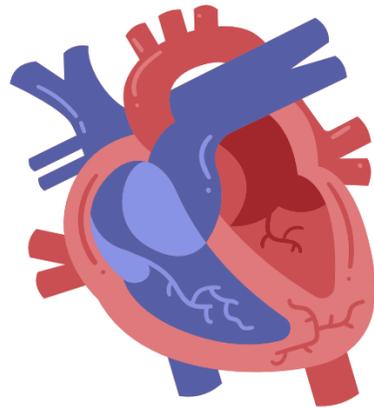
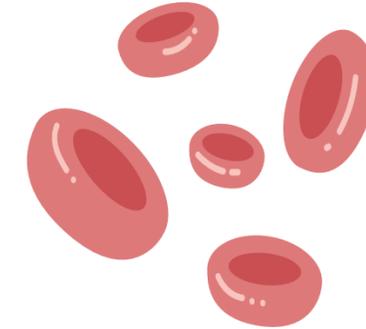




جمهورية العراق
وزارة التعليم العالي والبحث العلمي
جامعة المستقبل
كلية التقنية الطبية والصحية
قسم تقنيات المختبرات الطبية



Practical Hematology / 3rd stage ology



Rusul Mushtaq Talib Al-Muhammadawi

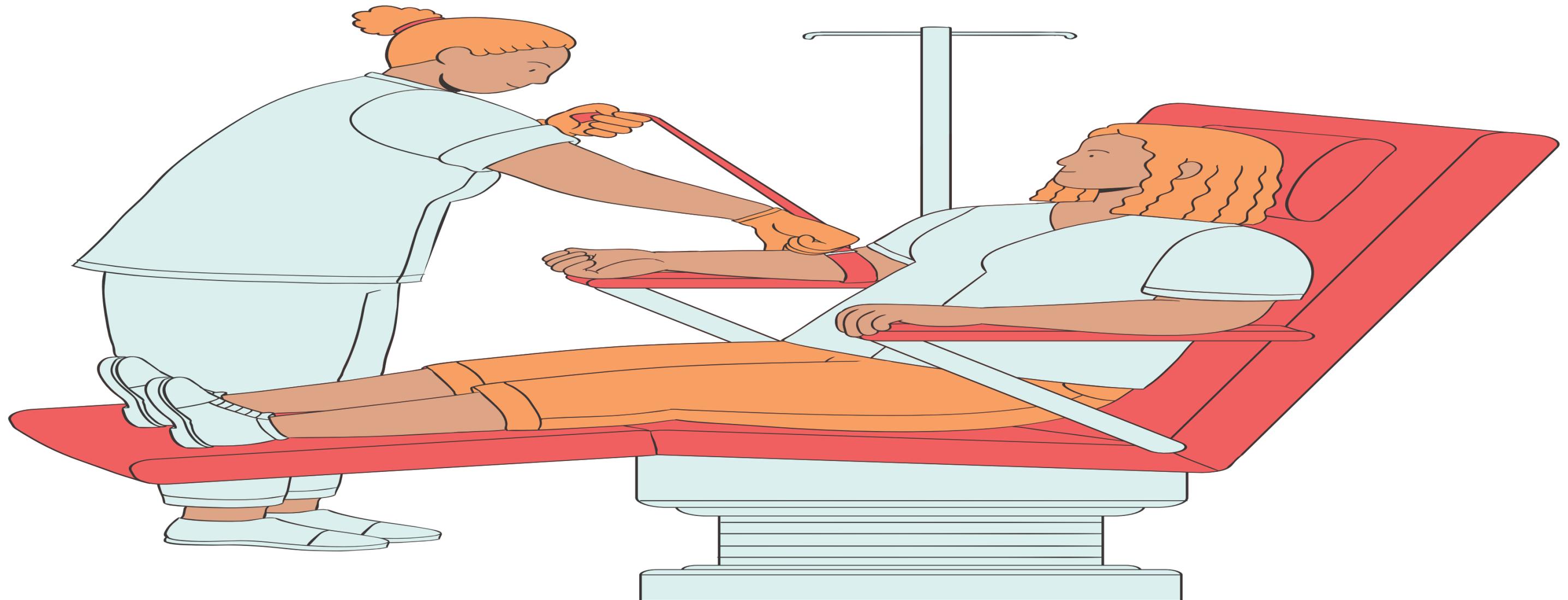
[Classroom](#)

<https://classroom.google.com/c/ODA3NDIxNzE5>

[Mzkz](#)

Class code
cfldolyf

Lecture 5-6: Manual And Automated Red Blood Cell (Rbc's) Count And Rbcs Indices

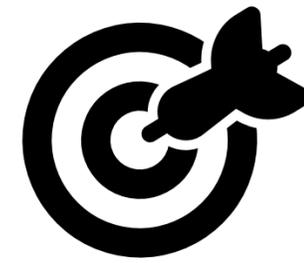


General Objective



- 1. Understand the principles of manual and automated RBC counting.**
- 2. Learn the main RBC indices (MCV, MCH, MCHC, RDW) and their clinical use.**
- 3. Use CBC results and RBC indices to classify and interpret types of anemia.**

behavioral Objectives



By the end of the lecture, the student should be able to:

Understand RBC count and RBC indices.

Distinguish anemia types using indices.

Interpret RBC-related CBC results.

Psychomotor Objectives

Perform manual RBC count.

Use automated analyzers.

Calculate RBC indices.

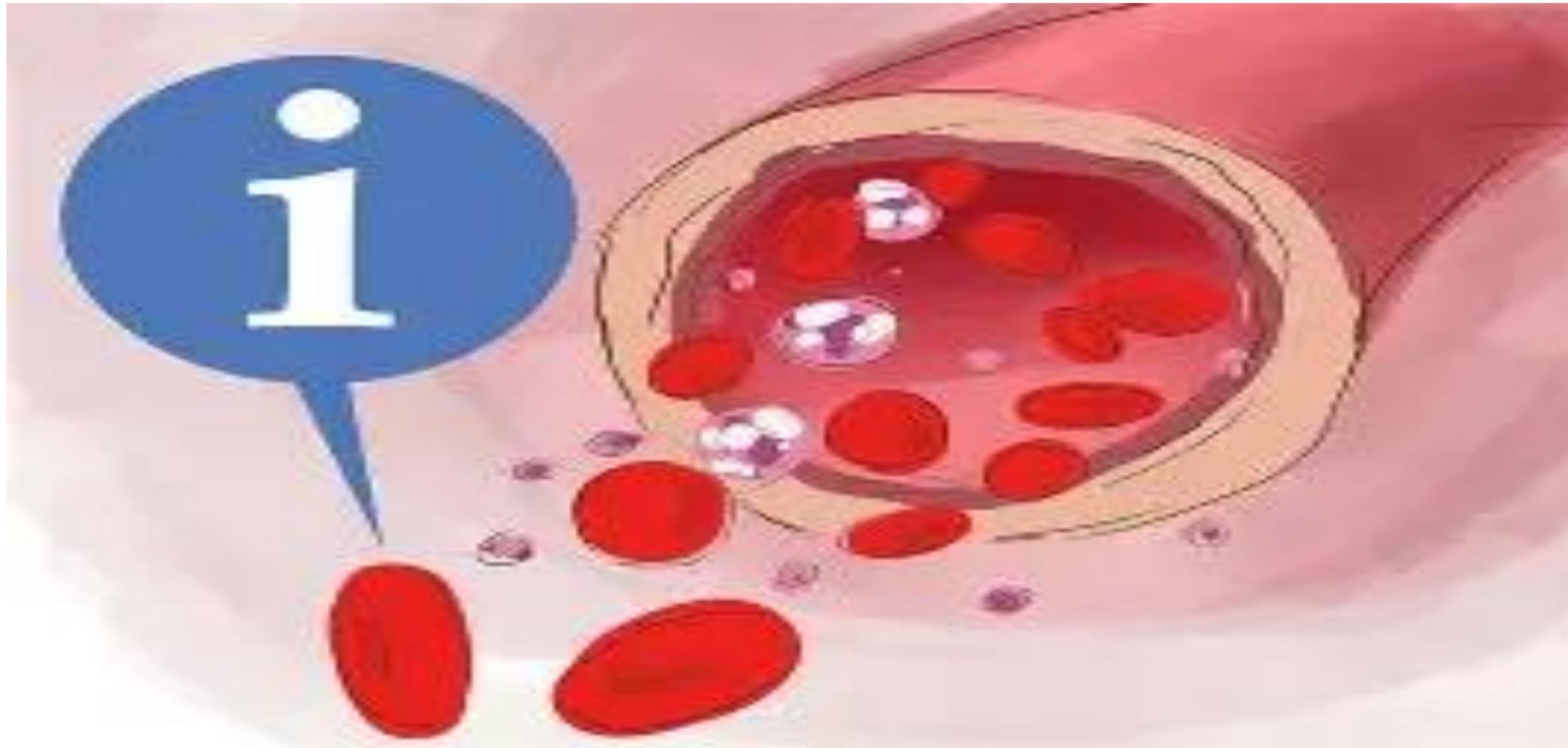
Affective Objectives

Commit to quality control.

Handle samples responsibly.

Work cooperatively in the lab.

Lecture 6: Manual and automated Red Blood Cell (RBC's) COUNT

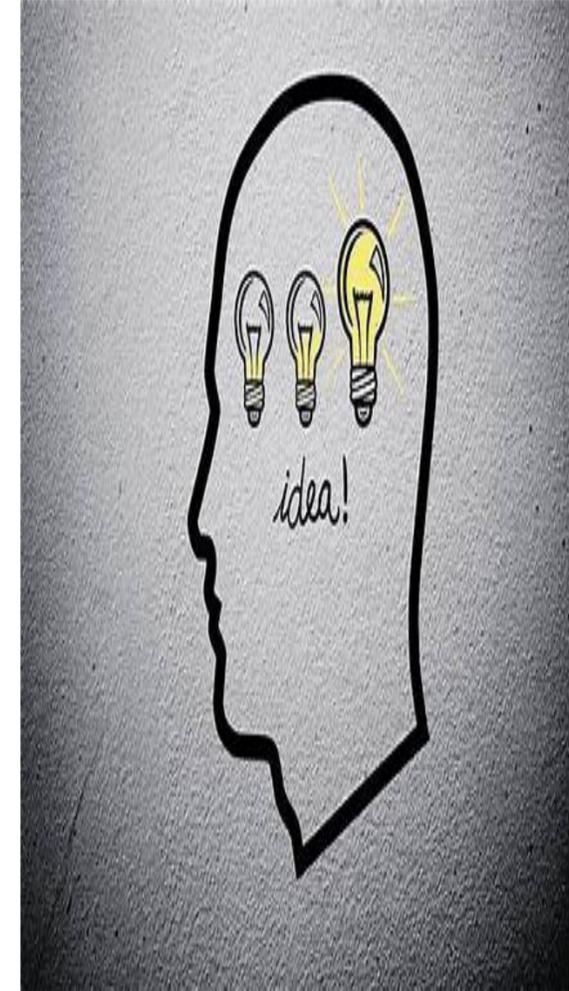


Question (Individual Activity):

2 minutes.

Why is the RBC count one of the first tests performed when evaluating a patient's condition?

**لماذا يُعدّ (RBC) من أولى الفحوصات التي تُجرى
دّكريات الدم الحمراء عند تقييم حالة المريض؟**



The image features several red blood cells, depicted as red, biconcave discs, scattered around the central text. The cells are rendered with a slight 3D effect, showing a darker red center and a lighter red outer rim. The central text is highlighted with a yellow, torn-edge background.

Introduction:

The count of red blood cells, is the number of red counting

:

blood cells in mm³ of whole blood.

RBC count - Normal Values:

- Men: 4.5-6.2 x 10⁶/mm³**
- Women: 4.0-5.5 x 10⁶/mm³**
- at birth: 4.0-6.0 × 10⁶/mm³**
- 3 years – 10 years: 4.0-5.0 x 10⁶/mm³**

The RBC counting performed by:

- 1. Manually by Heamocytometer**
- 2. The blood cells automatic analyzer (Part of CBC; group of tests)**

Importance OF RBCS counting:

RBCs count less or more than normal, it is a screen test for anemia or polycythemia

- 1. Rbc count using Haemocytometer

- Materials:

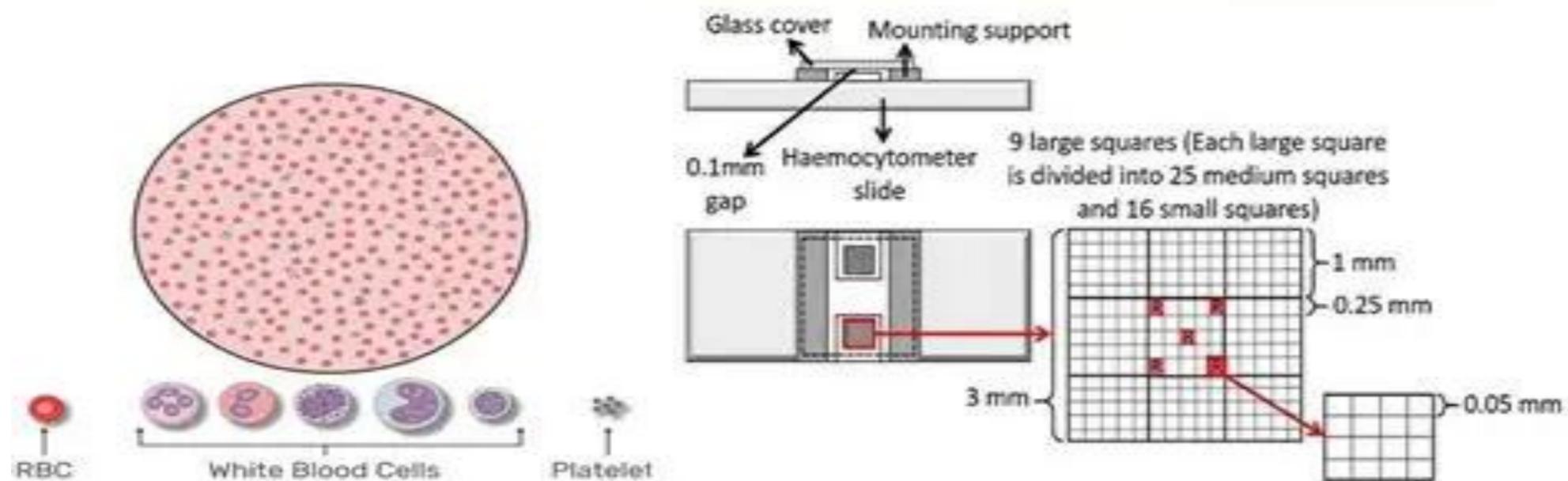
- Venous blood mixing with **EDTA** or capillary blood with heparin**
- Improved **Neubauer's counting chamber with Coverslips****
- RBC pipette and RBC **Diluting solution** (Hayem's Fluid), the**
- **Purpose of this fluid: its **isotonic solution** diluted blood, prevent****
- **lysis and blood sedimentation)****
- Compound Microscope**

Principle

- **Principle:** The blood is **diluted 200 times** with RBCs diluting fluid
- (1\200) in practice (**20ul blood and 4 ml dilution**).

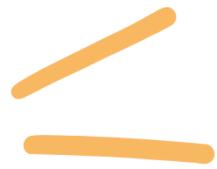


Total RBC Count Method





Method:



Procedure:

- 1. Draw blood by micropipette 20 ul.**
- 2. Mix the blood with diluting fluid 4ml.**
- 3. Mix the contents in glass tube for 2 min.**
- 4. Introducing the sample into the Neubauer chamber (10ul from mixture).**
- 5. To count the RBCs the microscope must be switched to 40X objective**
- 6. Count RBCs from R marked 5 squares**
- 7. Rbcs count in*10.000 cells of blood**

Individual Activity

What happens if the blood sample is not mixed well with the diluting fluid?

ماذا يحدث إذا لم يتم خلط عينة الدم جيداً مع محلول التخفيف؟

Why do we count RBCs in only 5 R-marked squares instead the entire grid?

لماذا نعد كريات الدم الحمراء في 5 مربعات فقط المعلّمة بـ R بدلاً من عدّ الشبكة بأكملها؟



2 minutes.

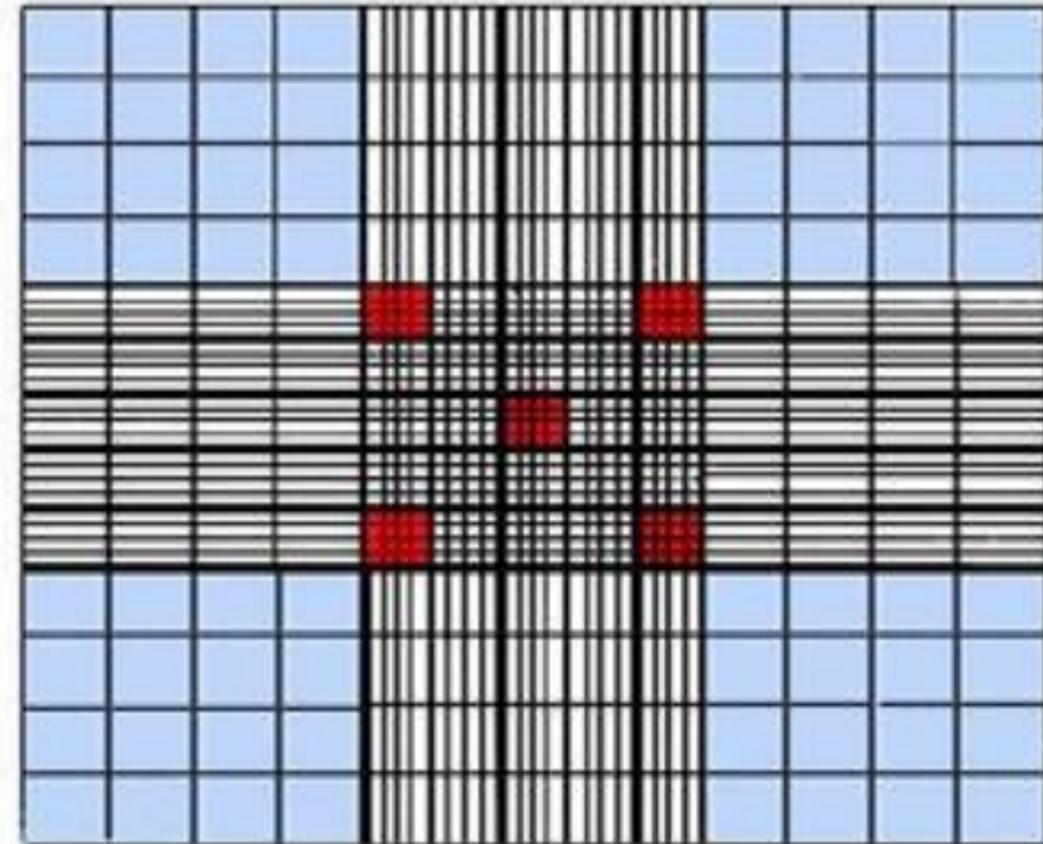
Calculation:

$$\text{Count (/l)} = \frac{\text{No. of the counted cells.}}{\text{Volume of the blood (}\mu\text{l)}} \times \text{dilution} \times 10^6.$$

$$\text{Count (/l)} = \frac{N}{0.02} \times 200 \times 10^6 / \text{l}.$$

$$\text{Number of red cells count / l} = N \times 10,000$$

■ areas of the grid where WBC are counted



■ areas of the grid where RBC are counted

Discussion

Why does the number of RBCs differ between males and females?

How do age, physical activity, and nutrition influence RBC count?



Causes of decreased RBC count:

- ❑ Impaired red blood cell (RBC) production
- ❑ Increased RBC destruction (hemolytic anemia's)
- ❑ Blood loss
- ❑ Fluid overload (hemodilution)



Causes of high red blood cell count:

- ❑ High altitudes, Hypoxia, Smoking, Dehydration
- ❑ Polycythemia vera (often a hereditary problem)
- ❑ Congestive heart disease, Certain lung diseases
- ❑ Erythropoietin doping by athletes to boost their performance
- ❑ Some types of anemia has high RBC count such as β -thalassemia

Physiological effect on Rbc count:

1-age 2-sex 3-Activity 4-nutrition 5-pregnancy 6-brest feeding 7 psychological Emotions



2. Automated Red blood cell count:

Electronic counter is based on the principle of aperture impedance method.



Videos

1 minutes

4



الفيديو التوضيحي



Lecture 7: RBCs indices



Red cells indices :

- They are calculated from total red cell count, hematocrit(pcv) and hemoglobin.
- It can determined by **automated hematology** analyzer in CBC test or manual



Usefulness of RBCs Indices



- It used to help diagnose the cause **of anemia**
- These parameters are useful in classifying anemia's into **microcytic**, normocytic, **or macrocytic**; and hypochromic or normochromic..

Note:

three most used RBCs indices are the MCV, MCH and MCHC

□ They include :

1. Total red blood cells (RBC): The number of red cells is given as an absolute number per litre.

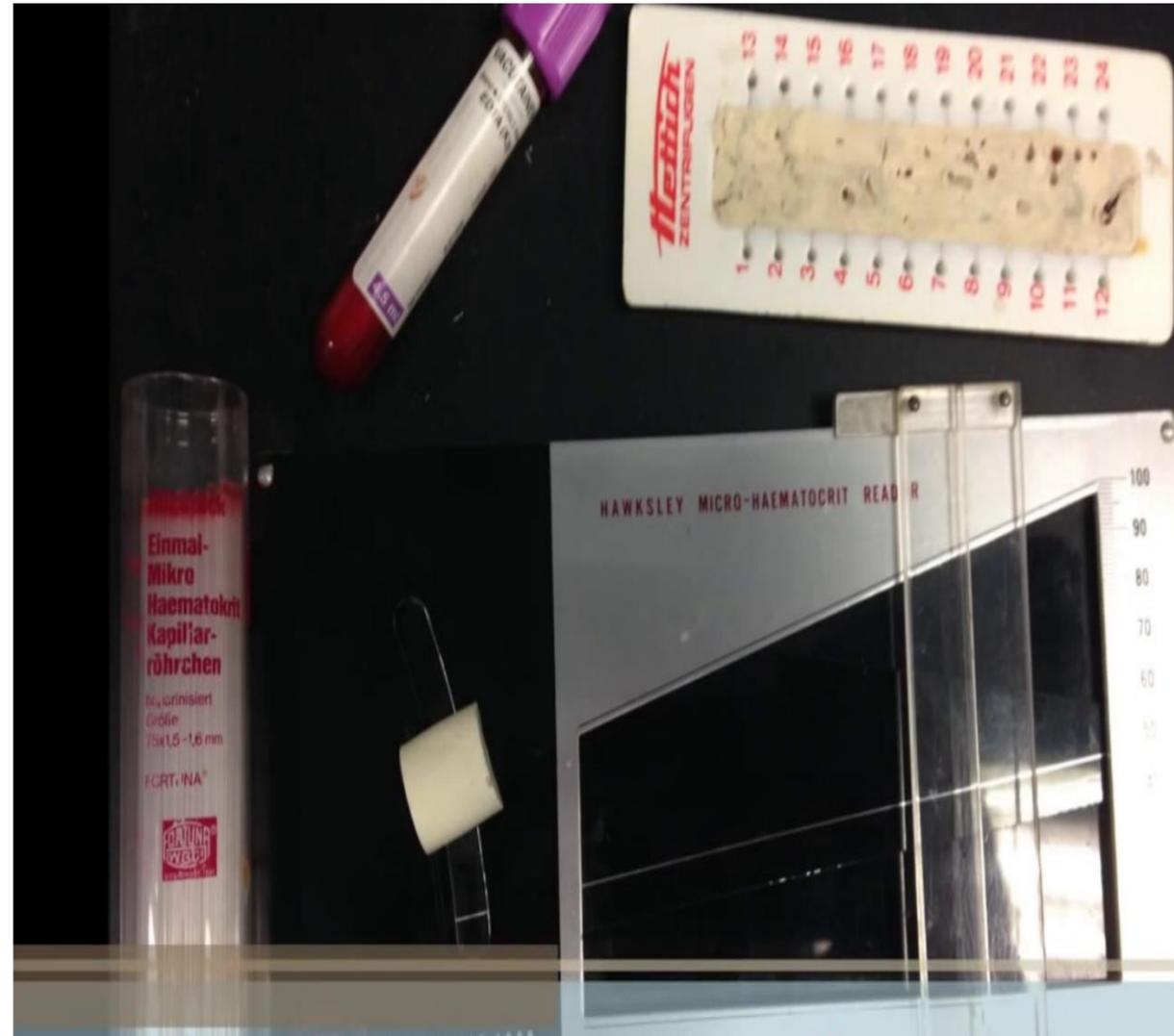
2. Hemoglobin (Hb): The amount of hemoglobin in the blood, expressed in (grams per decilitre) (d/dl). (Low hemoglobin is called anemia.)

3. Hematocrit or packed cell volume (PCV) : This is the fraction of whole blood volume that consists of red blood cells.

4. Mean corpuscular volume (MCV) : The average volume of the single red cell.

5. Mean corpuscular hemoglobin (MCH) : The average amount (or weight) of hemoglobin per single red blood cell.

Tools



Note:

6. Mean corpuscular hemoglobin concentration (MCHC): The average concentration (or weight) of hemoglobin inside all the red blood cells. It correlates with the degree of hemoglobinization of the red cells on the peripheral blood film.

7. Red blood cell distribution width (RDW): A measure of the variation of the RBC population.

RBC indices

RBCs indices		Unit	Normal range	usefulness
MCV	$\mathbf{Mcv} = \frac{hct}{rbc} \times 10$	Femtoliter fl	80-100 fl	MCV increased in macrocytic anemia and decreased in microcytic anemia like IDA and thalassaemia
MCH	$\mathbf{MCH} = \frac{Hb}{rbc} \times 10$	Picogram pg	27_32 pg	MCH increased in macrocytic anemia and decreased in microcytic anemia like IDA and thalassaemia
MCHC	$\mathbf{MCH} = \frac{Hb}{pcv} \times 100$ <i>Hb g/dl</i> OR $\mathbf{MCH} = \frac{MCH\ pg}{MCV\ fl} \times 100$	Percentage Or g/dl or g/l	32_36 g/dl or percentage	MCHC is useful guide to measure the degree of hypochromasia present in IDA

microcytic anemia than
macrocytic anemia

Used to distinguished
IDA from thalassemia

Question (Individual Activity):

4 minutes.

Why does MCV decrease in iron deficiency anemia (IDA)?

1 لماذا ينخفض MCV في فقر الدم الناتج عن نقص الحديد (IDA)؟

Why do MCH and MCV typically decrease together in microcytic anemias?

2 لماذا ينخفض كل من MCH و MCV معًا في الأنيميا الصغيرة الكريات

Why does RDW increase in iron deficiency anemia but stays normal in thalassemia trait?

لماذا يرتفع RDW في نقص الحديد بينما يبقى طبيعيًا في الثلاسيميا؟



THANK YOU!

I hope you learn something
new today!

