**IQRA NATIONAL UNIVERSITY**

**DEPARTMENT OF ALLIED HEALTH SCIENCES**

**Final -Term Examination (Spring-202)**

**Course Title: Hematology (MLT 2nd semester) Instructor: Adnan Ahmad**

**Time: 6 hours Max Marks: 50**

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**Note:**

* **Attempt All(five) questions from this section, all questions carry equal marks.**
* **Use only Blue / Black Ink other than diagrams**
* **Answer Briefly and to the point, avoid un-necessary details**
* **Possession of Mobile Phones is strictly prohibited**
* **Every question must be attempted within one single page of two sided specified in answer book**

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**Q:1 Discus developmental stages of erythropoiesis.**

**Ans**. **Erythropoiesis :**

**from Greek 'erythro' meaning "red" and 'poiesis' meaning "to make") is the process which produces**[**red blood cells**](https://en.m.wikipedia.org/wiki/Red_blood_cell)**(erythrocytes), which is the development from erythropoietic stem cell to mature red blood cell.**

**In the process of red blood corpuscle maturation, a cell undergoes a series of differentiations. The following stages of development all occur within the bone marrow: A hemocytoblast, a multipotent hematopoietic stem cell, becomes. a common myeloid progen(itor or a multipotent stem cell, and then.**

1. **A**[**hemocytoblast**](https://en.m.wikipedia.org/wiki/Hemocytoblast)**, a**[**multipotent**](https://en.m.wikipedia.org/wiki/Multipotent)[**hematopoietic**](https://en.m.wikipedia.org/wiki/Hematopoietic)[**stem cell**](https://en.m.wikipedia.org/wiki/Stem_cell)**, becomes**
2. **a common myeloid progenitor or a**[**multipotent stem cell**](https://en.m.wikipedia.org/wiki/Multipotent_stem_cell)**, and then**
3. **a unipotent stem cell, then**
4. **a [pronormoblast](https://en.m.wikipedia.org/wiki/Pronormoblast" \o "Pronormoblast), also commonly called an proerythroblast or a rubriblast.**
5. **This becomes a basophilic or early normoblast, also commonly called an erythroblast, then**
6. **a polychromatophilic or intermediate normoblast, then**
7. **an orthochromatic or late normoblast. At this stage the nucleus is expelled before the cell becomes**
8. **a**[**reticulocyte**](https://en.m.wikipedia.org/wiki/Reticulocyte)**.**

Q2. **Enlist common causes of poor blood filam ( Blood smear)**

**Ans. Blood smear :**  A blood film—or peripheral blood smear—is a thin layer of [blood](https://en.m.wikipedia.org/wiki/Blood) smeared on a glass [microscope slide](https://en.m.wikipedia.org/wiki/Microscope_slide) and then stained in such a way as to allow the various blood cells to be examined microscopically. Blood films are examined in the investigation of [hematological](https://en.m.wikipedia.org/wiki/Hematology" \o "Hematology) (blood) disorders and are routinely employed to look for blood [parasites](https://en.m.wikipedia.org/wiki/Apicomplexa), such as those of [malaria](https://en.m.wikipedia.org/wiki/Malaria) and [filariasis](https://en.m.wikipedia.org/wiki/Filariasis" \o "Filariasis).

**Common causes of a poor blood smear :**

1. **Drop of blood too large or too small**
2. **Spreader slide pushed across the slid in a jerky manner**
3. **Failure in keep the entire edge of the spreader slide against the slide while making the smear**
4. **Failure in keep the spreader slide at a 30° angel with the slide**
5. **Failure to push the spreader slide completely across the slide**
6. **Irregular spread with ridges and long tail: edges of spreader dirty or chipped ; dusty slide**
7. **Holes in film - slide contaminated with fat or grease and air bubbles**
8. **Cellular degenerative changes: delay in fixing inadequate fixing time or methanol contaminated with water**

**Q3. Briefly explain Granulupoeisis in detail**

**Ans. Granulupoiesis** : (or granulocytopoiesis) is a part of haematopoiesis, that leads to the production of granulocytes. .It leads to the production of three types of mature granulocytes: neutrophils (most abundant, making up to 60% of all white blood cells), eosinophils (up to 4%) and basophils (up to 1%).

Granulopoiesis is the process by which committed hemopoietic progenitor cells develop into granulocytes under the influence of various growth factors and cytokines.

-Neutropils Lobulated, dark nucleus, Neutrophils mature grey cytoplasm with small granules

Neutrophilic band or stab cells Horse-shoe shaped, darkening nucleus, grey mature cytoplasm

Neutrophilic metamyelocytes Oval to kidney bean-shaped, indented nucleus, grey mature cytoplasm with a weak blue tent

Neutrophilic myelocytes Large, oval, non-indented nucleus, large amount of cytoplasm with specific and non-specific granules

Promyelocyte Large, oval, non-indented nucleus, large amount of sky blue cytoplasm with non-specific granules.

**Neutrophil production in bone marrow**

--Neutrophils are produced within haematopoietic cords interspersed within the venous sinuses of the bone marrow

-- Neutrophil population in the bone marrow can be subdivided into three pools: the stem cell pool, the mitotic pool and the post-mitotic pool

Stem cell pool →undifferentiated haematopoietic stem cells (HSCS),

Mitotic pool → committed granulocytic progenitor cells that are undergoing proliferation and differentiation.

Post-mitotic pool → Fully differentiated mature neutrophils which forms the bone marrow reserve, available for release

--Principal regulator of physiological granulopoiesis is nulocyte colony stimulating factor (G- whose effects include-

--Commitment of progenitor cells to the myeloid lineage, proliferation of granulocytic precursors, reduction of transit time through the granulocytic compartment, and release of mature cells from the bone marrow.

-- Lack the G-CSF receptor and humans who express a dominant negative receptor mutation are profoundly neutropenic.

**Neutrophil release from bone marrow**

-- Journey upto the tissue is needed for proper functioning.

-- CXC chemokine receptor 4 (CXCR4), a G-protein coupled receptor, is also expressed at low levels on the cell surface of mature neutrophils and important for release of neutrophils

• Interacts with stromal- derived factor 1 (SDF-1), a CXC chemokine that is produced constitutively by bone marrow stromal cells. The interaction between CXCR4 and SDF-1 retains neutrophils within the marrow environment

• G-CSF exerts its multiple effects on neutrophil homeostasis is by inhibiting the CXCR4-SDF-1 axis. Treatment of mice with G-CSF decreases stromal cell SDF-1 production, which correlates with an increase in neutrophil release.

--In the promyelocyte stage: Primary granules, large peroxidase-positive granules that stain metachromatically (reddish-purple) with a polychromatic stain such as Wright stain, are formed. Most of the granules are spherical and have a diameter of 500 nm, but ellipsoid, crystalline forms and small granules connected by filaments also are present.

**Q4 . what is iron deficiency anemia? Also discuss it causes.**

**Ans. Iron deficiency anemia.** Iron deficiency anemia is a common type of anemia — a condition in which blood lacks adequate healthy red blood cells. Red blood cells carry oxygen to the body's tissues.

As the name implies, iron deficiency anemia is due to insufficient iron. Without enough iron, your body can't produce enough of a substance in red blood cells that enables them to carry oxygen (hemoglobin). As a result, iron deficiency anemia may leave you tired and short of breath.

**CAUSES.**

Iron deficiency anemia occurs when your body doesn't have enough iron to produce hemoglobin. Hemoglobin is the part of red blood cells that gives blood its red color and enables the red blood cells to carry oxygenated blood throughout your body.

**Causes of iron deficiency anemia include:**

* **Blood loss.** Blood contains iron within red blood cells. So if you lose blood, you lose some iron. Women with heavy periods are at risk of iron deficiency anemia because they lose blood during menstruation. Slow, chronic blood loss within the body — such as from a peptic ulcer, a hiatal hernia, a colon polyp or colorectal cancer — can cause iron deficiency anemia. Gastrointestinal bleeding can result from regular use of some over-the-counter pain relievers, especially aspirin.
* **A lack of iron in your diet.** Your body regularly gets iron from the foods you eat. If you consume too little iron, over time your body can become iron deficient. Examples of iron-rich foods include meat, eggs, leafy green vegetables and iron-fortified foods. For proper growth and development, infants and children need iron from their diets, too.
* **An inability to absorb iron.** Iron from food is absorbed into your bloodstream in your small intestine. An intestinal disorder, such as celiac disease, which affects your intestine's ability to absorb nutrients from digested food, can lead to iron deficiency anemia. If part of your small intestine has been bypassed or removed surgically, that may affect your ability to absorb iron and other nutrients.
* **Pregnancy.** Without iron supplementation, iron deficiency anemia occurs in many pregnant women because their iron stores need to serve their own increased blood volume as well as be a source of hemoglobin for the growing fetus.

**SYMPTOMS:**

Iron deficiency anemia signs and symptoms may include:

* Extreme fatigue
* Weakness
* Pale skin
* Chest pain, fast heartbeat or shortness of breath
* Headache, dizziness or lightheadedness
* Cold hands and feet
* Inflammation or soreness of your tongue
* Brittle nails
* Unusual cravings for non-nutritive substances, such as ice, dirt or starch
* Poor appetite, especially in infants and children with iron deficiency anemia

**Q5. Classify anemia on the basis of morphology. With example**

**Ans.** Anemia is classified by **morphology** or **pathophysiology**. The **morphological classification** is based partly on the size or volume of the red blood cell. Normocytic would indicate a red blood cell of a normal size or volume. Microcytic indicates an abnormally small cell, and macrocytic indicates an abnormally large cell.

## **Morphological Classification**

Anemia is classified in two ways, either morphological classification or pathophysiological classification. The morphological classification is based on the size or volume of the red blood cell and may also be classified by the hemoglobin content of the red blood cell. A red blood cell of a normal size or volume is said to be *normocytic*.

With our earlier terminology lesson this term becomes easy to recall. With this understanding it is easy to see that if the cell volume is decreased, then we will have an abnormally small cell, or it is said to be *microcytic*, and if the volume is increased, we will have an abnormally large cell, and we can use the term *macrocytic*.

A morphological classification of anemia can also be *normochromic*, which we know from our terminology lesson means red blood cells with normal hemoglobin content. Or they could be *hypochromic*, meaning low hemoglobin content, or *hyperchromic*, meaning high hemoglobin content.

At this point you might be wondering why we would go to so much trouble to try and classify anemias. The reason is because categorizing an anemia is useful in determining what is going on in the body and, therefore, defining the underlying condition.

For **example**, microcytic, hypochromic cells are seen in iron-deficiency anemia, and macrocytic, normochromic cells are characteristic of a deficiency of B12 or folic acid.

**THE END**