IN THE DEPARTMENT OF LABORATORY MEDICINE...

To better serve our patients in the hospital and in our healthcare system, and to process the samples efficiently, we equipped our laboratory with Laboratory Automation System and other instruments.
Better equipment comes with more complex technologies

We have barcode readers and sensors to automate the process.

**AUTOMATION = FASTER TAT!**
Points to Note for Good Sample Results

1. Type of sample

2. Information on iSMART labels

3. Adequate sample volume

4. Quality of sample

5. Alignment of Laboratory Accession label
To IMPROVE PATIENT’S EXPERIENCE DURING THEIR STAY:
• Reducing redraw
• Improving the results TAT

PLEASE HELP US TO HELP YOU…
Points to Note for Good Sample Results

1. Type of sample

2. Information on iSMART labels

3. Adequate sample volume

4. Quality of sample

5. Alignment of Laboratory Accession label
1. Type of Sample

It is important to ensure the correct type of sample is collected and sent to our laboratory as soon as possible for analysis.

1. Samples with **correct tube type**
2. Samples with **correct preservative**

Please refer to our test catalogue for additional information on sample requirements, collection procedures, reference ranges as well as relevant information on our services.
1. Type of Sample – Tube Type

- SSTII (with gel)
  - Renal Panel 1 (RP1)
  - Liver Panel 1 (FT1)

- EDTA
  - Full Blood Count (FBC)
  - Mycophenolic Acid (MPA)
  - Homocysteine (HCY)

- Sodium Fluoride
  - Lactate (LAC)
  - Glucose Fasting (GLUF)

Please refer to our test catalogue for additional information on sample requirements, collection procedures, reference ranges as well as relevant information on our services.

- Check **which tube type** is appropriate for which test before collecting sample from patient

- Different tube types contain **different preservatives** which may interfere with results
Urine Samples – Correct Preservatives

Plain Container
• No preservatives

Boric Acid Container
• Prevent bacterial growth
• For urine culture

Screw cap securely, but do not over tighten → Avoid leakage
• Containers cannot be use interchangeably
• Boric acid interferes with pH results and denatures protein
Use Correct Preservatives to Avoid Recollection

- No preservatives
  - Albumin
  - Chloride
  - Copper
  - Cortisol
  - Creatinine
  - Creatinine Clearance
  - M Bands
  - Potassium
  - Protein
  - Sodium
  - Urea

- Thymol
  - Calcium
  - Citric Acid
  - Magnesium
  - Oxalate
  - Phosphate
  - STONE

- Hydrochloric acid
  - Catecholamines
  - Metaneprines
  - Pheochromocytoma Screen
  - 5HIAA
  - VMA

Please refer to our test catalogue for additional information on sample requirements, collection procedures, reference ranges as well as relevant information on our services.
# Urine Preservative Guide

In cases whereby there is a combination of tests for urine samples, please refer to the guide for appropriate preservatives.

<table>
<thead>
<tr>
<th>Test</th>
<th>Random</th>
<th>24h Urine</th>
<th>Diet/Drug Restrictions</th>
<th>No preservative</th>
<th>3 g Thymol</th>
<th>20 mL 6N HCl</th>
<th>10 g Boric Acid</th>
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</tbody>
</table>
Points to Note for Good Sample Results

1. Type of sample
2. Information on iSMART labels
3. Adequate sample volume
4. Quality of sample
5. Alignment of Laboratory Accession label
2. Information on iSMART Label

- **Accession no.**
- **Lab Accession no.**
- **Tube Type**
- **Test Request**
- **Sample Type**
- **Urgent/Routine**
- **Testing Lab**
- **Number of tubes x of total**
- **Order of draw**
- **Ordering Doctor**
- **Collection date & time**
- **Ward/Clinic**

**Dept of Laboratory Medicine**
- CO = Core Laboratory
- CH = Chemistry
- HM = Haematology
- MB = Microbiology
- MD = Molecular Diagnostic Centre
- BTS = Blood Transfusion Services
Points to Note for Good Sample Results

1. Type of sample

2. Information on iSMART labels

3. Adequate sample volume

4. Quality of sample

5. Alignment of Laboratory Accession label
3. Adequate Sample Volume

Having sufficient blood/specimen levels ensure patients’ samples can be processed on the Laboratory Automation as soon as possible, without manual intervention.

Sodium Citrate Tube Needs to be 90% filled

Having sufficient blood/specimen ensures the correct blood:anticoagulant ratio to prevent dilution of coagulation factors.
3. Adequate Sample Volume – Blood Gases

**ADULTS**
- Insufficient
- Air gap
- Empty
- Sufficient sample

**PAEDS**
- Insufficient
- Sufficient sample

- **3ml**
- **~0.175ml**
3. Adequate Sample Volume – Blood Cultures

Blood Culture bottles needs to be sufficiently filled

- **Aerobic**
- **Anaerobic**

**Adult sample tubes**: 10ml

**Paeds sample tube**: 4ml

Lower blood volumes leads to:
- False negative results
- Slower time to detection and recovery of organisms
Points to Note for Good Sample Results

1. Type of sample

2. Information on iSMART labels

3. Adequate sample volume

4. Quality of sample

5. Alignment of Laboratory Accession label
4. Quality of Sample

Recommended to separate serum/plasma from blood cells within **TWO hours** of sample collection.

**Appropriate condition** of the sample for the test
- **Temperature**
- **Wrapped with foil**

Please refer to our test catalogue for additional information on sample requirements, collection procedures, reference ranges as well as relevant information on our services.
4. Quality of Sample – Collecting at the right time

**Oral Glucose Tolerance**
- Eg. OGT2, OGT3

**Indocyanine Green**
- Eg. Baseline, 30mins, 60mins
- (Obtain from Pharmacy)
- 0min, 15min

**Synacthen Test**
- Eg. Baseline, 30mins, 60mins

**Therapeutic Drug Monitoring**
- Eg. Cyclosporin, Vancomycin

**Diet Restriction, Fasting**
- Eg. Catecholamines, Metanephrines, VMA, PTH, Insulin
4. Quality of Sample – Blood Gases

Air bubbles may seriously affect the arterial sample, parameters related to $pO_2$ will be biased

$\uparrow pO_2$, $\downarrow pCO_2$, $\uparrow O_2$ saturation
4. Quality of Sample

What causes haemolysed samples?

- Leaving tourniquet on for extended time (> 1 minute)
- Excessive fist clenching
- Vigorous mixing of blood tube
- Purging blood from syringe to vacutainer via needle
- Residual alcohol from wet swab
- Traumatic draw (collapsed vein/excessive probing)

Consequences of haemolysed samples

- Falsely elevated Potassium and enzyme levels
- Inaccurate results
- Result will be invalidated if there is gross haemolysis
- A repeat sample may be required
4. Quality of Sample

What causes drip arm contaminated samples?
• Blood taken from the arm which an IV drip line was inserted

Consequences of drip arm contaminated samples
• Increased drip analytes e.g. Glucose, Potassium
• Dilutional effect which lowers other analyte concentrations
• A repeat sample must be taken
Order of Draw

**NOTE:**
1. **Tourniquet time ≤ 1 minute**
2. Use a **plain (red)** discard tube when using a **butterfly needle** if the first tube collected is **sodium citrate (blue)**
3. **Draw blood culture bottles first** (Aerobic followed by Anaerobic)
Order of Draw (Microtainer/Paeds Tube)

- Blood Culture
- Sodium Citrate (4 mixes)
- Lithium Heparin (8 mixes)
- EDTA (8 mixes)
- Sodium Fluoride (8 mixes)
- SSTII (with gel) (5 mixes)
- Plain (5 mixes)

***MIX ADEQUATELY!***

If not mixed adequately, tubes with anticoagulants (SSTII and red tubes) will not clot completely.
Order of Draw (Microtainer/Paeds Tube)

- **If aliquoting from syringe, DO NOT** purge blood from syringe to vacutainer via needle as it will cause hemolysis of the precious paeds blood sample.

- **BE ALERT** to cap the correct colour cap to the correct tube!

Remember to gently invert tubes after aliquoting to mix the anticoagulant.

Please refer to Lab Medicine > Test Catalogue > Test Collection Information > Paediatrics Collection Guide for more information on number of blood tubes to collect for tests required.
4. Quality of Sample – Order of Draw

What causes EDTA contaminated samples?

1. Incorrect order of draw (EDTA tube drawn before SST or Red top tube)
2. The wrong (EDTA) cap is being replaced on the lithium heparin green top tube for plasma collection
   • This causes **EDTA contamination** in serum tubes

Consequences of EDTA contaminated samples

• Falsely elevated Potassium
• Falsely low Calcium and ALP results
• **A repeat sample must be taken**
Points to Note for Good Sample Results

1. Type of sample
2. Information on iSMART labels
3. Adequate sample volume
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5. Alignment of Laboratory Accession label
5. Labelling Sample Tubes Correctly

When sticking labels on sample tubes, MAKE SURE

1. Barcode is aligned straight for analyser barcode readers to read

2. **Unique Identifiers** are visible
   - Patient Name
   - Patient I/C Number

3. Leave a visible window to allow laboratory personnel to check
5. Labelling Sample Tubes Correctly

UNACCEPTABLE EXAMPLES OF SPECIMEN LABELLINGS
These types of specimen labelling are not accepted by our Laboratory Automation System
• Manual intervention is required to reprint the appropriate labels
• Causes increased result turnaround time
• Results in a longer waiting time for the patient = Unhappy experience for patient
5. Labelling Sample Tubes Correctly

- **Barcode position not straight**
  - Barcode cannot be read

- **Barcode position too low**
  - Barcode cannot be read
  - Wrinkled label at the bottom of tube may cause mechanical error

- **Barcode label over the cap**
  - Tube cap cannot be removed by analyser

- **2 barcode labels on 1 tube**
  - 2 barcodes read
  - Confuses automation system

- **Barcode in wrong direction**
  - Barcode cannot be read

- **No barcode label on tube**
  - Do not know sample belongs to which patient
  - **Compromises Patient Safety**

- **Many tubes sharing 1 barcode labels**
  - Cannot be loaded on Automation system
  - **Compromises Patient Safety**
Group and Crossmatch Tube

DO NOT pre label tubes

Samples collection MUST be a continuous process
To prevent transcription errors
A leading cause of fatal transfusion reactions

ALWAYS check the identity of the patient and labels must be hand-written

-   PATIENT FULL NAME
-   PATIENT NRIC NO
-   Phlebotomist’s signature
-   DATE & TIME

Please refer to Lab Medicine > Test Catalogue > Test Collection Information > Blood Transfusion Services Collection Information
GROUP & CROSSMATCH FORM

<table>
<thead>
<tr>
<th>Type &amp; Screen</th>
<th>Group &amp; Crossmatch Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Group</td>
<td>ABO, Rh, K, S, P</td>
</tr>
</tbody>
</table>

**Handwritten in capitals**
- PATIENT NAME
- PATIENT NRIC
- DATE OF BIRTH

**Give history**

**Dated & signed by phlebotomist**

---

**Paper Form**

**Aurora Form**
Toxicology Forms

SEND COMPLETED FORM AND SAMPLES WITH NUH SPECIMEN LABELS TO THE LAB.

Please paste NUH specimen seal between the cap and the body of tube/urine bottle as shown.

You can obtain the form at Labmed resources > eForms > General Lab Forms > Toxicological Investigation
Timed Urine

For Outpatients

→ Measure and record total urine volume on small container
→ Transfer 100ml urine to small container
→ Bring small container back to NUH

Patient convenience!
Dispensation of CORE Lab-Issued Items

Staff nurse or book a porter, **indicate test name and item(s) to be collected.**

**Send**

- Royal Blue (Plain)
  - Copper, Aluminium, Zinc, Selenium
- Royal Blue (EDTA)
  - Arsenic, Cadmium, Lead, Manganese, Mercury
- TB Spot Tube
- Plasma EDTA Meta
  - Catecholamine Fractionation, Free, Plasma
- UTM Swab
  - Measles Virus RNA Amplification (PCR)
  - Mycoplasma Pneumonia DNA Amplification (PCR)
- Cortisol, Saliva Collection Kit
- i-STAT Cartridges
  - G3+, CG4+, EG7+
- i-STAT 9V Batteries and Thermal paper

**Collect**

- Filter Paper Blood Spot Card
  - National Newborn Screening (NENS)
- Self-sealing Capillary Tubes
  - Bilirubin, Paediatrics
- ABG Multicap Capillary Tubes
- 24 Hour Urine Bottle

*It is not necessary to call the lab to reserve these items as the lab is open 24/7*

For other items, please refer to test catalogue

At Department of Laboratory Medicine, Reception, Main Building, Level 3.
Dispensation of Haematology Lab-Issued Item

**SEND**
staff nurse or book a porter, **indicate test name** and item(s) to be collected.

**COLLECT**
at Department of Laboratory Medicine, Reception, Main Building, Level 3.

- **Bone Marrow Biopsy Needle**
  - Bone Marrow Aspiration Kit

Please call x25354 for appointment before collecting kit.

Send **completed form**, labelled sample tubes and **kit** back to Haematology Lab, preferably before 4pm.

*For other items and more information, please refer to test catalogue or call x25354.*
Dispensation of Microbiology Lab-Issued Items

- **Aerobic and Anaerobic Culture**
  - Chocolate Plate
  - CDC ANA Blood Plate

- **Fungus Culture**
  - Sabouraud’s plate with chloramphenicol

- **Microsporidium Microscopy**
  - Glass Slide

- **Respiratory IF**
- **Influenza A, B, RSV PCR**
- **Herpes Simplex Virus (HSV) IF**
- **Varicella-Zoster Virus (VZV) IF**
  - UTM and Flocked Swab

- **Boric Acid Urine container (Paeds)**

- **Acanthamoeba culture**
  - Page’s Saline

*For other items, please refer to test catalogue or call x24343.*
Dispensation of Molecular Diagnosis Centre-Issued Items

**Send**
staff nurse or book a porter, indicate test name and item(s) to be collected.

**Collect**
at Molecular Diagnosis Centre, Main Building, Level 3.

- **Cervical sampler**
  - A cervical brush and a tube containing specimen transport medium for HPV testing

- **cobas PCR media (Swab)**
  - Transport medium for endocervical and urethral swab specimens for Chlamydia trachomatis and/or Neisseria gonorrhoeae PCR testing

*For other items, please refer to test catalogue or call x24384.*
Main Building, Level 3 Map

PLEASE DIRECT PORTERS TO THE CORRECT LOCATION TO COLLECT LAB-ISSUED ITEMS

Not drawn to scale
Sendout Testing Services

Tests not performed in DLM...What can lab do?
- Send to local or overseas laboratories

What?
Common referred tests
- Order & collect in CCOE/Aurora
- Specimen handling instructions are available

What?
Tests with special requirements
- For enquiries, contact Clinical Chemistry @ x24346 for specimen collection, handling instructions & billing issues

When...?
- Mondays to Fridays
- Send specimen before 3 pm

Why?
- Complex
- Need to comply with referred lab requirements
FROM WARDS AND CLINICS...

...TO NUH LABORATORY

Let us work together!

Quality Sample in  Quality Result out