **Table 3** for the collection procedure. For urgent cases, please consult the pathologist on-call.

4.3 Certain outsourced tests may require special requirements procedures e.g. Anti-A and Anti-B titre and HLA Typing. Refer to **Table 4** for further instructions.

5. Receipt of Specimen

All specimens for diagnostic tests and tests that are related to the use of blood and blood products will be received either by a porter or pneumatic tube. A timely arrival of correct specimens in the right condition is vital as failure to adhere to these requirements may cause a delay in the release of blood and blood products. Refer to **Table 3** and **Table 4** for details.

6. Rejection of Specimen

Blood specimen sent for compatibility testing shall meet the suggested minimum requirement (please refer to section 3.0). An exception is given only in a life-threatening situation after consulting and obtaining approval from the pathologist-on-call. The reasons for specimen rejection in transfusion medicine and haematology section are similar.

A specimen can be rejected due to following reasons:

6.1.1 Inadequate labelling. There should be three patient identifiers e.g. name, IC number and RN. The label should be preferably handwritten. However, pre-printed labels are acceptable.

6.1.2 The PER-SS-BT 105 form is inadequately filled up. The form shall also contain three patient's identifiers and other important information (Refer to **Table 2**).

6.1.3 Any discrepancy between patient's label and request form.

7. Reporting of Results

For the GXM request, a copy of the form will be handed to the ward personnel who comes to collect the blood or blood product for transfusion. Another copy is maintained in the transfusion laboratory. All GXM and GSH forms will be scanned and kept in patient's respective file in UniMEDS.

8. Issuing, Storage and Transport of Blood and Blood Products to the Ward

8.1 Issuing

Blood and blood product will be ready at the time they are required. However, about half an hour is needed to thaw the blood products (FFP

and cryoprecipitate) and they will not be available immediately. The shelf life of thawed blood products is 24 hours. If the thawed product were not used within the stipulated time, it shall be discarded.

8.2 Collection

Upon collection of blood/blood products, at least two personnel (SO/MLT and staff nurse or PPK) are involved in checking and ensuring the information on the request form and recipient card/Bed Head Ticket (BHT) label are matched. Information that needs to be checked are:

- Blood/blood product number
- Type of blood/blood product
- Blood group (ABO & Rh(D)
- Name of the patient receiving the blood/blood product
- I/C number of the patient
- RN of the patient
- The expiry date of the blood/blood product

The name of ward personnel who collects the blood/blood product shall be recorded by the laboratory staff.

8.3 Storage and Transport

Blood and blood product should be kept in the laboratory until it is collected and transfused. Upon collection, the ward staff shall transport the issued blood to the ward or returned the blood to the laboratory without delay. Transportation shall be carried out at an appropriate temperature. Ideally, the issued blood/blood product should be transfused without delay.

However, in the event where the delay is inevitable, the ward shall keep the blood at the appropriate temperature and condition or the ward shall return to the laboratory as soon as possible. If the blood/blood products are not kept at the appropriate temperature, the quality of blood/blood products will be affected and shall be discarded.

9. Administration of Blood and Blood Products

9.1 Administration of blood and blood products

9.1.1 Issued blood shall be transfused without delay. Packed cells and whole blood should be transfused within 30 minutes of removal from the refrigerator and the process of each unit shall not exceed 4 hours.

9.1.2 Platelet should be transfused as soon as it is received from the laboratory and the transfusion process should not exceed more than 30 minutes.

9.1.3 FFP and cryoprecipitate should be transfused as it is received from the laboratory and the transfusion process should be carried out at a rate that the patient can tolerate.

9.2 Discontinued transfusion

9.2.1 Any blood/blood product remaining from a discontinued transfusion **SHALL NOT** be used.

9.2.2 The remainder of blood shall be clearly labeled as **USED BLOOD** and returned to the transfusion laboratory immediately.

9.2.3 Details and reasons for discontinuation shall be documented in the patient's case note and a memo should be sent to the transfusion laboratory.

9.3 Return of used blood bags

9.3.1 The ward shall be responsible to return used blood bags and compatibility card/BHT card label which has been filled up to the transfusion laboratory within 48 hours.

9.4 Return of unused blood products

9.4.1 The ward shall return all unused blood products immediately to the transfusion laboratory. The unused blood product that is returned to the blood bank shall be discarded unless it is kept at an appropriate temperature.

9.4.2 The ward shall inform the laboratory if any of the unused blood product returned to the laboratory has not complied with the storage or transportation temperature.

10. Group, Screen and Hold (GSH) Protocol

10.1 A Group, Screen and Hold (GSH) protocol consists of (ABO) and Rh(D) grouping and an antibody screening on the patient's plasma. The laboratory has the GSH protocol that adhered to a locally established Maximum Surgical Blood Ordering Schedule (MSBOS) where appropriate.

10.2 The conversion of GSH to GXM can be made within three (3) days of sample collection. After three (3) days, a new blood sample is needed for crossmatching.

10.3 If the likelihood of blood usage is minimal, a GSH protocol is recommended in the first place. If the blood is required urgently, an emergency crossmatched blood should be available for issue after 30 minutes of the request. However, if blood requirement is not urgent, the crossmatched

blood will be ready within two (2) hours or at the time indicated by the requestor.

11. Group & Crossmatch (GXM) Protocol

11.1 Group & Crossmatch (GXM) consists of (ABO) and Rh(D) grouping, antibody screening of patient's plasma and crossmatching patient and donor unit for compatibility.

11.2 GXM shall be requested for cases with a high possibility for transfusion at the time it is requested.

11.3 A full GXM procedure takes about one (1) hour to be completed.

11.4 In the event of incompatible crossmatch and positive antibody cases which are not able to be resolved in-house, a new specimen will be requested and sent to PDN for further investigations e.g. for antibody identification and supply of compatible blood.

11.5 The clinician is advised to communicate with the pathologist on-call regarding the urgency of the transfusion requirement.

12. Emergency Request

12.1 An emergency crossmatch only involves the first phase of crossmatching procedure (immediate spin) with a specific blood group. This process takes about 15 minutes and blood can be supplied within 30 minutes.

12.2 The following second and third phases will be continued and should there be any incompatibility detected during these phases, the staff will immediately contact the ward or the requesting doctor for discontinuation of the transfusion.

12.3 Releasing blood for an emergency requires a signed statement of the requesting doctor (including IC number) indicating that the clinical situation is urgent to issue blood.

12.4 The emergency-crossmatch (and release of blood) can only be performed in a life-threatening situation and requires careful clinical judgment as the test for compatibility has not been completed at the time of issue.

12.5 Safe-O blood is also available for use should the need arises. However, the timely release of safe-O blood requires communication and coordination with the pathologist-on-call. The attending specialist must directly consult the pathologist-on-call. A **pre-transfusion sample** and **complete request form** are **MANDATORY**. A full crossmatch procedure will be performed after the release of safe-O blood. Any incompatibility during the procedure will be informed to the physician and transfusion must be stopped immediately.

13. Maximum Surgical Blood Ordering Schedule (MSBOS)

The MSBOS is based on retrospective analysis of actual blood usage associated with the individual elective surgical procedure. For procedures in which blood transfusion is not likely to be needed, **GSH** should be ordered.

On the other hand, a **GXM** should be requested for procedures that would likely require a blood transfusion (please refer to Appendix 5 for our current MSBOS, updated in 2021).

14. Adverse Transfusion Event

Investigation of a transfusion reaction is performed when there is an alleged reaction after transfusion of blood or blood product. If an adverse transfusion reaction is suspected, the transfusion shall be stopped immediately. A doctor shall immediately assess and stabilise the patient. Further management depends on the type and severity of the reaction.

14.1 <u>If the patient develops fever >38°C:</u>

14.1.1 A blood sample labeled as POST TRANSFUSION SAMPLE 1 is taken immediately as soon as transfusion reaction is noted. This sample goes to the transfusion laboratory for repeat pre-transfusion testing: ABO & Rh(D) grouping, antibody screening, compatibility testing and Direct Coombs Test (if indicated).

14.1.2 Blood for culture & sensitivity testing should be collected from the patient and send to Medical Microbiology & Parasitology Laboratory.

14.1.3 The remaining blood bag content and the transfusion set (without needle) including unused crossmatched units should be sent to the transfusion laboratory for further investigation.

14.2 <u>If an acute haemolytic transfusion is suspected, follow the procedures below:</u>

14.2.1 Blood labeled as POST TRANSFUSION SAMPLE 1 is collected immediately as soon as transfusion reaction is noted. Send the sample to transfusion laboratory for repeat pre-transfusion testing: ABO & Rh(D) grouping, antibody screening, compatibility testing and Direct Coombs Test.

14.2.2 Several different tests using blood as a specimen should be requested for Peripheral Blood Film (PBF), DIVC screen, LDH, bilirubin and renal profile.

14.2.3 A urine sample is collected for haemoglobinuria assessment.

14.3 <u>For a suspected case of delayed transfusion reaction, a second sample is recommended. The following steps shall be undertaken:</u>

14.3.1 Blood labeled as POST TRANSFUSION SAMPLE 2 is taken for ABO & Rh(D) grouping, antibody screening, compatibility testing and Direct Coombs Test.

14.3.2 Several different tests using blood as a specimen should be requested for Peripheral Blood Film (PBF), DIVC screen, LDH, bilirubin and renal profile.

14.3.3 A urine sample is collected for haemoglobinuria assessment.

14.4 <u>For a patient who develops fever <38°C or mild skin rash/pruritus or both:</u>

14.4.1 Blood labeled as POST TRANSFUSION SAMPLE 1 is taken for ABO & Rh(D) grouping, antibody screening and compatibility testing.

Note: If reactions occur as above, transfusion of blood must be stopped temporarily. The patient is given paracetamol and/or an anti-histamine. If symptoms and signs have resolved i.e. skin reaction or patient's temperature is decreasing and vital signs are satisfactory, transfusion can be continued with close observation.

14.5 The doctor in charge should withdraw the blood samples, fill in the forms and ensure that the samples, blood bags and forms reach the transfusion laboratory and other laboratories (chemical pathology, microbiology and haematology) at the earliest possible time. The doctor should complete the Request Form for Transfusion Reaction Investigation (Blood and Blood Products) (please refer to **Appendix 7**) and write INVESTIGATION OF TRANSFUSION REACTION on other request forms.

15. Enquiry for Laboratory Services

Any enquiries regarding the laboratory services please contact the following phone numbers:

ENQUIRY	CONTACT NO./EXTENSION
Transfusion Medicine related tests (Specimen reception)	5215
Blood and blood product request	5209
MLT and pathologist on-call	Refer to the monthly on-call roster for the contact numbers

LIST OF TESTS

Table 3: LIST OF IN-HOUSE TESTS FOR HAEMATOLOGY AND TRANSFUSION MEDICINE

(Refer to Clinical Indications and Reference Ranges: Appendix 4 and 5)

NO	TEST	SPECIMEN TYPE	SPECIMEN CONTAINER	VOLUME REQUIRED	INSTRUCTION
LIST OF SINGLE TESTS FOR HAEMATOLOGY SECTION					
1.	Complete Blood Count (CBC)	Whole Blood	EDTA Tube	2 - 3mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
2.	Complete Blood Count + Differential Count (CBC+Diff)	Whole Blood	EDTA Tube	2 - 3mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
3.	Reticulocytes	Whole Blood	EDTA Tube	2 - 3mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
4.	Erythrocyte Sedimentation Rate	Whole Blood	EDTA Tube	2 - 3mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
5.	Prothrombin Time (PT)/International Normalised Ratio (INR)	Whole Blood	Citrate Tube	2 mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
6.	Activated Partial Thromboplastin Time (APTT)	Whole Blood	Citrate Tube	2 mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
7.	Fibrinogen	Whole Blood	Citrate Tube	2 mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
8.	Thrombin Time (TT)	Whole Blood	Citrate Tube	2 mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
9.	Quantitative D-Dimer	Whole Blood	Citrate Tube	2 mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
10.	G6PD	Whole Blood/Cord Blood	EDTA Tube	1-2 mL	To reach the laboratory as soon as possible.

LIST OF SINGLE TESTS FOR TRANSFUSION MEDICINE SECTION					
11.	ABO and Rh(D) Grouping	Whole Blood	EDTA Tube	2 - 3mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
12.	Direct Coombs Test	Whole Blood	EDTA Tube	2 - 3mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
13.	Indirect Coombs Test / Antibody Screening	Whole Blood	EDTA Tube	2 - 3mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
14.	Rh(D) Phenotyping	Whole Blood	EDTA Tube	2 - 3mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
LIST OF PROFILE TESTS FOR HAEMATOLOGY SECTION					
15.	**Coagulation Screen**				
	Prothrombin Time (PT)	Whole Blood	Citrate tube	2 mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
	INR				
	Activated Partial Thromboplastin Time (APTT)				
16.	**Mixing Test for APTT**				
	Activated Partial Thromboplastin Time (APTT) for patient	Whole Blood	Citrate tube	2 mL	Must be clinically indicated and another anticoagulant use has been ruled out.
	Activated Partial Thromboplastin Time (APTT) for Normal Pool				
	Activated Partial Thromboplastin Time				

	(APTT) for Immediate Mixing				
	Activated Partial Thromboplastin Time (APTT) for 2-hour Incubation				
17.	**Mixing Test for PT**				
	Prothrombin Time (PT) for patient	Whole Blood	Citrate tube	2 mL	Must be clinically indicated and other anticoagulant use has been ruled out.
	Prothrombin Time (PT) for Normal pool				
	Prothrombin Time (PT) for Immediate Mixing				
	Prothrombin Time (PT) for 2-hour Incubation				
18.	**DIVC Screen**				
	Prothrombin Time (PT)	Whole Blood	Citrate tube	2 mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
	INR				
	Activated Partial Thromboplastin Time (APTT)				
	Fibrinogen				
	D-Dimer				
19.	**Peripheral Blood Film**				
	Complete Blood Count + Differential Count	Whole Blood	EDTA Tube	2 - 3mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
	Peripheral Blood Film (PBF) Comment				

20.	**Bone marrow Examination**				
	Complete Blood Count + Differential Count	Whole Blood	EDTA Tube	2 - 3mL	By appointment only and discussion with pathologist-on-call.
	Peripheral Blood Film (PBF) Comment				
	Bone marrow staining	Bone marrow aspiration and trephine aspirate	EDTA tube, glass slides, a container with 10% formalin as a fixative.	• 5 – 6 ml of BMA aspirate. • 1- 2 cm of trephine tissue.	
21.	**Hb Analysis**				
	Complete Blood Count + Differential Count	Whole Blood	EDTA Tube	2 - 3mL	To reach the laboratory as soon as possible. Sample integrity at room temperature is within 4 hours.
	Peripheral Blood Film (PBF) Comment				
	Hb Analysis (HPLC)				
	Hb Analysis (CE)				

LIST OF PROFILE TESTS FOR TRANSFUSION MEDICINE SECTION					
22.	**Group, Screen & Hold (GSH)**				
	ABO and Rh(D) Grouping	Whole Blood	EDTA Tube	2 - 3mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
	Indirect Coombs Test / Antibody				
23.	**Group & Crossmatch (GXM)**				
	ABO and Rh(D) Grouping	Whole Blood	EDTA Tube	2 - 3mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours.
	Indirect Coombs Test / Antibody				
	Crossmatch (depends on number of units being requested)				
24.	**Investigation of Transfusion Reaction -**				
	ABO and Rh(D) Grouping (Post transfusion sample)	Whole Blood	EDTA Tube	2 - 3mL	To reach the laboratory as soon as possible. Sample integrity is within 4 hours. To fill up the request form for Transfusion Reaction Investigation (Blood and Blood Products). Other related tests depending on the clinician's judgement i.e., haemoglobin urine test, PBF, liver function test and blood culture. The test must be requested in separate forms.
	Indirect Coombs Test / Antibody (Post transfusion sample)				
	Crossmatch (post-transfusion sample)				

Table 4: LIST OF OUTSOURCED TESTS FOR HAEMATOLOGY & TRANSFUSION MEDICINE
(Refer to Clinical Indications and Reference Ranges: Appendix 4 and 5)

	LIST OF TESTS FOR HAEMATOLOGY SECTION							
NO	**TEST**	**SPECIMEN TYPE**	**SPECIMEN CONTAINER**	**VOLUME REQUIRED**	**FORM**	**INSTRUCTION**	**DESTINATION**	**TURN AROUND TIME (WORKING DAYS)**
1.	ALL screen (E2A-PBX1, ETV6-RUNX1, MLL-AF4, BCR-ABL e1a2, SIL-TAL1)	Bone marrow / Whole Blood	EDTA Tube	3 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment. To request CBC+DIFF separately.	UMMC	14
2.	AML screen (RUNX1-RUNX1T1, CBFB-MYH11)	Bone marrow / Whole Blood	EDTA Tube	3 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment. To request CBC+DIFF separately.	UMMC	14
3.	BCR-ABL1 quantitation (e13a2, e14a2)	Bone marrow / Whole Blood	EDTA Tube	3 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment. To request CBC+DIFF separately.	UMMC	14

4.	BCR-ABL1 TKD Mutation Analysis	Bone marrow / Whole Blood	EDTA Tube	3 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment. To request CBC+DIFF separately.	UMMC	14
5.	CD34	Whole Blood / Bone Marrow / PBSC	EDTA Tube	3 mL	PER PAT. 301	By appointment only. Inform the lab before requesting transport arrangements.	UMMC	7 working days, verbal report – 24 hours
6.	CD4/CD8	Whole Blood	EDTA Tube	3 mL	PER PAT. 301	By appointment only. Inform the lab before requesting transport arrangements.	UMMC	7 working days, verbal report – 24 hours
7.	Chromosomal analysis (Oncology)	Bone marrow	Lithium heparin	3 mL	Borang Permohonan Ujian Khusus (Unit sitogenetik, PPUKM)	Special transport medium - obtained from the lab, by appointment only	PPUKM	21
8.	Chromosomal analysis (post-natal)	Bone marrow	Lithium heparin	3 mL	Borang Permohonan Ujian Khusus (Unit sitogenetik, PPUKM)	Special transport medium - obtained from the lab, by appointment only	PPUKM	21

9.	DNA Analysis for alpha Thalassaemia	Whole Blood	EDTA tube	3 mL	DNA Analysis for Thalassemia Syndrome (IMR/CaRC/HAEM/22/2203/03(1) REQForm	Hb Analysis must be done before requesting. The test must be requested together with CBC+DIFF. This test strictly requires written informed consent from the patient/guardian.	HKL	45
10.	DNA Analysis for beta Thalassaemia	Whole Blood	EDTA tube	3 mL	Borang Permohonan Ujian Molekular Genetik (PPUKM)	Hb Analysis must be done before requesting. The test must be requested together with CBC+DIFF. This test strictly requires written informed consent from the patient/guardian.	PPUKM	45
11.	Erythropoietin	Whole Blood	Plain tube	3 mL	PERPAT.301	NA	UMMC	30
12.	Factor VIII Assay (Haemophilia A)	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant before requesting otherwise requests will be rejected by PDN. Strictly PDN Guidelines.	PDN	30
13.	Factor VIII Inhibitor	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant before requesting otherwise requests will be rejected by PDN. Strictly PDN Guidelines.	PDN	30

14.	Factor IX Assay (Haemophilia B)	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant before requesting otherwise requests will be rejected by PDN. Strictly PDN Guidelines.	PDN	30
15.	Factor XIII Assay	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant before requesting otherwise requests will be rejected by PDN. Strictly PDN Guidelines.	PDN	30
16.	Immunophenotyping	Bone marrow / Whole Blood	EDTA	3 mL	PER PAT. 301	By appointment only. Inform the lab before requesting transport arrangements. For reliable flow cytometric analysis, the specimen must be sent to the laboratory immediately. Specimen kept for more than 6 hours is not suitable for analysis.	PPUKM	30 working days, verbal report – 24 hours
17.	FLTT3-ITD/D835 mutation	Bone marrow / Whole Blood	EDTA Tube	3 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment. To request CBC+DIFF separately.	UMMC	14

18.	JAK V617F	Bone marrow / Whole Blood	EDTA Tube	3 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment. To request CBC+DIFF separately.	UMMC	14
19.	JAK2 ex12/MPL ex10 mutation	Bone marrow / Whole Blood	EDTA Tube	3 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment. To request CBC+DIFF separately.	UMMC	14
20.	NPM1 mutation	Bone marrow / Whole Blood	EDTA Tube	4 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment. To request CBC+DIFF separately.	UMMC	14
21.	Other Factor Assay	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant before requesting otherwise request will be rejected by PDN. Strictly PDN Guidelines.	PDN	30

22.	Platelet Antibody Screening	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant before requesting otherwise request will be rejected by PDN. By appointment from Monday to Thursday only. Strictly PDN Guidelines.	PDN	30
23.	PML-RARA detection (bcr1, bcr2, bcr3)	Bone marrow / Whole Blood	EDTA Tube	4 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment. To request CBC+DIFF separately.	UMMC	14
24.	Protein C	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant before requesting otherwise request will be rejected by PDN. Strictly PDN Guidelines.	PDN	30
25.	Protein S	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant before requesting otherwise request will be rejected by PDN. Strictly PDN Guidelines.	PDN	30
26.	Thrombophilia profile i) Lupus Anticoagulant ii) Anti-phospholipid	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant before requesting otherwise request will be rejected by PDN. Strictly PDN Guidelines.	PDN	30

	iii) Anti-beta 2-glycoprotein							
27.	von Willebrand Study	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant before requesting otherwise request will be rejected by PDN. Strictly PDN Guidelines.	PDN	30

	LIST OF TESTS FOR TRANSFUSION MEDICINE SECTION							
NO	**TEST**	**SPECIMEN TYPE**	**SPECIMEN CONTAINER**	**VOLUME REQUIRED**	**FORM**	**INSTRUCTION**	**DESTINATION**	**TURN AROUND TIME (WORKING DAYS)**
28.	Anti-A and Anti-B titre	Whole Blood	EDTA Tube	3 mL	PDN Quality Form – PDN/IH/QP-01/04)	Strictly by appointment only.	PDN	The official report is ready in 2 weeks.
29.	Antibody Identification	Whole Blood	EDTA Tube & Plain Tube (Red)	4 mL each	PER-SS-BT 105 (GSH/GXM Form) & PDN Quality Form – PDN/IH/QP-01/04)	Only performed when the patient has a positive antibody. Urgent request is entertained for a patient that requires transfusion. Antibody identification is also sent for the patient who is incidentally found to be positive antibody screening for GSH request. The request is initiated by the lab and it is important to identify the antibody for a future emergency.	PDN	The official report is ready in 2 weeks. Blood is ready once the investigation is completed.
30.	Antibody Identification (Extended)	Whole Blood	EDTA Tube & Plain Tube (Red)	4 mL each	PER-SS-BT 105 (GSH/GXM Form) & PDN Quality Form – PDN/IH/QP-01/04)	Only performed when the patient has a positive antibody. Urgent request is entertained for a patient that requires transfusion. Antibody identification is also sent for the patient who is incidentally found to be positive antibody screening for GSH request. The request is initiated by the lab and it is important to identify the antibody for a future emergency.	PDN	The official report is ready in 2 weeks. Blood is ready once the investigation is completed.

31.	HLA Typing Class I & II (Loci A, B, DR)	Whole Blood	EDTA Tube	8 mL	HLA Typing Request Form (IMR)	Must be clinically relevant (transplant purpose) prior to request otherwise request will be rejected. By appointment from Monday to Thursday only. The blood shall need to reach the outsourced lab by 10.30 am.	IMR	30
32.	HLA Typing Class I (Loci A, B, C) - Low Medium Resolution (SSP)	Whole Blood	EDTA Tube	8 mL	HLA Typing Request Form (IMR)	Must be clinically relevant (transplant purpose) prior to request otherwise request will be rejected. By appointment from Monday to Thursday only. The blood shall need to reach the outsourced lab by 10.30 am.	IMR	30
33.	HLA Typing Class I (Loci A, B, C) High Resolution (SSO) - per locus	Whole Blood	EDTA Tube	8 mL	HLA Typing Request Form (IMR)	Must be clinically relevant (transplant purpose) prior to request otherwise request will be rejected. By appointment from Monday to Thursday only. The blood shall need to reach the outsourced lab by 10.30 am.	IMR	30
34.	HLA Typing Class I (Loci A, B, C) - High Resolution (SBT)	Whole Blood	EDTA Tube	8 mL	HLA Typing Request Form (IMR)	Must be clinically relevant (transplant purpose) prior to request otherwise request will be rejected. By appointment from Monday to Thursday only. The blood shall need to reach the outsourced lab by 10.30 am.	IMR	30

35.	HLA Typing Class II (Loci DR, DQ) - Low/Medium Resolution (SSP)	Whole Blood	EDTA Tube	8 mL	HLA Typing Request Form (IMR)	Must be clinically relevant (transplant purpose) prior to request otherwise request will be rejected. By appointment from Monday to Thursday only. The blood shall need to reach the outsourced lab by 10.30 am.	IMR	30
36.	HLA Typing Class II (Loci DR, DQ) - High Resolution (SSO) - per locus	Whole Blood	EDTA Tube	8 mL	HLA Typing Request Form (IMR)	Must be clinically relevant (transplant purpose) prior to request otherwise request will be rejected. By appointment from Monday to Thursday only. The blood shall need to reach the outsourced lab by 10.30 am.	IMR	30
37.	HLA Typing Class II (Loci DR, DQ) - High Resolution (SBT)	Whole Blood	EDTA Tube	8 mL	HLA Typing Request Form (IMR)	Must be clinically relevant (transplant purpose) prior to request otherwise request will be rejected. By appointment from Monday to Thursday only. The blood shall need to reach the outsourced lab by 10.30 am.	IMR	30
38.	HLA Antibody Test	Whole Blood	Plain Tube (Gel)	6 mL of recipient blood	HLA Antibody Test Request Form	Must be clinically relevant (transplant purpose) prior to request otherwise request will be rejected. By appointment from Monday to Thursday only. The blood shall need to reach the outsourced lab by 10.30 am.	IMR	30

39.	HLA Crossmatching (CDC)	Whole Blood	Plain tube (gel) + sodium heparin tube	6 mL WB in a plain tube (gel) of recipient blood + 18 mL WB in sodium heparin of donor blood	HLA Crossmatch Test Request Form (Living Donor)	Must be clinically relevant (transplant purpose) prior to request otherwise request will be rejected. By appointment from Monday to Thursday only. The blood shall need to reach the outsourced lab by 10.30 am.	IMR	30
40.	HLA Crossmatching (Flow Cytometry)	Whole Blood	Plain tube (gel) + sodium heparin tube	6 mL WB in a plain tube (gel) of recipient blood + 18 mL WB in sodium heparin of donor blood	HLA Crossmatch Test Request Form (Living Donor)	Must be clinically relevant (transplant purpose) prior to request otherwise request will be rejected. By appointment from Monday to Thursday only. The blood shall need to reach the outsourced lab by 10.30 am.	IMR	30

MEDICAL MICROBIOLOGY & PARASITOLOGY

1. INTRODUCTION

Medical microbiology plays a major role in the infectious disease discipline and knowledge in this field is essential to the clinical management of infections. Medical Microbiology & Parasitology specialty is particularly involved in the detection and identification of the causative organism, management of the patient including screening, treatment monitoring and research development.

2. SERVICES

The microbiology unit provides the following services:

- Diagnostic and research services comprise bacteriology, virology, mycology, immunology, and parasitology.
- Participation in hospital infection control activities related to antibiotic stewardship and surveillance, as well as control and prevention of hospital-acquired infections.

3. REQUEST

- All Microbiology and Parasitology tests should be requested through the UniMEDS and hardcopy laboratory forms shall be used in the event of off-line.
- **Outsource tests**
  - A communication shall take place between the requestor and the laboratory before transportation and sending out the specimen. A standard request form; PERPAT-301 should be used for outsourced tests performed in KKM's Hospital laboratory.
  - Request for urgent test **MUST** involve communication between the requesting clinician and the Clinical Microbiologist on duty.

4. SPECIAL/PROCEDURES OF SPECIMEN COLLECTION & TRANSPORT

- **Blood**
  - All blood culture & sensitivity (C&S) specimens should be collected before antibiotic administration.
  - Skin decontamination with 70% alcohol followed by povidone-iodine should be carried out prior to venepuncture.

- In the event delay is inevitable, keep the bottle of C&S at room temperature.

- **Cerebrospinal Fluid (CSF)**
  - The CSF specimens should be collected prior to antimicrobial therapy.
  - Place CSF into sterile leak-proof container.
  - Collect a sufficient volume of fluid. Suggested volumes are:
    - 2 ml for bacterial culture
    - 2 ml for fungal culture
    - 2 ml for mycobacterial culture
  - Transport CSF to the laboratory immediately.

  *NB: Do **NOT** refrigerate CSF unless viral studies are requested.*

- **Sputum for acid fast bacilli (AFB)**
  - Three (3) consecutives morning sputum should be collected as the specimen of choice.
  - Sputum is expectorated directly into a sterile container.

  NB: Specimen that is grossly salivary is unsatisfactory/unsuitable for examination and will be rejected

- **Urine**
  - The first morning voided urine should be collected as the specimen of choice. If this is not possible, the urine should be allowed to incubate in the bladder for a minimum of 2 hours before collection. This is an important point to remember for patients with indwelling catheters.
  - **Midstream urine (MSU):** The periurethral area (tip of penis in male, labial folds and vulva in female) is cleansed well with water. The first portion of the voiding urine is not collected. At least 5ml of the midstream portion of the early morning is voided directly into a sterile container.
  - **Catheterised urine**: These specimens are obtained by aspirating urine from the proximal lumen of the catheter with a syringe (**DO NOT** collect specimen from the urine bag).
  - **Suprapubic aspiration**: Direct the needle into the urinary bladder just above the symphysis pubis after the suprapubic skin decontamination done. Aspirate the urine with a syringe and transfer to a sterile container
  - Immediate dispatch (1 to 2 hours) is expected. If this is not possible, specimen should be kept in the refrigerator (no longer than 18 hours). Therefore, it is important that the time of specimen collection is marked on the patient's request.

- **Detection of other organisms causing e.g. diphteria, pertussis, peptic ulcer due to *H. pylori* etc.**
  - Swab from nose, throat or wound for C&S: Transport the swab using Amies or Stuart medium for suspected cases of *C. diphtheriae* or *C. ulcerans* infection.

  - Tissue from pseudo-membrane for C&S: The specimen should be placed in the container containing sterile saline and **NOT** formalin. The specimen should be sent immediately to the laboratory without any delay. If delay is inevitable the specimen should be kept in the refrigerator.

  - Tissue biopsy for *H. pylori* detection: The tissue is a specimen of choice as patients may not receive antibiotics or anti secretory drugs especially proton pump inhibitors (PPI).

  NB: Pre-treatment of the tissue biopsy with saline may improve the recovery of H.pylori.
  - *Detection of Mycobacterium tuberculosis* Complex (MTBC)/Non-tuberculous *Mycobaterium* (NTM)

    - TB culture & TB PCR: fresh specimen in sterile container with correct labelling should be sent immediately to the laboratory. Specimen received after 48 hours of collection will be rejected.
    - Other molecular test (e.g. respiratory sample PCR, HIV PCR, Hep C PCR, HBV DNA, etc.: appointment is encouraged due to requirement of special preparation. Please contact the laboratory for further assistance.

  ***NB:** All specimen for C&S: Specimen should be placed in a proper container with correct labelling, and **immediately** reached laboratory **within 2 hours** of collection. In the event of transportation delay, specimen should be kept in **refrigerator** (**except for CSF**).*

5. RECEIPT OF SPECIMEN

All specimens will be received at the Specimen Reception Counter, CDL, HUiTM Puncak Alam.

6. REPORTING OF RESULTS

- A preliminary report of positive sterile body fluids results will be informed to clinic/ward via phone by Clinical Microbiologist on duty/Medical Officer/Science Officer/MLT and documented.
- Final results will be validated by Clinical Microbiologist/Medical officer/Science Officer and the report will be issued via UniMEDS.

- Critical results as listed below will be informed via phone to the requestor by the laboratory staff and documented.
  - A positive result of Gram stain from sterile clinical specimen.
  - A positive blood film for malarial parasite (BFMP).
  - Infectious screening (HbsAg, anti-HBs, anti-HCV and HIV combo) from sharp/needle stick injury (NSI) case.

7. SERVICE AFTER OFFICE HOURS AND DURING PUBLIC HOLIDAYS

- Specimens sent for bacteriology, mycology, virology etc and will be processed as usual on weekends and public holidays from 8.00 am to 5.00 pm.
- There is one (1) MLT working on stand-by basis to process urgent (e.g: NSI) specimen.

8. SUPPLIES

The supply of containers relevant to medical microbiology &parasitology examination can be obtained from the central store of Sg. Buloh and Selayang Campus respectively.

9. RESEARCH

The MMP Unit is supporting the research work and activities by facilitating research from both internal and external research.

10. ENQUIRY OF LABORATORY SERVICES

Enquiries regarding the laboratory services can be made at 03-39610822/23.

LIST OF TESTS

IN-HOUSE & OUTSOURCED TESTS IN MEDICAL MICROBIOLOGY & PARASITOLOGY

BACTERIOLOGY AND SEROLOGY						
NO.	**TEST**	**SPECIMEN TYPE**	**VOLUME REQUIRED**	**SPECIMEN CONTAINER**	**INSTRUCONS**	**DESTINATION**
1.	AFB stain	Sputum & Other clinical specimens	3ml	Sterile	Collect 3 consecutive early mornings (fresh) sputum (NOT SALIVA). Send within 2-4 hours.	CDL
2.	TB Culture & Sensitivity	All specimens	3ml	Sterile	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	UMMC
3.	Bacterial Antigen (Latex Antigen detection)	CSF	3ml	Sterile	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG.BULOH
4.	*Burkholderia pseudomallei* antibody	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	IMR
5.	*Chlamydophila pneumoniae/ C.trachomatis/ C.psittaci* antibody	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG.BULOH
6.	*Clostridium difficile* Combo Test (Gdh+ Toxin A+B)	Stool (fresh)	Not applicable	Stool container	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG.BULOH
7.	Culture and Sensitivity	Blood	5ml-10ml (adult) 2-3ml (paediatric)	Blood culture (aerobic & anaerobic) bottle Blood culture (paediatric) bottle	Inoculate blood collected with aseptic technique. If the sample is not sent immediately, please do not refrigerate it. Please leave it at room temperature.	CDL
8.	Culture and Sensitivity	Sputum	Not applicable	Sterile	Sample should not be saliva. Send within 2-4 hours.	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTIONS	DESTINATION
9.	Culture and Sensitivity	tracheal aspirates/BAL /NPA	3ml	sterile	The sample should not be saliva. Send within 2-4 hours	CDL
10.	Culture and Sensitivity	/Pleural fluids s	5ml	Sterile	Send within 2-4 hours. Send immediately	CDL
11.	Culture and Sensitivity	Nasal / Per nasal / Throat swab	Not applicable	Amies Transport Medium	Send within 2-4 hours.	CDL
12.	Culture and Sensitivity	CSF	1- 3ml	Sterile	Send immediately.	CDL
13.	Culture and Sensitivity	Peritoneal fluid	5ml	Sterile	Send immediately.	CDL
14.	Culture and Sensitivity	Ear discharge/Ear swab	Not applicable	Sterile	Send within 2-4 hours.	CDL
15.	Culture and Sensitivity	Vitreous and Aqueous Fluid	1-3ml	Sterile	Send immediately.	CDL
16.	Culture and Sensitivity	Eye discharge	Not applicable	Sterile	Send within 2-4 hours.	CDL
17.	Culture and Sensitivity	Contact lens	Not applicable	Sterile	Send within 2-4 hours.	CDL
18.	Culture and Sensitivity	Corneal Scrapping	Not applicable	Sterile	Send within 2-4 hours.	CDL
19.	Culture and Sensitivity	HVS/ Endocervical swab	Not applicable	Amies Transport Medium	Send within 2-4 hours.	CDL
20.	Culture and Sensitivity	LVS	Not applicable	Amies Transport Medium	Only for medicolegal case investigation. Send immediately.	CDL
21.	Culture and Sensitivity	Urethral swab/Penile swab	Not applicable	Amies Transport Medium	Send within 2-4 hours.	CDL

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTIONS	DESTINATION
22.	Culture and Sensitivity	Urine	5ml	Sterile	Please collect morning midstream urine and send it within 2-4 hours.	CDL
23.	Culture and Sensitivity	Stool	Not applicable	Stool container	Send within 2-4 hours.	CDL
24.	Culture and Sensitivity	Rectal swab	Not applicable	Amies Transport Medium	Send within 2-4 hours.	CDL
25.	Culture and Sensitivity	Pus	Not applicable	Sterile	Please specify the site of collection. Send within 2-4 hours.	CDL
26.	Culture and Sensitivity	Wound swab/ulcer swab	Not applicable	Amies Transport Medium	Please specify the site of collection. within 2-4 hours.	CDL
27.	Culture and Sensitivity	Tissue/Bone	Not applicable	Sterile	Please specify the site of collection. within 2-4 hours.	CDL
28.	MRSA Screening	Nasal/axilla/groin swab	Not applicable	Amies Transport Medium	Please specify the site of collection. Send within 2-4 hours.	CDL
29.	Culture and Sensitivity	Bone marrow	5-10ml (adult) 2-3ml (paediatric)	Blood culture bottle	Inoculate bone marrow collected with aseptic technique. If the sample is not sent immediately, please do not refrigerate it. Please leave it at room temperature.	CDL
30.	*Legionella* Antigen	Urine	5ml	Sterile	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH
31.	*Leptospira* IgM	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH
32.	*Leptospira:* Microscopic agglutination test (MAT)	Blood	5ml	Plain tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	IMR

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTIONS	DESTINATION
33.	*Rickettsia* antibody	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
34.	RPR	Blood	5ml	Gel tube	Send the sample to CDL within 2-4 hours.	CDL
35.	TPPA/TPHA	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
36	FEME (Fluids)	Sterile body fluids	3ml	Sterile	Send within 2-4 hours.	CDL

NB:

- *All sterile specimens should **NOT** be refrigerated. It should be sent immediately to the laboratory.*
- *All specimens for C&S should be sent before antibiotic administration.*

MOLECULAR BACTERIOLOGY						
NO	**TEST**	**SPECIMEN TYPE**	**VOLUME REQUIRED**	**SPECIMEN CONTAINER**	**INSTRUCTIONS**	**DESTINATION**
1.	Gene Xpert Ultra MTB RIF	Sputum/ BAL	Not applicable	Sterile	Send immediately	CDL

VIROLOGY AND SEROLOGY						
NO	**TEST**	**SPECIMEN TYPE**	**VOLUME REQUIRED**	**SPECIMEN CONTAINER**	**INSTRUCTIONS**	**DESTINATION**
1.	Adenovirus Antigen (IF)	Sputum/tracheal aspirates/NPA/BAL	Not applicable	Sterile	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
2.	Cytomegalovirus IgM	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
3.	Cytomegalovirus IgG	Blood	5ml	Sterile	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
4.	Dengue IgM	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
5	Dengue IgG	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
6.	NS1 Antigen (Dengue)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
7.	Enterovirus Antigen (IF)	CSF	1ml	Sterile	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
8.	Epstein Barr Virus IgM	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH

NO	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTIONS	DESTINATION
9.	Epstein Barr Virus IgG	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
10.	Hepatitis A Virus IgM	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
11.	Hepatitis B surface antigen (HBsAg)	Blood	5ml	Gel tube	Send the sample within 2-4 hours.	CDL
12.	Hepatitis B surface antibody)(HBsAb)	Blood	5ml	Gel tube	Send sample within 2-4 hours.	CDL
13.	Hepatitis B core IgM (HBc IgM)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
14.	Hepatitis B core total antibody (HBc total Ab)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
15.	Hepatitis B e Antigen (HBeAg)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
16.	Hepatitis B e Antibody (HBeAb)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	HOSP. SG. BULOH
17.	Hepatitis C Antibody (Anti HCV)	Blood	5ml	Gel tube	Send sample within 2-4 hours.	CDL

NO	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTIONS	DESTINATION
18.	Herpes simplex Type 1 & 2 Antibody (IgM)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH
19.	Herpes simplex Type 1 & 2 Antibody (IgG)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH
20.	HIV 1 & 2 Antigen/antibody COMBO	Blood	5ml	Gel tube	Send sample within 2-4 hours. The patient's consent is to be obtained and documented on the request form before blood collection.	CDL
21.	HIV 1 &2 (Particle agglutination)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	CDL
22.	HIV 1 &2 (Western Blot)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	UMMC
23.	Influenza A Virus Antigen (IF)	Sputum/tracheal aspirates/NPA/BAL	Not applicable	Sterile	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	UMMC
24.	Influenza B Virus Antigen (IF)	Sputum/tracheal aspirates/NPA/BAL	Not applicable	Sterile	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	UMMC

NO	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTIONS	DESTINATION
25.	Influenza C Virus Antigen (IF)	Sputum/tracheal aspirates/NPA/BAL	Not applicable	Sterile	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	UMMC
26.	Japanese encephalitis Antibody (IgM)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH
27.	Japanese encephalitis Antibody (IgG)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH
28.	Japanese encephalitis Antibody (IgM)	CSF	1-3ml	Sterile	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH
29.	Measles Virus Antibody (IgM)	Blood	5ml	Sterile	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH
30.	Measles Virus Antibody (IgM)	Blood	5ml	Sterile	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH
31.	Mumps Virus Antibody (IgM)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH
32.	Mumps Virus Antibody (IgG)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH

NO	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTIONS	DESTINATION
33.	Nipah Virus Antibody (IgM)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	UMMC
34.	Nipah Virus Antibody (IgG)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	UMMC
35	Rubella IgM	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours	HOSP. SG. BULOH
36	Rubella IgG	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours	HOSP. SG. BULOH
37.	Respiratory Syncytial Virus Antigen (IF)	Sputum/tracheal aspirates/NPA/BAL	Not applicable	Sterile	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH
38	SARS COV 2 Rapid Test kit Antigen (RTK Ag)	Nasopharyngeal swab	Not applicable	Falcon tube	Transportation with triple packaging /ice pack. Sample must reach within 4 hours upon collection	CDL
39	Mycoplasma Antibody	Blood	5 ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours	LABLINK
40	Coxiella Burnetti Antibody	Blood	5 ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours	Gribbles

41	Brucella Antibody	Blood	5 ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours	Gribbles
42	Bartonella antibody	Blood	5 ml	Gel tube	Complete PER PAT.301 form and send it along with sample within 2-4 hours	IMR

MOLECULAR VIROLOGY						
NO	**TEST**	**SPECIMEN TYPE**	**VOLUME REQUIRED**	**SPECIMEN CONTAINER**	**INSTRUCTIONS**	**DESTINATION**
1	SARS CoV2 RNA	Nasopharyngeal /Oropharyngeal swab	Not applicable	VTM	Transportation with triple packaging /ice pack.	CDL
2	CMV Qualitative and Quantitative	Blood Urine Eye vitreous fluid Tissue biopsy BAL Amniotic fluid CSF Saliva Semen Swab	3-5ml 3 ml 0.2 ml Min 2cm 1-3ml 1-3ml 1-3ml 103ml 1-3ml 1-3ml 1-3ml	EDTA Sterile	Transported on ice	Geneflux
3	BK & JC Virus Qualitative and Quantitative	Blood Serum CSF Urine	3-5ml 3-5ml 0.5-1 ml 1-3ml	EDTA Sterile Sterile	Transported on ice	Geneflux
4	HBV DNA	Blood	3-5ml	EDTA	Transported on ice	Geneflux
5	HCV RNA	Blood	3-5ml	EDTA	Transported on ice	Geneflux
6	HIV RNA (Qualitative)	Blood	3-5ml	EDTA	Transported on ice	Geneflux
7	HIV viral load	Blood	3-5ml	EDTA	Transported on ice	Geneflux

MYCOLOGY						
NO	**TEST**	**SPECIMEN TYPE**	**VOLUME REQUIRED**	**SPECIMEN CONTAINER**	**INSTRUCTIONS**	**DESTINATION**
1.	*Aspergillus* Species Antibody	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH
2.	*Cryptococcal* Antigen	CSF/Blood	5ml	Sterile/Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HOSP. SG. BULOH
3.	Fungal Culture and Sensitivity	Blood	5-10ml (adult) 2-3ml (paediatric)	Blood culture for fungal bottle	Inoculate blood collected with aseptic technique. If the sample is not sent immediately, please do not refrigerate it. Please leave it at room temperature.	CDL
4.	Fungal Culture and Sensitivity	CSF	1-3ml	Sterile	Send immediately.	CDL
5.	Fungal Culture and Sensitivity	Pleural fluid	5ml	Sterile	Send immediately.	CDL
6.	Fungal Culture and Sensitivity	Peritoneal fluid	5-10ml	Sterile	Send immediately.	CDL
7.	Fungal Culture and Sensitivity	Pus	Not applicable	Sterile	Send sample within 2-4 hours.	CDL
8.	Fungal Culture and Sensitivity	Vitreous/Aqueous Fluid	3ml	Sterile	Send immediately.	CDL

NO	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTIONS	DESTINATION
9.	Fungal Culture and Sensitivity	Hair / Nail	Not applicable	Wrap with filter paper	Send sample within 2-4 hours.	CDL
11.	Fungal Culture and Sensitivity	Tissue	Not applicable	Sterile	Please specify the site of collection. Send sample within 2-4 hours.	CDL
12.	*Histoplasma* Antibody	Blood	5ml	Gel tube	Send sample within 2-4 hours.	HOSP. SG. BULOH
13	*Pneumocystis jirovecii molecular*	BAL Induced sputum	1-3ml		Transport in ice	Geneflux

MOLECULAR MYCOLOGY						
NO	**TEST**	**SPECIMEN TYPE**	**VOLUME REQUIRED**	**SPECIMEN CONTAINER**	**INSTRUCTIONS**	**DESTINATION**
1	*Pneumocystis jirovecii molecular*	BAL	1-3ml	Sterile	Transport in Ice	Geneflux

IMMUNOLOGY						
NO	**TEST**	**SPECIMEN TYPE**	**VOLUME REQUIRED**	**SPECIMEN CONTAINER**	**INSTRUCTIONS**	**DESTINATION**
1.	Anti-nuclear antibody (ANA)	Blood	5ml	Gel tube	Send sample within 2-4 hours.	CDL
2.	Anti - double-stranded DNA antibody (anti-dsDNA)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	IMR
3.	Anti- mitochondrial antibody (AMA)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample to CDL within 2-4 hours.	IMR
4.	Anti - phospholipid antibody	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	IMR
5.	Anti-cardiolipin	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	IMR
6.	Anti-Ro (SS-A)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	IMR
7.	Anti - La (SS-B)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	IMR
8.	Extractable Nuclear antibody (ENA)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	UMMC

NO	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTIONS	DESTINATION
9.	Anti -Neutrophil Cytoplasmic antibody (ANCA)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	UMMC
10.	Rheumatoid factor (RF)	Blood	5ml	Gel tube	Send the sample within 2-4 hours.	CDL
11.	Immunoglobulin A	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	LABLINK
12.	Immunoglobulin G	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	LABLINK
13.	Immunoglobulin M	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	LABLINK
14.	Immunoglobulin E	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	LABLINK
15.	HLA B 27	Blood	10 ml	EDTA tube	By appointment ONLY.	IMR
16.	Anti-CCP	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with the sample within 2-4 hours	LABLINK

PARASITOLOGY						
NO	**TEST**	**SPECIMEN TYPE**	**VOLUME REQUIRED**	**SPECIMEN CONTAINER**	**INSTRUCTIONS**	**DESTINATION**
1.	Malaria Microscopy (BFMP)- Thin & Thick Blood Smears	Blood	2ml	EDTA	Send immediately.	CDL
2.	Microfilaria Microscopy – Thin & Thick Blood Smear	Blood	2ml	EDTA	Send the sample during operational hours.	CDL
3.	*Trichomonas vaginalis* – wet mount	HVS	Not applicable	Amies Transport Medium	Send within 2-4 hours.	CDL
4.	Ova & Cysts – Microscopy (Direct Smear)	Stool	20-50 gm	Stool container	Send the sample within 2-4 hours.	CDL
5.	Coccidian Oocysts (Crypto, Isospora, Cyclospora) – special staining methods	Stool	20-50 gm	Stool container	Complete PER PAT.301 form and send it along with the sample within 2-4 hours.	HSB

APPENDIX

Appendix 1: Chemical Pathology Tests & Clinical Indications

TEST	INDICATIONS
Albumin	The determination of albumin allows monitoring of a controlled patient dietary supplementation and serves also as an excellent test of liver function.
ALP	1. To screen for or monitor treatment for a liver or bone disorder. 2. A rise of the ALP occurs with all forms of cholestasis, particularly with obstructive jaundice. It is also elevated in diseases of the skeletal system, such as Paget's disease, hyperparathyroidism, rickets and osteomalacia, as well as with fractures and malignant tumors.
ALT	To evaluate the function of the liver. Elevated ALT level is found in hepatitis, cirrhosis, obstructive jaundice, carcinoma of the liver and chronic alcohol abuse.
Amylase	Suitable for the diagnosis and monitoring of acute pancreatitis and acute attacks during chronic pancreatitis.
Blood Gases	1. To determine oxygen and carbon dioxide saturation in patient blood. It also determines the acidity (pH) of the blood. 2. The test is used to evaluate respiratory diseases and conditions that affect the lungs. It helps determine the effectiveness of oxygen therapy. The test also provides information about the body's acid/base balance, which can reveal important clues about lung and kidney function and the body's general metabolic state.
AST	1. To detect liver damage and/or to help diagnose liver disease. 2. Elevated serum levels are found in hepatobiliary diseases, such as cirrhosis, metastatic carcinoma, viral hepatitis, myocardial infarction. 3. Decreased AST levels are found in patients undergoing renal dialysis or those with vitamin B6 deficiency.
Bilirubin	1. To screen for or monitor liver disorders or haemolytic anemia. 2. Elevated serum bilirubin is found in haemolytic anaemia (unconjugated), liver disorders and biliary obstruction.
Calcium	1. To evaluate calcium levels in the body. 2. Increases in serum PTH or Vitamin D are usually associated with hypercalcemia. Increased serum calcium levels may also be observed in multiple myeloma and other neoplastic diseases. 3. Hypocalcemia may be observed in a patient with hypoparathyroidism, nephrosis or pancreatitis.
Chloride	1. To evaluate electrolyte imbalance. 2. Decreased chloride includes reduced dietary intake, prolonged vomiting, reduced renal reabsorption as well as some forms of acidosis and alkalosis. 3. Increased chloride values are found in dehydration, kidney failure, some forms of acidosis, high dietary or parenteral chloride intake, and salicylate poisoning.
Creatine Kinase	1. Elevated CK serum levels are found in skeletal muscle disease, particularly muscular dystrophy. 2. Serum CK activity is also increased after cerebral ischaemia, acute cerebrovascular disease and head injury.
Creatinine	The most common test used to assess renal function.

TEST	INDICATIONS
C-reactive protein	1. To identify the presence of inflammation and to monitor response to treatment for an inflammatory disorder. 2. Elevated CRP is found in patients with a tissue-damaging process such as infection, inflammatory diseases and malignant neoplasms.
Cortisol	The cortisol status of a patient is used to diagnose the function or malfunction of the adrenal gland, the pituitary, and the hypothalamus. e.g.: a) Overproduction (e.g. Cushing's syndrome) b) Underproduction (e.g. Addison's disease)
Oestradiol	1. The determination of oestradiol is utilized clinically in the elucidation of fertility disorders in the hypothalamus-pituitary-gonad axis, gynecomastia, oestrogen-producing ovarian and testicular tumors and in hyperplasia of the adrenal cortex. 2. Further clinical indications are the monitoring of fertility therapy and determining the time of ovulation within the framework of in vitro fertilization.
Ferritin	To determine total iron storage capacity; to help diagnose iron deficiency or iron overload.
FSH	1. Determination of the FSH concentration is used in the elucidation of dysfunctions within the hypothalamus-pituitary-gonads system. 2. The determination of FSH in conjunction with LH is utilized for the following indications: congenital diseases with chromosome aberrations, polycystic ovaries (PCO), amenorrhoea (causes), and menopausal syndrome.
Free T4	1. To evaluate thyroid gland function. 2. To help in the diagnosis of hyperthyroidism or hypothyroidism.
Free T3	Determination of this hormone concentration is important for the diagnostic differentiation of euthyroid, hyperthyroid, and hypothyroid states.
Folate	Aids in the detection of folate deficiency.
GGT	To assist in the diagnosis and monitoring of hepatobiliary diseases.
Glucose	To be used in the diagnosis and treatment of carbohydrate metabolism disorders including diabetes mellitus and hypoglycemia.
HDL-C	1. To determine the risk of atherosclerotic disease. 2. Elevated HDL-cholesterol concentrations are protective against coronary heart disease, while reduced HDL-cholesterol concentrations, particularly in conjunction with elevated triglycerides, increase the cardiovascular risk.
Haemoglobin A1c	1. To monitor blood glucose control in individuals with diabetes mellitus (Indicate the mean blood glucose level in 8-12 weeks). 2. HbA1c predicts the development of diabetic complications in diabetes patients and can be used for the diagnosis of diabetes mellitus.
Iron (total)	Aids in the diagnosis of iron deficiency anaemia and iron overload.
LDH	1. Elevated serum levels of LDH have been observed in a variety of disease states. The highest levels are seen in patients with megaloblastic anemia, disseminated carcinoma, leukemias and trauma. 2. Mild increases in LDH activity have been reported in cases of haemolytic anemias, muscular dystrophy, pulmonary infarction, hepatitis, nephrotic syndrome and cirrhosis.

TEST	INDICATIONS
LDL-cholesterol	1. To determine the risk of atherosclerotic disease. 2. Strong predictor for coronary atherosclerosis.
Luteinizing Hormone	1. Determination of the LH concentration is used in the elucidation of dysfunctions within the hypothalamus-pituitary-gonads system. 2. The determination of LH in conjunction with FSH is utilized for the following indications: congenital diseases with chromosome aberrations (e.g.Turner's syndrome), polycystic ovaries (PCO), clarifying the causes of amenorrhea, menopausal syndrome, and suspected Leydig cell insufficiency.
Magnesium	1. To evaluate electrolyte imbalance. 2. Increased serum magnesium concentrations occur in renal failure, acute diabetic acidosis, dehydration, or Addison's disease. 3. Hypomagnesemia may be observed in chronic alcoholism, malabsorption, severe diarrhoea, acute pancreatitis, diuretic therapy, prolonged parenteral fluid therapy without magnesium supplementation, and kidney disorders such as glomerulonephritis and tubular reabsorption defects.
Microalbumin (urine)	It is considered an important marker for glomerular dysfunction. Slightly elevated albumin excretion in urine, called microalbuminuria, is of particular importance in the early diagnosis of diabetic nephropathy.
Phosphorus	To evaluate the level of phosphorus and as a marker to evaluate an abnormal calcium level.
Potassium	1. To evaluate an electrolyte imbalance. 2. Hypokalaemia can be found in reduced intake of dietary potassium or excessive loss of potassium from the body by prolonged vomiting, diarrhoea or increased kidney excretion. 3. Hyperkalaemia may be caused by dehydration or shock, severe burns, diabetic ketoacidosis, and retention of potassium by the kidney.
Progesterone	The determination of progesterone is utilized in a fertility diagnosis for the detection of ovulation and assessment of the luteal phase.
Prolactin	Evaluation of anterior pituitary tumour hyper- or hypofunction.
Sodium	1. To evaluate electrolyte imbalance. 2. Decreased levels of sodium include prolonged vomiting or diarrhoea, diminished reabsorption in the kidney and excessive fluid retention. 3. Increased sodium includes excessive fluid loss, high salt intake, and increased kidney reabsorption.
TiBC	Aid in the diagnosis of iron deficiency anaemia and iron overload.
Testosterone	1. The determination of testosterone in women is helpful in the diagnosis of an androgenic syndrome (AGS), polycystic ovaries (Stein-Leventhal syndrome) and when an ovarian tumor, adrenal tumor, adrenal hyperplasia or ovarian insufficiency is suspected. 2. Testosterone is determined in men when reduced testosterone production is suspected, e.g. hypogonadism, oestrogen therapy, chromosome aberrations (as in the Klinefelter's syndrome) and liver cirrhosis.

TEST	INDICATIONS
Total protein	Total protein measurements are used in the diagnosis and treatment of a variety of diseases involving the liver, kidney, or bone marrow, as well as other metabolic or nutritional disorders.
Triglycerides	The determination of triglycerides is utilized in the diagnosis and treatment of patients having diabetes mellitus, nephrosis, liver obstruction, lipid metabolism disorders and numerous other endocrine diseases.
Troponin T	Cardiac troponin T (cTnT) is a biomarker of myocardial injury. A major utility is for diagnosis, risk stratification and management of the acute coronary syndrome.
TSH	TSH is a very sensitive and specific parameter for assessing thyroid function and is particularly suitable for early detection or exclusion of disorders in the central regulating circuit between the hypothalamus, pituitary and thyroid. It is also used to screen for congenital hypothyroidism in newborns.
Urea	Urea is one of the most widely used tests for renal function apart from creatinine.
Uric acid	Uric acid measurements are used in the diagnosis and treatment of numerous renal and metabolic disorders, including renal failure, gout, leukemia, psoriasis, starvation or other wasting conditions, and of patients receiving cytotoxic drugs.
Vancomycin	Vancomycin test is used to monitor the amount of drug in the blood to ensure that it is adequate but not excessive. The effectiveness of vancomycin depends on keeping blood levels at a therapeutic level (minimum effective concentration), for the duration of therapy. Excessive concentrations of vancomycin must be avoided because high levels can result in toxicity, specifically ototoxicity (hearing damage) and nephrotoxicity (kidney damage).
Vitamin B12	Aids in the detection of vitamin B_{12} deficiency in individuals with macrocytic or unexplained anaemia, or unexplained neurologic disease.

Appendix 2: Chemical Pathology Tests & Reference Ranges

NO.	TESTS	METHOD	SPECIMEN TYPE	REFERENCE RANGE/UNIT
1.	Alanine Aminotransferase (ALT)	IFCC Modified (no pyridox. phosphate)	Serum	Men : <41.0 U/L Women : <33.0 U/L
2.	Albumin	BCG-Citrate Buffer	Serum	Adults : 35-52 g/L Paediatric range: Newborns : 0-4d : 28-44 g/L Children : 4d-14d : 38-54 g/L Children 14-18yr : 32-45 g/L
		Immunoturbidimetric	2nd morning Urine	Adults : <20.0 mg/L
			Urine 24 hour	<30 mg/24h
3.	Alkaline Phosphatase (ALP)	AMP Buffer-rate (IFCC)	Serum	Adults:- Men : 40-130 U/L Women : 35-105 U/L Children:- 1 d : <250 U/L 2-5 d : <231 U/L 6d-6m : <449 U/L 7m-1yr : <462 U/L 1yr-3yr : <281 U/L 4yr-6yr : <269 U/L 7yr-12yr : <300 U/L 13yr-17yr :<187 U/L(Women) 13yr-17yr :<390 U/L(M)
4.	Amylase	IFCC Based - EPS	Serum	Adults : 28-100 U/L
			Urine (random)	Men : 16 - 491 U/L Women :21 - 447 U/L
5.	Aspartate Aminotransferase (AST)	IFCC Modified (no pyridox. phosphate)	Serum	Men : <40.0 U/L Women : <32.0 U/L
6.	Bilirubin (direct)	Diazonium salt	Serum	Adult : ≤ 5.0 µmol/L
7.	Bilirubin (total)	Diazonium salt	Serum	Adults : ≤21.0 µmol/L Newborn & Paediatrics 1d : <137µmol/L 2d : <222 µmol/L 3d – 4d : <290 µmol/L 5d – 17y : ≤ 17 µmol/L
8.	Calcium	5-nitro-5'-methyl-BAPTA	Serum	Serum: 0-10d : 1.90-2.60 mmol/L 10d-2y :2.25-2.75 mmol/L 2-12y :2.20-2.70 mmol/L 12-18y : 2.10-2.55 mmol/L 18-60y : 2.15-2.50 mmol/L 60-90y : 2.20-2.55 mmol/L > 90y : 2.05-2.40 mmol/L
			Urine 24 Hrs	2.5-7.5 mmol/24h

NO.	TESTS	METHOD	SPECIMEN TYPE	REFERENCE RANGE/UNIT
9.	Corrected calcium	Calculated	Serum	Serum: 0-10d : 1.90- 2.60 mmol/L 10d-2y : 2.25-2.75 mmol/L 2-12y : 2.20-2.70 mmol/L 12-18y : 2.10-2.55 mmol/L 18-60y : 2.15-2.50 mmol/L 60-90y : 2.20-2.55 mmol/L > 90y : 2.05-2.40 mmol/L
10.	Creatinine	Jaffe (Alk. Picrate-rate, compensated)	Serum	Adults: Men: 62-106 µmol/L Women: 44-80 µmol/L Children Neonates(premature): 25-91 µmol/L Neonates (full term): 21-75 µmol/L 2-12m: 15-37 µmol/L 1-<3y: 21-36 µmol/L 3-<5y: 27-42 µmol/L 5-<7y: 28-52 µmol/L 7-<9y: 35-53 µmol/L 9-<11y: 34-65 µmol/L 11-<13y: 46-70 µmol/L 13-<15y: 50-77 µmol/L
			Urine (1st morning urine)	Men: 3.45–22.9 mmol/L Women: 2.47 – 19.2 mmol/L
			Urine 24 Hr	Men: 9-21 mmol/24h Women: 7-14 mmol/24h Creatinine clearance Adults: 71-151 mL/min
11.	Cholesterol	Cholesterol Oxidase/Peroxidase	Serum	Adults: <5.2 mmol/L
12.	Creatine Kinase	Catalytic CK activity (340nm)	Serum	Men: <190.0 U/L Women: <170.0 U/L
13.	Cortisol	Electro-chemiluminescence (Competitive)	Serum	Morning (7-10 am): 171 – 536 nmol/L Evening (4 -8 pm): 64 – 327 nmol/L
14.	C-Reactive Protein (Latex)	Particle enhanced turbidimetric assay	Serum	Adults: < 5.0 mg/L
15.	Oestradiol	Electro-chemiluminescence (Competitive)	Serum	Adults Women: Follicular Phase : 98.1–571 pmol/L Ovulation Phase :176.5–1153.0 pmol/L Luteal Phase: 122.0–1094.0 pmol/L Post-menopause: 18.4–183.0 pmol/L Pregnancy: 1st trimester: 563.0–11249.0 pmol/L 2nd trimester: 5729.0–69547.0 pmol/L 3rd trimester: 36810.0- 110100.0 pmol/L Adult Men: 99.4 – 192 pmol/L

NO.	TESTS	METHOD	SPECIMEN TYPE	REFERENCE RANGE/UNIT
16.	Ferritin	Electro-chemiluminescence (Sandwich)	Serum	Men: 30-400 µg/L Women: 13-150 µg/L
17.	Folate	Electro-chemiluminescence (Competitive)	Serum	Men: 10.4-78.9 nmol/L Women: 10.4-78.9 nmol/L
18.	Follicle Stimulating Hormone (FSH)	Electro-chemiluminescence (Sandwich)	Serum	Adults Women: Follicular Phase: 3.5 – 12.5 IU/L Ovulation Phase: 4.7 – 21.5 IU/L Luteal Phase: 1.7 – 7.7 IU/L Post-menopause: 25.8 - 134.8 IU/L Adults Men: 1.5 – 12.4 IU/L
19.	Free Thyroxine (FT4)	Electro-chemiluminescence (Competitive)	Serum	Adults: 12.0-22.0 pmol/L Newborn: 11.0-32.0 pmol/L 6 days – 3 months: 11.5-28.3 pmol/L 4-12 months: 11.9-25.6 pmol/L 1-6 years: 12.3-22.8 pmol/L 7-11 year: 12.5-21.5 pmol/L 12-20 years: 12.6-21.0 pmol/L
20.	Gamma-Glutamyl transferase (GGT)	Enzymatic colorimetric assay Other g-Glut-3-carboxy-nitro	Serum	Men: <60 U/L Women: <40 U/L
21.	Glucose	Hexokinase	Plasma	**Based on 2006 WHO criteria** **Fasting Plasma Glucose:** 3.5–6.0 mmol/L (Normal) 6.1- 6.9 mmol/L (Impaired fasting glucose) ≥7.0 mmol/L (Diabetes mellitus) **Random Plasma Glucose:** < 7.8 mmol/L (Normal) 7.8–11.0 mmol/L (Impaired glucose tolerance) > 11.0 mmol/L (Diabetes mellitus)
			Urine (random) Urine 24 hours	Random urine: 0.06-0.83 mmol/L 24-hour urine: <2.78mmol/24H
			CSF	Children: 3.33-4.44 mmol/L Adults : 2.22-3.89 mmol/L
22.	HbA1c	High performance liquid chromatography (HPLC)	Plasma	**According to the American Diabetes Association (ADA)** ≥6.5% or 48 mmol/mol (Diabetic) 5.7-6.4% or 39-47 mmol/mol (Pre-Diabetic) <5.7% or 39 mmol/mol (non-diabetic)

NO.	TESTS	METHOD	SPECIMEN TYPE	REFERENCE RANGE/UNIT
23.	HDL-Cholesterol	Non-separation method (Cholesterol esterase/oxidase)	Serum	**According to *NCEP ATP III Guidelines** Men : ≥ 1.0 mmol/L Women: ≥1.3 mmol/L
24.	Iron (total)	Ferrozine	Serum	Adults: 5.83 - 34.5 µmol/L
25.	ISE (Na, K, Cl)	ISE-Indirect (diluted)	Serum	Sodium: 136-145 mmol/L Potassium: 3.5-5.1 mmol/L Chloride: 98-107 mmol/L
			Urine (24-hour)	Sodium: 40 – 220 mmol/24 hrs Potassium: 25 – 125 mmol/24 hrs Chloride: 110 -250 mmol/24 hrs
26.	Lactate Dehydrogenase (LDH)	UV assay (Lactate to Pyruvate)	Serum	Women: 135 – 214 U/L Men: 135 – 225 U/L Children (2–15 years): 120 – 300 U/L Newborn (4 – 20 days): 225 – 600 U/L
27.	LDL-Cholesterol	According to Friedewald formula	Serum	**Target LDL-c based on cardiovascular risk** Low risk: < 3.0 mmol/L Moderate risk: < 3.0 mmol/L High risk: < 2.6 mmol/L or reduction of > 50% from baseline Very high risk: < 1.8 mmol/L or reduction of > 50% from baseline or reduction of >50% from baseline
28.	Luteinizing Hormone (LH)	Electro-chemiluminescence (Sandwich)	Serum	Women Follicular Phase: 2.4 – 12.6 IU/L Ovulation Pha: 14 –96 IU/L Luteal Phase: 1.0 – 11.4 IU/L Post-menopause: 7.7 – 58.5 IU/L Men: 1.7 – 8.6 IU/L
29.	Magnesium	Xylidyl Blue	Serum	Newborn: 0.62-0.91 mmol/L 5 m–6Y : 0.70-0.86 mmol/L 6Y–12 Y : 0.70-0.86 mmol/L 12Y-20Y : 0.70-0.91 mmol/L 20Y-60Y : 0.66-1.07 mmol/L 60Y-90Y : 0.66-0.99 mmol/L >90Y : 0.70-0.95 mmol/L
			Urine 24 Hrs	3.0-5.0 mmol/24hrs

** Adult Treatment Panel (ATP), National Cholesterol Education Program (NCEP)*

NO.	TESTS	METHOD	SPECIMEN TYPE	REFERENCE RANGE/UNIT
30.	Phosphate	Phosphomolybdate formation	Serum	Men 1D-30D :1.25 - 2.25 mmol/L 1M-12M :1.15 - 2.15 mmol/L 1Y-3Y :1.00 - 1.95 mmol/L 4Y-6Y :1.05 -1.80 mmol/L 7Y-9Y :0.95 - 1.75 mmol/L 10Y-12Y :1.05 - 1.85 mmol/L 13Y-15Y :0.95 - 1.65 mmol/L 16Y-18Y :0.85 - 1.60 mmol/L Adults :0.80 -1.45 mmol/L Women 1D-30D :1.40 - 2.50 mmol/L 1M-12M :1.20 - 2.10 mmol/L 1Y-3Y :1.10 - 1.95 mmol/L 4Y-6Y :1.05 - 1.80 mmol/L 7Y-9Y :1.00 - 1.80 mmol/L 10Y-12Y :1.05 - 1.70 mmol/L 13Y-15Y :0.90 - 1.55 mmol/L 16Y-18Y :0.80 - 1.55 mmol/L Adults :0.81 - 1.45 mmol/L
			Urine (1st morning) Urine 24 Hrs	Urine 1st-morning urine: 13-44 mmol/L 24-hour urine: 13-42 mmol/24H
31.	Progesterone	Electro-chemiluminescence (Competitive)	Serum	Women Follicular Phase : 0.181 – 2.84 nmol/L Ovulation Phase : 0.385 – 38.1 nmol/L Luteal Phase : 5.82 – 75.9 nmol/L Post-menopause: < 0.401 nmol/L Men: < 0.5 nmol/L
32.	Prolactin	Electro-chemiluminescence (Sandwich)	Serum	Women (not pregnant): 102-496 mIU/L Men : 86-324 mIU/L
33.	Total Protein	Biuret/endpoint (with blank)	Serum	**According to *Tietz Textbook** Newborn:46-70 g/L 1W :44-76 g/L 7M-1Y :5 -73 g/L 1Y-2Y :56-75 g/L >3Y :60-80 g/L Adults :64-83 g/L
34.	Total Protein Urine/CSF	Turbidimetric	Urine (random)	Adults: <0.15 g/L
			Urine 24Hrs	Adults: <0.14 g/24h
			CSF	Adults: 0.15-0.45 g/L

***** *Lopez, J. (2015). Carl A. Burtis and David E. Bruns: Tietz fundamentals of clinical chemistry and molecular diagnostics.*

NO.	TESTS	METHOD	SPECIMEN TYPE	REFERENCE RANGE/UNIT
35.	Testosterone	Electro-chemiluminescence (Competitive)	Serum	Adults Men (20 – 49 years) :8.64 – 29.0 nmol/L Men (≥ 50 years) :6.68 – 25.7 nmol/L Women (20 - 49 years): 0.29 – 1.67 nmol/L Women (≥ 50 years) : 0.10 – 1.42 nmol/L
36.	Thyroid Stimulating Hormone (TSH)	Electro-chemiluminescence (Sandwich)	Serum	Adults: 0.270-4.20 mIU/L Newborn: 0.70-15.2 mIU/L 6 days – 3 months: 0.72-11.0 mIU/L 4-12 months: 0.73-8.35 mIU/L 1-6 years: 0.70-5.97 mIU/L 7-11 years: 0.60-4.84 mIU/L 12-20 years: 0.51-4.30 mIU/L
37.	Triglycerides	Lipase/Glycerol kinase/GPO-PAP	Serum	**According to *NCEP ATP III Guidelines** Adults: <1.7 mmol/L
38.	hs Troponin T	Electro-chemiluminescence (Sandwich)	Serum	Adults: ≤14 ng/L
39.	Unsaturated Iron Binding Capacity (UIBC)	Direct determination with Ferrozine	Serum	Men: 22.3 61.7 µmol/L Women: 24.2-70.1 µmol/L
40.	Urea	Urease-Kinetic (340nm)	Serum	Adults: 2.78-8.07 mmol/L
			Urine (24 h)	Adults: 428-714 mmol/24 h
41.	Uric acid	Uricase/peroxidase	Serum	Men : 142.8-339.2 µmol/L Women: 202.3-416.5 µmol/L
			Urine 24hrs	1200-5900 µmol/24H
42.	Vancomycin	Kinetic interaction of microparticles in a solution (KIMS)	Serum	Trough: 10.0 – 20.0 mg/L Peak : 20.0 – 40.0 mg/L
43.	Vitamin B12	Electro-chemiluminescence (Competitive)		Men : 145-569 pmol/L Women: 145-569 pmol/L

** Adult Treatment Panel (ATP), National Cholesterol Education Program (NCEP).*

Blood Gases

NO.	TESTS	METHOD	SPECIMEN TYPE	REFERENCE RANGE/UNIT
1.	pH	Potentiometric electrodes	Whole Blood	ABG: 7.35 – 7.45 VBG: 7.31 – 7.41
2.	pCO^2	Severinghaus principle		ABG : 32.0 –48.0 mmHg VBG: 41.0 – 51.0 mmHg
3.	pO^2	Clark measurement		ABG : 83.0 – 108.0 mmHg VBG: 30 – 40 mmHg
4.	HCO^3	Calculated test		21.0 – 26.0 mmol/L
5.	SpO_2	Calculated test		ABG : 94.0 – 98.0 % VBG: 70 – 80 %
6.	BE	Calculated test		-2.0 – 3.0

NB: *ABG – Arterial blood gases, VBG – Venous blood gases*

Urine Full Examination Microscopy Examination (FEME)

A) Macroscopic Examination

NO.	TESTS	METHOD	REFERENCE RANGE/UNIT
1.	Bilirubin	Diazonium salt	<3.4 µmol/L
2.	Erythrocytes	Peroxidase-like activity of Hb	0-5 Ery/µL
3.	Glucose	Glucose oxidase/peroxidase reaction	<1.7 mmol/L
4.	Ketone	Legal's test	<0.5 mmol/L
5.	Leucocytes	Indoxyl ester with diazonium salt	<10 Leu/µL
6.	Nitrite	Griess test	Negative
7.	pH	Hydrogen ions concentration	4.8 – 7.4
8.	Protein	Protein error of a pH indicator	<0.1 g/L
9.	Specific gravity	Detection of ion concentration (Presence of cation, protons are released and produce color change)	1.016 – 1.022
10.	Urobilinogen	Ehrlich's Test	< 17 µmol/L

B) Microscopic Examination

NO.	TYPE OF SEDIMENTS	NORMAL FINDINGS
1.	Erythrocytes	< 5 cells/µL
2.	Leucocytes	<10 cells/µL
3.	Epithelial cells	Renal tubular - negative Other epithelial cells < 10
4.	Hyaline cast	Occasional (1 – 5 casts)
5.	Epithelial cast	Negative
6.	Erythrocyte cast	Negative
7.	Granulated cast	Negative
8.	Leucocyte cast	Negative
9.	Crystals	Negative
10.	Bacteria	Negative
11.	Yeast cells	Negative

Appendix 3: Additional Rejection Criteria, Chemical Pathology

1. Short request interval
    a. HbA1c request < 8 weeks from the previous testing.
2. Insufficient amount of urine:
    a. Urine drug of abuse and Urine toxicology - less than ¾ universal urine container.
    b. Urine 24-hour cortisol and catecholamines – less than 750ml.
3. Renin test is requested without aldosterone.
4. Renin and aldosterone samples are collected at different sampling times.

Appendix 4: Clinical Indication for Haematology and Transfusion Medicine Requests

No.	Tests	Clinical Indications
1.	CBC	Enquiry of general haematology status. Suspected anaemia, polycythaemia, thrombocytosis, thrombocytopenia, leucocytosis, leucopoenia, leukaemia.
2.	CBC+DIFF	Enquiry of general haematology status. Suspected anaemia, polycythaemia, thrombocytosis, thrombocytopenia, leucocytosis, leucopoenia, leukaemia. All subsets of leucocytes are able to be investigated.
3.	Reticulocytes	To differentiate acute from chronic anaemia.
4.	ESR	Inflammation marker which is a non-specific test used to help diagnose conditions associated with acute and chronic inflammation, including infections, cancers, and autoimmune diseases.
5.	PBF	General enquiry of haematology status, validation of blood count results and monitoring haematological abnormalities or haematological responses to disease or inflammation/infection.
6.	PT/INR	General haemostasis test monitors clotting function when treated with warfarin (anticoagulant/anticlotting) therapy.
7.	APTT	General haemostasis test monitors clotting function when treated with heparin (anticoagulant/anticlotting) therapy. Suspected haemophilia or inhibitors.
8.	Fibrinogen	Suspected dysfibrinogenaemia, hypofibrinogenaemia.
9.	Thrombin Time	Enquiry of clotting mechanism of the blood. Suspected haemostatic disorder, disseminated intravascular disorder (DIC), heparin contamination.
10.	D-Dimer	D-dimer concentration is determined by a blood test to help diagnose thrombosis. Suspected thrombotic disorders, e.g. Deep vein thrombosis (DVT) or pulmonary embolism (PE). In patients suspected of disseminated intravascular coagulation (DIC), D-dimers may aid in the diagnosis. Its main use is to exclude thromboembolic disease where the probability is low.
11.	GSH	A test that is requested where patient's blood sample will be typed for ABO and Rh(D) grouping and screened for the unexpected antibody. It is ordered when there is any chance that the patient may require blood during admission. A GSH protocol should be used in accordance with the locally established Maximum Surgical Blood Order Schedule (MSBOS).
12.	GXM	GXM shall be requested for cases with high possibility for blood transfusion. Indications for transfusion are (1) active bleeding/blood loss, (2) low haemoglobin level, (3) comorbidities (i.e. CAD), (4) symptomatic anaemia and (5) age.
13.	DCT	A screening test to check for the presence of antibodies (and/or complement proteins) that are bound to the surface of red blood cells (RBCs). This test is used to determine whether the cause of red cell haemolysis is due to antibodies/complements that are attached to RBCs.

Appendix 5: Routine Haematology Test & Reference Range

Parameter	Unit	Men (Adult)	Women (Adult)	Children (7M – 12M)	Children (2Y – 6 Y)	Children (6Y – 12Y)
WBC	$x10^9$/L	*4 – 10*	*4 – 10*	*6 – 16*	*5 - 15*	*5 – 13*
RBC	$x10^{12}$/L	*4.5 – 5.5*	*3.8 – 4.8*	*3.9 – 5.1*	*4.0 – 5.2*	*4.0 – 5.2*
HGB	g/dL	*13.0 – 17.0*	*12.0 – 15.0*	*11.1 – 14.1*	*11.0 – 14.0*	*11.5 – 15.5*
HCT	%	*40 – 50*	*36 – 46*	*30 - 38*	*34 – 40*	*35 – 45*
MCV	fL	*83 – 101*	*83 – 101*	*72 – 84*	*75 – 87*	*77 - 95*
MCH	pg	*27 – 32*	*27 – 32*	*25 – 29*	*24 – 30*	*25 – 33*
MCHC	g/dL	*31.5 – 34.5*	*31.5 – 34.5*	*32.0 – 36.0*	*31.0 – 37.0*	*31.0 – 37.0*
PLT	$x10^9$/L	*150 – 410*	*150 – 410*	*200 – 550*	*200 – 490*	*170 - 450*
NEUT	%	*40 – 80*	*40 – 80*	-	-	-
LYMP	%	*20 - 40*	*20 – 40*	-	-	-
MONO	%	*2 - 10*	*2 – 10*	-	-	-
EOS	%	*1 - 6*	*1 – 6*	-	-	-
BAS	%	*0 – 2*	*0 – 2*	-	-	-
NEUT	$x10^9$/L	*2.0 – 7.0*	*2.0 – 7.0*	*1.0 – 7.0*	*1.5 – 8.0*	*2.0 – 8.0*
LYMP	$x10^9$/L	*1.0 – 3.0*	*1.0 – 3.0*	*3.5 – 11.0*	*6.0 – 9.0*	*1.0 – 5.0*
MONO	$x10^9$/L	*0.2 – 1.0*	*0.2 – 1.0*	*0.2 – 1.0*	*0.2 – 1.0*	*0.2 – 1.0*
EOS	$x10^9$/L	*0.02 – 0.5*	*0.02 – 0.5*	*0.1 – 1.0*	*0.1 – 1.0*	*0.1 – 1.0*
BAS	$x10^9$/L	*0.02 – 0.1*	*0.02 – 0.1*	*0.02 – 0.1*	*0.02 – 0.1*	*0.02 – 0.1*
Reticulocytes	%	*0.5 – 2.5*	*0.5 – 2.5*			
Reticulocytes	$x10^9$/L	*50 – 100*	*50 – 100*	*30 – 100*	*30 – 100*	*30 – 100*

Adapted from Haematological Values, Dacie's Book, Practical Haematology, 11th Edition, 2012

Parameter	Unit	0D – 2D	3D – 6D	7D – 13D	14D – 30D	31D – 60D	61D – 90D	91D – 180D
WBC	$x10^9$/L	*10 – 26*	*7 – 23*	*6 – 22*	*6 – 22*	*5 – 19*	*5 – 15*	*6 – 18*
RBC	$x10^{12}$/L	*5.0 - 7.0*	*4.0 – 6.6*	*3.9 – 6.3*	*3.6 – 6.2*	*3.0 – 5.4*	*3.1 – 4.3*	*4.1 – 5.3*
HGB	g/dL	*14.0 – 22.0*	*15.0 – 21.0*	*17.1 – 17.9*	*16.1 – 16.9*	*11.5 – 16.5*	*9.4 – 13.0*	*11.1 – 14.1*
HCT	%	*45 - 75*	*45 – 67*	*42 – 66*	*31 – 71*	*33 – 53*	*28 – 42*	*30 – 40*
MCV	fL	*100 – 110*	*92 – 118*	*88 – 126*	*86 – 124*	*92 – 116*	*87 – 103*	*68 – 84*
MCH	pg	*31 – 37*	*31 – 37*	*31 – 37*	*31 – 37*	*30 – 36*	*27 – 33*	*24 – 30*
MCHC	g/dL	*30 – 36*	*29 – 37*	*28 – 38*	*28 – 38*	*29 - 37*	*29 – 36*	*30 – 36*
PLT	$x10^9$/L	*100 – 450*	*210 - 500*	*160 - 500*	*170 - 500*	*200 - 500*	*210 – 650*	*200 – 550*
NEUT	$x10^9$/L	*4 – 14*	*3 – 5*	*3 – 6*	*3 – 7*	*3 – 9*	*1 – 5*	*1 – 6*
LYMP	$x10^9$/L	*3 – 8*	*2 – 8*	*3 – 9*	*3 – 9*	*3 – 16*	*4 – 10*	*4 – 12*
MONO	$x10^9$/L	*0.5 – 2.0*	*0.5 – 1.0*	*0.1 – 1.7*	*0.1 – 1.7*	*0.3 – 1.0*	*0.4 – 1.2*	*0.2 – 1.2*
EOS	$x10^9$/L	*0.1 – 1.0*	*0.1 – 2.0*	*0.1 – 0.8*	*0.1 – 0.9*	*0.2 – 1.0*	*0.1 – 1.0*	*0.1 – 1.0*
BAS	$x10^9$/L	*0.02 – 0.1*	*0.02 – 0.1*	*0.02 – 0.1*	*0.02 – 0.1*	*0.02 – 0.1*	*0.02 – 0.1*	*0.02 – 0.1*
Reticulocytes	$x10^9$/L	*120 - 400*	*50 – 350*	*50 – 100*	*50 – 100*	*20 – 60*	*30 – 50*	*40 – 100*

Coagulation Test	Unit	Male	Female	Remarks
Prothrombin Time (PT)	Seconds	12 -15		Normal range depends on changes of reagent lot number
Activated Partial Thromboplastin Time (APTT)	Seconds	31 - 47		
Fibrinogen	g/L	2 - 4		
Thrombin Time	Seconds	14 - 21		
INR		Therapeutic range 2.0 – 3.0		

Appendix 6: Maximum Surgical Blood Ordering Schedule (MSBOS)

	Name of Procedure	GSH/GXM
	Cardiology	
1	Cardiac catheterisation	GSH
2	Coronary angiogram	GSH
3	Pacemaker insertion	GSH
	Cardiothoracic	
1	VATS	
	+bullectomy	GSH
	+lobectomy	3
2	CABG	4
3	CABG with preoperative autologous blood donation (PABD)	4-n (n = no. of PABD bag)
4	Minimally invasive cardiac surgery (MICS)	2
5	Valve repair i.e.MVR, atrial etc	4
	Obstetrics & Gynaecology	
1	Vaginal hysterectomy	GSH
2	Total abdominal hysterectomy (TAH)	2
3	Total abdominal hysterectomy with bilateral salpingo-oophorectomy (TAHBSO)	2
4	Myomectomy	2
5	Ovarian Cystectomy	GSH
6	Termination of pregnancy - Dilatation & Curettage (D&C)	GSH
7	Vaginal repair	GSH
8	Manual removal of placenta (MRP)	GSH
9	Caesarean section	2

10	Evacuation under anaesthesia for Postpartum haemorrhage (PPH)	2
11	Total Laparoscopic Hysterectomy	GSH
12	Laparoscopic Sacrocolpopexy	GSH
13	Transcervical Resection of Myoma (TCRM)	GSH
14	Ectopic pregnancy (not ruptured); laparoscopy	GSH
15	Ectopic pregnancy (ruptured); laparoscopy/ laparotomy	2
16	Diagnostic hysteroscopy	GSH
General Surgery		
1	Abdominal-perineal resection	2
2	Cholecystectomy	GSH
3	Gastrectomy	2
4	Hemicolectomy, small bowel resection	GSH
5	Hiatus hernia repair: Abdominal	GSH
6	Anterior resection	2
7	Perforated viscus	GSH
8	Mastectomy	GSH
9	Oesophagectomy	4
10	Pancreatectomy	4
11	Portocaval shunt	4
12	Splenectomy	2
13	Thyroidectomy, parathyroidectomy	GSH
14	Varicose veins	GSH
15	Vagotomy	GSH
16	Whipple's procedure	4
17	Exploratory Laparotomy (for bleeding)	4
18	Resection of retroperitoneal tumour	4
19	Hepatectomy	4

Orthopaedic		
1	Femoral osteotomy	2
2	Fractured humerus for fixation	GSH
3	Fractured femur for internal fixation	2
4	Laminectomy, spinal fusion	2
5	Harrington rods	4
6	Putti-Platt shoulder repair	GSH
7	Total hip replacement	2
8	Total knee replacement	GSH
9	Total shoulder replacement	GSH

*Last updated in March 2021

Appendix 7

HUiTM-CLD-CDL(HTM)-F-001

Hospital UiTM
Universiti Teknologi MARA

REQUEST FORM FOR TRANSFUSION REACTION INVESTIGATION (BLOOD AND BLOOD COMPONENTS)

1. When a patient has an adverse reaction to any blood or blood component, **STOP** transfusion immediately. **URGENTLY** inform the doctor in charge of the patient and the Blood Bank.

2. Report all reactions and do the following:

   2.1 Preserve the blood bag and giving set with all attached labels. Seal it securely and send immediately to the Blood Bank.

   2.2 Send the following samples for transfusion reaction investigation to the Blood Bank or relevant laboratory.

   a. Post-transfusion sample 1 (immediately)
   - I. 3 mls of blood in EDTA tube
   - II. 3 mls of blood in plain tube
   - III. urine for haemoglobinuria

   b. Post-transfusion sample II (after 24 hours)
   - I. 3 mls of blood in EDTA tube
   - II. 3 mls of blood in plain tube
   - III. urine for haemoglobinuria

   3.3 Please send for other appropriate investigations if necessary.

   2.4 Please refer to Section 10: Adverse effect of transfusion in Handbook on Clinical Use of Blood for details.

Hospital: ……..... Ward/Clinic: ……

Patient's name: …… IC/Passport No: ……..……

Race: ……..…….. Age: ……..… Sex: ……..…..

Diagnosis……

i. Date and time transfusion started …….

ii. Date and time of onset of reaction ……

iii. Blood/ Blood Component Serial No. ……

iv. Volume Blood/ Blood Component transfused ……

v. Blood Pressure: Before transfusion …… After transfusion ……

Effective Date of Use:

Adapted from Transfusion Practice Guidelines for Clinical and Laboratory Personnel, National. Blood Centre, Malaysia.

1/2

vi. Temperature: Before transfusion …… After transfusion ……

vii. Nature of Reaction: Tick off (√) the positive symptoms/signs.

Fever	☐ Shock	☐ Haematuria	☐
Chills /Rigors	☐ Jaundice	☐ Haemoglobinuria	☐
Urticaria	☐ Dyspnoea	☐	
Pain	☐ (Location of pain if present.....……)		

viii. Solution used for starting IV drip: - N.Saline / 5% Dextrose / Others ……

ix. History of previous transfusion: Yes / No

Date of last transfusion: ……

x. History of previous transfusion reaction if any:

……

……

xi. Medication (If any, please specify):

……

xii. Applicable for female patients ONLY:

History of pregnancy: Yes / No No. of pregnancies: ……

History of abortion: Yes / No No. of abortions: ……..…....

xiii. History of transplant: ……...

Date of transplant: ……

*Please describe the event in chronological order if multiple bags of blood/blood products are transfused per admission (as attachment)

Date: …… Signature: ……..……..

Name: ……..……

PLEASE SEND THIS FORM TO THE BLOOD BANK WITH ALL REQUIRED SAMPLES FOR INVESTIGATION

Effective Date of Use:

Adapted from Transfusion Practice Guidelines for Clinical and Laboratory Personnel, National. Blood Centre, Malaysia.

Appendix 8: Rejection Criteria, Haematology & Transfusion Medicine

A) In-house test

Test	Reason of rejection/ Rejection Criteria
Activated Partial Thromboplastin Time (APTT)	Haemolysed, Insufficient, Overfilled, Clotted, HCT >55%
CBC + Differential	Clotted, Lipaemic, Insufficient
Coagulation Screen	Haemolysed, Insufficient, Overfilled, Clotted, HCT >55%
Complete Blood Count	Clotted, Lipaemic, Insufficient
DIVC Screen	Haemolysed, Insufficient, Overfilled, Clotted, HCT >55%
Erythrocyte Sedimentation Rate	Haemolysed, Insufficient, Clotted
Quantitative D-Dimer	Haemolysed, Insufficient, Overfilled, Clotted, HCT >55%
Fibrinogen	Haemolysed, Insufficient, Overfilled, Clotted, HCT >55%
G6PD	Post-transfusion sample
Mixing Test	Haemolysed, Insufficient, Overfilled, Clotted, HCT >55%, Not clinically indicated (Use of anticoagulant has not been ruled out)
Peripheral Blood Film	Clotted, Lipaemic, Insufficient, Clotted
Prothrombin Time	Haemolysed, Insufficient, Overfilled, Clotted, HCT >55%
Reticulocyte Count	Clotted, Lipaemic, Insufficient
Thrombin Time	Haemolysed, Insufficient, Overfilled, Clotted, HCT >55%

B) Outsourced test

Test	Outsourced institution	Reason of acceptance	Reasons of Rejection/ Rejection criteria
ALL screen (E2A-PBX1, ETV6-RUNX1, MLL-AF4, BCR-ABL e1a2, SIL-TAL1)	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection.
AML screen (RUNX1-RUNX1T1, CBFB-MYH11)	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection.

Anti-A & Anti-B titre	PDN	1 EDTA tube (4ml)	Insufficient sample, improper tube collection.
Antibody Identification	PDN	1 EDTA tube (2ml), 1 plain tube (4ml) - red stopper	Insufficient sample, improper tube collection.
Antibody Identification (Extended)	PDN	1 EDTA tube (2ml), 1 plain tube (4ml) - red stopper	Insufficient sample, improper tube collection.
Anti-D titre	PDN	1 EDTA tube (2ml), 1 plain tube (4ml) - red stopper	Insufficient sample, improper tube collection.
BCR-ABL1 detection (e1a2, e13a2, e14a2)	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection.
BCR-ABL1 quantitation (e13a2, e14a2)	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection.
BCR-ABL1 TKD Mutation Analysis	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection.
CD4/CD8	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection.
Chromosomal analysis (Karyotyping) for Oncology	PPUKM	Lithium heparin tube	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
Chromosomal analysis for post-natal case	PPUKM	Lithium heparin tube	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
DNA analysis for Alpha Thalassaemia	HKL	Minimum 4ml fresh EDTA blood	Repetitive request, only done once, no Hb analysis done before the request.
DNA analysis for Beta Thalassaemia	PPUKM	Minimum 4ml fresh EDTA blood	Repetitive request, only done once, no Hb analysis done before the request.
Erythropoietin	PPUM	4ml of a plain tube (red stopper)	Haemolysed blood, improper tube collection.

Factor IX Assay (Haemophilia B)	PDN	3 bottles of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of the last request), improper sample collection, inadequate history, wrong indication for test, not following the PDN Guidelines.
Factor VIII Assay (Haemophilia A)	PDN	3 bottles of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of the last request), improper sample collection, inadequate history, wrong indication for test, not following the PDN Guidelines.
Factor VIII Inhibitor	PDN	3 bottles of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of the last request), improper sample collection, inadequate history, wrong indication for test, not following the PDN Guidelines.
Factor XIII Assay	PDN	3 bottles of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of the last request), improper sample collection, inadequate history, wrong indication for test, not following the PDN Guidelines.
Factor Assay: Others	PDN	3 bottles of citrate tube double spin, stored frozen -80C or else send immediately.	Repetitive request (within 6 months of the last request), improper sample collection, inadequate history, wrong indication for test, not following the PDN Guidelines.
FISH: IGH Break Apart Probe (14q32.3)	PPUKM	Lithium heparin tube	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
FISH-(CLL): P53/ATM, D13S319/ 13q34/ CEP12	PPUKM	Lithium heparin tube	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
FISH-(MDS): D7S522/ CEP7	PPUKM	Lithium heparin tube	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.

FISH-(MDS): CSF1R/ D5S23, D5S721	PPUKM	Lithium heparin tube	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
FISH-(MDS): EGR1/ D5S23, D5S721	PPUKM	Lithium heparin tube	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
FISH-(MM): D13S319/ 13q34	PPUKM	Lithium heparin tube	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
FISH-(MM): IGH/ FGFR3	PPUKM	Lithium heparin tube	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
FISH-(MM): IGH/ MAF	PPUKM	Lithium heparin tube	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
FISH-(MM):TP53	PPUKM	Lithium heparin tube	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
Flow Cytometry (Immunophenotyping) - Bone Marrow	PPUKM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
Flow Cytometry (Immunophenotyping) – Whole Blood	PPUKM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
FLTT3-ITD/D835 mutation	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
G6PD Enzyme Level	PPUKM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
Hb Analysis	HKL	Minimum 4ml fresh EDTA blood	Repetitive request, only done once, post-transfusion sample.
HLA Typing Class I (Loci A, B, C) – High Resolution (SBT)	IMR	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
HLA Typing Class I (Loci A, B, C) – High Resolution (SSO) – per locus	IMR	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.

HLA Typing Class I (Loci A, B, C) – Low Medium Resolution (SSP)	IMR	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
HLA Typing Class I & II (Loci A, B, DR)	IMR	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
HLA Crossmatching (CDC)	IMR	1 plain tube (4ml) - red stopper, 1 sodium heparin tube	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
HLA Crossmatching (Flow Cytometry)	IMR	1 plain tube (4ml) - red stopper, 1 sodium heparin tube	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
HLA Typing Class II (Loci DR, DQ) – Low Medium Resolution (SSP)	IMR	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
HLA Typing Class II (Loci DR, DQ) – High Resolution (SBT)	IMR	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
HLA Typing Class II (Loci DR, DQ) – High Resolution (SSO) – per locus	IMR	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
HLA Antibody Test	IMR	1 plain tube (4ml) - yellow stopper	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
JAK V617F	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
JAK2 ex12/MPL ex10 mutation	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
Lymphocyte Subset – Full (B & T Cell)	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
NPM1 mutation	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.

Osmotic Fragility	PPUM	Special heparinised bottle (from PPUM)	Aging sample (>24hours), insufficient sample, improper tube collection, sample sent without an appointment.
Platelet Antibody Screening	PDN	By appointment, 3 bottles of citrate tube	No appointment, wrong sample collection.
PML-RARA detection (bcr1, bcr2, bcr3)	PPUM	Minimum 4ml fresh EDTA blood	Aging sample, insufficient sample.
Protein C	PDN	3 bottles of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of the last request), improper sample collection, inadequate history, a wrong indication of the test, acute thrombosis event, not following the PDN Guidelines.
Protein S	PDN	3 bottles of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of the last request), improper sample collection, inadequate history, a wrong indication of the test, acute thrombosis event, not following the PDN Guidelines.
Thrombophilia Profile	PDN	3 bottles of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of the last request), improper sample collection, inadequate history, a wrong indication of the test, acute thrombosis event, not following the PDN Guidelines.
von Willebrand Studies	PDN	3 bottles of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of the last request), improper sample collection, inadequate history, a wrong indication of the test, acute thrombosis event, not following the PDN Guidelines.

Appendix 9: Turn-around time (TAT) for in-house & outsource tests in Medical Microbiology & Parasitology.

A) TAT of in-house test

NO.	LIST OF TESTS	TAT
	Bacteriology and serology	
1	Culture and Sensitivity- All samples	2-5 days
2	FEME	48 hours
3	Blood Culture C&S - Preliminary results	1 hour
4	Positive/Detected Acid Fast Bacilli (AFB) on Modified Kinyoun Stain	1 working day
5	RPR	Run twice a week 3-7 days
	Virology and serology	
6	Serology Test i) Anti- HIV ii) HBsAg iii) Anti HCV iv) Anti HBs	Run twice a week 3-7 days
7	Needle Stick Injury i) Anti-HIV ii) HBsAg iii) Anti HCV iv) Anti HBs v) HIV particle agglutination (PA)	2 hours
8	SARS CoV-2 RTK Ag	1 hour
	Mycology	
9.	Culture & Sensitivity	14 days
	Parasitology	
10	BFMP	3 hours
11	Microfilaria microscopy	1 working day
12	*Trichomonas vaginalis* wet mount	1 working day
13	Ova and cyst microscopy	1 working day
	Immunology	
.14	Rapid Test ii) ANA iii) RF	Run twice a week 3-7 days
	Molecular Microbiology	
15	SARS-CoV-2 rRT-PCR	2-3 days
16	Gene Xpert for SARS-CoV-2 Detection	3 hours
17	Gene Xpert MTB/RIF Ultra for MTB Detection	1 working day

B) TAT (outsourced tests)

	LIST OF TESTS	OUTSOURCE LABORATORY	TAT
IMMUNOLOGY			
1	Antinuclear cytoplasmic antibody (ANCA) i) p-ANCA ii) c-ANCA	LABLINK	7-10 working days
2	Tryptase		
3	Anti-double stranded DNA antibody (Anti-dsDNA)		
4	Liver Autoantibody Screening 1. Anti-mitochondrial antibody (AMA) 2. Anti-Smooth Muscle Ab (ASMA) 3. Anti-Liver Kidney Microsomal Ab (anti-LKM) 4. Anti-Gastric Parietal Cell Ab (GPC)		
5	ENA (Extranuclear antibody) 1. Anti-Smith 2. Anti-RNP 3. Anti-Ro (SSA) 4. Anti-La (SSB) 5. Anti -Jo 6. Anti-Scl 70 7. Anti-Histones		
6	IgA IgM IgG IgE		
7	Anti-CCP		
BACTERIOLOGY AND SEROLOGY			
8	*Brucella* IgG *Brucella* IgM	IMR	7-10 working days
9	Melioidosis IgM		
10	Total IgE IgE to *Aspergillus*		
11	*Bartonella* Ab total		
12	HLA-B27		
13	*Legionella* Antigen		

14	Leptospira IgM	Hospital Sungai Buloh	7-10 working days
15	Rickettsial antibody		
16	*Toxoplasma* IgG *Toxoplasma* IgM		
17	*Mycoplasma* Ab Total		
18	*Chlamydophila pneumoniae/ C.trachomatis/C.psittaci* antibody		
19	Antistreptolysin O antibody titre (ASOT)		
20	TB Culture	UMMC/LABLINK	2 months
21	TB PCR/ Line Probe Assay		3 working days
22	Anti-cardiolipin antibody		7-10 working days
23	TPPA/TPHA	HSB/LABLINK	7-10 working days
VIROLOGY AND SEROLOGY			
24	Adenovirus Antigen (IF)	Hospital Sungai Buloh	7-10 working days
25	Cytomegalovirus IgM		
26	Cytomegalovirus IgG		
27	Dengue IgM & IgG		
28	NS1 Antigen (Dengue)		
29	Enterovirus Antigen (IF)		
30	*Epstein Barr Virus* IgM		
31	*Epstein Barr Virus* IgG		
32	Hepatitis B e Antigen (HBeAg)		
33	Hepatitis B e Antibody (HBeAb)		
34	Hepatitis A Virus IgM		
36	Hepatitis B core IgM (HBc IgM)		
37	Hepatitis B core total antibody (HBc total Ab)		
38	*Herpes simplex* Type 1 & 2 Antibody (IgM)		
39	*Herpes simplex* Type 1 & 2 Antibody (Ig G)		
40	HIV 1 &2 (Western Blot)		

41	Influenza A Virus Antigen (IF)	Hospital Sungai Buloh	7-10 working days
42	Influenza B Virus Antigen (IF)		
43	Influenza C Virus Antigen (IF)		
44	Japanese encephalitis Antibody (IgM)		
45	Japanese encephalitis Antibody (IgG)		
46	Japanese encephalitis Antibody (IgM)		
47	Measles Virus Antibody (IgM)		
48	Measles Virus Antibody (IgM)		
49	Mumps Virus Antibody (IgM)		
50	Mumps Virus Antibody (IgG)		
51	Nipah Virus Antibody (IgM)		
52	Nipah Virus Antibody (IgG)		
53	Rubella IgG		
54	Rubella IgM		
55	HBV DNA	GENEFLUX	3 days
56	HCV RNA		3 days
57	HIV RNA		7- 10 days
58	JK and BK Virus		7- 10 days
59	CMV PCR		7- 10 days
60	*Coxiella burnetti* antibody	GRIBBLES	7- 10 days
MYCOLOGY			
61	*Histoplasma* antibody	Hospital Sungai Buloh	7-10 days
62	*Pneumocystis jirovecii molecular* Qualitative	GENEFLUX	3 days
PARASITOLOGY			
63	Coccidian Oocysts (*Cryptosporidium, Isospora, Cyclospora*) – special staining methods	Hospital Sungai Buloh	7-10 days

Appendix 10: Rejection Criteria, Medical Microbiology & Parasitology

GUIDELINES FOR REJECTION CRITERIA FOR MEDICAL MICROBIOLOGY & PARASITOLOGY SPECIMENS

GENERAL:

- No patient identification on test request form/order.
- No patient identification on specimen container or slides.
- A mismatch between the name of the patient on the specimen and the name on the test request form/order.
- No sample origin/source.
- No test indicated on test request form/order.

SPECIFIC:

Improper specimen collection/quality and transportation

- Unsterile /wrong collection container.
- Specimen leaked from the container.
- Dry swab.
- Specimens for culture were received in fixative (formalin).
- No/absence of specimen in a container.
- Insufficient quantity-insufficient specimen to perform testing.
- Improper transport medium.
- Urine specimen collected more than 6 hours before receiving in the laboratory.
- Duplicate specimens were collected within a 24-hour period (except for blood culture in cases whereby infective endocarditis is suspected).
- Lysed serum for serological tests.
- Specimens that are more than 24 hours from the time of collection.
- Any specimen deemed unsuitable for the request (after consultation with Clinical Microbiologist).

NOTE:

The following specimens are deemed ***precious,*** and the laboratory should **accept** the specimens even though they may fall under the rejected specimen category.

Precious specimens: Specimens are regarded as precious when the specimens are difficult to obtain, involve an invasive procedure and if rejected will be subject to difficulties/problems in obtaining new specimens.

These specimens include but are not limited to the following:

1. Specimens obtained via invasive procedures
   - Biopsy specimen
   - Bone marrow aspirate
   - Broncho alveolar lavage

- Pus aspirates performed under imaging guidance
- Sterile fluids (except blood culture)
  - CSF
  - Pericardial fluid
  - Pleural fluid
  - Peritoneal fluid
  - Synovial fluid
  - Amniotic fluid (via amniocentesis)
  - Urine obtained via suprapubic aspiration

2. Specimens obtained during surgical procedures in operation theatre
3. Medico-legal specimens
4. Autopsy specimens

Appendix 11: Rejection Form

HUiTM-CLD-CDL-F-016

Hospital UiTM
Universiti Teknologi MARA

SPECIMEN REJECTION FORM

Patient Name : _____

Registration No. : _____

Lab ID : _____

Requester (Clinic/Ward) : _____

Date & Time of Reception : _____

Test Request : _____

Reason for Rejection :

	Defective label
	Missing label
	Wrong label
	Incomplete Request form
	Hemolyzed sample
	Lipaemic sample
	Icteric sample
	Clotted sample
	Expired collection containers
	Wrong collection containers
	Broken or cracked collection containers
	Insufficient specimen
	No specimen received (only request form received)
	Improper transportation method (specify:)
	Temperature not maintained
	Delayed specimen received
	Repetitive test order/double request
	Test is not clinically indicated
	Out of sample stability
	Test is not offered
	Improper Specimen Collection
	Others (specify:)

Informed by : _____

Received by : _____

Date & Time informed : _____

Effective Date of Use:

HOSPITAL UNIVERSITI TEKNOLOGI MARA (HUiTM)
42300 Bandar Puncak Alam,
Selangor Darul Ehsan.

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