UNIVERSITI TEKNOLOGI MARA

CLINICAL LABORATORY HANDBOOK

FACULTY OF MEDICINE, UNIVERSITI TEKNOLOGI MARA

DEPT. OF PATHOLOGY &
DEPT. OF MEDICAL MICROBIOLOGY & PARASITOLOGY (MMP)

STANDARDS MALAYSIA
ACCREDITED LABORATORY

1ST EDITION

FACULTY OF MEDICINE

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MS ISO 15189
TESTING
SAMM NO. 688

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STANDARDS MALAYSIA
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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 staff and the community.

Faculty of Medicine
Universiti Teknologi MARA,
Sungai Buloh Campus
Selangor Darul Ehsan.

International Standard Book Number:

Clinical Laboratory Handbook, First Edition
Edited by AP Dr. Fadzilah Mohd Nor @ Ghazali et. al.
First Edition, January 2019

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FOREWORD

Alhamdulillah, in the name of Allah, the Compassionate, and the most Merciful. The 1st edition of our Clinical Laboratory handbook, is presented to serve as a revised version of the third edition of the CPDRL handbook. It contains updates on the new organization of the laboratory with Pathology and Medical Microbiology & Parasitology (MMP) as separate departments but working under one Quality Management System. This handbook also lists the available laboratory tests and specific guidelines for proper collection and handling of samples as well as retrieval of results. You will find details within the various clinical pathology services including help with contacts, and incorporation of suggestions and comments from auditors, customers and respectful individuals.

Each laboratory section has details about the services offered by the laboratory and some specific requirements depending on the examination requested. We are also continuously increasing our efforts to provide quality services in diagnostics and complementing in research activities. Please ensure that you understand the process and your specific responsibilities in this regard.

We welcome any comments on the service provided. This will enhance our programme of continuous review and upgrade of laboratory work to reflect changing medical practice.

Congratulations and thank you to Pathology & MMP colleagues for their contribution, tirelessly working and continuous support in reviewing and completing this handbook. This handbook would certainly serve as an important resource and reference for laboratory tests requirements.

Assoc. Prof. Dr. Noor Kaslina Mohd Kornain
Laboratory Coordinator,
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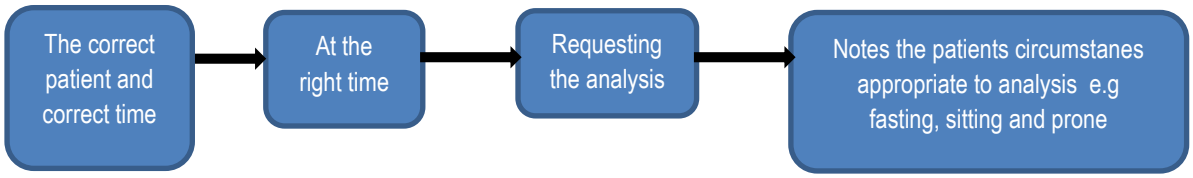
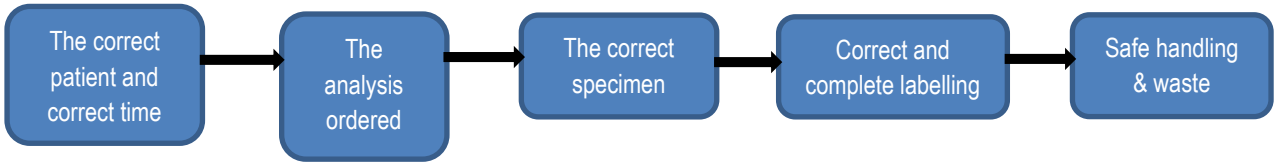
Faculty of Medicine
Universiti Teknologi MARA

FLOW OF RESPONSIBILITIES

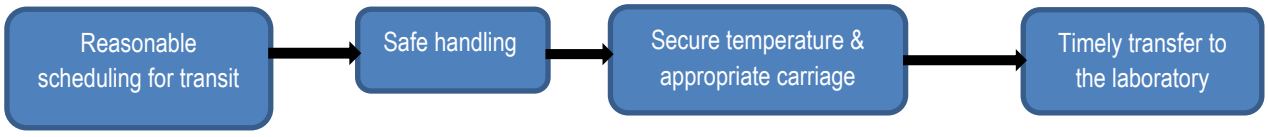
Step 1: The requesting clinician ensures:



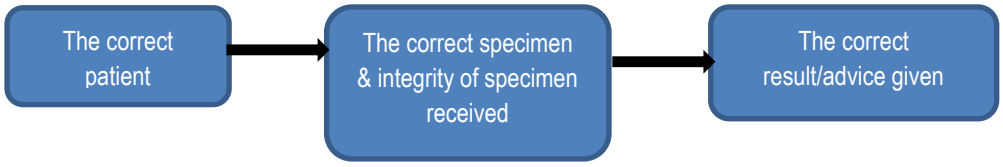
Step 2: The nurse, clinician and phlebotomist collecting specimen ensures:



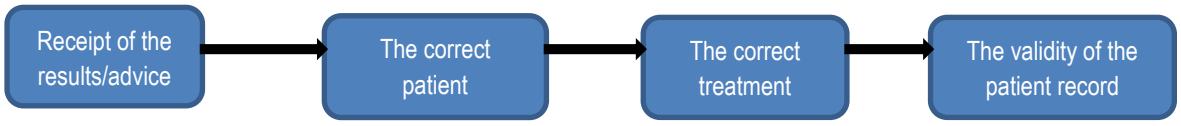
Step 3: The person undertaking logistics stage ensures:



Step 4: The laboratory checks and ensures:



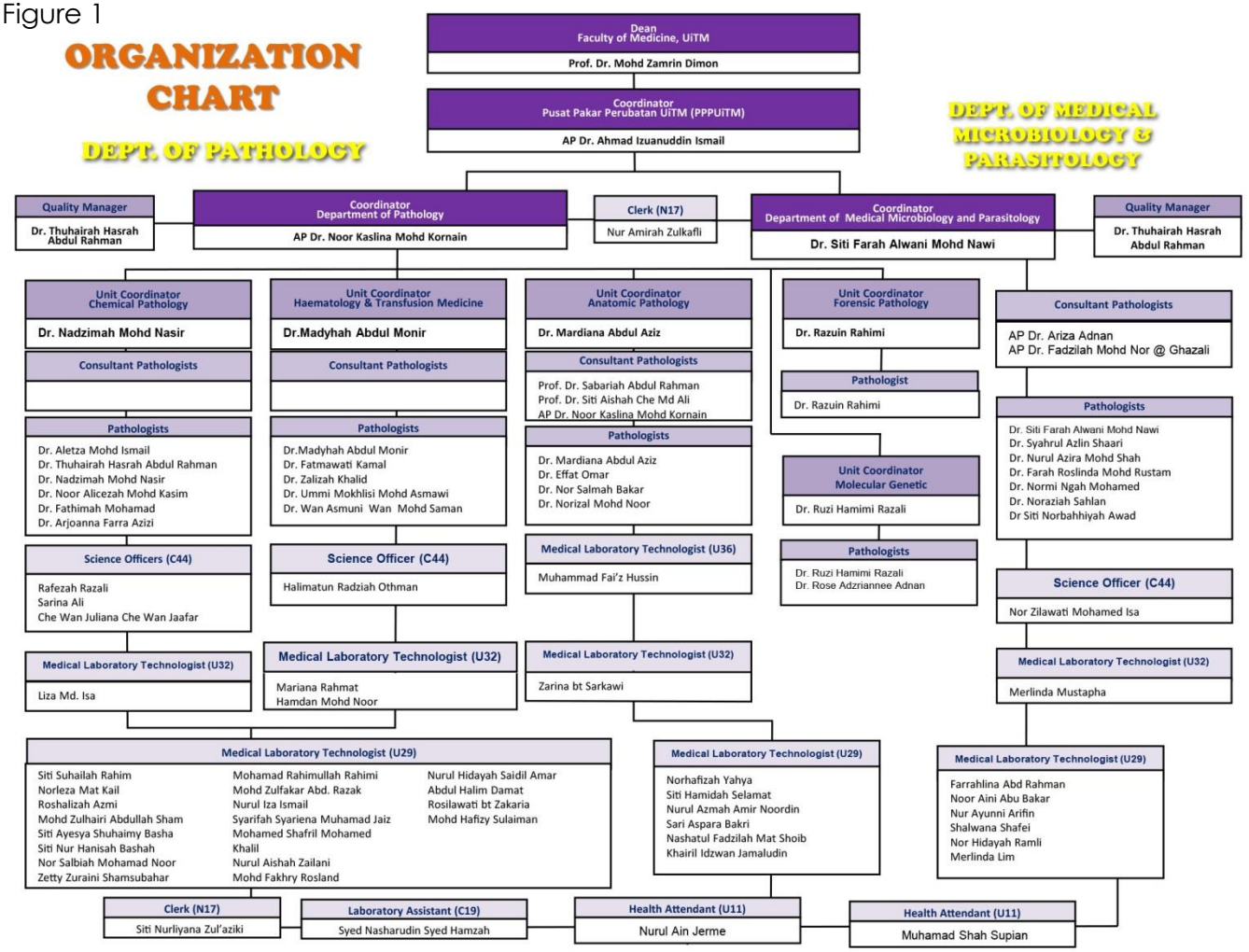
Step 5: The responsible clinician checks and ensures:



Flow of responsibilities, adopted and adapted from National Health Service (NHS), Foundation trust, UK.

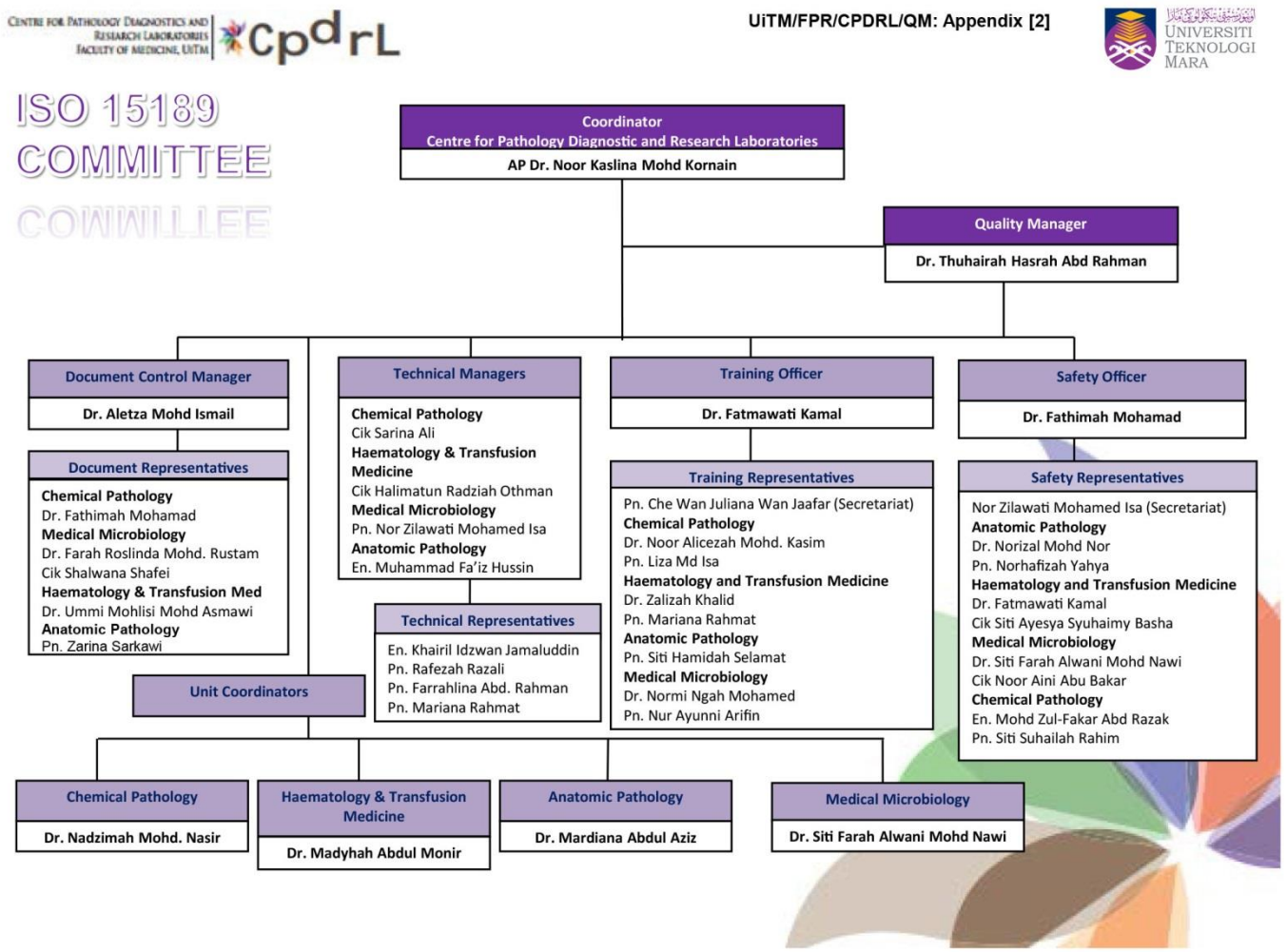
ORGANIZATION CHART: DEPARTMENTS OF PATHOLOGY AND MEDCIAL MICROBIOLOGY& PARASITOLOGY (MMP)

Figure 1



ORGANIZATION CHART
INTERNATIONAL STANDARD ORGANIZATION (ISO)15189

Figure 2



DEFINITIONS

Phlebotomy

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

Urgent

Requiring immediate action or attention. The abuse or overuse 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 finite portion of that specimen which is taken for analysis.

Specimen Collection

Producing a specimen from a patient for laboratory analysis.

Specimen Handling

The process of handling, manipulating, and storing of collected patient's specimen or packaging prior to transportation.

Specimen transport

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

GENERAL OPERATING POLICIES

INTRODUCTION

The Departments 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 December 2014. It is continually upgrading test repertoire offered to reflect medical development. The laboratory comprises of four (4) specialties including Chemical Pathology, Haematology & Transfusion Medicine, Anatomic Pathology, Medical Microbiology & Parasitology (MMP).

LOCATION

The laboratory is located in Sg. Buloh Campus and Selayang Campuses. In Sg Buloh Campus, the laboratory is located on the first floor of the UiTM Medical Specialist Centre (UiTMSC) whilst in Selayang Campus, the laboratory is located on the 5th floor of Specialist Clinic Complex.

ORGANIZATIONAL STRUCTURE

Please refer to Figures 1 and 2.

FUNCTIONS

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

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

OPERATION HOURS

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

CPDRL	TIME
Sg. Buloh Campus	24 hours
Selayang Campus	8.00am - 5.00pm

The laboratory in Sg. Buloh campus provides 24 hours service in all specialties except Anatomic Pathology. The Pathologist and Clinical Microbiologist are available for consultation or assistance during and after office hours for both 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's request form is made available on the UniMEDS system. All test requests shall be ordered through the UniMEDS system by authorized healthcare staff and accompanied by the properly collected specimens. In the event of laboratory information system (LIS) 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 acceptance of requests.

All personal and medical details will be confidential, and prior consent will 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 request form (UniMEDS). In areas where a physician/nurse/staff draw laboratory specimens, proper patient identification and specimen labeling will be the responsibility of the physician/nurse/staff member.

Compare information from the patient with the information on the request form (UniMEDS) and/or the patient's identification tag/bracelet.

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

SPECIMEN COLLECTION

Collect blood specimens using accepted venepuncture technique. Draw whole blood in an amount of 2 1/2 times 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 the 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:anticoagulant ratios to ensure that 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)
    - 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 venipuncture site. Applying light pressure, remove the needle from the vein, and activate the safety mechanism.
  - Dispose of needles and syringes to the sharp container.
  - Label appropriately all tubes.

SPECIMEN LABELING

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

Proper labeling includes computer-generated labels or hand labeled tubes printed with the following information:

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

Urgent requests must be indicated and appropriately labeled.

Note: For blood bank specimens, refer to 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 mentioned, specimen 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 specified test list of the individual specialty.

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

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

Place each blood bottles, leakproof aliquot tube, or primary specimen container in a transport bag available from ???. The bags are in double layered and biohazard labeled. 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 AREA

The Main Specimen Reception Area (MSRA) will receipt specimen for Chemical Pathology and Haematology and Transfusion Medicine daily. However, after 5.00 pm., Saturday, Sunday, and public holidays MSRA will also receive the specimen for related MMP and cytology examination.

Receipt of specimen for MMP and Anatomic Pathology 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 Pathologist & Clinical Microbiologist on duty/ Science Officer / Senior MLT. Clinical advice on interpretation of test results are 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 collection of other urgent results are the responsibility of the requester.

All the outsource test results will be acknowledged by Pathologist / Clinical Microbiologist on duty/ 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
- Test is not clinically indicated
- 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 retains 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, please contact 03 - 61265209 / 5215 / 5241/ 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 UniMEDS 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, participating in relevant proficiency testing and quality assessment scheme at the national, regional and / international level, and operates a schedule internal quality audit, corrective action and quality improvement.

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

- Reagent assessment
- Method validation to ensure 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 of appropriate skills and subspecialty services to meet the expanding clinical requirements.

To ensure the laboratory abides to 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, we are always keen to receive any enquiry, comments, and feedback you may have regarding the service we provide and would welcome any suggestions on ways in which we might be able to improve the service.

Complaints can be performed by printing and filling up the 'CPDRL Complaint Form' available from the CPDRL website at http://medicine.uitm.edu.my and sending it to the laboratory site either in Sg Buloh or Selayang campus.

A Customer Satisfaction Survey is also available from the departmental website at http://medicine.uitm.edu.my for you to give further feedback on laboratory's service. Kindly print and fill up the survey and return to us at the reception counters of Sg. Buloh or Selayang laboratories.

Please feel free to contact the individual specialty representatives:

- Chemical Pathology: Cik Sarina Ali / Pn. Rafezah Razali (03 - 61265215 / 5213)
- Haematology & Transfusion Medicine: Cik Halimatun Radziah Othman (03 - 61265209 / 5215)
- Anatomic Pathology: En. Muhammad Fa'iz Hussin(03-61265053)
- Medical Microbiology & Parasitology: Pn. Norzilawati Mohd Isa (03-61265240)
- Selayang Campus laboratory: Pn. Che Wan Juliana (03 - 61264813/4814)

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Clerk..... 61267663/4

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Pathologist

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Pathologist

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Pathologist

Science Officer
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Pathologist

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Pathologist

Dr. Siti Norbahiyah Awad..... 61267391
Pathologist

Science Officer
Pn. Norzilawati Mohd. Isa..... 61265241

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 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 which are offered over a 24-hour period
- List of tests offered:
  - Renal Profile
  - Blood Gases
  - Liver Function Test
  - Bone Profile
  - Glucose
  - Calcium
  - Corrected Calcium
  - Creatine Kinase
  - Troponin T
  - Amylase
  - Body Fluids Biochemistry
  - Bilirubin (total/direct)
  - Urine FEME (dipstick only)
  - Magnesium
  - Phosphate
  - Urine Pregnancy Test
  - C-reactive protein (CRP)

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 (eg endocrine tests, HbA1c and functional tests)
- Turnaround time – 5 working days.

3. REQUEST FORMS

All Chemical Pathology tests from Sg. Buloh and Selayang campus should be requested using UniMEDS online ordering system. In the event when UniMEDS 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 test to primary samples can be requested but subjected to sample integrity and sufficiency. Please contact 5209/5215 prior to 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 certain time of day.

- Procedure of Collection
  - Request for the 24-hour urine bottle from the laboratory.
  - On the day of collection, discard the first urine voided. Time of first urine voided is the start of the timing for the 24hour collection.
  - Collect the second and subsequent voided urine for 24-hour from the timed start into the 24hour urine bottle.
  - At the end of 24 hour, collect the last urine voided. Refrigeration of the sample during collection period is advisable. Label the bottle as directed and send immediately to the laboratory.
  - Ensure patient information on the specimen bottles is complete before they are returned to the laboratory.
  - Avoid direct urination into the 24-hour urine bottle to prevent splashback of preservatives.

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 sample.
  - Send the sample with 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.
  - Blood samples must be labelled with patient details and "**2HPP**".
  - Send the second sample immediately to the laboratory

5. RECEIPT OF SPECIMEN

All specimens will be received at the MSRA. Specimens should arrive within the stipulated time given in the table "List of Test".

6. REPORTING OF RESULTS

All results will be verified by the Medical Laboratory Technologists (MLTs) and validated by the Science Officer and/or Pathologist on duty.

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)	-
-	pCO2 (arterial)	69.92 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	239 µmol/L
-	CSF-Protein	1.87 g/L
-	Urea	19.0 mmol/L
-	Uric Acid	500 µmol/L

CRITICAL LIMIT FOR CHEMICAL PATHOLOGY

Critical results listed above will be informed via phone and documented.

Reference

a) *Critical Limit for Chemical Pathology, Quick Guide for Improving Notification of Critical Laboratory Results in MOH Hospitals, February 2010*
b) *eJIFCC: www.ifcc.org/ejifcc*

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

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTION	DESTINATION
1.	5-HIAA	Urine 24-hour	24-hour collection	24-hour urine container	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
2.	Acetaminophen (PCM)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh
3.	Adrenocorticot-rophin Hormone (ACTH)	Plasma	2 ml	K_2EDTA tube in ice	**By appointment.** Pre-chill the tube & syringe overnight before use. Complete PER PAT.301 form and send immediately to Chemical Pathology lab.	UMMC
4.	Alanine transferase (ALT)	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
5	Alkaline phosphatase (ALP)	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
6.	Alcohol (Ethanol)	Serum	3 ml	Plain without gel	Complete TDM form (available at - Chemical Pathology lab) and send it along with sample to the lab within 2-4 hours.	HKL
7.	Aldosterone	Plasma	3 ml	EDTA	**By appointment.** Complete PER PAT.301 form and send immediately to Chemical Pathology lab. Request together with Renin test.	UMMC
8.	Albumin	Serum Urine (24-hour)	3 ml 20 ml	Plain tube Urine collection container	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
9.	Albumin: creatinine ratio	Urine	3 ml	Urine collection container	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
10.	Alpha-1-antitrypsin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send immediately to Chemical Pathology lab	UMMC
11.	Alpha fetoprotein (AFP)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh

12.	Aluminium	Plasma	6 ml	Special Tube (Royal Blue Trace Element Tube)	**By appointment.** Make an appointment with Chemical Pathology lab 2 weeks prior to blood taking. Get royal blue trace element tube from the Chemical Pathology lab. Complete PER PAT.301 form and send it along with sample to Chemical Pathology Lab immediately.	UMMC
13.	Ammonia	Plasma	2 ml	K_2EDTA tube in ice	Complete PER PAT.301 form and send immediately to Chemical Pathology lab	Hosp. Sg Buloh
14	Amylase	Serum Urine (random)	3 ml 20 ml	Plain tube Urine collection container	Send to Chemical Pathology lab within 2-4 hours	Chemical Pathology lab
15.	Anti-Insulin	Serum	3 ml	Plain tube	**By appointment.** Please make appointment with the laboratory 2 weeks before blood taking. Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	IMR
16.	Anti-Mullerian Hormone	Serum	3 ml	Plain tube	**By appointment.** Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab immediately.	UMMC
17.	Anti-thyroglobulin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
18.	Anti-thyroid peroxidase	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
19.	Apolipoprotein (a)	Serum	3 ml	Plain tube	**By appointment.** Complete Gribbles request Form (available atChemical Pathology lab) and send it along with sample to the lab within 2-4 hours.	Gribbles
18.	Apolipoprotein (b)	Serum	3 ml	Plain tube	**By appointment.** Complete Gribbles request Form (available at Chemical Pathology	Gribbles

					lab) and send it along with sample to the lab within 2-4 hours.	
19.	Aspartate transaminase (AST)	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
20.	Bence Jones Protein	Urine (random)	20 ml	Urine collection container	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
21.	Benzodiazepine	Serum Urine (random)	3 ml 20 ml	Plain tube Urine collection container	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh
22.	Beta HCG	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh
23	Bilirubin (Total/direct)	Serum	3 ml	Plain tube	Send to Chemical Pathology labwithin 2-4 hours. Protect from light.	Chemical Pathology lab
24.	Brain-Type Natrieuretic Peptide (BNP)	Plasma	3 ml	EDTA tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
25	Cadmium (Blood)	Whole Blood EDTA	4 ml	Special Tube EDTA	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
26	Cadmium (Urine)	Urine (random)	20 ml	Acid-wash plain bottle	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours	UMMC
27.	Caeruloplasmin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send to Chemical Pathology lab within 2-4 hours.	HKL
28.	Calcitonin	Serum	3 ml	Plain tube	**By appointment.** Complete Gribbles request Form (available at Chemical Pathology lab) and send it along with sample to the lab within 2-4 hours.	Gribbles
29.	Calcium	Serum Urine (24-hour)	3 ml 24-hour collection	Plain tube 24-hour urine	Do not use tourniquet during blood sampling Send to Chemical Pathology lab within 2-4 hours. For 24-hour urine sample, refrigerate	Chemical Pathology lab

				container with 5 ml of 6 mol/L HCL acid	urine collection.	
30.	Carbamazepine	Serum	3 ml	Plain tube	Complete TDM form (available atChemical Pathology lab) and send it along with sample to the lab within 2-4 hours.	UMMC
31.	CA-125	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh
32.	CA 15-3	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	HKL
33.	CA 19-9	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh
34.	CEA	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh
35.	Chloride	Serum	3 ml	Plain tube	Send to Chemical Pathology within 2-4 hours.	Chemical Pathology lab
36.	Cholesterol (total)	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
37.	C-peptide	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology labwithin 2-4 hours.	UMMC
38.	C-reactive protein (CRP)	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
39.	Complement 3	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh
40.	Complement 4	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology Lab within 2-4 hours.	Hosp. Sg Buloh

41.	Cortisol	Serum 24-hours urine	3 ml 24-hour urine	Plain tube 24-hour urine container	Send to Chemical Pathology lab within 2-4 hours. Complete PER PAT.301 form and send it along with sample to Chemical Pathology within 2-4 hours. Refrigerate during collection.	Chemical Pathology lab UMMC
42.	Copper	Serum 24-hours urine	3 ml 24-hour urine	Plain tube 24-hour urine container	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours. For 24-hour urine sample, refrigerate during collection.	IMR
43.	Creatine kinase	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
44.	Creatinine	Serum Urine (random) 24-hour urine	3 ml 20 ml 24-hour urine collection	Plain tube Urine collection container 24 hour urine container	Send to Chemical Pathology lab within 2-4 hours Refrigerate during urine 24-hour collection.	Chemical Pathology lab
45.	Cyclosporin	Whole blood	3 ml	EDTA	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
46.	Delta ALA	Urine (random) 24-hour urine	20 ml 24-hour urine collection	Urine collection container 24 hour urine container	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours Refrigerate during 24-hour urine collection.	IMR
47	DHEAS	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
48.	Digoxin level	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along	UMMC

					with sample to Chemical Pathology lab within 2-4 hours.	
49.	Estradiol	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
50.	Faecal occult blood	Stool (random)	-	Plain container	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
51.	Fat globules	Stool	-	Plain container	**By appointment.** Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
52.	Ferritin	Serum	3 ml	Plain tube	Test will be analysed by batch once a week (on Thursday). Send sample to Chemical Pathology lab within 2-4 hours.	Chemical Pathology Lab
53.	Free T4	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
54.	Free T3	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
55.	Folate	Serum	3 ml	Plain tube	Test will be analysed by batch once a week (on Thursday). Send sample to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
56.	Fructosamine	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
57.	Follicular stimulating hormone (FSH)	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
58.	Gamma glutamyl transferase (GGT)	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
59.	Gastrin	Serum	3 ml	Plain tube	**By appointment.** Fasting sample. Complete Gribbles request Form (available at Chemical Pathology lab) and send it along with sample to the lab within 2-4 hours.	Gribbles
60.	Gentamicin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh

61.	Glucose	Serum 24-hour urine	3 ml 24-hour urine collection	Fluoride tube (fasting or random) 24 hour urine container	Fasting or random sample. At least 8 hours fast is required for fasting samples. Send to Chemical Pathology lab within 2-4 hours. Refrigerate during urine 24-hour collection.	Chemical Pathology lab
62.	Growth Hormone	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
63.	Haptoglobin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
64.	HbA1c	Blood	3 ml	EDTA	Send to Chemical Pathology lab within 2-4 hours. Test will be **REJECTED** if last request was within 8 weeks.	Chemical Pathology lab
65.	Homocystein	Plasma	3 ml	EDTA	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
66.	High sensitive CRP	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours..	UMMC
67.	Insulin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
68.	Insulin growth factor (IGF-1)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
69.	Iron	Serum	3 ml	Plain tube	Test will be analysed by batch once a week (on Thursday). Send sample to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
70.	Islet Cell Antibody (ICA)	Serum	3 ml	Plain tube	**By appointment.** Please make appointment with the laboratory 2 weeks	IMR

					before blood taking. Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	
71.	Lactate	Plasma	3 ml	Flouride tube in ice	Complete PER PAT.301 form and.send the sample to Chemical Pathology lab immediately.	Hosp. Sg Buloh
72.	Lactate dehydrogenase (LDH)	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
73.	Lipase	Serum	3 ml	Plain tube	**By appointment.** Complete Gribbles request Form (available at Chemical Pathology lab) and send it along with sample to the lab within 2-4 hours.	Gribbles
74.	Lithium	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
75.	Luteinising hormone (LH)	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
76.	Magnesium	Serum 24-hour urine	3 ml 24-hour urine collection	Plain tube 24 hour urine collection container with 10 ml of 6 mol/L HCL acid	Send to Chemical Pathology lab within 2-4 hours. Refrigerate during 24-hour urine collection.	Chemical Pathology lab
77.	Mercury (blood)	Whole blood EDTA	6 ml	Special tube EDTA	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab immediately.	UMMC
78	Mercury (Urine)	Random urine	50 ml	Urine collection container	**By appointment.** Contact Chemical Pathology lab ONE (1) week before sample collection. Complete Gribbles request Form (available at Chemical Pathology lab) and send it along with sample to the lab within 2-4 hours.	Gribbles
79.	Metanephrine	24-hour urine	24-hour urine collection	24 hour urine collection container with 10 ml of 25% HCL	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours. Refrigerate during urine 24-hour collection.	UMMC

80.	Myoglobin	Urine (random)	20 ml	Urine collection container	**By Appointment.** Sample must be freshly collected. Complete IEM form (avalaible atChemical Pathology lab) and send it along with sample to the lab within 2-4 hours.	IMR
81	Oligoclonal Band	CSF & Serum	10 ml CSF & 3 ml serum	Sterile Bijou Bottle (for CSF) & Plain tube (blood)	**By Appointment.** Sample must be freshly collected. Complete IMR request form (avalaible at Chemical Pathology lab) and send it along with samples to the lab within 2-4 hours. CSF specimen **MUST** be accompanied with serum specimen.	IMR
82.	Osmolality	Serum Urine	3 ml 20 ml	Plain tube Urine collection container	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
83.	Parathyroid hormone (intact)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
84.	Phenytoin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh
85.	Phosphate	Serum Urine (random)	3 ml 20 ml	Plain tube Urine collection container	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
86.	Porphyrin/Porpho bilinogen	Urine (random)	20 ml	Urine collection container	**By Appointment.** Complete PER PAT.301 form. Requires at least 5 ml of fresh urine and protect it from light (wrap the bottle with aluminum foil before sending to the lab). Send the sample to Chemical Pathology lab immediately.	UMMC
87.	Potassium	Serum Urine (random)	3 ml 20 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.Refrigerate during 24-hour urine collection	Chemical Pathology lab

		24-hour urine	24-hour urine collection	Urine collection container 24 hour urine container		
88.	Progesterone	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
89.	17-hydroxy progesterone	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample toChemical Pathology lab within 2-4 hours.	UMMC
90.	Prolactin	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
91.	Procalcitonin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
92.	Protein: creatinine ratio	Urine	3 ml	Urine collection container	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
93.	Protein electrophoresis	Serum Urine	3 ml 20 ml	Plain tube Urine collection container	Both serum and urine tests **MUST** be requested together. Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	HKL
94.	PSA (total)	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh
95.	Renin	Plasma	3 ml	EDTA	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours. **MUST** be requested together with Aldosterone test.	UMMC
96.	Salicylic Acid	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh
97.	SHBG	Serum	3 ml	Plain tube	**By appointment.** Complete Gribbles Laboratory Request Form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Gribbles

98.	Sirolimus	Whole blood	3 ml	EDTA	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
99.	Sodium	Serum Urine (random) 24-hour urine	3 ml 20 ml 24-hour urine collection	Plain tube Urine collection container 24 hour urine container	Send to Chemical Pathology lab within 2-4 hours. Refrigerate during 24-hour urine collection.	Chemical Pathology lab
100.	Stool Reducing Sugar	Stool	-	Plain container	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
101.	Tacrolimus	Whole blood	3 ml	EDTA	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
102.	Thyroglobulin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
103.	Thyroid Stimulating Immunoglobulin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
104.	Testosterone (total)	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
105.	Total iron binding capacity (TIBC)	Serum	3 ml	Plain tube	Test will be analysed by batch once a week (on Thursday). Send sample to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
106	Triglyceride	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
107.	hs Troponin T	Serum	3 ml	Plain tube	Send to Chemical Pathology lab immediately.	Chemical Pathology lab
108.	Thyroid Stimulating Hormone (TSH)	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours..	Chemical Pathology lab

109.	TSH Receptor Antibody	Serum	3 ml	Plain tube	**By appointment.** Complete Gribbles Request Form (available at Chemical Pathology lab) and send it along with sample to the lab within 2-4 hours.	Gribbles
110.	Total protein	Serum Urine (random) 24-hour urine	3 ml 20 ml 24-hour urine collection	Plain tube Urine collection container 24 hour urine container	Send to Chemical Pathology lab within 2-4 hours. Refrigerate during 24-hour urine collection.	Chemical Pathology lab
111.	Unsaturated Iron Binding Capacity (UIBC)	Serum	3 ml	Plain tube	Test will be analysed by batch once a week (on Thursday). Send sample to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
112.	Urine Phase Contrast	Urine (random)	20 ml	Urine collection container	**By appointment.** Complete Gribbles Request Form (available at Chemical Pathology lab) and send it along with sample to the lab within 2-4 hours.	Gribbles
113.	Urea	Serum 24-hour urine	3 ml 24-hour urine collection	Plain tube 24 hour urine container	Send to Chemical Pathology lab within 2-4 hours. Refrigerate during 24-hour urine collection	Chemical Pathology lab
114.	Uric acid	Serum 24-hour urine	3 ml 24-hour urine collection	Plain tube 24 hour urine container with 10 ml of 10% NaOH (2.5 N NaOH)	Send to Chemical Pathology lab within 2-4 hours. Refrigerate during 24-hour urine collection.	Chemical Pathology lab
115.	Urine pregnancy test (UPT)	Urine	2ml	Urine collection container	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
116.	Valproic acid	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh
117.	Vancomycin	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	Hosp. Sg Buloh
118.	Vitamin B12	Serum	3 ml	Plain tube		Chemical Pathology lab

					Test will be analysed by batch once a week (on Thursday). Send sample to Chemical Pathology lab within 2-4 hours.	
119.	Vitamin D	Serum	3 ml	Plain tube	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours.	UMMC
120.	Zinc (Urine)	24-hour urine	24-hour urine collection	24 hour urine container	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours. Refrigerate during 24-hour urine collection.	HKL

PROFILE						
No.	**Test**	**Specimen Type**	**Volume Required**	**Specimen container**	**Instruction**	**Destination**
1.	**Fasting serum lipids** 1. TC 2. TG 3. LDL-c 4. HDL-c	Serum	3 ml	Plain tube	Fasting sample required (at least 8-hour fast) Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
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 Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
3.	**Renal Profile** 1. Urea 2. Creatinine 3. Sodium 4. Potassium	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
4.	**OGTT** 1. Fasting Plasma Glucose 2. Glucose-2HPP	Plasma	3 ml	Fluoride tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
5.	**BUSE** 1. Urea 2. Sodium 3. Potassium	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology
6.	**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 Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab

7.	**CSF biochemistry** 1. Glucose 2. Protein, Total	CSF	1-2 ml	Bijou bottle	Send to Chemical Pathology lab immediately.	Chemical Pathology lab
8.	**Female infertility studies** 1. FSH 2. LH 3. Estradiol 4. Progesterone	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
9.	**Thyroid Function Test** 1. TSH 2. Free T4	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
10.	**Amenorrhea studies** 1. FSH 2. LH 3. Estradiol	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
11.	**Short Synacthen Test (cortisol)** 1. Cortisol, 0 hour 2. Cortisol, 30 min 3. Cortisol, 60 min	Serum	3 ml	Plain tube	Send to Chemical Pathology lab within 2-4 hours.	Chemical Pathology lab
12.	**Catecholamines** 1. Epinephrine 2. Norepinephrine 3. Dopamine	24-hour urine	24-hour urine collection	Urine 24-hour container with 10 ml of 9 mol/L HCL acid	Complete PER PAT.301 form and send it along with sample to Chemical Pathology lab within 2-4 hours. Refrigerate during 24-hour urine collection.	HKL
13.	**Blood Gases (Arterial or Venous)** 1. pH 2. PCO2 3. PO2 4. HCO3 5. Base Excess	Whole Blood	1ml	Heparin 1cc syringe	Send to lab immediately in ice waterbath	Chemical Pathology lab

14.	**Urine Drug of Abuse** 1. Amphetamine 2. Cannabinoids 3. Morphine	Urine (random)	At least ¾ of urine container.	Urine Container	1. Complete UPD form (availaible at Chemical Pathology lab). 2. Urine must be collected at least ¾ of urine container. 3. Seal the urine container after collection. 4. Send to Chemical Pathology lab within 2-4 hours.	HKL
15.	**Urine Drug of Toxicology** 1. Amphetamine 2. Cannabinoids 3. Morphine 4. Ketamine	Urine (random)	At least ¾ of urine container.	Urine Container	1. Complete UPD form (availaible at Chemical Pathology lab). 2. Urine must be collected at least ¾ of urine container. 3. Seal the urine container after collection. 4. Send to Chemical Pathology lab within 2-4 hours.	HKL
16.	**Celiac Profile** 1. Anti-Gliadin Antibody 2. Anti-Endomysial Antibody 3. Tissue Trasnglutaminase Antibody	Serum	3 ml	Plain tube	**By appointment.** Complete PER PAT.301 form and send it along with sample to Chemical Pathology within 2-4 hours. Refrigerate during	IMR
17.	**Insulin Autoantibodies** 1. GAD 2. IA2	Serum	8 ml x 2 tubes	Plain tubes	**By appointment.** Complete Gribbles request Form (available at Chemical Pathology lab) and send it along	Gribbles

					with sample to lab within 2-4 hours. Please send 2 separate plain tubes.	
18.	**Aldosterone Renin Ratio (ARR)**	Plasma	3 ml	K_2 EDTA	**By appointment**. 1) 2) 1. Complete PER PAT.301 form and send it along with sample immediately toChemical Pathology lab. 3) Refer to Appendix for comprehensive guideline.	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) Gynae based cytology
   ii) Non-gynae 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 evaluation services.

HISTOPATHOLOGY

1.0 ROUTINE SURGICAL AND BIOPSY SPECIMENS

1.1 SPECIMEN COLLECTION AND HANDLING

1.1.1 All specimens must be sent to the designated Anatomic Pathology reception counter, CPDRL, Level 1, PPUiTM.

1.1.2 If there are multiple specimens from the same patient, these must be completely collected prior to arrival to 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 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 specimen / samples to be fixed. Formalin and containers can be collected at the pharmacy during office hours.

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 specimen.

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 **REQUISITION FORM**

1.2.1 All specimens must be accompanied by a requisition form.

1.2.2 Internal (UiTM) requests:

1.2.2.1 All requests shall be made via UniMEDS. Please select the relevant test request according to the category and provide relevant clinical information.

1.2.2.2 For multiple specimens, please ensure that request for each specimen is done separately on the system. Requests for histopathology or cytology have to be filled in separate forms.

1.2.2.3 If an urgent result is required, please tick the "Priority" column on the request page.

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

1.2.2.5 Any specific additional details can be written on the form (e.g urgent/biohazard).

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 eg UPSC must be accompanied by completed relevant request forms

1.2.4 *External requests for second opinion:*

1.2.4.1 Please communicate directly with the specific pathologist.

1.2.4.2 Please provide cover letter with relevant clinical information and contact information along with the referral material and previous histopathology report, if any.

1.3 CRITERIA FOR RECTIFICATION

For certain requests which do not fulfil the unit's requirements, the requester shall be contacted to rectify the request by filling in the rectification form. Please see examples of rectification criteria in **Appendix - Rectification Criteria for Anatomic Pathology Unit.** The specimen will only be processed following satisfactory corrective actions.

2.0 FROZEN SECTION

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

2.1 SPECIMEN COLLECTION AND HANDLING

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

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

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

2.1.4 All specimens 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 frozen section are best placed first in the operating list to ensure no disruption to the service.

2.2 REQUISITION FORM

Please refer Histopathology section 1.2.

2.3 CRITERIA FOR RECTIFICATION

Please refer 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 At least 3mm core of fresh tissue, in a clean air tight container or in phosphate buffer solution (PBS). Do not put fresh tissue on gauze.

3.1.3.2 Send specimen to the laboratory immediately. If 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 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 REQUISITION FORM

Please refer Histopathology section 1.2.

3.3 CRITERIA FOR RECTIFICATION

Please refer Histopathology section 1.3.

CYTOLOGY

1.0 GYNAECOLOGY CYTOLOGY

1.1 SPECIMEN COLLECTION AND HANDLING

1.2 SPECIMEN COLLECTION AND HANDLING

- ***Conventional smears:***

  1.2..1 Label a clean glass slide with patient's name and at least one other unique identifier (e.g NRIC, MRN no.).

  1.2..2 Avoid using lubricant on the speculum.

  1.2..3 Obtain an adequate sample from the cervix. Smear the material onto the labelled glass slide about as thick as a blood film.

  1.2..4 Fix the slide immediately using a spray fixative.

  1.2..5 Air-dry the fixed slide.

  1.2..6 Place the slide in a slide mailer and despatch to the Anatomic Pathology reception counter, Level 1, UiTMSC (PPUiTM).

- ***Liquid-based cytology:***

  1.2..1 Label the vial with patient's name and at least one other unique identifier (e.g NRIC, MRN no.).

  1.2..2 Avoid using lubricant on the speculum.

  1.2..3 Obtain an adequate sample from the cervix using an appropriate broom-like sample collection device.

  1.2..4 Rinse the broom in the vial containing fixative solution. Discard the collection device.

  1.2..5 Tighten the cap. Send the vial along with a completed request form to Anatomic Pathology reception counter, Level 1, UiTMSC (PPUiTM).

  1.2..6 The specimen collection kit may be collected from the Anatomic Pathology Unit, Level 1, UiTMSC (PPUiTM) Sg Buloh.

1.3 REQUISITION FORM

Please refer Histopathology section 1.2.

1.4 CRITERIA FOR RECTIFICATION

Please refer Histopathology section 1.3.

2.0 NON-GYNAE CYTOLOGY

2.1 SPECIMEN COLLECTION AND HANDLING

- ***Fine needle aspiration cytology and brushings***

2.1.1 Spread aspirated / brushing material onto glass slides labelled in pencil with the patient's name and one other unique identifier (e.g NRIC, MRN no).

2.1.2 For alcohol-fixed smears, immediately immerse slides in 95% alcohol for at least 30 minutes or use spray-fixative.

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

2.1.4 For cell block preparation, place the aspirated material into cytolyt-containing tube. Label the container with patient details.

2.1.3.1 Send the slides / sample along with the completed request form to Anatomic Pathology reception counter, Level 1, UiTMSC (PPUiTM).

2.1.4 Body fluid cytology

2.1.4.1 ***Ascitic/peritoneal/pleural/pericardial fluid, bronchial washing and lavage, cerebrospinal fluid, cyst fluid:***

2.1.4.1.1 Collect in sterile universal container. Label with patient details. Despatch immediately. If delay is anticipated, refrigerate specimen at 2-8°C.

2.1.4.2 Sputum:

2.1.4.2.1 The specimen should be obtained first thing in the morning, before the patient eats, drinks or cleans their teeth. Preferably the sample should be collected on three consecutive days.

2.1.4.2.2 Instruct the patient to cough deeply and collect the sputum in a sterile universal container. Label with patient details. Despatch immediately. If delay is anticipated, refrigerate specimen at 2-8°C.

2.1.4.3 Urine:

2.1.4.3.1 Collect mid-stream urine sample in a sterile universal container. Avoid submitting the first morning urine. Label with patient details. Despatch immediately. If delay is anticipated, refrigerate specimen at 2-8°C.

2.2 REQUISITION FORM

Please refer Histopathology section 1.2.

2.3 RECTIFICATION CRITERIA

Please refer Histopathology section 1.3.

3.0 FINE NEEDLE ASPIRATION CYTOLOGY (FNAC) SERVICES

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

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

3.1 FNAC Clinic

- This is an appointment-based clinic, run by the pathologist and his/her team, to perform the FNAC procedure as well as to ensure optimal amount of sample is taken for proper interpretation.
- The clinic takes place every Tuesday, 2-5pm, in the Imaging Unit, Level 1, UiTMSC (PPUiTM)
- Please book an appointment with the pathologist-in-charge at least 24-hour in advance.
- All internal requests have to be made via UniMEDS. Please print the generated form and barcode for the patient to bring along to the FNAC clinic.
- Other external requests (eg UPSC) must be accompanied by relevant request forms. Please refer Histopathology section 1.2.
- Patients must be properly informed of the date/time and location of the FNAC clinic appointment.

3.2 Rapid On-Site Evaluation (ROSE) Service

- This service is provided to ensure optimal amount of sample has been taken by radiologist/clinician.
- There is no specific scheduled day/time set for this service however the pathologist-in-charge must be informed at least 24-hour in advance.
- All internal requests are to be made via UniMEDS. Other external requests (eg UPSC) must be accompanied by relevant request forms. Please refer Histopathology section 1.2.

3.3 In-patient FNAC Service

- This is FNAC service provided for inpatients.
- There is no specific scheduled day/time set for this service however the pathologist-in-charge must be informed at least 24-hour in advance.
- All internal requests are to be made via UniMEDS. Other external requests (eg UPSC) must be accompanied by relevant request forms. Please refer Histopathology section 1.2.

SPECIMEN REPORTING AND TURNAROUND TIME (TAT)

1.0 Histopathologist on duty will report all specimens and verify prior to 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 which 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. This is also known as supplementary reports, typically containing additional information not yet available at time of initial reporting.

2.6 *Turn Around Time* 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:

ITEM	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
Gynae / Non - Gynae 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.

2.0 UiTM Faculty of Medicine's 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. Please 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 requester 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 (eg 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 All requests must be made in writing and sent to the unit, for attention of the pathologist in-charge.

3.4 Requester must make arrangements to collect the material requested.

3.5 All borrowed diagnostic material / stained sections / paraffin blocks must be returned as soon as external review is complete.

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

Specimen type	Container	Sample volume/size	Remarks
Histopathology			
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 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 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 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 lab).		
FNAC of any site - smears	i) Smear onto labelled slides. Fix immediately (either immerse in 95% alcohol or spray-fix). ii) Smear onto labelled slides. Air-dry.	As collected.	Despatch immediately.
FNAC of any site – for cell block	Place in cytolyt-containing tube.	As collected.	Despatch immediately.
Brushing (eg Bronchial) - smears	i) Smear onto labelled slides. Fix immediately (either immerse in 95% alcohol or spray-fix). ii) Smear onto labelled slides. Air-dry.	As collected.	Despatch immediately.
Brushing (eg Bronchial) – for cell block	Place in cytolyt-containing tube.	As collected.	Despatch immediately.
Sputum	Sterile specimen container.	As collected.	
Urine	Sterile specimen container.		

Specimen type	Container	Sample volume/size	Remarks
Other body fluids (eg ascitic fluid, pleural fluid etc)	Sterile specimen container.		Despatch immediately. If delay is anticipated, refrigerate at 2-8°C.

Rectification Criteria for Anatomic Pathology Unit

Examples of cases which will require rectification include:

1. Specimens with no request form, inappropriate request form, damaged, or incompletely filled request forms.
2. Incorrectly labelled specimen container
3. Discrepancy between details on request form and specimen container
4. Inappropriate specimen container

HAEMATOLOGY AND TRANSFUSION MEDICINE

The Haematology and Transfusion Medicine specialty provides diagnostic and consultative services to UiTM Medical Specialist Centre (UiTMSC) for patient management. It also receives specimens for research purposes. There are two main services operating in our unit:

A. Haematology
B. Transfusion Medicine

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

In both campuses, the laboratory shares Main Specimen Reception Area (MSRA) with Chemical Pathology. 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 specimen through UniMEDS system.

A. HAEMATOLOGY

1. Services

The diagnostic services are divided into:

a) Routine tests
These tests are offered during office hours (please refer to test list in Appendix 1). The turnaround time (TAT) for routine in-patient and out-patient are 4 hours and 5 days respectively.

b) Urgent tests
- These are short TAT tests for immediate patient management as indicated by clinician on the request form. Urgent tests are offered 24 hours.
- The following list are 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 blood film review is required.
  3. Reticulocytes – TAT – 60 minutes
  4. Coagulation Screen – PT/INR & APTT – 90 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. Hb Analysis) and outsourced to the referral laboratories (refer to test list in Appendix 2). For the outsourced tests, the TAT depends on the complexity of test.

2. Request forms

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

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

2.3 Specimen for haematology tests i.e. CBC or CBC+DIFF can **ONLY** be shared with HbA1c. The labeling must be done appropriately and separate forms for haematology and chemical pathology tests are needed. Failure to follow can lead to tests not done.

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. Please refer to Appendix 2 for further detail of the request form.

3. Special Collection Procedures

A number of in-house and outsourced tests require special collection procedure. Please refer to Appendix 1 and 2 for instructions. Failure to follow specific procedure may cause rejection.

4. Receipt of Specimen

All specimens will be received at the Main Specimen Reception Area (MSRA) either by a porter or pneumatic tube. Timely arrival of specimens in the right condition is vital as failure to follow can lead to erroneous results and misinterpretation. Please refer to Appendix 1 and 2 for details.

5. Rejection of Specimen

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

a) Incomplete request form
b) Misidentification of patient.
c) Mislabeling of specimen.
   Short draw (specimen less than the recommended volume) may lead to erroneous results. Example includes inadequate blood sample in citrate tube results in wrong ratio of blood: anticoagulant
d) Inadequate mixing that results in clotted sample.
e) Wrong tube/wrong anticoagulant.
f) Haemolysis/lipemia
   - 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.
g) Exposure to light and/or extreme temperatures. This can affect analyte's stability.
h) Improper timed specimen/delayed delivery to laboratory. This can affect analyte's stability.
i) Improper storage prior to specimen dispatch. This can affect analyte's stability.
j) Improper collection of specimens
   - Heparin contaminated specimen may result in falsely prolonged APTT.
   - Specimen collected from the intravenous line may cause a dilutional effect leading to falsely low count for HGB, WBC, RBC and PLT.

There are a number of outsourced tests that need to be dispatched on the same day as the integrity of analyte of interest may be affected if there is a delayed delivery to the respective laboratory. Therefore, an appointment has to be made prior to specimen collection. For Hb Analysis, there is no appointment needed but it has to be sent early in the week i.e. Monday to Wednesday as prior work up needs to be done in house before it is being outsourced.

Rejection of specimen will be informed through phone call by laboratory staff and it 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 and Pathologist. Results after office hours will be verified by a trained Medical Laboratory Technologist. If there is any uncertainty, the MLT will consult the pathologist on-call.

The hard copy of test report is available in the pigeon hole of the respective unit. Results are not to be conveyed by phone as it may cause misinterpretation. However, critical result of life-threatening analyte will be informed via phone call by laboratory

staff. The ward/clinic must acknowledge the notification of result and this action will be documented.

ABNORMAL LIFE - THREATENING HAEMATOLOGY RESULTS TO BE INFORMED TO THE WARDS ILLUSTRATED IN THE TABLE BELOW:

No	Analyte	Unit	Low Critical Limit	Upper Critical Limit	Remark/Action
			ADULT		
1.	Haemoglobin	g/dL	6.0	19.0	Check specimen clotted?
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		
1.	Haemoglobin (Paeds)	g/dL	7.0	20.0	Check specimen clotted?
2.	Haemoglobin (Neonate)	g/dL	8.0	22.0	Check specimen clotted?
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	
8.	INR		-	>5	

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

7.0 Enquiry for Laboratory Services

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

Item	Extension No.
Haematology test (preferably for specimen reception and result)	5215
Haematology test (preferably for issue on analytical part)	5209/5214
MLT and pathologist on-call	Refer to monthly on-call roster for contact number

B. Transfusion Medicine

1. Services

The laboratory provides diagnostic tests related to the use of blood and blood products to all clinical departments in UiTM Medical Specialist Centre. All diagnostic works were adapted from Transfusion Practice Guideline for Clinical and Laboratory Personnel, 4th Edition 2016 by Pusat Darah Negara. The guideline is available at the following link; http://pdn.gov.my/index.php?option=com_jdownloads&Itemid=111&view=viewcategory&catid=2&lang=ms. Apart from diagnostic tests, the laboratory also provides blood (packed cells, typed blood etc.) and blood components for patients at this centre. All blood and blood products are obtained from the Pusat Darah Negara (PDN) on a periodic basis and case by case basis. This handbook also outlines the procedures for requesting and transfusing blood and blood products in elective and emergency situation, reporting of adverse transfusion reactions, storage and administration of blood and blood products.

The following tests are performed as part of diagnostic service:

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 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

There are tests that are outsourced to the referral laboratories i.e. Pusat Darah Negara (PDN) and Institute for Medical Research (IMR). PDN performs diagnostic tests that are related to the use of blood and blood products when patient is found to have antibody(ies) towards red cell antigens. On the other hand, IMR performs most of diagnostic tests that are related to solid organ transplant i.e. renal transplant.

Please refer to Appendix 1 and 2 for list of tests that are offered in-house and outsourced. The appendixes also contain detail of test preparation and request forms needed in order to request for the respective tests.

2. Request forms

2.1 All diagnostic tests shall be requested through UniMEDS system. Specimen shall arrive in the laboratory with UniMEDS form. Additional test to primary sample can be requested in separate request form. However, the request is subjected to analyte's stability. Please contact the laboratory prior to requesting an additional test.

2.2 For tests that are run in outsourced laboratories, they shall be requested through UniMEDS system. The specimen shall arrive in the laboratory with the UniMEDS and respective forms of the outsourced laboratory. Refer to Appendix 2 for further detail of the request form.

2.3 Prescribing blood and blood products are the sole responsibility of the doctor managing the patient. However, the treating doctor is encouraged to consult the pathologist on the type of products to be issued, quantity, duration of infusion, precautions and any other related issues.

2.4 All requests for blood and blood components (packed cells, platelet, fresh frozen plasma and cryoprecipitate) must be made ~~on~~ using the PER-SS-BT 105 form. It must be filled completely and clearly by the treating doctor. This is important for the laboratory to provide blood and blood product in a timely manner.

	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	
9.	Time the blood/component required	Please tick appropriate box available. Do not give vague statement e.g. "as soon as possible" or "PRN"- this would assist the laboratory staff in prioritising the blood request. The maximum time to hold a crossmatched 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/component 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 Appendix 1 and 2 for specimen collection which are related to diagnostic tests.

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

3.1 Patient identification and blood sampling for compatibility testing

The process of taking and labelling specimen 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 Patient must be correctly identified by checking the patient's wristband. If possible, ask 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 unconscious patient, the identification is done through the patient's wristband and confirmed by patient's relative.

3.1.3 A wristband with a unique number is given for patient with an emergency casualty whom cannot be reliably identified. The number will be used to identify the patient until full patient's detail is 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 person. The person has to 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 patient's bedside immediately after blood taking.

3.2.3 The label must contain three patient's identifiers; name, RN and IC number.

3.2.4 We encourage handwritten label but we accept pre-printed label as long as precautions in 3.1 have been followed.

3.2.5 The doctor's name and signature (and stamping) on the request form also implies that he/she has ensured that the sample has been accurately identified.

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

3.3 Specimen requirement for elective surgery or elective transfusion

3.3.1 For patient who already has history of blood group and antibody screening status, specimen should be sent to the laboratory at least 24 hours before the blood is required.

3.3.2 For patient with known RhD negative or known red cell antibody cases (antibody positive cases), specimen must be sent to the laboratory **at least ONE WEEK** prior to the requirement date, e.g. planned surgeries or expected date of delivery. Ample time is needed for PDN to provide the blood by recruiting an adequate number of donors to meet the requirements.

3.3.3 In case of intraoperative and postoperative bleeding when many units of blood and blood components are required, more specimens and request forms may be needed.

3.3.4 If the patient requires repeated transfusions during the present admission, a new specimen is needed after 3 days or when the current specimen has been totally used up for compatibility testing.

3.4 Specimen requirement for blood components such as platelet, fresh frozen plasma and cryoprecipitate

3.4.1 New request for blood components must be sent with a blood sample and a request form. Each of blood component requires separate request form.

3.4.2 If a patient had received a transfusion of blood component within the previous 3 months in the same hospital (provided that the transfusion was completed without any complication and the laboratory has at least 2 records of blood grouping in the information system), a new blood sample is not required for blood component request. However, a copy of previous request form clearly stating the blood grouping shall be attached to the new request form.

3.4.3 If previous request form is not available, a fresh blood sample shall be sent to the laboratory to determine the patient's blood group.

4. Special Collection Procedures

4.1 Blood grouping for infant less than 4 months of age **MUST** be accompanied with 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 hour. Please refer to Appendix 2 for collection procedure. For urgent cases, please consult pathologist on-call.

4.3 Other outsourced tests may require special requirement procedure for example Anti-A and Anti-B titre and HLA Typing, please refer to Appendix 2 for further instructions. Failure to follow specific procedure can result in specimen being rejected.

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 at the Main Specimen Reception Area (MSRA) either by a porter or pneumatic tube. Timely arrival of correct specimens in a right condition is vital as failure to follow can lead to delay in blood and blood product release. Refer to Appendix 1 and 2 for details.

6. Rejection of Specimen

Blood specimen sent for compatibility testing shall meet the suggested minimum requirement (please refer to section 3.0). Exception is given only in life threatening situation after consulting and obtaining an approval from the pathologist. The reasons for specimen rejection in transfusion setting is almost similar with haematology section however, in transfusion setting, we highly emphasize on proper labelling to prevent adverse transfusion errors due to improperly labeled specimens. Therefore, the specimen is rejected if:

- Specimen is inadequately labelled. There should be three patient's identifiers i.e. name, IC number and RN). We encourage hand-written patient's label as stated in PDN's guideline, however we accept pre-printed patient's label as long as all precautions in patient identification have been followed.
- PER-SS-BT 105 form is inadequately filled up. The form shall contain three patient's identifiers and other important information (please refer to section 2.0). We accept form with legible hand-writing but we reject form with only patient's identification label without any other information.
- Discrepancies between patient's label and request form. Exceptions are made only in life threatening situation where these discrepancies are corrected by the treating doctors via an official memo.

7. Reporting of Results

The hard copy of diagnostic test report is available in the pigeon hole of the respective unit. The PER-SS-BT 105 form for crossmatching (GXM) and Group, Screen & Hold (GSH) will be maintained in the transfusion laboratory. For GSH request, the copy of the form is available in the pigeon hole. For GXM request, the copy of the form will be handed to the ward personnel who comes to collect the blood or blood component for transfusion.

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

8.1 Issuing

Blood and blood component will be ready at the time they are required. However, about half an hour is needed to thaw the blood components (FFP and cryoprecipitate) and they are not available immediately. It is important to firmly decide the use of blood component before they are thawed as they are going to be discarded if not used after 24 hours post thawing.

8.2 Collection

Upon collection of blood/blood components, 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/BHT label are matched. The information that have to be checked are:

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

The name of ward staff collecting the blood/blood component shall be recorded by the laboratory staff.

8.3 Storage and Transport

Blood and blood component 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 blood to the laboratory without delay. Transportation shall be carried out in an appropriate temperature. Ideally, the issued blood/blood components should be transfused without delay. However, in the event where the delay is inevitable, the ward shall maintain the blood at the appropriate temperature and condition until they are use or the ward shall return to the laboratory as soon as possible. If the blood/blood components are not kept at the appropriate temperature, the quality of blood/blood products will be affected and are not suitable for use leading to wastage.

9. Administration of Blood and Blood Components

9.1 Administration of blood and blood components

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 transfusion laboratory immediately.

9.2.3 Details and reasons for discontinuation shall be documented in the patient's case note and memo 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 completely and clearly filled up to the transfusion laboratory within 48 hours.

9.4 Return of untransfused blood

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

9.4.2 The ward shall inform the laboratory if any of the untransfused blood 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 patient's plasma. A GSH protocol should be used in accordance to the locally established Maximum Surgical Blood Order Schedule (MSBOS).

10.2 The conversion of GSH to GXM can only be made within three (3) days in the event that crossmatching is required at a later stage. 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 requester.

11. Group & Crossmatch (GXM) Protocol

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

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

11.3 The full GXM procedure takes about two (2) hours to be completed. However, in the event of emergency blood can be issued after 30 minutes of request.

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 i.e. for antibody identification and supply of compatible blood.

11.5 The clinician is advised to communicate with the pathologist regarding the urgency of the requirement for arrangement of getting blood from PDN.

12. Emergency Request

12.1 An emergency crossmatching process only involves first stage crossmatch (immediate spin saline phase) with a group specific blood. 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 requesting doctor to stop 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 sufficiently urgent to require release of blood.

12.4 The emergency crossmatch (and release of blood) can only be performed in a life-threatening situation and it requires a careful clinical judgement as the safety assurance is reduced hence it requires close monitoring of patient.

13. Maximum Surgical Blood Ordering Schedule (MSBOS)

The Maximum Surgical Blood Order Schedule (MSBOS) is a schedule based on retrospective analysis of actual blood usage associated with the individual elective surgical procedure. For those procedures in which blood is not likely to be used, GSH is ordered. On the other hand, a full crossmatch is done for procedures in which blood will be used (please refer to Appendix 5 for our current MSBOS, updated in 2017).

14. Adverse Transfusion Event

Investigation of transfusion reaction is performed on patients having reactions to whole blood, packed cells, platelet, FFP or cryoprecipitate. 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 If patient develops fever >38°C:

14.1.1 Blood sample labeled as POST TRANSFUSION SAMPLE 1 is taken immediately as soon as transfusion reaction is noted. This sample goes to 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 sample from patient is taken for blood culture. This sample goes to Microbiology Laboratory.

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

14.2 If haemolytic transfusion is suspected:

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

14.2.2 Blood sample is taken for Peripheral Blood Film (PBF).

14.2.3 Blood sample is taken for DIVC screen are taken.

14.2.4 Blood sample is taken for serum LDH, serum bilirubin and renal profile is also taken.

14.2.5 Urine sample is taken for haemoglobinuria assessment.

14.3 For suspected cases of acute haemolytic transfusion reaction or delayed transfusion reaction:

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

14.3.2 Blood sample is taken for Peripheral Blood Film (PBF).

14.3.3 Blood sample is taken for DIVC screen are taken.

14.3.4 Blood sample is taken for serum LDH, serum bilirubin and renal profile is also taken.

14.3.5 Urine sample is taken for haemoglobinuria assessment.

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

14.4.1 Blood sample labeled as POST TRANSFUSION SAMPLE 2 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. Patient is given paracetamol and/or anti histamine. If symptom and sign 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 the forms and ensure that the samples, blood bags and forms reach transfusion laboratory, biochemistry, microbiology and haematology laboratories at earliest possible time. The doctor should complete the Reguest Form for Tranfusion Reaction Investigation (Blood and Blood Components) (please refer to Appendix 6) and write INVESTIGATION OF TRANSFUSION REACTION on other request forms.

15. Enquiry for Laboratory Services

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

ENQUIRY	CONTACT/EXTENSION
Transfusion Medicine related tests (preferably for specimen reception and result)	5215
Enquiries on blood and blood component request	5209
MLT and pathologist on-call	Refer to monthly on-call roster for contact number

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 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 laboratory as soon as possible. Sample integrity is within 4 hours.
3.	Reticuloytes	Whole Blood	EDTA Tube	2 - 3mL	To reach laboratory as soon as possible. Sample integrity is within 4 hours.
4.	Erythrocyte Sedimentation Rate	Whole Blood	EDTA Tube	2 - 3mL	To reach laboratory as soon as possible. Sample integrity is within 4 hours.
5.	Prothrombin Time (PT)	Whole Blood	Citrate Tube	2 mL	To reach laboratory as soon as possible. Sample integrity is within 4 hours.
6.	International Normalised Ratio	Whole Blood	Citrate Tube	2 mL	To reach laboratory as soon as possible. Sample integrity is within 4 hours.
7.	Activated Partial Thromboplastin Time (APTT)	Whole Blood	Citrate Tube	2 mL	To reach laboratory as soon as possible. Sample integrity is within 4 hours.
8.	Fibrinogen	Whole Blood	Citrate Tube	2 mL	To reach laboratory as soon as possible. Sample integrity is within 4 hours.
9.	Thrombin Time (TT)	Whole Blood	Citrate Tube	2 mL	To reach laboratory as soon as possible. Sample integrity is within 4 hours.
10.	D-Dimer	Whole Blood	Citrate Tube	2 mL	To reach laboratory as soon as possible. Sample integrity is within 4 hours.

LIST OF SINGLE TESTS FOR TRANSFUSION MEDICINE SECTION					
11.	ABO and Rh(D) Grouping	Whole Blood	EDTA Tube	2 - 3mL	To reach laboratory as soon as possible. Sample integrity is within 4 hours.
12.	Direct Coombs' Test	Whole Blood	EDTA Tube	2 - 3mL	To reach 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 laboratory as soon as possible. Sample integrity is within 4 hours.
14.	Rh(D) Phenotyping	Whole Blood	EDTA Tube	2 - 3mL	To reach 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 laboratory as soon as possible. Sample integrity is within 4 hours.
	INR				
	Activated Partial Thromboplastin Time (APTT)				
16.	**DIVC Screen**				
	Prothrombin Time (PT)	Whole Blood	Citrate tube	2 mL	To reach laboratory as soon as possible. Sample integrity is within 4 hours.
	INR				
	Activated Partial Thromboplastin Time (APTT)				
	Fibrinogen				
	D-Dimer				
17.	**Peripheral Blood Film**				
	Complete Blood Count + Differential Count	Whole Blood	EDTA Tube	2 - 3mL	To reach laboratory as soon as possible. Sample integrity is within 4.
	Peripheral Blood Film (PBF) Comment				
18.	**Bone marrow and Trephine Examination**				
	Complete Blood Count + Differential Count	Whole Blood	EDTA Tube	2 - 3mL	By appointment only and the request must be clinically indicated
	Peripheral Blood Film (PBF) Comment				
	Bone marrow staining	Bone marrow aspiration and trephine aspirate	EDTA tube, glass slides, container with 10% formalin as fixative	• 5 – 6 ml of BMA aspirate • 1- 2 cm of trephine tissue	
	Trephine H&E Staining				
	Bone marrow report				

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

LIST OF OUTSOURCE TESTS FOR HAEMATOLOGY & TRANSFUSION MEDICINE

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

NO	TEST	SPECIMEN TYPE	SPECIMEN CONTAINER	VOLUME REQUIRED	FORM	INSTRUCTION	DESTINATION	TURN AROUND TIME (WORKING DAYS)
	LIST OF TESTS FOR HAEMATOLOGY SECTION							
1.	ALL screen (E2A-PBX1, ETV6-RUNX1, MLL-AF4, BCR-ABL e1a2, SIL-TAL1)	Bone marrow / Whole Blood	EDTA Tube	4 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment only. Inform lab before requesting for transport arrangement.	UMMC	14
2.	AML screen (RUNX1-RUNX1T1, CBFB-MYH11)	Bone marrow / Whole Blood	EDTA Tube	4 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment only. Inform lab before requesting for transport arrangement.	UMMC	14
3.	BCR-ABL1 quantitation (e13a2, e14a2)	Bone marrow / Whole Blood	EDTA Tube	4 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment only. Inform lab before requesting for transport arrangement.	UMMC	14
4.	BCR-ABL1 TKD Mutation Analysis	Bone marrow / Whole Blood	EDTA Tube	4 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment only. Inform lab before requesting for transport arrangement.	UMMC	14
5.	CD34	Whole Blood / Bone Marrow / PBSC	EDTA Tube	3 mL	Perpat. 301	By appointment only. Inform lab before requesting for transport arrangement.	HKL	7 working days, verbal report – 24 hours
6.	CD4	Whole Blood	EDTA Tube	3 mL	Perpat. 301	By appointment only. Inform lab before requesting for transport arrangement.	HKL	7 working days, verbal report – 24 hours

7.	CD8	Whole Blood	EDTA Tube	3 mL	Perpat. 301	By appointment only. Inform lab before requesting for transport arrangement.	HKL	7 working days, verbal report – 24 hours
8.	Chromosomal analysis	Whole Blood	Lithium heparin	3 mL	Chromomosal Analysis Form (Biology Reproductive Laboratory, LPPKN)	Peripheral blood only. Strictly by appointment on Tuesday only. Sample must reach outsourced lab by 10am.	LPPKN	14
9.	Cytogenetic (For Leukaemia case only)	Bone marrow	Special transport medium	3 – 4 mL	Bone Marrow Cytogenetics IMR form	Special transport medium - obtained from the lab, strictly by appointment only	IMR	45
10.	DNA Analysis for alpha thalassaemia	Whole Blood	EDTA tube	4 mL	DNA Analysis For Thalassemia Syndrome (IMR/CaRC/HAEM /22/2203/03(1)RE QForm	Hb Analysis must be done prior to requesting. Test must be requested together with CBC+DIFF. This test strictly requires written informed consent from patient/guardian.	HKL	30
11.	DNA analysis thalassaemia - common mutation (IMR)	Whole Blood	EDTA tube	4 mL	DNA Analysis For Thalassemia Syndrome (IMR/CaRC/HAEM /22/2203/03(1)RE QForm	Hb Analysis must be done prior to requesting. Test must be requested together with CBC+DIFF. This test strictly requires written informed consent from patient/guardian.	IMR	30
12.	DNA analysis thalassaemia - uncommon mutation (IMR)	Whole Blood	EDTA tube	4 mL	DNA Analysis For Thalassemia Syndrome (IMR/CaRC/HAEM /22/2203/03(1)RE QForm	Hb Analysis must be done prior to requesting. Test must be requested together with CBC+DIFF. This test strictly requires written informed consent from patient/guardian.	IMR	30

13.	DNA analysis Hb Variant (IMR)	Whole Blood	EDTA tube	4 mL	DNA Analysis For Thalassemia Syndrome (IMR/CaRC/HAEM /22/2203/03(1)RE QForm	Hb Analysis must be done prior to requesting. Test must be requested together with CBC+DIFF. This test strictly requires written informed consent from patient/guardian.	IMR	30
14.	Erythropoietin	Whole Blood	Plain tube	3 mL	Perpat. 301	By appointment only. Inform lab before requesting for transport arrangement.	UMMC	30
15.	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 prior to request otherwise request will be rejected by PDN.	PDN	30
16.	Factor VIII Inhibitor	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant prior to request otherwise request will be rejected by PDN.	PDN	30
17.	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 prior to request otherwise request will be rejected by PDN.	PDN	30
18.	Factor XIII Assay	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant prior to request otherwise request will be rejected by PDN.	PDN	30
19.	Flow cytometry	Bone marrow / Whole Blood	EDTA	4 mL	Perpat. 301	By appointment only. Inform lab before requesting for transport arrangement. For reliable flowcytometric analysis, specimen must be sent to the laboratory immediately. Specimen kept for more than 6 hours is not suitable for analysis.	HKL	30 working days, verbal report – 24 hours

20.	FLTT3-ITD/D835 mutation	Bone marrow / Whole Blood	EDTA Tube	4 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment only. Inform lab before requesting for transport arrangement.	UMMC	14
21.	G6PD (Qualitative)	Whole Blood	EDTA Tube	2 mL	Perpat. 301	-	UMMC	7
22.	Hb Analysis	Whole Blood	EDTA Tube	3 mL	Perpat. 301	Must be clinically relevant prior to request otherwise request will be rejected by HKL. Request can be done either from Monday to Wednesday only as it needs in-house work up before it is being outsourced.	HKL	30
23.	JAK V617F	Bone marrow / Whole Blood	EDTA Tube	4 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment only. Inform lab before requesting for transport arrangement.	UMMC	14
24.	JAK2 ex12/MPL ex10 mutation	Bone marrow / Whole Blood	EDTA Tube	4 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment only. Inform lab before requesting for transport arrangement.	UMMC	14
25.	Kleihauer Test	Whole Blood	EDTA Tube	3 mL	Perpat. 301	By appointment only. Inform lab before requesting for transport arrangement.	HKL	7
26.	Neutrophil Alkaline Phosphatase	Whole Blood	EDTA Tube	3 mL	Perpat. 301	By appointment only. Inform lab before requesting for transport arrangement.	HKL	7
27.	NPM1 mutation	Bone marrow / Whole Blood	EDTA Tube	4 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment only. Inform lab before requesting for transport arrangement.	UMMC	14

28.	Other Factor Assay	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant prior to request otherwise request will be rejected by PDN.	PDN	30
29.	Platelet Antibody Screening	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant prior to request otherwise request will be rejected by PDN. By appointment from Monday to Thursday only.	PDN	30
30.	PML-RARA detection (bcr1, bcr2, bcr3)	Bone marrow / Whole Blood	EDTA Tube	4 mL	Molecular & Genetic Analysis Lab Form, UMMC form	By appointment only. Inform lab before requesting for transport arrangement.	UMMC	14
31.	Protein C	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant prior to request otherwise request will be rejected by PDN.	PDN	30
32.	Protein S	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant prior to request otherwise request will be rejected by PDN.	PDN	30
33.	Thrombophilia profile i) Lupus Anticoagulant ii) Anti-phospholipid iii) Anti-beta 2-glycoprotein	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant prior to request otherwise request will be rejected by PDN.	PDN	30
34.	von Willibrand Study	Whole Blood	Citrate tube	6 mL (in 3 citrate bottles)	PDN Quality Form – Haematology / Serology Request Form	Must be clinically relevant prior to request otherwise request will be rejected by PDN.	PDN	30

	LIST OF TESTS FOR TRANSFUSION MEDICINE SECTION							
35.	Anti-A and Anti-B titre	Whole Blood	EDTA Tube	6 mL	PDN Quality Form – PDN/IH/QP-01/04)	Strictly by appointment only.	PDN	Official report is ready by 2 weeks.
36.	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 patient has positive antibody. Urgent request is entertained for patient that requires transfusion. Antibody identification is also sent for 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 future emergency.	PDN	Official report is ready by 2 weeks. Blood is ready once investigation is completed.
37.	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 patient has positive antibody. Urgent request is entertained for patient that requires transfusion. Antibody identification is also sent for 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 future emergency.	PDN	Official report is ready by 2 weeks. Blood is ready once investigation is completed.

38.	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. Blood shall need to reach outsourced lab by 10.30am.	IMR	30
39.	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. Blood shall need to reach outsourced lab by 10.30am.	IMR	30
40.	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. Blood shall need to reach outsourced lab by 10.30am.	IMR	30
41.	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. Blood shall need to reach outsourced lab by 10.30am.	IMR	30
42.	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. Blood shall need to reach outsourced lab by 10.30am.	IMR	30

43.	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. Blood shall need to reach outsourced lab by 10.30am.	IMR	30
44.	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. Blood shall need to reach outsourced lab by 10.30am.	IMR	30
45.	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. Blood shall need to reach outsourced lab by 10.30am.	IMR	30
46.	HLA Crossmatching (CDC)	Whole Blood	Plain tube (gel) + sodium heparin tube	6 mL WB in 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. Blood shall need to reach outsourced lab by 10.30am.	IMR	30
47.	HLA Crossmatching (Flow Cytometry)	Whole Blood	Plain tube (gel) + sodium heparin tube	6 mL WB in 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. Blood shall need to reach outsourced lab by 10.30am.	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 identification of the causative organism, as well as management of the patient, screening, monitoring and research development.

2. SERVICES

Microbiology unit provides the following services:

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

3. REQUEST

- All Microbiology and Parasitology tests from Sg. Buloh Campus & Selayang Campus should be requested through UniMEDS system, and hardcopy laboratory form shall be used in the event of off line
- **Outsource tests**
  - A communication shall take place between the requester and the laboratory prior to transporatation and sending out the specimen. A Standard request form; PER PAT-301 should be used for outsourced test perform 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 prior to 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 the room temperature.

- **Cerebrospinal Fluid (CSF)**
  - CSF specimens should be collected prior to antimicrobial therapy.
  - Place CSF into sterile leak-proof container.
  - Submit 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 specimens 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 for bacteriological 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.
  - **Catheterized 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. diphteriae, pertussis, peptic ulcer due to *H. pylori* etc.**
  - Specimens for culture: send swabs taken from the nose, throat or wounds for culture of C. diphtheriae and C. ulcerans by using Amies or Stuart transport media.
  - Pseudo-membrane specimen for culture should be placed in the container containing sterile saline and **NOT** formalin. The specimen should be sent immediately to the laboratory without any delay. Ifdelay is inevitable the specimen should be kept in the refrigerator.

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- For *H. pylori* detection a biopsy specimen collected during endoscopy is the specimen of choice, as patients may not recived antibiotics or anti secretory drugs especially proton pump inhibitors (PPI).
  NB: Pre-treatment of the biopsy specimens by washing in saline could improve the recovery of H.pylori.
- *Detection of Mycobacterium tuberculosis* Complex (MTBC) /Non-tuberculos *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 the proper containe 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 at the Medical Microbiology & Parasitology laboratory during office hours from Monday to Friday. Refer general operating policies for after office hours, Saturday, Sunday, and public holidays.

6. REPORTING OF RESULTS

- A preliminary report of positive results of all sterile body fluids will beinformed to clinic/ward via phone by Clinical Microbiologist on duty/ science officer / MLT and documented.
- Final report will be issued on manual basis for Sg. Buloh Campus and via LIS/HIS for Selayang Campus respectively.
- Critical results as listed below will be informed via phone 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 case.

7. SERVICE AFTER OFFICE HOURS AND DURING PUBLIC HOLIDAYS

- Specimens sent for bacteriology, mycology and needle stick injury 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: needle stick injury cases) specimen.

8. SUPPLIES

The supply of containers relevant to microbiological examination can be obtained from the central store for Sg. Buloh Campus and Selayang Campus respectively.

LIST OF IN-HOUSE & OUTSOURCE TESTS IN MEDICAL MICROBIOLOGY & PARASITOLOGY

BACTERIOLOGY AND SEROLOGY						
NO.	**TEST**	**SPECIMEN TYPE**	**VOLUME REQUIRED**	**SPECIMEN CONTAINER**	**INSTRUCTIONS**	**DESTINATION**
1.	AFB microscopy	Sputum & Other clinical specimen	3ml	Sterile	Collect 3 consecutive early morning (fresh) sputum (Not Saliva) . Send within 2-4 hours.	CPDRL
2.	TB Culture	All specimens	3ml	Sterile	Complete PER PAT.301 form and send it along with 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 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 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 sample within 2-4 hours.	HOSP. SG.BULOH
6.	*Clostridium difficile* Toxin and culture	Stool (fresh)	Not applicable	Stool container	Complete PER PAT.301 form and send it along with 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.	CPDRL
8.	Culture and Sensitivity	Sputum	Not applicable	Sterile	Sample should not be saliva. Send within 2-4 hours.	CPDRL

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

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTIONS	DESTINATION
24.	Culture and Sensitivity	Rectal swab	Not applicable	Cary-Blair transport medium	Send within 2-4 hours.	CPDRL
25.	Culture and Sensitivity	Pus	Not applicable	Sterile	Please specify site of collection. Send within 2-4 hours.	CPDRL
26.	Culture and Sensitivity	Wound swab/ulcer swab	Not applicable	Amies Transport Medium	Please specify site of collection. within 2-4 hours.	CPDRL
27.	Culture and Sensitivity	Tissue	Not applicable	Sterile	Please specify site of collection. within 2-4 hours.	CPDRL
28.	MRSA Screening	Nasal/axilla/groin swab	Not applicable	Amies Transport Medium	Please specify site of collection. Send within 2-4 hours.	CPDRL
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.	CPDRL
30.	*Legionella* Antigen	Urine	5ml	Sterile	Complete PER PAT.301 form and send it along with sample within 2-4 hours.	HOSP. SG. BULOH
31.	*Leptospira* antibody	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample within 2-4 hours.	HOSP. SG. BULOH
32.	*Rickettsia* antibody	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH

NO.	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTIONS	DESTINATION
33.	RPR	Blood	5ml	Gel tube	Send sample to CPDRL within 2-4 hours.	CPDRL
34.	TPPA/TPHA	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH
35.	Widal Test (*Salmonella* antibody)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	UMMC

NB:

- *All sterile samples should not be refrigerated. It should be sent immediately to the laboratory.*
- *All culture samples should be sent prior to antibiotic therapy initiated.*

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 sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH
2.	Cytomegalovirus IgM	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH
3.	Cytomegalovirus IgG	Blood	5ml	Sterile	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH
4.	Dengue IgM	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH
5.	NS1 Antigen (Dengue)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH
6.	Enterovirus Antigen (IF)	CSF	1ml	Sterile	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH
7.	Epstein Barr Virus IgM	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH
8.	Epstein Barr Virus IgG	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH

NO	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTIONS	DESTINATION
9.	Hepatitis A Virus IgM	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH
10.	Hepatitis B surface antigen (HBsAg)	Blood	5ml	Gel tube	Send sample ~~to~~ CPDRL within 2-4 hours.	CPDRL
11.	Hepatitis B surface antibody)(HBsAb)	Blood	5ml	Gel tube	Send sample within 2-4 hours.	CPDRL
12.	Hepatitis B core IgM (HBc IgM)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH
13.	Hepatitis B core total antibody (HBc total Ab)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH
14.	Hepatitis B e Antigen (HBeAg)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH
15.	Hepatitis B e Antibody (HBeAb)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH
16.	Hepatitis C Antibody (Anti HCV)	Blood	5ml	Gel tube	Send sample within 2-4 hours.	CPDRL
17.	Herpes simplex Type 1 & 2 Antigen (IF)	Skin lesion/genital lesion	Not applicable	Smears on slide	Please call the 'MLT' for smears on teflon coated slide.	HOSP. SG. BULOH
18.	Herpes simplex Type 1 & 2 Antibody (IgM)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	HOSP. SG. BULOH

NO	TEST	SPECIMEN TYPE	VOLUME REQUIRED	SPECIMEN CONTAINER	INSTRUCTIONS	DESTINATION
19.	Herpes simplex Type 1 & 2 Antibody (IgG)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with 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. Patient's consent is need to be obtained and documented on request form prior to blood collection.	CPDRL
21.	HIV 1 &2 (Particle agglutination)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample within 2-4 hours.	HOSP. SG. BULOH
22.	HIV 1 &2 (Western Blot)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL 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 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 sample within 2-4 hours.	UMMC
25.	Influenza C Virus Antigen (IF)	Sputum/tracheal aspirates/NPA/BAL	Not applicable	Sterile	Complete PER PAT.301 form and send it along with sample within 2-4 hours.	UMMC
26.	Japanese encephalitis Antibody (IgM)	Blood	5ml	Gel tube	Complete PER PAT.301 form and	HOSP. SG. BULOH

					send it along with sample within 2-4 hours.	
27.	Japanese encephalitis Antibody (IgG)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with 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 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 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 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 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 sample within 2-4 hours.	HOSP. SG. BULOH
33.	Nipah Virus Antibody (IgM)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with 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	UMMC

					sample within 2-4 hours.	
35.	Parvo Virus Antibody (IgM)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample within 2-4 hours.	HOSP. SG. BULOH
36.	Parvo Virus Antibody (IgG)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with 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 sample within 2-4 hours.	HOSP. SG. BULOH

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 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 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.	CPDRL
4.	Fungal Culture and Sensitivity	CSF	1-3ml	Sterile	Send immediately.	CPDRL
5.	Fungal Culture and Sensitivity	Pleural fluid	5ml	Sterile	Send immediately.	CPDRL
6.	Fungal Culture and Sensitivity	Peritoneal fluid	5-10ml	Sterile	Send immediately.	CPDRL
7.	Fungal Culture and Sensitivity	Pus	Not applicable	Sterile	Send sample to CPDRL within 2-4 hours.	CPDRL
8.	Fungal Culture and Sensitivity	Vitreous/Aqueous Fluid	3ml	Sterile	Send immediately.	CPDRL
9.	Fungal Culture and Sensitivity	Hair / Nail	Not applicable	Wrap with filter paper	Send sample to CPDRL within 2-4 hours.	CPDRL
11.	Fungal Culture and Sensitivity	Tissue	Not applicable	Sterile	Please specify site of collection. Send sample within 2-4 hours.	CPDRL
12.	*Histoplasma* Antibody	Blood	5ml	Gel tube	Send sample within 2-4 hours.	HOSP. SG. BULOH

IMMUNOLOGY						
NO	**TEST**	**SPECIMEN TYPE**	**VOLUME REQUIRED**	**SPECIMEN CONTAINER**	**INSTRUCTIONS**	**DESTINATION**
1.	Anti-nuclear antibody (ANA)	Blood	5ml	Gel tube	Send sample to CPDRL within 2-4 hours.	CPDRL
2.	Anti - double stranded DNA antibody (AntidsDNA)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	IMR
3.	Anti- mitochondrial antibody (AMA)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	IMR
4.	Anti - phospholipid antibody	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample to CPDRL within 2-4 hours.	IMR
5.	Lupus anticoagulant	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample within 2-4 hours.	IMR
6.	Anti-cardiolipin	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample within 2-4 hours.	IMR
7.	Anti-Ro (SS-A)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample within 2-4 hours.	IMR
8.	Anti - La (SS-B)	Blood	5ml	Gel tube	Complete PER PAT.301 form and send it along with sample within 2-4 hours.	IMR
9.	Rheumatoid factor (RF)	Blood	5ml	Gel tube	Send sample within 2-4 hours.	CPDRL

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

APPENDIX

Appendix 1: Chemical Pathology Test & Clinical Indication

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 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 of AST levels found in patients undergoing renal dialysis or those with vitamin B6 deficiency
Bilirubin	1. To screen for or monitor liver disorders or hemolytic anemia. 2. Elevated serum bilirubin are found in hemolytic anaemia (unconjugated), liver disorders and in 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 patient with hypoparathyroidism, nephrosis and 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. The use of total CK and CKMB in the diagnosis of myocardial infarction is the most important single application of CK measurement. 3. Serum CK activity is also increased after cerebral ischemia, acute cerebrovascular disease and head injury.
Creatinine	1. the most commonly used to used test to assess renal function 2. to monitor renal dialysis
C-reactive protein	1. To identify the presence of inflammation and to monitor response to treatment for an inflammatory disorder 2. Elevated of CRP is found in patients with tissue-damaging process such as infection, inflammatory disease 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 eg: a) Overproduction (e.g. Cushing's syndrome) b) Underproduction (e.g. Addison's disease)
Estradiol	1. The determination of estradiol is utilized clinically in the elucidation of fertility disorders in the hypothalamus-pituitary-gonad axis, gynecomastia, estrogen-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
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), amenorrhea (causes), and menopausal syndrome.
Free T4	1. To evaluate thyroid gland function 2. To help in the diagnosis of hypothyroidism or hyperthyroidism. 3. To screen for hypothyroidism in newborns
Free T3	Determination of this hormone concentration is important for the diagnostic differentiation of euthyroid, hyperthyroid, and hypothyroid states.
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 idiopathic 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
Hemoglobin A1c	1. To monitor blood glucose control in individuals with diabetes mellitus (Indicate the mean blood glucose level in 3 months) 2. HbA1c predicts the development of diabetic complications in diabetes patients and can be used for the diagnosis of diabetes mellitus.
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, myocardial infarction, disseminated carcinoma, leukaemia and trauma. 2. Mild increasesin LDH activity have been reported in cases of hemolytic anemias, muscular dystrophy, pulmonary infarction, hepatitis, nephrotic syndrome and cirrhosis.
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 diarrhea, 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 as the most important marker for glomerular dysfunction. Slightly elevated albumin excretion in urine, called microalbuminuria, is of particular importance in the early diagnosis of diabetic nephropathy.
Osmolality	1. Serum osmolality is indicated to evaluate the etiology of hyponatremia and may be used to screen for alcohol intoxication by means of the osmolal gap. 2. Urine osmolality is used to measure the number of dissolved particles per unit of water in the urine. It is useful in diagnosing renal disorders of urinary concentration and dilution and in assessing hydration status.
Phosphorus	To evaluate the level of phosphorus and a 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, diarrhea, 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 fertility diagnosis for the detection of ovulation and assessment of the luteal phase.
Sodium	1. To evaluate electrolyte imbalance. 2. Decreased levels of sodium include prolonged vomiting or diarrhea, diminished reabsorption in the kidney and excessive fluid retention. 3. Increased sodium includes excessive fluid loss, high salt intake, and increased kidney reabsorption.
Testosterone	1. The determination of testosterone in women is helpful in the diagnosis of 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. in hypogonadism, estrogen therapy, chromosome aberrations (as in the Klinefelter's syndrome) and liver cirrhosis.
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 an independent prognostic marker which can predict the near-, mid- and even long-term outcome of patients with 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.
Urea	Urea is the most widely used screening test for renal function.
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.

Appendix 2: Chemical Pathology Test & Reference Range

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 Pediatric 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(Females) 13yr-17yr :<390 U/L(Males)
4.	Amylase	IFCC Based - EPS	Serum	Adults : 28-100 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: <137 µmol/L 2d : <222 µmol/L 3d – 4d: <290 µmol/L 5d – 17y: ≤ 17 µmol/L

NO.	TESTS	METHOD	SPECIMEN TYPE	REFERENCE RANGE/UNIT
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
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: Women: 44-80 µmol/L Men : 62-106 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
11	Creatinine	Jaffe (Alk.Picrate-rate,compensated	Urine (1st morning urine)	Females : 2.47 – 19.2 mmol/L Males : 3.45 – 22.9 mmol/L
12.	Creatinine	Jaffe (Alk.Picrate-rate,compensated)	Urine 24 Hr	Females: 7-14 mmol/24h Males : 9-21 mmol/24h Creatinine clearance Adults : 71-151 mL/min
13.	Cholesterol	Cholesterol Oxidase/Peroxidase	Serum	Adults : <5.2 mmol/L
14.	Creatinine Kinase	Catalytic CK activity (340nm)	Serum	Men : <190.0 U/L Women : <170.0 U/L

15.	Cortisol	Electrochemilumine-scence (Competitive)	Serum	Morning (7-10 am): 171 – 536 nmol/L Evening (4 -8 pm) : 64 – 327 nmol/L
16.	C-Reactive Protein (Latex)	Particle enhanced turbimetric assay	Serum	Adults : < 5.0 mg/L
17.	Estradiol	Electrochemiluminescence (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 Postmenopause : <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
18.	Follicle Stimulating Hormone (FSH)	Electrochemiluminescence (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 Postmenopaus : 25.8 - 134.8 IU/L Adults Men: 1.5 – 12.4 IU/L
19.	Free Triiodotyro-nine (FT3)	Chemilumine-scent (Competitive)	Serum	Infant (1D -23M): 5.1 - 8.0 pmol/L Children (2Y -12Y): 5.1 - 7.4 pmol/L Adolescent (13Y-21Y) : 4.7 -7.2 pmol/L Adult : 3.5 – 6.5 pmol/L
20.	Free Thyroxine (FT4)	Chemilumine-scent (Competitive)	Serum	Infant (1D -23M) :12.1 - 18.6 pmol/L Children (2Y -12Y) :11.1-18.1 pmol/L Adolescent (13Y-21Y) : 10.7-18.4 pmol/L Adult:- Euthyroid : 11.5-22.7 Hypothyroid : < 11.5 Hyperthyroid: >22.7
21.	Gamma-Glutamyltransferase (GGT)	Enzymatic colorimetric assay Other g-Glut-3-carboxy-nitro	Serum	Males: <60 U/L Females: <40 U/L
22.	Glucose	Hexokinase	Plasma	**<u>Based on 2006 WHO criteria</u>** **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 :** < 11.1 mmol/L

23.	HbA1c	High performance liquid chromatography (HPLC)	Plasma	**According to ADA** >8% or 64 mmol/mol : Action Suggested*] [<7% or 53 mmol/mol : Goal**] [<6.5% or 48 mmol/mol : Non-Diabetic Level]
24.	HDL-Cholesterol	Non sep-DxSO4/PEG mod enzymes	Serum	**According to NCEP ATP III Guidelines** Females : ≥1.3 mmol/L Males : ≥ 1.0 mmol/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)	Pyruvate >0.7 mmolar (P-L)	Serum	Adults : 240 – 480 U/L
27.	LDL-Cholesterol	According to Friedewald's 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
28.	Luteinizing Hormone (LH)	Electrochemiluminescence (Sandwich)	Serum	Females:- Follicular Phase: 2.4 – 12.6 IU/L Ovulation Phase: 14 –96 IU/L Luteal Phase : 1.0 – 11.4 IU/L Postmenopause: 7.7 – 58.5 IU/L Males : 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	2.5-8.5 mmol/24hrs

NO.	TESTS	METHOD	SPECIMEN TYPE	REFERENCE RANGE/UNIT
30.	Phosphate	Phosphomolybdate formation	Serum	Males 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 : 0.8 -1.45 mmol/L Females 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
31.	Progesterone	Electrochemiluminescence (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 Postmenopaus: < 0.401 nmol/L Men: < 0.5 nmol/L
32.	Prolactin	Electrochemiluminescence (Sandwich)	Serum	Women (not pregnant) 102-496 µIU/mL Men 86-324 µIU/mL
33.	Total Protein	Biuret/endpoint (with blank)	Serum	Newborn : 46 - 70 g/L 1W : 44 -76 g/L 7M-1Y : 51 - 73 g/L 1Y-2Y : 56 - 75 g/L >3Y : 60 - 80 g/L Adults : 64 - 83 g/L
34.	Testosterone	Electrochemiluminescence (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
35.	Thyroid Stimulating Hormone (TSH)	Chemilumine-scent (sandwich)	Serum	2 to <12y/o : 0.64 – 6.27mIU/L 12 to <18y/o : 0.51 – 4.94 mIU/L >18 y/o : 0.55 – 4.78 mIU/L

NO.	TESTS	METHOD	SPECIMEN TYPE	REFERENCE RANGE/UNIT
36.	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
37.	Triglycerides	Lipase/Glycerol kinase/GPO-PAP	Serum	**According to NCEP ATP III Guidelines** Adults: <1.7 mmol/L
38.	hs Troponin T	Electrochemiluminescence (Sandwich)	Serum	Adults: < 14 ng/L
39.	Urea	Urease-Kinetic (340nm)	Serum	Adults : 2.78-8.07 mmol/L
			Urine (24 h)	Adults: 428-714 mmol/24 h
40.	Uric acid	Uricase/peroxidase	Serum	Men : 202.3-416.5 µmol/L Women : 142.8-339.2 µmol/L

Blood Gases

ABG – Arterial blood gases
VBG – Venous 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

Urine Full Examination Microscopy Examination (FEME)
A) Macroscopic Examination

NO.	TESTS	METHOD	REFERENCE RANGE/UNIT
1.	Bilirubin	Diazonium salt	Negative
2.	Erythrocytes	Peroxidase-like activity of Hb	Negative
3.	Glucose	Glucose oxidase/peroxidase reaction	Negative
4.	Ketone	Legal's test	Negative
5.	Leucocytes	Indoxyl ester with diazonium salt	Negative
6.	Nitrite	Griess test	Negative
7.	pH	Hydrogen ions concentration	4.8 – 7.4
8.	Protein	Protein error of a pH indicator	Negative
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	Only 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 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 time.

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, leucopenia, leukaemia
2.	CBC+DIFF	Enquiry of general haematology status. Suspected anaemia, polycythaemia, thrombocytosis, thrombocytopenia, leucocytosis, leucopenia, 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 hematological abnormalities or hematological 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 to 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*

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*

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

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 catherisation	GSH
2	Coronary angiogram	GSH
3	Pacemaker insertion	GSH
Cardiothoracic		
1	VATS	
	+bullectomy	GSH
	+lobectomy	3
2	CABG	4
	Minimally invasive cardiac surgery (MICS)	4
3	Valve repair i.e. MVR, atrial etc	4
Obstetrics & Gynaecology		
1	Vaginal hysterectomy Total abdominal hysterectomy (TAH) Total abdominal hysterectomy with bilateral salpingo-oophorectomy (TAHBSO)	GSH 2 2
2	Myomectomy	2
3	Ovarian Cystectomy	GSH
4	Termination, D&C	GSH
5	Vaginal repair	GSH
6	Manual removal placenta	GSH
7	Caesarian section	2
8	Evacuation under anaesthesia for PPH	2
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: April 2018

Appendix 7

UiTM/FOM/DOP/WI/TM-7: APPENDIX [1]

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 I (immediately)
      I. 10 mls of blood in EDTA bottle
      II. 10 mls of urine for haemoglobinuria

   b. Post-transfusion sample II (after 24 hours)
      I. 10 mls of blood in EDTA bottle
      II. 10 mls of urine for haemoglobinuria

   2.3 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 .....

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

Effective date of use: 23rd August 2018

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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: .....

Date: ..... Signature: .....

Name: .....

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

Effective date of use: 23rd August 2018

Appendix 8: Rejection Criteria, Haematology & Tranfusion 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
Fibrin D-Dimer	Haemolysed, Insufficient, Overfilled, Clotted, HCT >55%
Fibrinogen	Haemolysed, Insufficient, Overfilled, Clotted, HCT >55%
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) Outsource 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
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
BLOOD: DNA Analysis For Thalasemia	HKL	Minimum 4ml fresh EDTA blood	Repetitive request, only done once
BLOOD: CD4	HKL	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection
BLOOD: CD8	HKL	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection
Cytogenetics (For cases other than Leukaemia)	HKL	Special transport medium	Aging sample (>24hours), insufficient sample, improper tube collection
Cytogenetics (For Leukaemia case only)	IMR	Special transport medium	Aging sample (>24hours), insufficient sample, improper tube collection
Erythropoetin	PPUM	4ml of plain tube (red stopper)	Haemolysed blood, improper tube collection
Factor IX Assay (Haemophilia B)	PDN	3 bottle of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of last request), improper sample collection, inadequate history, wrong indication for test
Factor VIII Assay (Haemophilia A)	PDN	3 bottle of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of last request), improper sample collection, inadequate history, wrong indication for test
Factor VIII Inhibitor	PDN	3 bottle of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of last request), improper sample collection, inadequate history, wrong indication for test
Factor XIII Assay	PDN	3 bottle of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of last request), improper sample collection, inadequate history, wrong indication for test
Other Factor Assay	PDN	3 bottle of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of last request), improper sample collection, inadequate history, wrong indication of test
Flow Cytometry (Immunophenotyping)	HKL	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection

FLTT3-ITD/D835 mutation	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection
Hb Analysis	HKL	Minimum 4ml fresh EDTA blood	Repetitive request, only done once
JAK V617F	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection
JAK2 ex12/MPL ex10 mutation	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection
NPM1 mutation	PPUM	Minimum 4ml fresh EDTA blood	Aging sample (>24hours), insufficient sample, improper tube collection
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 bottle of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of last request), improper sample collection, inadequate history, wrong indication of test
Protein S	PDN	3 bottle of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of last request), improper sample collection, inadequate history, wrong indication of test
Thrombophilia Profile / Lupus Anticoagulant	PDN	3 bottle of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of last request), improper sample collection, inadequate history, wrong indication for test
von Willebrand Studies	PDN	3 bottle of citrate tube double spin, stored frozen -80C or else send immediately	Repetitive request (within 6 months of last request), improper sample collection, inadequate history, wrong indication for test

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

A) TAT of in-house test

NO.	LIST OF TEST	TAT
1.	Culture and Sensitivity- All samples	2-5 days
2.	Blood Culture C&S - Preliminary results	1 hour
3.	Serology Test i) Anti HIV ii) HBsAg iii) Anti HCV iv) Anti HBs	Run twice a week 3-7 days
4.	Needle Stick Injury i) Anti HIV ii) HBsAg iii) Anti HCV iv) Anti HBs	2 hours
5.	Rapid Test i) RPR ii) ANA iii) RF	Run twice a week 3-7 days
6.	BFMP	3 hours
7.	Positive/Detected Acid Fast Bacilli (AFB) on Modified Kinyoun Stain	1 working day

B) TAT of an outsource test

	LIST OF TEST	OUTSOURCE LABORATORY	TAT
IMMUNOLOGY			
1	Antinuclear cytoplasmic antibody (ANCA) i) p-ANCA ii) c-ANCA	IMR	7-10 working days
2	Tryptase		
3	Anti-nuclear antibody (ANA)	HOSPITAL SELAYANG	7-10 working days
4	Anti-double stranded DNA antibody (AntidsDNA)		
5	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)		
6	ENA (Extra nuclear 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		
7	IgA IgM IgG		
BACTERIOLOGY AND SEROLOGY			
8	Brucella IgG Brucella IgM	IMR	7-10 working days
9	Meliodosis IgM		
10	Total IgE IgE to Aspergillus		
11	Legionella Antigen	HOSPITAL SUNGAI BULOH	7-10 working days
12	Leptospira antibody		
13	Rickettsia antibody		
14	Toxoplasmosis IgG Toxoplasmosis IgM		
15	Mycoplasma Ab Total		
16	Chlamydophila pneumonia/ C.trachomatis/C.psittaci antibody		
17	Anti Streptolysin O		
18	TB Culture	UMMC	2 months
19	TB PCR/ Line Probe Assay		3 working days
20	Widal Test (Salmonella antibody)		7-10 working days
VIROLOGY AND SEROLOGY			
21	Hepatitis B e Antigen (HBeAg)	HOSPITAL SUNGAI BULOH	7-10 working days
22	Hepatitis B e Antibody (HBeAb)		
23	Hepatitis A Virus IgM		
24	Hepatitis B core IgM (HBc IgM)		
25	Hepatitis B core total antibody (HBc total Ab)		
26	Cytomegalovirus IgM		
27	Cytomegalovirus IgG		
28	Dengue IgM		
29	NS1 Antigen (Dengue)		

30	Herpes simplex Type 1 & 2 Antibody (IgM)		
31	Herpes simplex Type 1 & 2 Antibody (Ig G)		
32	Rubella IgG Rubella IgM		
33	HIV PA		
34	HCV PA		

Appendix 10: Rejection Critera, Medical Microbiology & Parasitology

GUIDELINES FOR REJECTION CRITERIA FOR MEDICAL MICROBIOLOGY & PARASITOLOGY SPECIMENS

GENERAL:

- No patient's identification on test request form/order
- No patient's identification on specimen container or slides
- Mismatch between name of patient on specimen and name on 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 container
- Dry swab
- specimens for culture received in fixative (formaline)
- No/absent of specimen in container
- Insufficient quantity-insufficient specimen to perform testing
- Improper transport medium
- Urine specimen collected more than 6 hours before receive in the laboratory.
- Duplicate specimens collected within 24 hour time period (except for blood culture in cases where by infective endocarditis is suspected)
- Lysed serum for serological tests
- Specimens which are more than 24 hours from time of collection.
- Any specimen deemed unsuitable for 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 specimens category.

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

These specimens include but 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 amniocentecis)
- 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

THE CENTRE FOR PATHOLOGY DIAGNOSTIC & RESEARCH LABORATORIES (CPDRL)

CLINICAL TRAINING CENTRE (CTC)
UNIVERSITI TEKNOLOGI MARA (UiTM), SG. BULOH CAMPUS
47000 SG. BULOH

SPECIMEN REJECTION FORM

Patient Name :
Registration No. :
Lab ID :
Requester (Clinic/Ward) :
Date & Time of Reception :
Test Request :

	Defective label
	Missing label
	Wrong label
	Incomplete Request form
	Haemolysed 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 centrifugation
	Repetitive test order/double request
	Test is not clinically indicated
	Out of sample stability
	Test is not offered
	Improper Specimen Collection
	Others (specify):

Reason for Rejection :

Informed by : _____

Received by : _____

Date & Time informed : _____

For more details, please contact:

i. Central Specimen Reception Counter 1st Floor, CTC) - ext. 5215
ii. Chemical Pathology/Haematology & Transfusion Medicine Laboratory (1st Floor, CTC) - ext. 5209/5214
iii. Medical Microbiology Laboratory (1st Floor, CTC) - ext. 5246
iv. Anatomic Pathology Laboratory (1st Floor, CTC) - ext. 5244

NOTES

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