Report On

Internship at Dhaka Healthcare System Hospital

By

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An internship report submitted to the Department of Mathematics and Natural Sciences in partial fulfillment of the requirements for the degree of

Bachelor of Science in Biotechnology

Department of Mathematics and Natural Sciences
Brac University
June 2024

Declaration

It is hereby declared that

1. The internship report submitted is our own original work while completing a degree at Brac University.
2. The report does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The report does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. We have acknowledged all main sources of help.

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Letter of Transmittal

Dr Iftekhar Bin Naser
Associate Professor
Mathematics and Natural Sciences
BRAC University
Merul Badda, Dhaka-1212

Subject: Submission of Internship Report

Dear Sir ,

We are very pleased to present our internship report conducted at Dhaka Healthcare Systems Hospital , the opportunity we obtained by your help.

We have attempted to complete the report with required information and details about what we learnt separated into different chapters.

We trust that the report will meet the requirements and your expectations.

Sincerely yours,

_____

Shanila Islam (20236010)
Inshera Ahmed (20236003)
Fawzia Faariha Kabir (20336019)
Mathematics and Natural Sciences
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Date: 26th June, 2024

Non-Disclosure Agreement

This agreement is made and entered into by and between Dhaka Healthcare Systems Hospital and the undersigned students, Inshera Ahmed (20236003), Shanila Islam (20236010.) and Fawzia Farihaa Kabir (20336019), Biotechnology programme, Department of Mathematics and Natural Sciences at Brac University to ensure there will be no disclosure of unauthorized information by the students about the hospital.

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Ref: DHSH/Intern/certificate/June/2024/01

Date: 25th June 2024

To Whom It May Concern

This is certify that Shanila Islam has completed internship with Dhaka Healthcare Systems Hospital from 26-05-2024 to 11-06-2024 as internee in Laboratory (Pathology) . She has proved to be a conscientious and reliable person whose conduct has been excellent during the tenure of her service. Her performance during this period is up to the required standard.

We wish her good luck in future endeavor.

Thankfully

Md. Saiful Alam
General Manager
Dhaka Healthcare Systems Hospital

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Ref: DHSH/Intern/certificate/June/2024/03

Date: 25th June 2024

To Whom It May Concern

This is certify that Inshera Ahmed has completed internship with Dhaka Healthcare Systems Hospital from 26-05-2024 to 11-06-2024 as internee in Laboratory (Pathology) . She has proved to be a conscientious and reliable person whose conduct has been excellent during the tenure of her service. Her performance during this period is up to the required standard.

We wish her good luck in future endeavor.

Thankfully

Md. Saiful Alam
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Ref: DHSH/Intern/certificate/June/2024/02

Date: 25th June 2024

To Whom It May Concern

This is certify that Fawzia Faariha Kabir has completed internship with Dhaka Healthcare Systems Hospital from 26-05-2024 to 11-06-2024 as internee in Laboratory (Pathology) . She has proved to be a conscientious and reliable person whose conduct has been excellent during the tenure of her service. Her performance during this period is up to the required standard.

We wish her good luck in future endeavor.

Thankfully

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Acknowledgement

We would love to offer our sincere gratitude and appreciation to all whose guidances have helped us to complete our internship and prepare this report, We would love to convey our sincere gratitude to **Dr. Iftekhar Bin Naser**, our advisor, and **Dr. Munima Haque**, course coordinator of Biotechnology Program, Department of mathematics and Natural Sciences, whose advice, guidance and motivation have encouraged us to pursue our internship with determination.

We would like to convey our sincere gratitude to **Dhaka Healthcare Systems Hospital** personnel for allowing us to complete our internship at their facility. I am thankful to the General Manager of Dhaka Healthcare Systems Hospital, **Md. Saiful Alam**, for permitting us and providing us the opportunity to perform the internship.

We would also like to appreciate **Ms. Anamika Akhter**, lab incharge of the **Pathology lab** whose guidance has helped us to learn about the lab's facilities and functionalities, as well as, for explaining all laboratory experiments thoroughly, allowing us to perform certain experiments and learn from the experiments.

Executive Summary

This internship report consists of our practical experience in the pathology laboratory of Dhaka Healthcare Systems Hospital which we completed within 17 days. This internship started from May 26th, 2024 and was completed on June 11th , 2024 as a requirement for our Bachelor of Biotechnology program under the Mathematics and Natural Science (MNS) Department of BRAC University.

Dhaka Healthcare Systems Hospital is a general hospital and diagnostic center where we gained theoretical and practical knowledge on blood sample collection, urine analysis, determining blood group, various manual serological tests such as Widal and Rapid diagnostic tests through kits to diagnose Malaria, Dengue, HIV et cetera. Additionally, we saw demonstrations of certain biochemistry and hematology tests which were automated which suited the hospital's fast paced environment by being less time consuming and efficient. Altogether, it was a remarkable opportunity to be familiar with laboratory protocols and tests conducted in a hospital.

Keywords: Pathology laboratory; Blood sample collection; Urinalysis; Blood group determination; Serological tests; Widal test;Malaria diagnosis; Dengue diagnosis; HIV diagnosis; Biochemistry tests; Hematology tests; Laboratory protocols

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List of Acronyms

C/S	Culture and Sensitivity
CBC	Complete Blood Count
DSHS	Dhaka Healthcare Systems Hospital
EDTA	Ethylenediaminetetraacetic Acid
EGFR	Estimated Glomerular Filtration Rate
HbA1c	Hemoglobin A1C or Glycated Hemoglobin
HBsAg	Hepatitis B Surface Antigen
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus
NS1	Non-structural protein 1 (of Dengue Virus)
pH	Power of Hydrogen
PSA	Prostate-specific Antigen
RDT	Rapid Diagnostic Test
RBC	Red Blood Cell
UTI	Urinary Tract Infection

Chapter 1

Dhaka Healthcare Systems Hospital

1.1 Introduction to Dhaka Healthcare Systems Hospital

Dhaka Healthcare systems hospital is a private Hospital situated at Madani Avenue, Vatara, Dhaka. It has been providing hospitable 24/7 healthcare service in the Vatara Thana area for over 3 years. The hospital caters to a large variety of patients and has doctors and consultants of various fields, some of which are:

1. Gynecology
2. Urology
3. Surgery
4. Neuro-surgery
5. Psychology
6. Dentistry and more.

It also has standard cabins, men's and women's wards, ICUs and operation theaters. Numerous tests are carried out in the hospital Pathology Lab, some of which are:

1. CBC
2. Blood grouping
3. Blood cross matching
4. Widal test, NS1 test, Malaria etc.
5. Lipid profile
6. Urine tests, urine analysis, UA etc.

1.2 Pathology Laboratory of Dhaka Healthcare Systems Hospital

The Pathology Lab is a well equipped and well staffed laboratory. It is located on the second floor, with a sample collection room on the same floor. The lab in itself is divided into 3 broad parts; the main area is equipped with automated and semi-automated machines to carry out serology, biochemistry, hematology etc tests. This area contains the following machines:

1. Fully automated biochemistry analyzer Sysmex BX-3010
2. Fully automated Hematology Analyzer DYMind DF50
3. Semi-automated Biochemistry Analyzer Microlab 300
4. Immunofluorescence quantitative analyzer Getein 1100
5. Easylyte plus (Na+, K+, Cl-) electrolyte analyzer

There are two subsections on the side, one for manual blood tests and another for urine sample storage, handling and testing. The manual blood tests include:

1. Blood grouping
2. Blood Cross matching
3. Widal test
4. HCV
5. HbsAg
6. Syphilis
7. HIV
8. NS1 test
9. IgG/IgM and more.

The Pathology lab is fully functional and operational 24/7. Samples are received at any time of the day and the tests are carried out in a timely manner. Reports are printed and then again cross checked by the lab incharge, before being signed and delivered.

Chapter 2

Blood Sample Collection

The first step in the laboratory work is sample collection. Blood samples are collected in 4 different types of tubes, according to the prescribed tests. These tubes are identified by their color and are red, lavender, blue, gray and black. Each tube has different reagents required for different tests hence blood is collected in specific tubes depending on the tests being conducted. The tubes and the tests they are used for, are shown in Table 1.1:

Table 1: Different blood sample tubes and their uses

Name	**Image**	**Reagents**	**Use**
Gray tube		Sodium fluoride, and sodium or potassium oxalate	Glucose tests like RBS

Black tube/ ESR tube		Sodium citrate	ESR test
Red tube/ Plain tube		No additives	All chemistry, serology and immunology tests, eg. Widal, kit tests etc.
Lavender tube		Potassium EDTA	Hematology and blood bank, eg. CBC tests.

Blue tube		3.2% Sodium Citrate	Coagulation and blood factor tests

The procedure to collect blood is described below:

1. The appropriate tube is chosen and labeled with the sample number.
2. A strap is put on and tightened just above the elbow.
3. The area is examined to find a prominent vein.
4. The patient may be asked to clench their fist to help veins become more visible.
5. The butterfly needle is inserted at a 45° angle.
6. Each tube has a mark till which it will fill.
7. The tubes will automatically stop filling once the mark has been reached.
8. The needle is taken out and a piece of cotton is put in the area to prevent bleeding out.
9. A bandage is applied after a moment.

The following precautions must be taken to ensure smooth blood collection without any harm done to the patient.

1. The area must be cleaned with a fresh alcohol pad before the needle is inserted.
2. The patient must not move about during the procedure, otherwise swelling or blood clotting may be observed.

3. The angle of the needle should be kept at around 45° angle, otherwise there may be a risk of not inserting the needle in the vein properly.

Chapter 3

Manual Serological Tests

3.1 Widal Test (Test for Typhoid)

The Widal test is a serological test used to diagnose typhoid fever, which is caused by the bacterium *Salmonella enterica* serotype *Typhi*. The test measures the levels of antibodies against the O and H antigens of *Salmonella enterica* serotype *Typhi* in a patient's blood serum. These antibodies are produced by the body in response to infection. The test involves mixing the patient's serum with antigens of the O and H types and observing for agglutination (clumping) of the antigens. The titre is the highest dilution of the serum that still shows agglutination.

The test is done using four available (O and H) antigens of *Salmonella enterica* serotype Typhi. The four reagents are:

1. **TO:** O antigen of *Salmonella Typhi*
2. **TH:** H antigen of *Salmonella Typhi*
3. **AH:** H antigen of *Salmonella Paratyphi A*
4. **BH:** H antigen of *Salmonella Paratyphi B*

Figure1: Four reagents for Widal test

Steps

1. 4 drops, each consisting of 20 microlitres of the patient's blood serum is taken on a glass plate using a micropipette.
2. Serially 4 reagents (TO, TH, AH, BH) are added using droppers of the reagent containing bottles.

Figure2: Mixing the reagents and the blood serum

3. Then the reagents and the serum drops were mixed.
4. For better mixing, the glass plate was put on a shaker for 1 minute.

Result

If any agglutination (on any of the mixed drops) is detected under white light, the result will be concluded as positive for Typhoid. On the other hand, if no agglutination is detected under white light, the result will be concluded as negative for Typhoid.

★ **Several important points for Typhoid-positive result:**

- **C/S test:** This test is done to determine appropriate antibiotic treatment and diagnosis in case of typhoid-positive result.
- **Blood Culture:** A sample of the patient's blood is cultured to check for the presence of *Salmonella Typhi* bacteria. If the bacteria are present, they will grow in the culture medium, confirming the disease.

- **Sensitivity Testing:** Once *Salmonella Typhi* is identified, sensitivity testing is performed to determine which antibiotics are effective in treating the infection. This is crucial because *Salmonella Typhi* has been found to develop resistance against several antibiotics.

3.2 Blood grouping

Blood grouping is a process used to classify blood into different types based on the presence or absence of specific antigens on the surface of red blood cells. The ABO system has four main blood groups: A, B, AB, and O. Each group is defined by the presence or absence of specific antigens (A and B) on the surface of red blood cells.

The Rh system of blood grouping is based on the presence or absence of the RhD antigen. The RhD antigen is responsible for the RhD positive or negative classification. This adds an additional layer of classification, resulting in eight blood groups: A+, A-, B+, B-, O+, O-, AB+, and AB-.

Blood Group Test involves mixing a sample of blood with different antibody solutions. The reaction of the blood cells with these antibodies determines the blood group.

Steps

1. One glass slide is divided in 3 separate parts (A, B and D)
2. 3 drops of blood, 20 microlitres each are taken on the slide using a micropipette.
    - Anti-A serum: Contains antibodies against the A antigen.
    - Anti-B serum: Contains antibodies against the B antigen.
    - Anti-D serum: Contains antibodies against the D antigen (used for determining Rh factor)

Figure3: Anti-A, Anti-B, Anti-D (Anti-Rh factor) antigens

3. The Anti-serums are added and mixed.

4. Then the glass slide is placed on the shaker for 1 minute.

Result

- When agglutination is seen in the Anti-A serum portion, antigen-A is present.
- When agglutination is seen in the Anti-B serum portion, antigen-B is present.
- When agglutination is seen in the Anti-D serum portion, Rh-positive antigen is present.

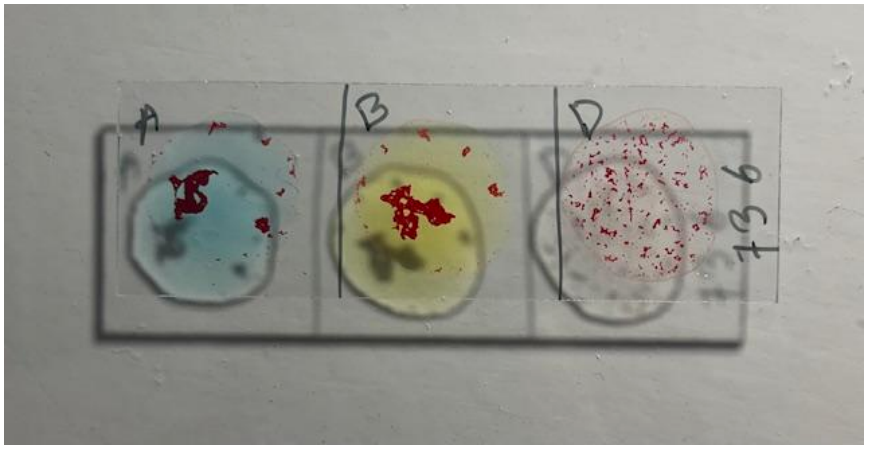

Figure4: Agglutination is seen in all three portions; antigen-A, antigen-B and Rh-positive antigen is present, therefore the blood group is AB^{+}

3.3 Cross Matching

Cross-matching is a test performed before a blood transfusion to check for compatibility between the donor and recipient. The test ensures that the recipient's immune system does not react against the donor's blood cells, preventing adverse reactions.

Steps

1. Blood drawn in a red/plain tube is centrifuged to separate the serum and the blood cells. Both donor and recepient’s blood are centrifuged.
2. 2 slides are taken to check the blood groups of both patient (recipient) and donor.
3. Another slide is taken for cross matching, which can be of 2 types : Minor and major
    - For Minor mix donor’s serum with recipient’s RBCs
    - For Major mix recipient’s serum with donor’s RBCs
4. For the RBCs blood is taken from the violet tube and for the serum blood is taken from the red tube.
5. Then both minor and major mix glass slides are put on the shaker for 1 minute.

Result

After mixing, if no agglutination is detected under the white light, then the blood of the donor and the blood of the patient is compatible.

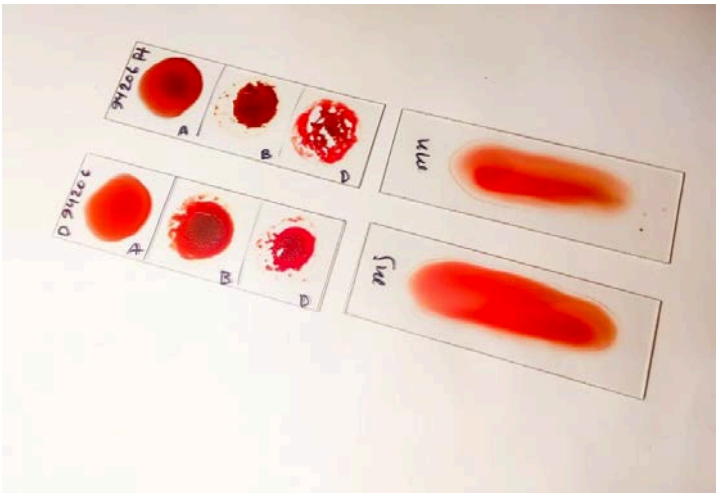

Figure5: No agglutination is seen in major mix or minor mix, therefore the donor's blood is compatible for the patient

Chapter 4

Kit Based Serological Tests

Rapid diagnostic tests (RDTs) were carried out in the serology laboratory of the hospital to detect various diseases such as malaria, dengue , HIV et cetera. These tests are typically designed to detect the presence of antibodies or antigens in a blood sample. The following tests were portrayed during the internship :

Table 2 : List of kit based serological tests for rapid detection

Name of Test	Procedure	Result Interpretation
1.HCV	1 drop serum is placed in the specimen well of the cassette followed by 2 drops of buffer solution .	After 10 to 15 minutes check the result. If positive it will show 2 lines, one in the control (C) region and one in the test (T) region. If negative there will be only one line in the (C) region and no line in the (T) region. Results should not be interpreted after 20 minutes to avoid false positives and negatives.
2.HBsAg	3 drops of serum are placed in the kit without the addition of a buffer .	Lines appear within 15 to 30 minutes. 2 lines , one in C and another in the T region appear to indicate positive result and only one line in C region means negative. After 30 minutes no result should be interpreted to avoid false results.
3.Syphilis	1 drop of serum and 1 drop of buffer added to the specimen well of the cassette.	Read results in 5 minutes . 2 lines , one in C and one in T indicate positive while only one line in C means negative. No result interpretation after 20 minutes to avoid false results.
4.HIV	1 drop of serum and 1 drop	Results read within 10-15

	of buffer placed on the well.	minutes. 2 lines one in C and another in T indicate positive while only one line in C means negative. No result interpretation after 20 minutes to avoid false results.
5.NS1 Antigen	Add 5 microlitre serum followed by 2 drops of buffer	Results read after 15 minutes. Positive indicated by 2 lines one in C region another in T. Only one line in C means negative. If negative then perform additional tests like IgG and IgM. When the infection has proceeded past the early stage (when NS1 antigen is evident) or when individuals exhibit symptoms past the acute phase, testing for IgM and IgG antibodies is especially helpful.

In all of the above-mentioned tests, if there were no lines even in the control region after incubation then it indicates an invalid result which means the test needs to be repeated with a new kit. The control line in a kit is used to ensure correct functioning of the test hence no line in the C region means the test did not function properly. Kit based tests are crucial to keep up with the high number of samples in hospitals to generate quick results. Additionally, the tests were carried out wearing gloves to avoid risk of infection and spread if the person performing tests has any cuts the patient's blood can come into contact with it and spread infection.

Figure6: Tests for Syphilis, HVC, HIV and HBsAg

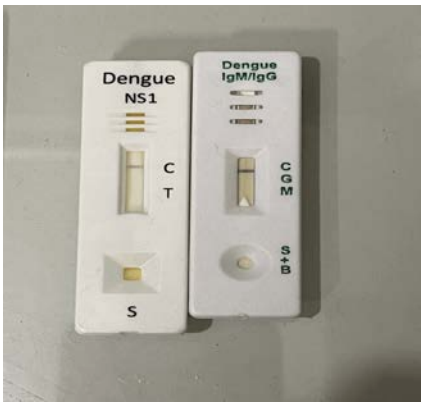

Figure7: Tests for NS1, IgG and IgM

Chapter 5

Machine run Serological, Electrolyte and Hematology

5.1 CBC

At first, blood samples are collected in tubes and then placed in a rotator to prevent it from being clotted and to ensure homogenization of the blood to properly mix all blood components required for proper CBC analysis. The machine used was Dymind DF50 Auto Hematology Analyzer which can do up to 60 tests per hour. First mode and ID was selected to choose the test and the sample ID and then sample from the tube is inserted through a sample probe. It uses different methods such as laser scatter, chemical dye and flow cytometry for CBC analysis where a laser is used to illuminate the cells and they interact and scatter light in different directions giving an idea of the cell shape and size. The machine was cleaned with a cleaning solution which was fed through the sample probe to ensure its proper functioning.

Figure8 : Rotator

Figure9 : Automatic Hematology Analyzer

5.2 Electrolyte Analysis

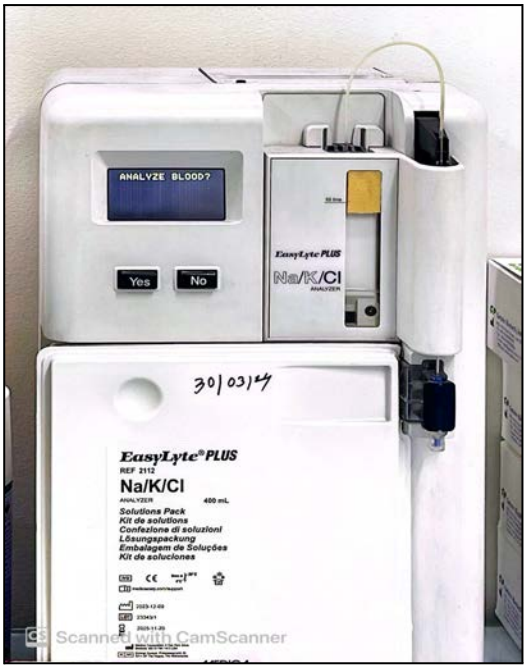

Figure10: Electrolyte analyser

To measure electrolytes such as Na+, K+, Cl- et cetera the machine named EasyLyte Plus was used which is a fully automated microprocessor controlled electrolyte system. After ensuring the machine is cleaned by feeding a cleaning solution through the sample probe, enter only blood serum separated from the whole blood sample through the probe. The machine will analyze the levels via the Ion selective electrode method which selectively responds to ions in the sample such as Na+, K+ and Cl- and the analyzer converts voltage signals into concentration values. The final results are displayed on the screen and the amount is given in mmol/L. It generates results within 60 seconds. This test is carried out to check for dehydration and kidney function and electrolyte imbalances. The simple maintenance and yes/no prompted operation makes it suitable for hospital laboratories. A chart of standard values for Na+, K+ and Cl- is used to compare the results and make interpretations.

5.3 Immunofluorescence Quantitative Analyzer

Figure11: Getein 1100 Immunofluorescence Quantitative Analyzer

The Getein 1100 is an automated small-scale analyzer that can use various types of samples like serum, urine, saliva etc. It is lightweight and easy to use that allows one-step tests. At DSHS, the Getein 1100 is used for the tests shown in Table 3.

Table 3: Tests carried out on Getein 1100 and their procedure

Name of test	Purpose	Procedure
1.PSA	Prostate specific antigen usually tested for prostate cancer detection	• Blood sample is centrifuged. • Machine is activated with the PSA test

		card. ● 100 microlitres of serum is put in the kit and the kit is placed in the machine. ● The result appears in 900 seconds.
2.HbA1c	Hemoglobin A1c to diagnose and manage diabetes	● Machine is activated with the HbA1c test card. ● 10 microlitres of whole blood is put in the tube with reagent. ● 100 microlitres of the mixture from the tube is put in the kit ● The result appears in 300 seconds.
3.Prolactin	Usually tested for pregnancy as levels increase in pregnant women	● Machine is activated with the Prolactin test card. ● 100 microlitres of

		serum is put in the kit and the kit is placed in the machine. ● The result appears in 900 seconds.
4.IgG	Allergy	● Machine is activated with the IgG test card. ● 100 microlitres of serum is put in the reagent tube and re-pipetted to mix. ● 100 microlitres of the mixture is put in the kit and placed in the machine. ● The result appears in 900 seconds.
5.T3	Thyroid function	● Machine is activated with the T3 test card. ● 40 microlitres of serum is put in the reagent tube and

		re-pipetted to mix. ● 100 microlitres of the mixture is taken in the kit and placed in the machine. ● The result appears in 900 seconds.
6.Beta - hCG	Pregnancy	● Machine is activated with the Beta-hCG test card. ● 40 microlitres of serum is put in the reagent tube & re-pipetted to mix. ● 100 microlitres of the mixture is taken in the kit and placed in the machine. ● The result appears in 900 seconds.

Chapter 6

Biochemistry Analysis

6.1 Fully-Automated Biochemistry Analyser

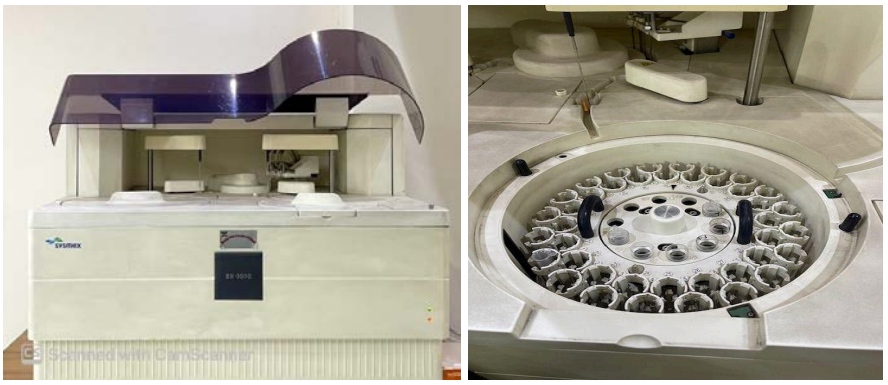

Figure12: Automated biochemistry analyser

For low- to mid-volume facilities or as a specialized analyzer for HbA1c testing, the Automated Chemistry Analyser, BX-3010, is the best option with a throughput of up to 404 tests per hour. The BX-3010 has an on-board hemolysis capability for HbA1c testing and was specifically made for labs to provide fast reports for diabetic individuals monitoring their glycemic state. Combined with high efficiency, accurate results, user friendly operation and low running cost, the BX-3010 enables even small laboratories to enjoy the benefits of advanced technology seen in a high throughput analyser.

★ **Several important points about the biochemistry analyser:**

- Easy operation with intuitive icons.
- Colour-coded indicator gives a quick overview of different tests on-board with information on remaining tests and expiry dates.
- Real-time results status detailing the time to completion of a test helps in time management.

- Low volume reagent requirement, 20µL-250 µL.
- Low water consumption, 5 liters per hour.

Benefits of the ready-to-use reagents:

- Stable, ready-to-use liquid reagents
- Long on-board stability and calibration stability
- Minimized interferences with lipid clearing system
- Standardized to international reference material/methods
- Barcoded reagents with multi-calibrator and control for easy handling

6.2 Semi-Automated Biochemistry Analysis

Figure13: Semi-automated biochemistry analyser Microlab 300

The Microlab 300 is a simple and versatile machine popular in many medium and smaller sized laboratories. It serves as a quick and easy back up to the fully automated biochemistry analyzer. It is able to carry out several tests of the following categories:

1. Clinical Chemistry
2. Special Proteins
3. Drugs of Abuse
4. Therapeutic Drugs
5. Electrolytes

At DHSH, this machine is frequently used to carry out Creatinine tests. The process is as follows:

1. The water blank is measured as per machine requirement.
2. 500 microlitres of each of the two reagents are added to a small test tube.
3. 100 microlitres of the serum sample is added.
4. The mixture is re-pipetted to mix.
5. The test tube is then fed through the tube.
6. The result appears on the monitor.

Figure14. Creatinine reagents

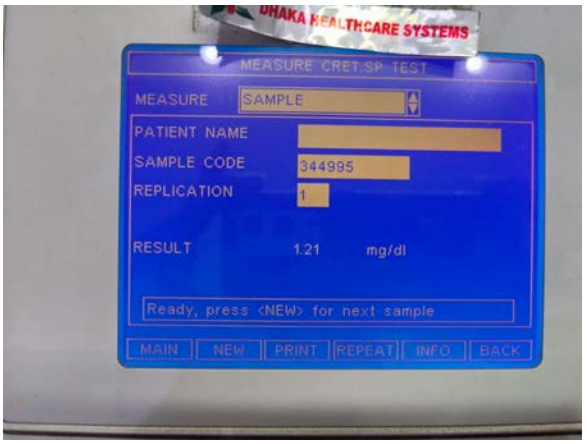

Figure15. Results displayed on the Microlab 300

Chapter 7

Microscopic Analysis

7.1 Blood Sample

For each CBC test , a drop of blood from the same sample was taken on a slide and a thin smear was prepared using another slide at a 30 to 45 degree angle. It is then placed on the microscope (Olympus CX23) to view blood cells. It is done to ensure accurate results and to see the cell morphology to look for any abnormalities. In dengue patients, observing slides help to get a rough estimate of the platelet ratio as dengue is known to lower platelet count severely. It is quite crucial to label each slide with appropriate patient ID to not confuse the samples and results.

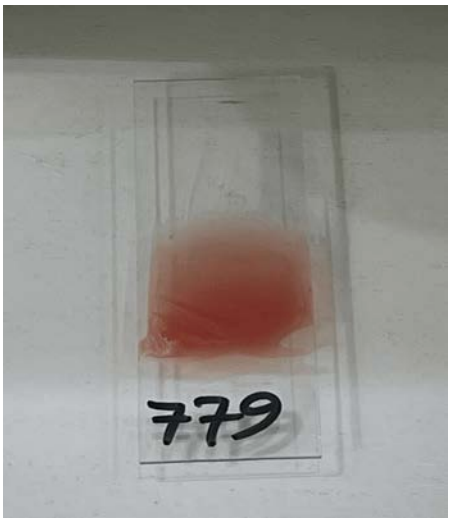

Figure16: Thin smear on slide

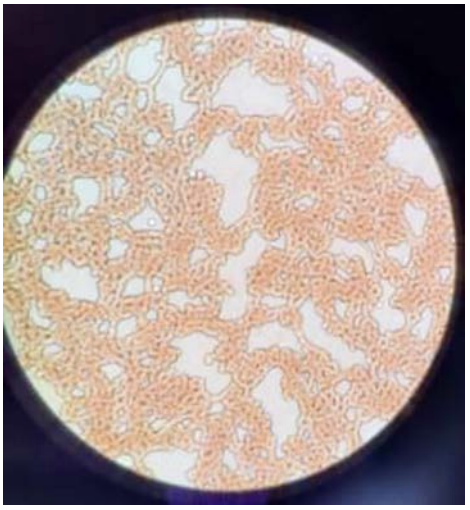

Figure17: Platelets under microscope

7.2 Urine Sample

For urine analysis at first a urinalysis test strip is dipped in urine and properly submerged for a few seconds then tap it at the sides of the container to remove any excess urine. After 45 seconds the level of glucose will be reflected by a color change, after 60 seconds it will show level of protein and pH. Different colors indicate different levels of glucose, protein and pH. After this , urine is taken in a tube and centrifuged at 2000 rpm for 12 to 15 minutes and then the supernatant is discarded. A small amount of liquid with sediment is left which is then put on a slide as a drop and then a cover slip is placed on top carefully to avoid air bubbles. Different cells present in urine were observed such as pus cells, white blood cells, red blood cells and epithelial cells. Normal range of pus cells is from 0-5/HPF and 8-10 HPF pus cells may indicate UTI.

Figure18: Urinalysis test strip

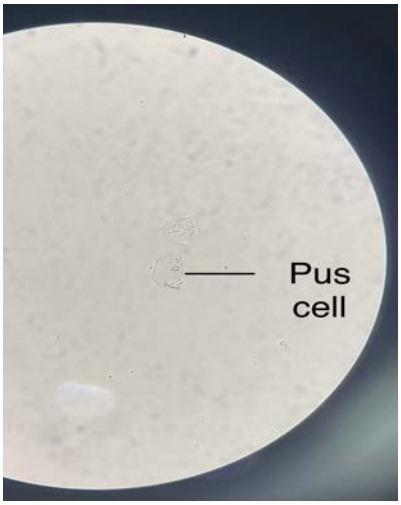

Figure19: Pus cells in urine

Conclusion

Our internship at Dhaka Healthcare Systems Hospital has enlightened us about various aspects of the healthcare industry starting from sample collection to diagnostic tests and report preparation. Furthermore it has taught us to give meticulous attention to get accurate results by preventing contamination and by repeating tests when necessary. Apart from the tests we also learnt how crucial it is to maintain the machines to ensure they are in proper working conditions. We also learnt the significance of teamwork in a lab to keep up with the fast paced hospital environment. Altogether it was a great opportunity to acquire new skills which we can apply in the future.

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