



Hematology



HISTOLOGY

☒ Sheet

☐ Slide

☐ Handout

Number: **1**

Subject: Histology lab

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Price:

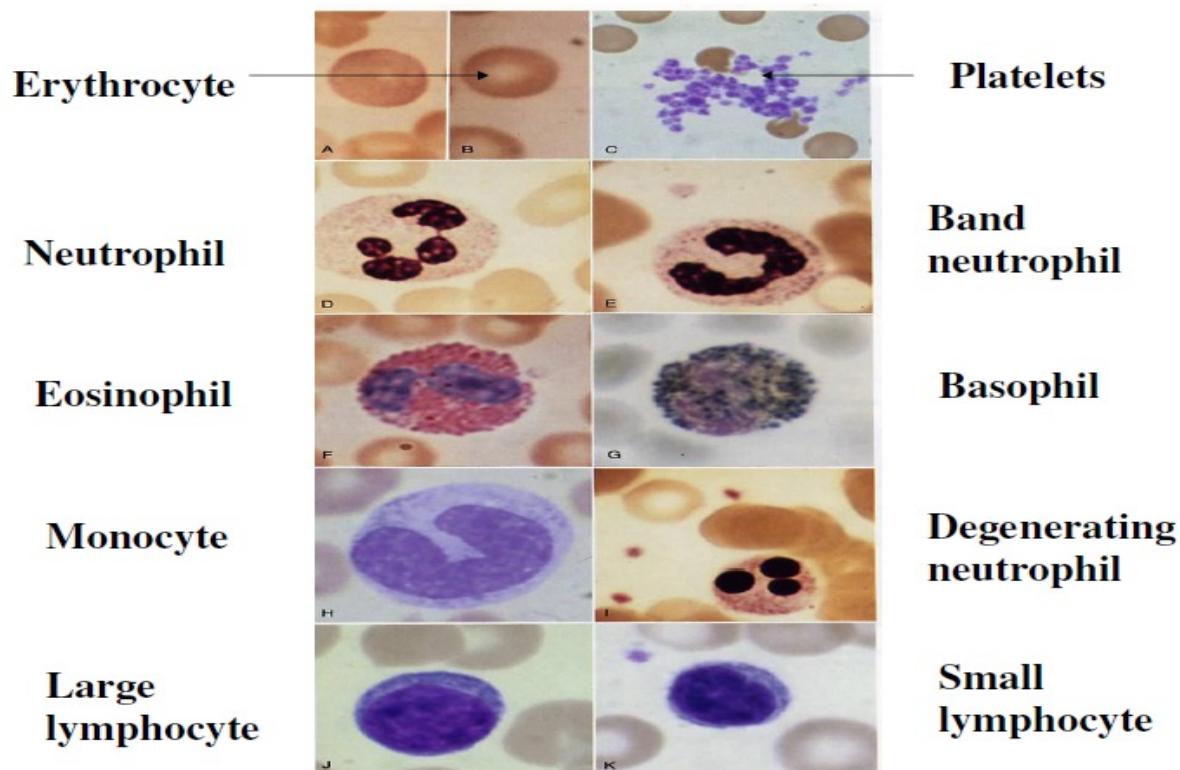
بسم الله الرحمن الرحيم

This sheet is super easy " a piece of cake literally " all the information were mentioned before so have fun ,,,,,,,

During the practical session of the exam " there will be no need to have colored pictures " and In case they are colored that will be even easier, so don't worry

THE MAIN GOAL HERE IS TO IDENTIFY THE CELL FOUND IN THE PICTURES SINCE THE REST OF INFORMATION IS ALREADY STORED IN OUR MEMORIES AS I HOPE,

The doctor used this figure to illustrate the lecture:



• Erythrocyte (RBCs) :

Shape: biconcave disk, the central part looks pale as it contains lesser amount of hemoglobin

Diameter: 7-8 μm , this number is really important since we use it to compare between cells " useful in identifying different cell types " for example the monocyte is almost 3 times bigger than RBCs (20 μm)

Total number:

Males: 4.5-6 million cell

Females: 3.5-5 million cell

The difference in numbers between males and females is related to **ANDROGENS** that stimulate erythropoiesis (the formation of RBCs).

Be careful, note: losing blood during the menstrual cycle isn't the real cause for the difference in RBCs count.

Important factors for erythropoiesis:

*erythropoietin

* folic acid

* vitamin B12

* iron

* proteins

Q: In the exam the doctor might point a cell " RBC for example " and he ask: this cell in order to be formed needs certain factors what are they?

Q: This cell how called it pass through small capillaries? remember the capillaries diameter almost 3-4 μm while the diameter of RBCs 7-8 μm

1-the biconcave shape 2- the flexibility of the cell membrane " it's fluid like" can gets smaller and bigger

Variation in size: microcytic (small cells) OR macrocytic (large cells)

The microcytic hypochromic anemia commonly is related to iron deficiency anemia.

Variation in shape: sickle cell anemia is the most common: the cells are not biconcave disk anymore instead they look like sickle (منجل)

Q: what is a reticulocyte? It's an immature RBC that is normal cell.

Q: when a reticulocyte is considered abnormal? when it's percentage in blood reach more than 1 %, this increment happens when: - Severe blood loss

- Anemia

Q: can you recognize a reticulocyte in a blood film? well, we can't as long as we use Leishman stain in the preparation. In order to recognize it we need to use brilliant crystal blue

Q: does a reticulocyte contain nucleus? No

Q: does this cell contain organelles? Yes, it contains minimal amount of organelles "mitochondria, Golgi apparatus " **what for?** to produce enzymes that are important for the maintenance of the cell membrane.

- **Platelets:**

In the lab we add one drop of blood on a slide and by using other slide we swap the drop over the first slide (in other word we simply spread it) to make a smear , we cover it using a cover slip , you will notice that platelets tends to stuck to the upper slide and most of them gather around " clumps " at the edges either at the beginning or at the end of the smear .

- Enucleated cells
- Biconvex
- Diameter: 1.5- 3.5 μm
- Counts normally for 150000 – 400000
- Contain several types of granules

Q: how is it formed? By fragmentation of megakaryocytes that already were megakaryoblast . (megakaryoblast \Rightarrow megakaryocyte \Rightarrow platelets)

If the number reaches 100000 the patient is having thrombocytopenia: high tendency of bleeding.

In physiology books they said that platelets contain 5 types of granules but here in histology it's all about 3 types:

- Alpha granules: the larger and contain mainly fibrinogen, clotting factors, platelet factor 4 and other things.
- Dense granules (Delta): contains ATP, ADP, serotonin
- Lambda granules (lysosomes) contain hydrolytic enzymes that lyses the blood clot when it forms.

****** the number of platelets is really important,

Suppose you have a patient with 110000 platelet count, you asked whether he have bleeding or not? Suppose he said no, so what is going on?

Mostly, the patient is suffering from internal bleeding (you can notice blood points "red points" beneath his skin).

STORY TIME:

A USMLE student, during the exam he have a CBC test, the platelets count was 100000, the examiner asked: what do you do to such patient?

Well, the right thing is to ask the patient whether he have been bleeding from his nose or whether he spots blood with his urine, you must as well notice the patients arms and looking for blood points.

- **Neutrophils, Band neutrophils:**

Q: By looking at the figure which one is the immature, the neutrophils or the band neutrophils? the Band (stab)

Q: what we call the increasing in the number of band cells: we call it shift to the left

Q: when do we found a shift to the left? in acute bacterial infection (tonsillitis, enteritis, dermatitis)

Q: how can we identify the neutrophils? by looking at the nucleus, it's a multilobed single nucleus 3-5 lobes

Q: can you see the granules? No, because it needs higher magnification

Q: other names of neutrophils? **microphage, polymorph**

The granules in the neutrophils are:

1 – Azurophilic granules (lysosomes) that contain peroxidase that is bactericidal

2 – Specific granules (phagocytin and lysozyme) both can destroy the cell membrane of bacteria (strongly bactericidal)

Q: what is meant by neutrophilia? increase in neutrophils number

Normally neutrophils (40 – 65) % of WBCs, in neutrophilia it gets higher.

Q: Types of neutrophilia:

- **Apparent neutrophilia:** increase in the circulating neutrophils as a result of shifting from **marginating pool to the circulation**.
it happens when we **increase muscular exercise** and it lasts for **hours only**, the bone marrow is relaxed without any increment in the production.
- **Real neutrophilia:** a real increment in the production of neutrophils **from the bone marrow**, it occurs **in infections** and it lasts for **days**.

Q: what attracts these neutrophils to the site of inflammation? chemotaxis

Neutrophils are the first cells that reach the site of infection.

Q: how does chemotaxis produced? by the reaction between the antibodies and antigens on the surface of bacteria.

Leukocytosis: increment in the number of WBCs

Neutropenia: reduction in the number of neutrophils

****Causes of leukocytosis:** **infections, leukemia (the worst)**

Q: Differences between acute and chronic leukemia:

Acute leukemia: more dangerous, stormy, severe anemia, severely tired patient, bleeding tendency.

Chronic leukemia: the patient might live up to 10 or 1 years without realizing his condition,

why is that? cause in chronic leukemia the increase is really happening to mature or nearly mature cells (cells of the last steps) like: band cells and metamyelocytes , while in acute leukemia early immature cells are increasing (myeloblast , promyelocytes , myelocytes) these cells can't perform the function of phagocytosis, accordingly immunity will drop .

Q: why do patients have anemia with acute leukemia? cause the myeloblast have increased at the expense of RBCs, in the bone marrow the myeloblast takes the place of RBCs stem cells

Q: what is the most important factor in anemia? what anemia really means? reduction in hemoglobin (for different reasons) instead of 15 it might reach 8 or 7.

The normal life span of RBCs is 120 days, in hemolytic anemia RBCs lyses faster (reduction in life span)

- **Eosinophils, Basophils**

The comparison between them is really important for the sake of exam ,,,,,,,,,,

Eosinophils: bilobed nucleus, red granules, acidophilic, stained by eosin, 1-6% of WBCs

Basophils: bilobed nucleus, blue granules, basophilic, stained by hematoxylin, less than 1%

Q: which one of them needs the other? eosinophils needs basophils since the products of basophils (histamine) chemotaxis eosinophils.

Eosinophil use (histaminases) to degrade histamine. in addition to "eosinophil-derived inhibitor " that inhibits and prevents basophils from producing histamine.

Both of them increase in allergy conditions.

Granules in basophils are metachromatic (stained by a red dye but it appears blue) containing proteoglycans.

Basophils contain (histamine, heparin, eosinophil chemotactic factor of anaphylaxis ECF-A)

Granulocytes are: 1- neutrophils 2- eosinophils 3 – basophils

Q: with regard to granulocytes find out which statement/s is /are right?

1- All of them contains lysozyme and phagocytin . ~~X~~ No this is limited to neutrophils

2- All of them are phagocytic ~~X~~ No this is limited to neutrophils and eosinophils

Neutrophils phagocytes bacteria while eosinophils phagocytes antigen antibody complex.

- **Monocytes:**

The largest cell type

Invaginated nucleus " kidney shaped " filling most of the cytoplasm

Cytoplasm containing granules (lysozyme that contain acid phosphatase and peroxidase)

Most of macrophages are of monocytic origin but not all of them

Q: does this cell play a role in immune reactions? yes, but this is not due to the production of macrophages but instead it is because of its role as antigen presenting cell (APC).

How is that? the APC will ingest the antigen and process it, then it will present it bound to MHC.

****without the binding to MHC there will be no immune reaction and the T- lymphocytes are not able to recognize the antigen at all.**

Q: All of the following cells are derived from monocyte except?

- 1- Kupffer cell
- 2- Microglial cell
- 3- Osteoclast
- 4- Langerhans cell of the skin
- ⑤- Epithelial reticular cell of the thymus
- ⑥- B – lymphocyte

This monocyte leaves the bone marrow and circulate in the blood, until it found an attraction due to chemotaxis or necrotaxis , it will be moved to tissue and transformed into macrophage.

- **Lymphocytes:**

- Very large nucleus filling almost the whole cytoplasm.
- The smallest cell
- 20-25 % of WBCs
- (6-9) μm \Rightarrow small lymphocyte
- (10-15) μm \Rightarrow large lymphocyte

The small lymphocytes are the most cell circulating in the blood

The large lymphocytes are mostly activated B – lymphocytes

B- lymphocytes become immunocompetent in the bone marrow then it leaves, reaching the lymph nodes to meet its antigen and reacting with it, it will start proliferation (it is active here) producing plasma cells and B memory cells.

Q: Does B- lymphocyte always need an APC in order to present its antigen? no, b- lymphocytes are able to recognize free antigen , but the reaction will be much stronger with the presence of APC that bound antigens to MHCII

On the surface of APC: MHC II

All of our body cells except RBCs: have MHC I

On the surface of virally infected cells, cancer cells: MHC I

****Endogenous antigen:** are abnormal proteins found on the surface of virally infected cells, cancer cells and its bounded to MHC I

****Exogenous antigen:** from bacteria mainly and other invaders, bound to MHC II on the surface of APC.

Q: by looking at the pictures can you tell whether it is B or T lymphocyte? no

B-lymphocytes are responsible for antibody mediated immune reaction while the T-lymphocytes responsible for cell mediated immune reaction.

Q: The simplest question in the exam might be the differences between B and T lymphocytes?

- T-lymphocytes an only recognize antigen bound to MHC over the surface of APC
- T-lymphocytes reacts with protein antigens only
- T-lymphocytes needs to be in close proximity to the infected cell in order to produce lymphotoxins that kills the cell, while B- lymphocytes produce antigens far away.

Finding a patient with lymphocytes level that reach 30% or higher, what is the cause probably?

Viral infection

Leukopenia: decrease in leukocytes in case of chemotherapy, radiotherapy or using certain drugs.

The doctor mentioned a story of an antibiotic (chloramphenicol), this antibiotic used to treat typhoid and paratyphoid fever as a wide spectrum antibiotic, but after a while they found out that this drug causes leukopenia so they stop using it.

In case the pictures in the exam are in black and white the most important point is to be able to differentiate between eosinophils and basophils:

Basophils: the granules are relatively small but numerous as well so you can't clearly see the bilobed nucleus

Eosinophils: the granules are bigger relatively but fewer and smoother so you can more easily to see the bilobed nucleus.

Q: could this picture (lymphocyte) can participate in antibody mediated immune reaction?

Since we can't recognize whether it's B or T lymphocyte, the answer is yes

Q: This cell needs its antigen to be presented over APC?

For the same previous reason, the answer is yes

**** Don't confuse yourself during the exam, and don't even try to ask the doctor whether the picture belongs to B or T lymphocyte, as soon as you see a lymphocyte suppose you are seeing both T and B and answer according to this unless the question is nice and specify the exact type.**

The END, wish you all best of luck

مرورا ببندقية الدرويش وجدت في قرارة نفسي أن الطب هو عشقي ، وبأن عيانه العسلية محفوفة بروبنز وجانقويرا، فبين الطب و عيوننا بندقية ، وليست كأى بندقية ، بين الطب و عيوننا آلاف من الأوراق المرمية ، بعضها للفهم والآخر للبصم و آخر لا يعرف أي قضية ، بين الطب و عيوننا مجلدات غريبة ، لإحاطتها وجب عليك أن تنتشل من العقارب ساعات جليلة ، ولا بد من أنك ستقطع علاقاتك الاجتماعية وحتما ستصاب باكتئاب خفيف وبيضع كلمات قاسية قوية ، ولا بد من أنك سترهق أحيانا و ستتوقف أياما وستمعن النظر لذاتك ولأحوال من حولك من رفاق الست الأبية ، ستضعف حيناً ولكن تذكر بأنك اخترت لروحك عظيماً ، تذكر بأنك اجتزت شوطاً لا يستهان به و بأن للعمر بقية ، تذكر بأن عشق الطب ما كان ولن يكون سوى شغف يلامس تفاصيلك ، روحك وأحلامك ، يلامس رؤياك مذ كنت طفلاً بأن الأبيض سيلاصقك عمرك كله، وبأن دعاء أحدهم سيرفع من عزمك يوماً ويسمح له بالوصول إلى نجمة في السماء ، تذكر بأن ما بين الطب و عيوننا سيتلاشى يوماً فكن على قدر اللقاء حينها ، تذكر بأن عزم روحك هو ما يحمل البندقية وما يتبع انطلاق رصاصاتها.

أجمل ما في الروح قدرها على التجدد، فنحن نعلن بدايات جديدة لأنفسنا في كل لحظة ولذلك فلنسمح لذواتنا بإعلان بداية جديدة ، بداية جديدة للانطلاق ، بداية لشحذ الهمم ، بداية للوصول إلى اللقاء . بقلم: روان أبو داود

لا أَبْرَحُ حَتَّى أَبْلُغَ