وزارة التعليم العالي والبحث العلمي
هيئة التعليم التقني
المعهد التقني الموصل

"الحقيبة التعليمية وطائفة الأعضاء"
لطلبة المرحلة الأولى في المعهد التقني الموصل

إعداد وتصميم
الاء غانم محمد
مدرس / قسم تقنيات الصيدلة
المعهد التقني الموصل
وزارة التعليم العالي والبحث العلمي
 الهيئة التعليم التقنية
 التخصصات: الطبية
 القسم: تقييات الصيدلة

<table>
<thead>
<tr>
<th>الساعات الأسبوعية</th>
<th>السنة الدراسية</th>
<th>الفصل الدراسية</th>
<th>اللغة العربية</th>
<th>اللغة الإنجليزية</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Physiology</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>اسم المادة</th>
<th>باللغة العربية</th>
<th>باللغة الإنكليزية</th>
<th>اللغة التدريس للمادة</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

أهداف المادة (النظرية): -
الأهداف العامة: -
مستطيع الطالب أن يكون قادراً على معرفة فائدة العمليات الفسلجية في تمرير الإنسان

الأهداف الخاصة: -
أن يكون الطالب قادرًا على معرفة:
1- أجهزة الجسم المختلفة.
2- وظائف الجسم المختلفة والعمليات الفسلجية التي تجري داخل جسم الإنسان.

أهداف المادة (العمل): -
الأهداف العامة: -
اكتساب الخبرة والمهارة في التجارب التي تجري لفحص ووظائف الأعضاء.

الأهداف الخاصة: -
أن يكون الطالب قادرًا على معرفة:
1- الأجهزة المستخدمة في قياس ووظائف الأعضاء.
2- كيفية استخدام الأجهزة في قياس ووظائف الأعضاء.
First modular unit

Introduction to physiology

1/ Overview

1/A – Target population :-

For students of first class
Technical Institute
Department of pharmacology
physiology

1/B – Rationale :-

The study of physiology is very important subject to be studied in order to have a good and a useful background for the student which helps them to understand what is physiology and what are the main component and functions of it.

1/C – Central Idea :-
Introduction to physiology

1 - Definition

2 – The cell

3- Cell membrane

1/ D – Instructions:-

1. Study overview thoroughly.

2. Identify the goal of this modular unit.

3. Do the pre test and if you:
   - get 9 or more you do not need to proceed.
   - get less than 9 you have to study this modular unit well.

4. After studying the text of this modular unit, do the post test, and if you:
   - get 9 or more, so go on studying modular unit three.
   - get less than 9, go back and study the second modular unit; or any part of it; again and then do the post test again.

2/ Performance Objectives :-

After studying the first modular unit, the student will be able to:

1- Know what is physiology.

2- Know what the cell.
3/ Pre test :-

Circle the correct answer ;- 

1- Physiology is the study of :-

a- functional activities  
b- blood composition  
c- blood diseases  
d- all of them

2- The general composition of cell membrane ;-  

a- lipid 99%  
b- proteins 55%  
c- Ca 55%  
d- 50%
what is physiology?

Physiology is the science of studying the functional activities and its mechanisms in biological body.
• Physiology derived from two Greek words – physis = nature logos = study
Physiology can be divided into viral physiology, bacterial physiology, cellular physiology, plant physiology, human physiology, and many more subdivisions.
• Human physiology is the science of studying the rule of physiological functions in human body.

Levels of Structural Organization
1- **Chemical level**: atom combine to form molecules
2- **Cell level**: molecules combine to form organelles, such as the nucleus which make up cell.
3- **Tissue level**: similar cells and surrounding material make up tissues.
4- **Organ level**: different tissues combine to form organs such as the urinary bladder.
5- **Organ system level**: organs, such as the urinary bladder and kidneys, make up an organ system.
6- **Organism level**: organ systems make up an organism.

**Cell Structures and Function**
The cell
Basic living unit of structure & function of the body.

- > 100 trillion cells in body.
- Very small (10-5 m in diameter).
- Highly organized.
- Variety of shapes & sizes.
- Each type of cells has a special function.

All Cells share certain characteristics:
- General cell structure & components.
- General mechanisms for changing nutrients to Energy.
- Deliver end products into their surrounding fluid.
- Almost all have the ability to reproduce.

3 principal parts:
- Plasma (cell) membrane.
- Cytoplasm & organelles.
- Nucleus.

The cell has two major compartments: the nucleus & the cytoplasm.
The cytoplasm contains the major cell organelles & a fluid called cytosol.

### General Cell Structure & Function

<table>
<thead>
<tr>
<th>Component</th>
<th>Structure</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plasma (cell) membrane</strong></td>
<td>Membrane composed of double layer of phospholipids in which proteins are embedded</td>
<td>Surrounds, holds cell together &amp; gives its form; controls passage of materials into &amp; out of cell</td>
</tr>
<tr>
<td><strong>Cytoplasm</strong></td>
<td>Fluid, jellylike substance b/w cell membrane &amp; nucleus in which organelles are suspended</td>
<td>Serves as matrix substance in which chemical reactions occur.</td>
</tr>
<tr>
<td><strong>Nucleus:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- <strong>Nuclear envelope</strong></td>
<td>Double-layered membrane that surrounds nucleus, composed of protein &amp; lipid molecules</td>
<td>Supports nucleus &amp; controls passage of materials b/w nucleus &amp; cytoplasm</td>
</tr>
<tr>
<td>- <strong>Nucleolus</strong></td>
<td>Dense nonmembranous mass composed of protein &amp; RNA molecules</td>
<td>Produces ribosomal RNA for ribosomes</td>
</tr>
<tr>
<td>- <strong>Chromatin</strong></td>
<td>Fibrous strands composed of protein &amp; DNA</td>
<td>Contains genetic code that determines which proteins (including</td>
</tr>
</tbody>
</table>
enzymes) will be manufactured by the cell

General composition of cell membrane:

- Proteins ....................... 55%
- Lipids .......................... 41%
  - Phospholipids ... 25%
  - Cholesterol ...... 12%  
  - Glycolipids ....... 4%
- Carbohydrates ............ 3%

General functions of cell membrane proteins:

1. Provide structural support.
2. Transport molecules across the membrane.
3. Enzymatic control of chemical reactions at cellular surface.
4. Some function as receptors for hormones.
5. Some function as regulatory molecules, that arrive at outer surface of the membrane.
6. Some act as antigens and induce the process of antibody formation.

Cytoplasmic Organelles: Structure & Function

<table>
<thead>
<tr>
<th>Component</th>
<th>Structure</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endoplasmic reticulum</td>
<td>System of interconnected membrane-forming canals &amp; tubules</td>
<td><strong>Agranular</strong> (smooth) ER metabolizes nonpolar compounds &amp; stores Ca$^{2+}$ in striated muscle cells; <strong>granular</strong> (rough) ER assists in protein synthesis</td>
</tr>
<tr>
<td>Ribosomes</td>
<td>Granular particles composed of protein &amp;</td>
<td>Synthesize proteins</td>
</tr>
<tr>
<td></td>
<td>Golgi complex</td>
<td>Mitochondria</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Cluster of flattened membranous sacs</td>
<td>Membranous sacs folded inner partitions</td>
</tr>
<tr>
<td></td>
<td>Synthesizes carbohydrates &amp; packages molecules for secretion. Secretes lipids &amp; glycoproteins</td>
<td>Release energy from food molecules &amp; transform energy into usable ATP</td>
</tr>
</tbody>
</table>

4 / post test ;-

Complete the following scentnces ;-

1- ....................... atom combain to form molecules .

2-___________ Granular particles composed of protein & RNA.

**Note**  Chick your answers in key answer  next page.

6/ Key answer ;-
(2) degree each

1- Pre test:-
   1-a
   2-b

(2) degree each

2-post test:-
   1-chemical level
   2-ribosome
First second unit

Introduction to hematology

1/ Overview

1 / A – Target population :-

For students of first class
Technical Institute
Department of pharmacology
Hematology

1 / B – Rationale :-

The study of blood and blood diseases is very important subject to be studied in order to have a good and a useful background for the student which helps them to understand what is blood and what are the main component and functions of it.

1 / C – Central Idea :-
Introduction to hematology

1 - Definition

2 –Composition of blood

3- Functions of blood

1/ D –Instructions:-

5. Study over view thoroughly.

6. Identify the goal of this modular unit.

7. Do the pre test and if you :
   • get 9 or more you do not need to proceed.
   • get less than 9 you have to study this modular unit well.

8. After studying the text of this modular unit ,do the post test , and if you :
   • get 9 or more , so go on studying modular unit three.
   • get less than 9 , go back and study the second modular unit ; or any part of it ; again and then do the post test again.

2/ Performance Objectives :-

After studying the first modular unit , the student will be able to:-

3- Know what is hematology.

4- Know the composition of blood.
3/ Pre test :-

Circle the correct answer ;- 

3- Hematology is the study of :-

a- blood formation  b- blood composition 
c- blood diseases  d- all of them

4- The formed elements of the blood constitutes ;- 

a- 99%  b- 45% 
c- 55%  d- 50%

5- One of the following is not a blood function ;- 

a- transport oxygen  b- fighting infection 
c- carry the products of digestion  d- regulates electrolyts

4-The serum contains the following blood proteins ;- 

a- Albumin +globulin  b- fibrinogen +globulin 
b- Albumin +fibrinogen+globulin  c- fibrinogen + globulin

4/ the text:-
**Hematology:**

Is the science that study the formation, composition, functions, and diseases of the blood.

**Composition of blood:** The total blood volume in adult is about (6) liters or (7-8 %) liters of the body weight.

The blood composed of:

1. Formed elements (45%):- Red blood cells, White blood cells, and platelets.

2. The plasma (55%):- It is the fluid portion of the blood.

   Approximately 90% of plasma is water. The remaining 10% is composed of protein [albumin, Globulin, and fibrinogen], Carbohydrates, vitamins, hormones, enzymes, Lipids and salts.

**Functions of the blood:** The blood is a transporting system as it circulates through the body, it has the following functions.

1. Transport oxygen from lungs to the tissues and CO₂ from tissues to the lungs.
2. Carry the products of digestion from the intestine to various tissues of the bodies.
3. Transport substances produced in various organs to other tissues for use.
4. Cellular elements of the blood help in fighting infections or aid in blood coagulation.
5. Waste products from tissues are picked up by the blood to be excreted through the skin and kidneys.

**Serum:** is the liquid portion expressed from the blood after it allowed to clot with adding anti coagulant. So it differ from
plasma in loss of fibrinogen which was utilize to form fibrin thread of the blood clot.
4 / post test ;- 

Complete the following sentences ;- 

1- The total blood volume in adult is----------

2- The blood is a ---------------- system

3- The liquid portion expressed from the blood after it allowed to clot is called----------------

4- The main function of white blood cells is------

5- The main function of the platelets is ----------

Note: Chick your answers in key answer next page.
6/ Key answer ;- 

(2) degree each 

2- Pre test:- 
  1-d 
  2-b 
  3-d 
  4-a 

(2) degree each 

2-post test:- 
  1-6 liter 
  2-transport system 
  3-serum 
  4-defence 
  5-prevention of blood loss
Third modular unit

Normal Red Blood Cell (RBC)

1/A - Target population :-

For students of first class
Technical Institute
Department of pharmacology
Hematology
1/ B –Rationale :-

This modular unit will give the students a wide knowledge about normal red blood cells.

1/ C –Central Idea :-

1- Erythropoiesis , substances needed for erythropoiesis.
2- Erythropoitein hormone, functions , factors affecting.
3- The kinetics of erythropoiesis,
4- Steps of erythropoiesis.
5- RBC , membrane structure , function

1/ D –Instructions:-

1. Study overview thoroughly.
2. Identify the goal of this modular unit.
3. Do the pre test and if you :-
   - get 9 or more you do not need to proceed.
   - get less than 9 you have to study this modular unit well.
4. After studying the text of this modular unit, do the post test, and if you :-
   - get 9 or more, so go on studying modular unit three.
   - get less than 9, go back and study the second modular unit; or any part of it; again and then do the post test again.
2/ performans objectives :-

After studying the third modular unit, the student will be able to :-

1- Know what is erythropoiesis.
2- Know erythropoietic cells.
3- Kinetic of erythropoiesis.
4- Know the shape, structure and functions of RBC.

3/ pre test :-

Enumerate :-

1- The substances needed for erythropoiesis.
2- The erythropoietic cells.
3- The factors that increase erythropoietin production.
4- The functions of RBC.
Erythropoiesis:
The process of red blood cell production.

Substances needed for erythropoiesis:
1- Metals: Iron, Manganese, Cobalt.
2- Vitamines: Vit B12, Folate, Vit C, Vit E, Vit B6 (pyridoxine), Thiamine, riboflavine, Pantothenic acid.
3- Amino acids.
4- Hormones.

Erythropoietin: a hormone that regulates erythropoietic activity. It is a heat stable glycoprotein, 90% of it is produced in the peritubular interstitial cells of the kidney, by renal factor erythrogeninon on plasma α2 globin substrate, and 10% in the liver and elsewhere. The stimulus for to erythropoietin production is the (O₂) tension in the tissues of the kidney.

Function of erythropoietin:
1- Controls the rate at which the erythropoietin sensitive marrow stem cells give rise to pro normoblasts.
2- Increase hemoglobin synthesis in the red blood cell precursors.
3- Decreasing the maturation time of red blood cell precursors.
4- Releasing marrow reticulocytes in to the peripheral blood at an earlier stage than normal.

Factors affecting erythropoietin production:-
- Increase production: 1- Hypoxia. 2- Anaemia. 3- Renal diseases.
  4- Drugs ex. Androgen, cobalt .. 5- Tumors.
- Decrease production : 1- Renal failure . 2- Secondary anemia of chronic Diseases

The kinetics of erythropoiesis :-
Inman the time required for erythropoiesis to proceed from undifferentiated stem cell to the reticulocytes is about (7) days and the final maturation time of these cells in the peripheral blood and spleen takes about (24) hours.
The erythrocytes circulates on average for (120) days[ Life span of RBC ], after which they are destroyed in the spleen.

Steps of erythropoiesis ( erythropoietic cells ) :-
1- Rubriblast [ pronormoblast ]
   It is 14-18 µm in diameter, dark blue basophilic cytoplasm due to the presence of large amount of ribonucleic acid (RNA) and protein synthesis, central relatively large nucleus round or oval reddish purple in color with fine chromatin, with one or two nucioli.

2- Basophilic normoblast [ prorubicyte ] :-
It is 10-15 µm in diameter, the cytoplasm is basophilic, with relatively large round or oval nucleus, with coarser chromatin than the previous stage, usually no nucleoli.

3-Poly chromatophilic normoblast [rubricyte]:

It is 8-14 µm in diameter, the cytoplasm is blue grey to pink grey, due to start of Hb production, round smaller nucleus, with more condensed coarse clumped chromatin, stain deep blue purple.

4-Orthochromic normoblast [metarubricyte]:

It is 7-10 µm in diameter, pinker cytoplasm, larger amount. Picnotic nucleus homogenous blue black mass with no structure. This is the main differences between the rubricyte and the metarubricyte. At the end of this stage the nucleus extrude.

5- Reticulocyte:

Reticulocyte same or slightly larger than mature RBC, pink or slightly pinkish grey cytoplasm, contains fine basophilic reticulum of ribosomal RNA and it is still able to synthesize Hb. Nucleus not present. This cell spend 1-2 days in the marrow, and also circulates in the peripheral blood for 1-2 days before maturing mainly in the spleen. The normal percentage of reticulocytes in circulating blood is 1-2% only.
It can be used as a clinical index in blood for erythropoietic activity of bone marrow, If the number of reticulocytes over 2% the bone marrow is hyper active, but if the number is less than 1% it is hypo active.
In the peripheral blood we see only reticulocytes and mature RBC.

6- Red blood cell [Erythrocyte, Normocytes]:
   It is non nucleated bicocave disc 6.7-8 µm in diameter, pink in color, paler at the center than the periphery. [normal RBC]

The biconcave shape of the RBC have the following benefits:
1- It allows the RBC to have the maximum membrane surface area for its size, which facilitate the transfer of gases in and out of the cell.
2- It enable the red cells to change its shape which is necessary for its travel through micro vessels.

RBC count:
   Adult male: 5,200,000 ± 300,000 cell/mm³.
   Females: 4,700,000±300,000 cell/mm³.
Babies (♀ and ♂) :- 6-7 millions/mm³ of blood due to hypoxic Condition.

**RBC membrane :-**

It is a bi polar lipid layer, integral membrane proteins, and a membrane skeleton. About 50% of the membrane is protein, 40% is fat, 10% is carbohydrates. Carbohydrates occur only on the external surface, while proteins are either peripheral or integral penetrating the bipolar lipid layer.

The membrane skeleton is formed by structural proteins that include α and β Spectrin, ankyrin, and actin. They are important in maintaining the biconcave shape of the RBC. Defects of the proteins may explain some of the abnormalities of the shape of the RBC membrane, e.g. hereditary Spherocytosis, and elliptocytosis. Acquired or congenital abnormalities in plasma cholesterol or phospholipid may be associated with other membrane abnormalities, e.g. target cells and acanthocytes.

The membrane contains enzymes and surface antigens.

**RBC function :-** It contain Hb which Supply Oxygen to the tissues, and remove carbon dioxide from the tissues.
5/ Post test :-

Complete the following sentences :-
1- The shape of RBC is----------------.
2- The life span of RBC is--------.
3- The hormone that regulates RBC formation is -----.
4- The first cell in the erythroid series in the bone marrow is -------
5- The last cell in the erythroide series in the bone marrow which then passes to peripheral blood is---

Note_ Chick your answers in key answer next pages.

6-key answer :-
1- Pre test :-

- **Substances needed for erythropoiesis:-**  
  1- Metals : -Iron , Manganese, Cobalt.
  2- Vitamines : - Vit B12, Folate, Vit C, Vit E, Vit B6 (pyridoxine), Thiamine, riboflavine, Pantothenic acid.
  3- Amino acids.
  4- Hormones.

- Erythropoietic cells are: -  
  a- pronormoblast  
  b- Basophilic normoblast,  
  c- Polychromatophilic normoblast  
  d- Orthochromic normoblast  
  e- Reticulocytes

- Factors increase erythropoietin production: -  
  a- Hypoxia.  
  b- Anemia.  
  c- Renal disease

- The functions of RBC is to carry oxygen from the lungs to the tissues and carry CO₂ from the tissues to the lungs
(2) points each

2- Post test

a- Biconcave disk.
b- 120 days.
c- Erythropoietin.
d- Pronormoblast.
e- Reticulocyte.