
بسم الله الرحمن الرحيم

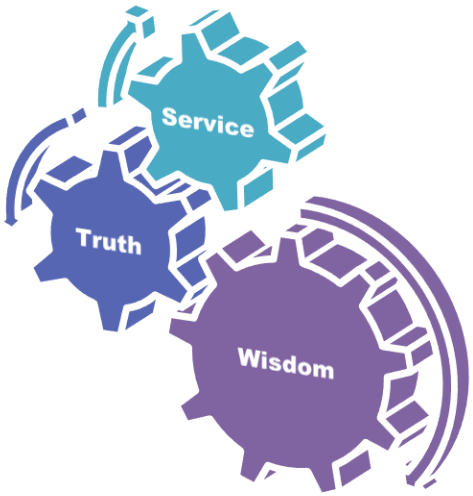
First Year MBBS (Batch 51)
MSK-1 Module
Practical/Skill lab
Determination of Hematocrit (HCT)

Dr. Ali Zain

18 April,2024

Table of Contents

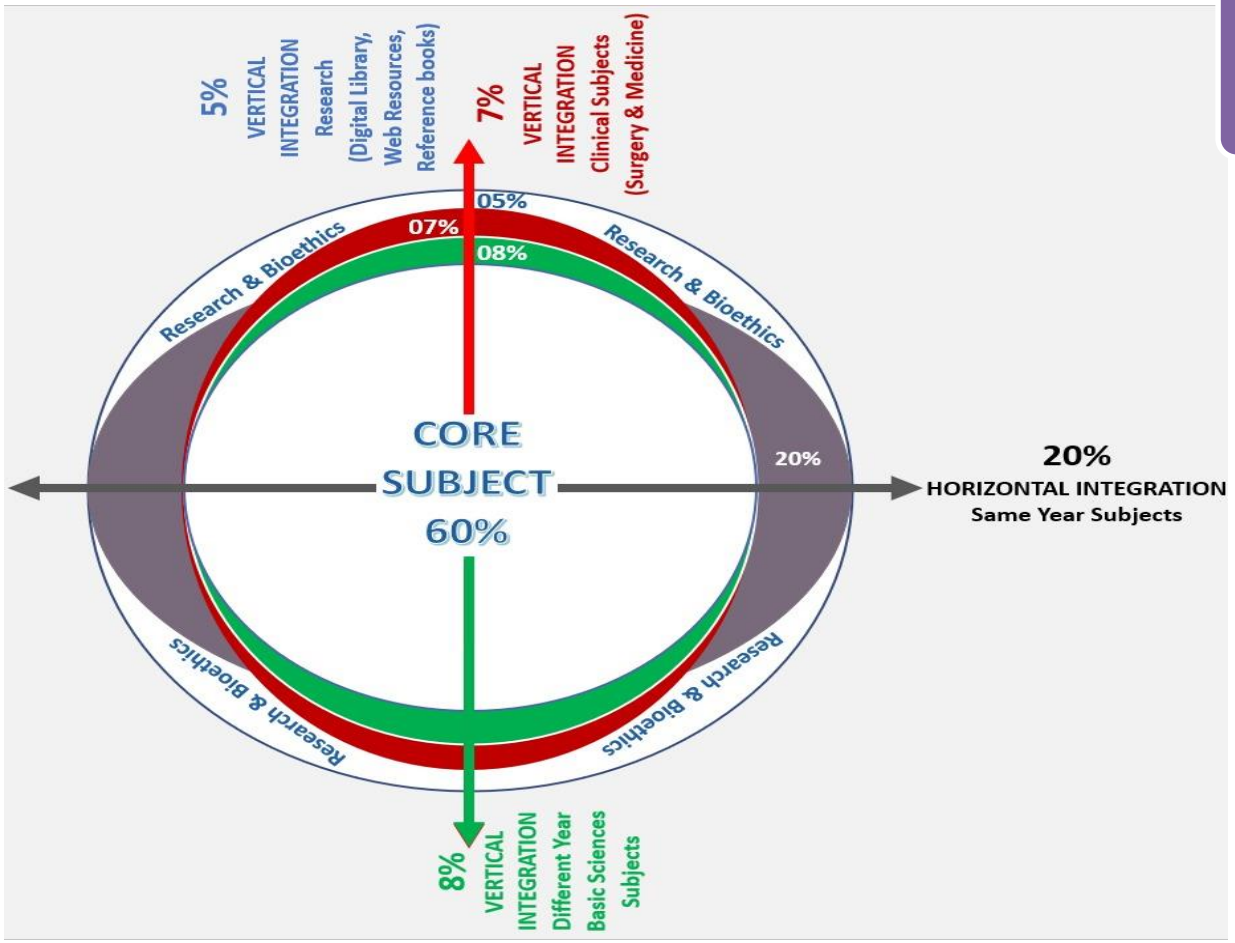
Motto



Vision; The Dream/Tomorrow

- To impart evidence based research oriented medical education
- To provide best possible patient care
- To inculcate the values of mutual respect and ethical practice of medicine

Professor Umar Model of Integrated Lecture



60% CORE SUBJECT

20% HORIZONTAL INTEGRATION
Physiology
biochemistry

8% VERTICAL INTEGRATION
Pathology
pharmacology

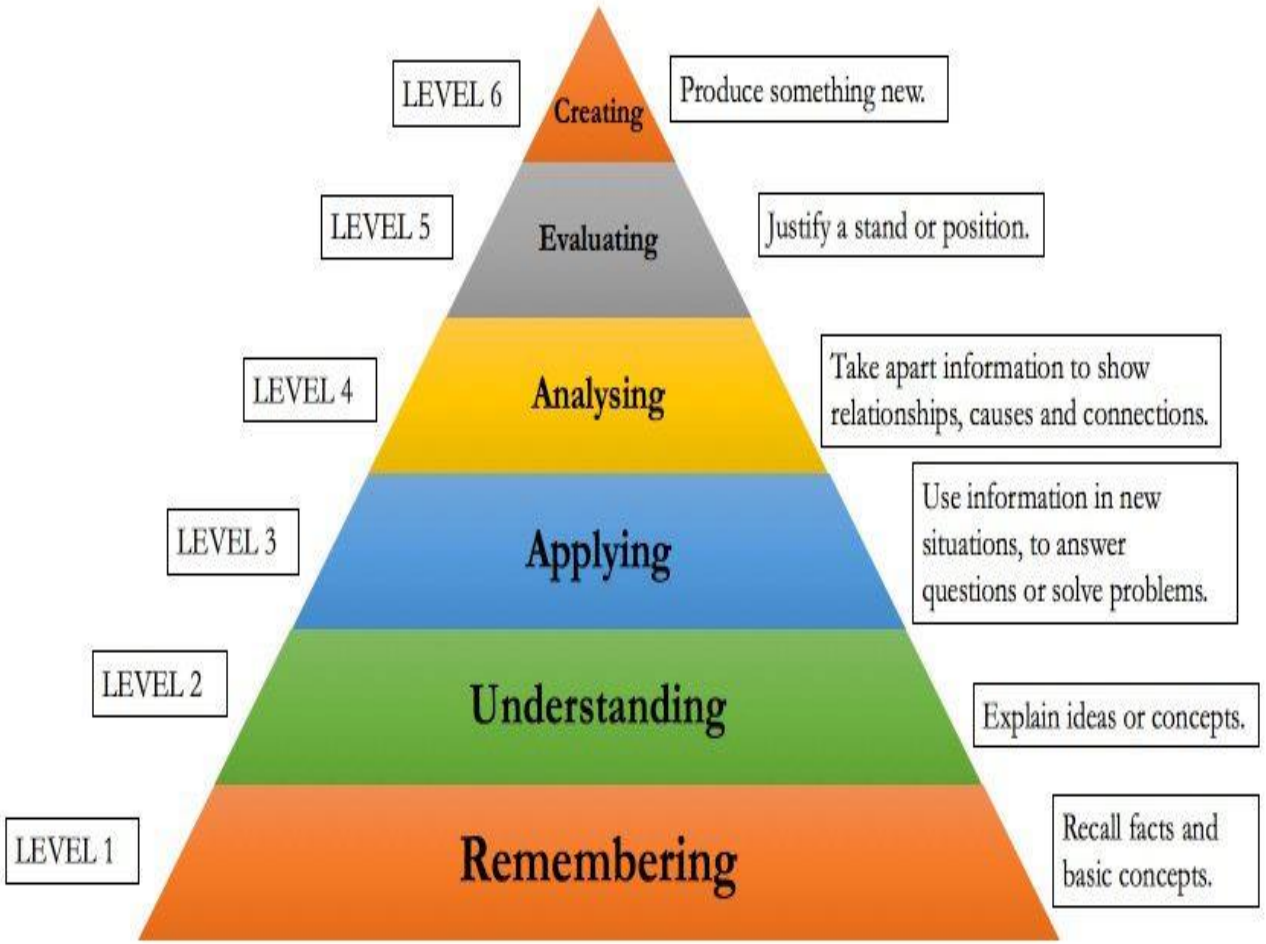
7% VERTICAL INTEGRATION
Clinical integration

5% VERTICAL INTEGRATION
Research, professionalism
Ethics
Digital library

BLOOM'S TAXONOMY : DOMAINS OF LEARNING

Sr. #	Domain of learning	Abbreviation	Levels of the domain	Meaning
1	cognition	C	C1	Recall / Remembering
2			C2	Understanding
3			C3	Applying / Problem solving
4	Psychomotor	P	P1	Imitation / copying
5			P2	Manipulation / Follows instructions
6			P3	Precision / Can perform accurately
7	Attitude	A	A1	Receiving / Learning
8			A2	Respond / Starts responding to the learned attitude
9			A3	Valuing / starts behaving according to the learned attitude

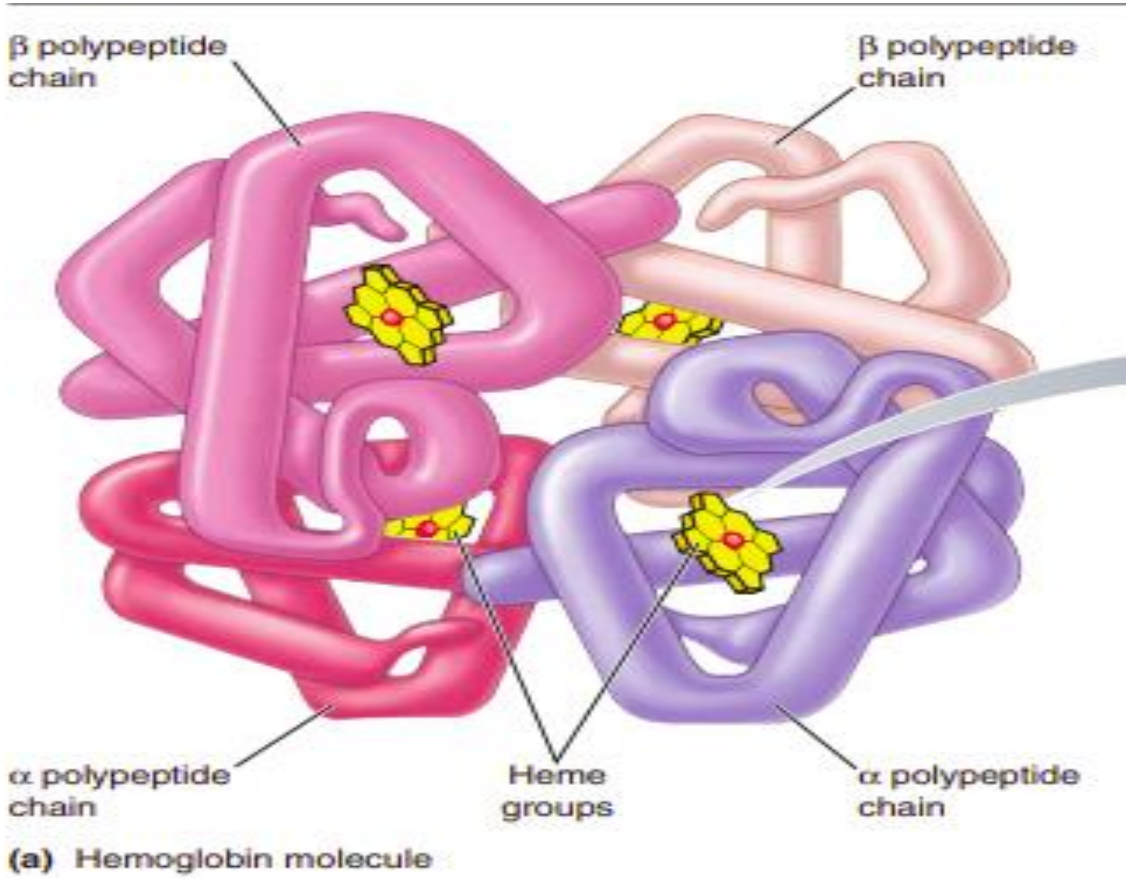
Diagrammatic Representation of Blooms Taxonomy



Learning Objectives

Sr. #	Learning Objectives	Domain of Learning
1	To determine the hematocrit	C2
2	To describe clinical importance of hematocrit	C2
3	To correlate between hematocrit and anemia	C3

Structure of Heamoglobin



(a) Hemoglobin molecule

Reference: Sherwood 9th Edition page number 38e

INTRODUCTION

- Hematocrit is defined The percentage by volume of packed red blood cells in a given sample of blood after centrifugation.
- The hematocrit may also be referred to as Packed Cell Volume (PCV) or erythrocyte volume fraction (EVF).

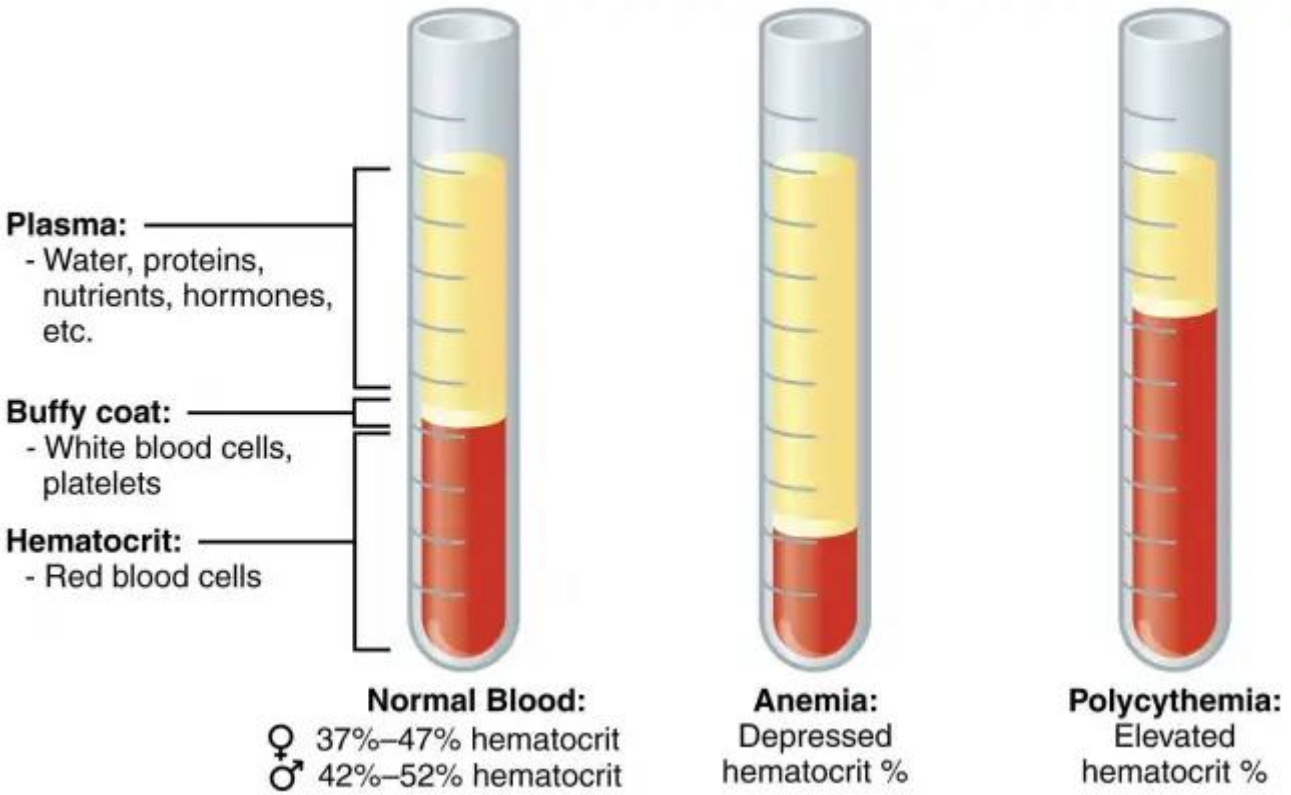
NORMAL RANGE OF HEMATOCRIT

- Normal levels of haematocrit for men range from 41% to 50%. Normal level for women is 36% to 48%.

CLINICAL IMPORTANCE OF HAEMATOCRIT

- Clinically, HCT is **used to identify anaemia and polycythaemia along with other parameters** (e.g., RBC count, Hb concentration). In anaemia, where there are fewer RBCs in the circulating blood relative to the total volume of the blood, the HCT decreases.

CLINICAL IMPORTANCE OF HAEMATOCRIT



METHODS OF DETERMINATION OF HAEMATOCRIT

Two methods:

- Microhematocrit
- Electronic cell counting

Core Knowledge

DETERMINATION OF HAEMATOCRIT BY MICROHAEMATOCRIT CENTRIFUGE

- Microhematocrit centrifuges are used for determination of volume fractions of erythrocytes (red blood cells) in blood and for separation of micro volumes of blood and solutions.

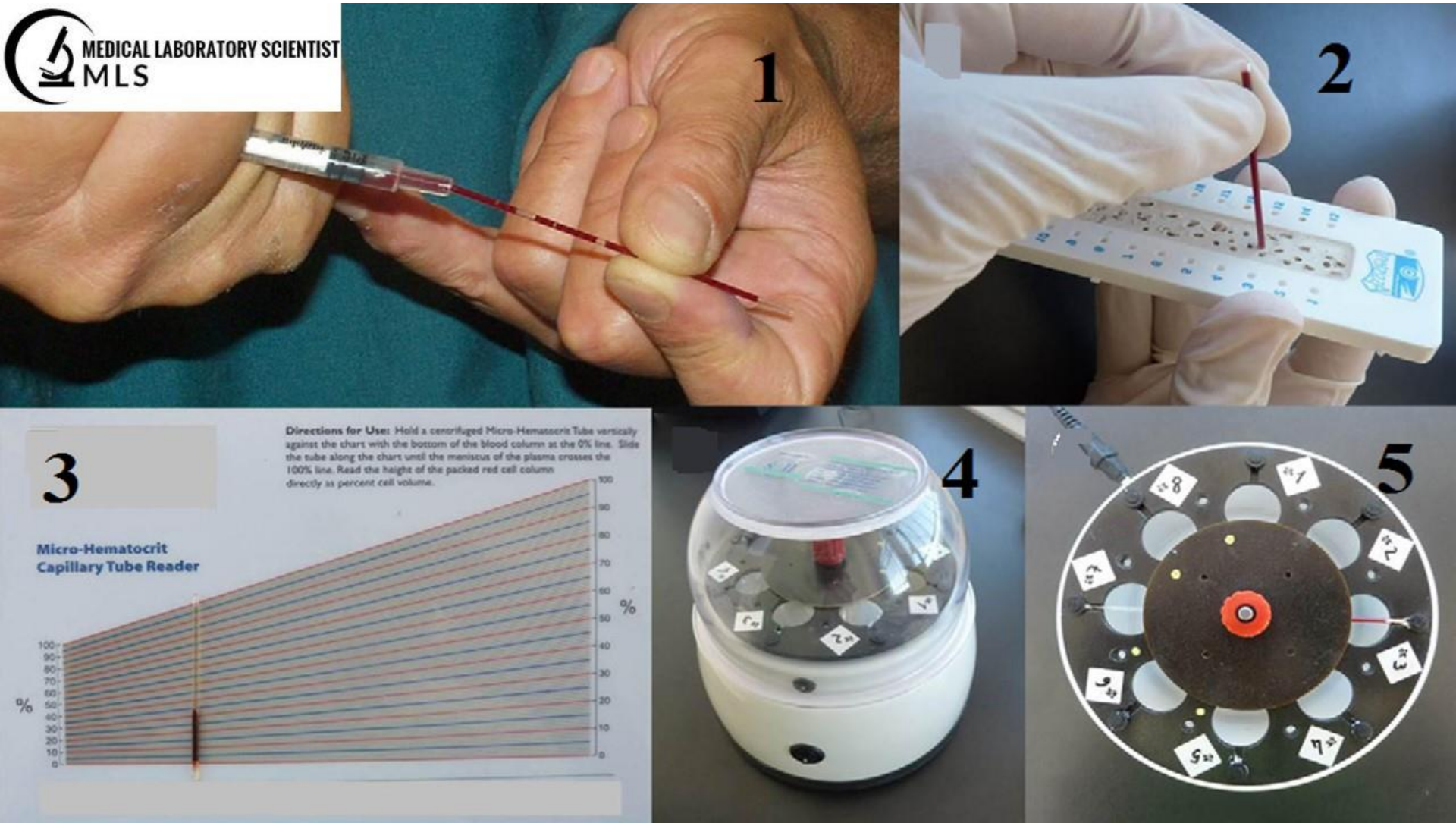
- It provides haematocrit (HCT) values.

Core Knowledge

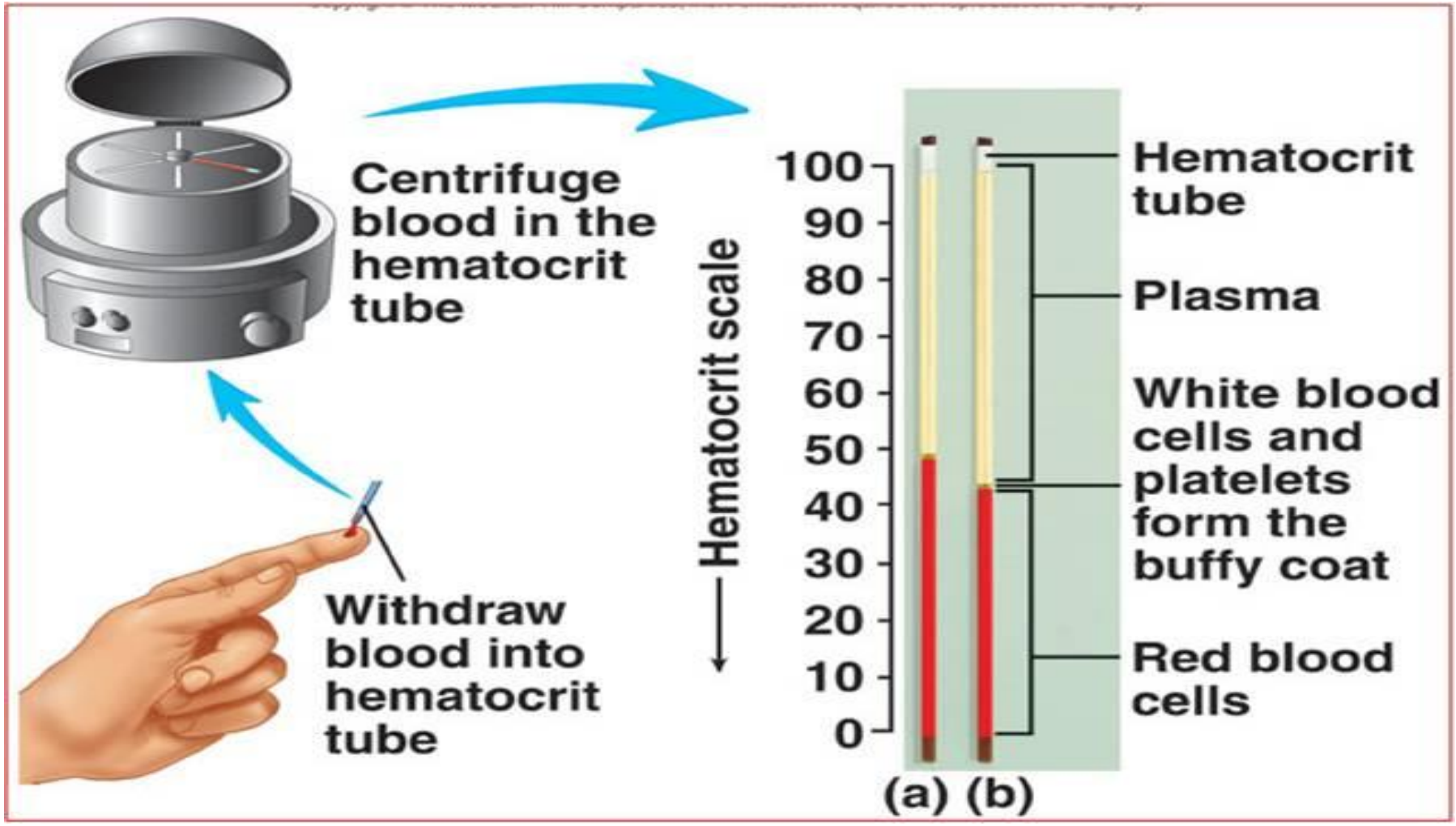
MATERIAL AND INSTRUMENTS

I. Microhematocrit tube (capillary tube) 75mm in length and 1mm in diameter which contains heparin and show a red ring at the end of the tube.
II. Microhematocrit centrifuge device.
III. Plastic seal to seal one end of Microhematocrit capillary tube.
IV. Microhematocrit reader.

MATERIAL AND INSTRUMENTS



MATERIAL AND INSTRUMENTS



PROCEDURE

1. Clean your finger with 70% alcohol and let dry.

2. Prick finger with lancet, near the tip but not too close to the nail. Prick so that blood flows freely. Try squeezing up from your wrist if blood does not flow after pricking finger.

3. Place the tip of a capillary tube onto a drop of blood on your finger.

PROCEDURE (continued)

4. Call your instructor to seal the tube.

5. The instructor will spin the tubes in a centrifuge (5 minutes at 10000 rpm).

7. Using a special reading device(since the capillary tube is not

OBSERVATIONS AND RESULTS

- Note that the blood has been separated into 3 layers:

I. A tall upper layer of clear plasma—amber slightly yellow-colored. It should not be pink or red which would indicate hemolysis of red cells in the sample or within the body in hemolytic diseases.

OBSERVATIONS AND RESULTS

(continued)

II. A greyish-white, thin layer (about 1 mm thick) the so-called “buffy layer”, consisting of platelets (thrombocytes) above and leukocytes below it.

III. A tall bottom layer of red cells which have been closely packed together. A greyish red line separates red cell layer from the layer of leukocytes above it.

OBSERVATIONS AND RESULTS

(continued)

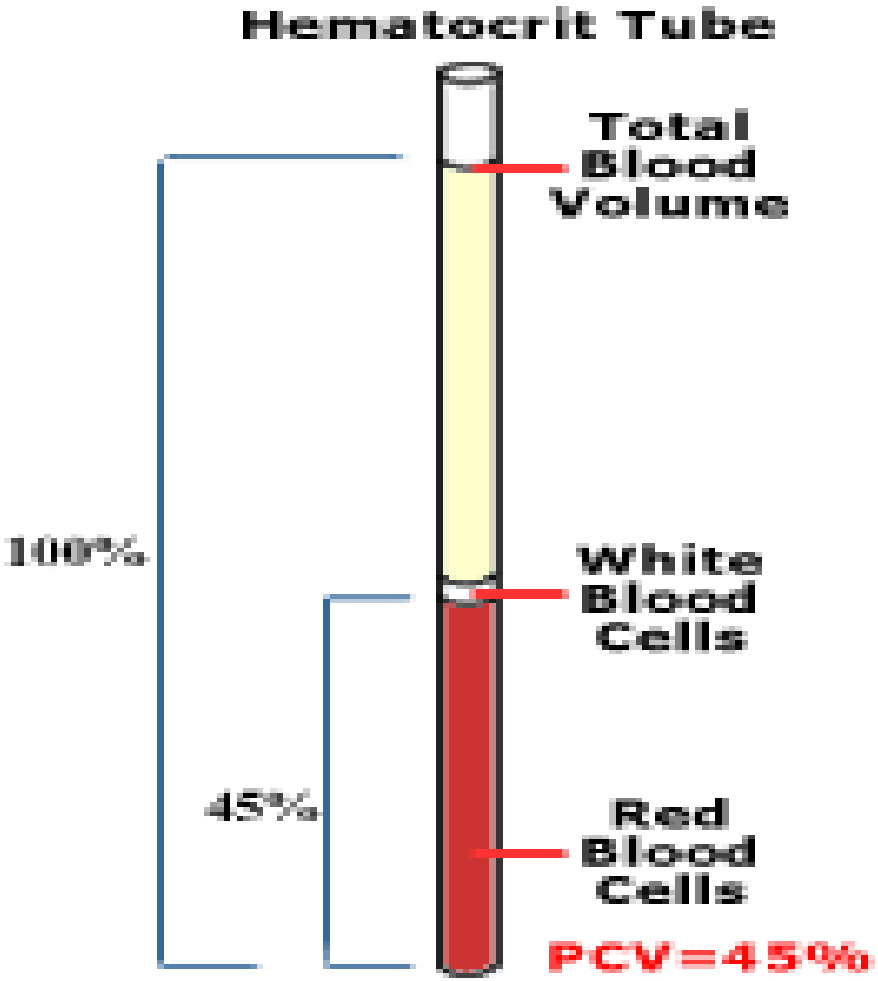
The percentage of the volume of blood occupied by the red cells constitutes hematocrit or packed cell volume.

Hct % = {Height of RBCs (mm) / Height of RBCs and plasma (mm)} × 100

For example, if the height of packed red cells is 45 mm, then
= 45/ 100 × 100 = 45 percent.

OBSERVATIONS AND RESULTS

(continued)



Core Knowledge

OBSERVATIONS AND RESULTS

(Continued)

- It also means that out of 100 volumes (or parts) of blood 45 volumes (or parts) are red cells and 55 volumes (or parts) are plasma.

- Thus, out of 1 liter of blood, 450 ml are red cells and 550 ml are plasma.

Core Knowledge

PRECAUTIONS

(Continued)

1. An increased amount of anti-coagulant decreases the Hct reading as a result of erythrocyte shrinking.

2. Improper sealing of the capillary tube causes a decreased Hct reading as a result of loss of blood during centrifugation. a higher number of erythrocytes are lost in relation to the plasma.

PRECAUTIONS

(Continued)

3. The microhematocrit centrifuge should never be forced to stop by applying pressure to the metal cover plate. This will cause the RBC layer to “sling” forward and results in a falsely elevated value.

PRECAUTIONS

(Continued)

4. The buffy coat of the specimen should not be included in the Hct reading, because its inclusion falsely elevates the result.

5. A decrease or increase in the readings may be seen if the microhematocrit reader is not used properly.

PRECAUTIONS

(Continued)

6. If too much time elapses between when the centrifuge stops and the capillary tube is removed, the red cells can begin to settle out and cause a false reading of the hematocrit.

QUESTIONS

(Continued)

Q. No. 1: What is the importance of determining haematocrit?

Answer: It is a simple but accurate test for determining the presence of anaemia or polycythaemia, as it is more accurate than the red cell count or HB. It is also employed for determining various absolute, corpuscular values. Sometimes it is used for screening for anaemia.

QUESTIONS

(Continued)

Q. No. 2: What is the normal value of haemoglobin in an adult male??

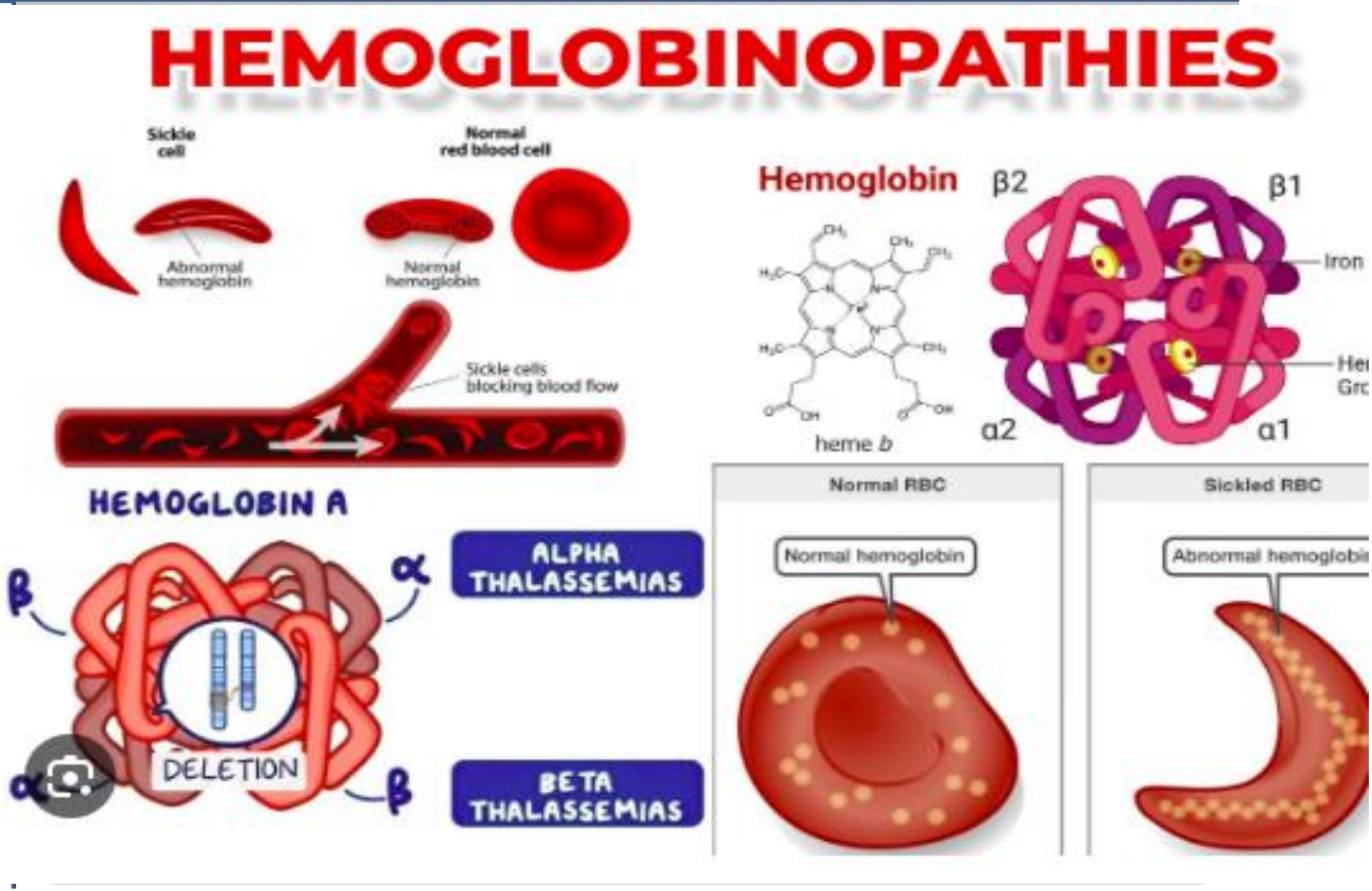
Answer: Normal results for adults vary, but in general are: Male: 13.8 to 17.2 grams per deciliter (g/dL) or 138 to 172 grams per liter (g/L)

QUESTIONS

(Continued)

Q. No. 3: What is the effect of a high haemoglobin concentration?

Answer: Increase in haemoglobin concentration increases the viscosity of blood which leads to an increase in peripheral resistance, and thus the blood pressure.



Reference: Google Image

Lesson Of The Day
Consent

Consent is the “autonomous authorization of a medical intervention by individual patients.

Relevant Case: If you want to draw sample of hospitalized patient ,you must ask from patient before sampling.

Suggested Research Article

Journal Name: diagnostics 2023

diagnostics

MDPI

Review

Applications of Artificial Intelligence in Thalassemia: A Comprehensive Review

Khaled Ferih [1,*], Basel Elsayed [1], Amgad M. Elshoeibi [1], Ahmed A. Elsabagh [1], Mohamed Elhadary [1], Ashraf Soliman [2], Mohammed Abdalgayoom [3] and Mohamed Yassin [1,3,*]

1 College of Medicine, QU Health, Qatar University, Doha P.O. Box 2713, Qatar
2 Hematology Section, Pediatrics Department, Hamad Medical Corporation (HMC), Doha P.O. Box 3050, Qatar
3 Hematology Section, Medical Oncology, National Center for Cancer Care and Research (NCCCR), Hamad Medical Corporation (HMC), Doha P.O. Box 3050, Qatar
* Correspondence: kf1800857@qu.edu.qa (K.F.); yassinmoha@gmail.com (M.Y.)

Abstract: Thalassemia is an autosomal recessive genetic disorder that affects the beta or alpha subunits of the hemoglobin structure. Thalassemia is classified as a hypochromic microcytic anemia and a definitive diagnosis of thalassemia is made by genetic testing of the alpha and beta genes. Thalassemia carries similar features to the other diseases that lead to microcytic hypochromic anemia, particularly iron deficiency anemia (IDA). Therefore, distinguishing between thalassemia and other causes of microcytic anemia is important to help in the treatment of the patients. Different indices and algorithms are used based on the complete blood count (CBC) parameters to diagnose thalassemia. In this article, we review how effective artificial intelligence is in aiding in the diagnosis and classification of thalassemia.

Keywords: artificial intelligence; thalassemia; diagnosis; B-thalassemia; iron deficiency anemia

Reference: https://link.springer.com/article/10.1007

Crux of Suggested Research Article

- Different indices and algorithms are used based on the complete blood count (CBC) parameters to diagnose thalassemia.
- In this article, we review how effective artificial intelligence is in aiding in the diagnosis and classification of thalassemia.

REFERENCES

1. Books:

- Guyton And Hall textbook of Medical Physiology 14th Edition
- Ganong's Review of Medical Physiology 25th Edition
- Sherwood, 9th edition.
- Silverthorn Physiology,6th edition
- Vander's Human Physiology,14th edition
- Google images.

2.Medical Journal articles:

Reference: https://link.springer.com/article/10.1007

3.Video link /youtube:

https://youtu.be/JtBtk00EiVM?si=y-2DAPW49eQwqU6N


Thank
you