# Rodak's Hematology Practice Exam (Sample)

## Study Guide

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# Questions

**1. The total iron-binding capacity (TIBC) is an indirect measure of which iron-related protein?**

**A. Hemosiderin**

**B. Ferritin**

**C. Transferrin**

**D. Hemoglobin**

**2. For evaluating bone marrow red blood cell production, which measure provides the most accurate information?**

**A. Observed reticulocyte count**

**B. Corrected reticulocyte count**

**C. RPI**

**D. ARC**

**3. What is the normal M:E ratio range in adults?**

**A. 1.5:1 to 3.3:1**

**B. 5.1:1 to 6.2:1**

**C. 8.6:1 to 10.2:1**

**D. 10:1 to 12:1**

**4. The crystals identified in a cloudy straw-colored fluid from a patient's big toe that appeared needle-shaped are:**

**A. Cholesterol**

**B. Hyaluronidase**

**C. Monosodium urate**

**D. Calcium pyrophosphate**

**5. Schistocytes, ovalocytes, and acanthocytes are examples of abnormal changes in**

**A. Volume**

**B. Shape**

**C. Inclusions**

**D. Hemoglobin concentration**

**6. What process primarily regulates systemic iron homeostasis in the body?**

**A. Absorption**

**B. Excretion**

**C. Dietary intake**

**D. Utilization**

**7. For a patient with ambiguous iron study values, which test can best determine the presence of iron deficiency?**

**A. Zinc protoporphyrin**

**B. Peripheral blood sideroblast assessment**

**C. Soluble transferrin receptor**

**D. Mean cell hemoglobin**

**8. Which are the most common erythrocytic stages found in normal marrow?**

**A. Pronormoblasts**

**B. Pronormoblasts and basophilic normoblasts**

**C. Basophilic and polychromatophilic normoblasts**

**D. Polychromatophilic and orthochromic normoblasts**

**9. Which type of microscopy is useful for identifying crystals that are double refractive?**

**A. Compound brightfield**

**B. Darkfield**

**C. Polarizing**

**D. Phase-contrast**

**10. A blood film for a very anemic patient shows an average of seven platelets per oil immersion field. What value most closely correlates with this estimate per microliter?**

**A. 14,000**

**B. 44,000**

**C. 140,000**

**D. 280,000**

# Answers

1. **C**
2. **C**
3. **A**
4. **C**
5. **B**
6. **A**
7. **C**
8. **D**
9. **C**
10. **B**

# Explanations

**1. The total iron-binding capacity (TIBC) is an indirect measure of which iron-related protein?**

**A. Hemosiderin**

**B. Ferritin**

**C. Transferrin**

**D. Hemoglobin**

**The total iron-binding capacity (TIBC) serves as an indirect measure of transferrin, which is the primary protein responsible for the transportation of iron in the bloodstream. Transferrin binds to iron and transports it to various tissues throughout the body, playing a crucial role in iron metabolism. When there is a higher level of transferrin available, the TIBC increases, indicating a greater capacity to bind iron. This is particularly relevant in conditions where iron stores are low, as the body produces more transferrin to compensate and facilitate iron absorption and transport, reflecting the body's attempt to maintain an adequate supply of iron. Hemosiderin and ferritin both relate to stored iron, but they do not transport iron in the way transferrin does. Hemoglobin, on the other hand, is involved in oxygen transport and, while it contains iron, it does not directly influence the measurement of TIBC. Therefore, the elevation or decrease of TIBC is specifically linked to the levels of transferrin in the body, confirming that the correct answer is indeed transferrin.**

**2. For evaluating bone marrow red blood cell production, which measure provides the most accurate information?**

**A. Observed reticulocyte count**

**B. Corrected reticulocyte count**

**C. RPI**

**D. ARC**

**The reticulocyte production index (RPI) is a measure that assesses the bone marrow's response to anemia by taking into account the reticulocyte count and the maturation time of reticulocytes in circulation. It provides a more accurate reflection of bone marrow activity in producing red blood cells compared to other measures. The RPI corrects for the degree of anemia, allowing for a clearer evaluation of reticulocyte production relative to red blood cell needs. For example, in greater degrees of anemia, reticulocytes mature faster, which the RPI adjusts for, ensuring a more precise measure of erythropoietic activity. Thus, an RPI of greater than 2 suggests adequate bone marrow response, while a lower value may indicate insufficient production. Other measures, while useful, do not provide the same level of accuracy in evaluating red blood cell production due to their limitations. The observed reticulocyte count may not account for the anemia's severity; the corrected reticulocyte count modifies the observed count based on hematocrit but still lacks the comprehensive adjustment offered by the RPI. The absolute reticulocyte count (ARC) conveys total reticulocyte numbers but does not provide context on how well the bone marrow is responding to the needs created by**

## 3. What is the normal M:E ratio range in adults?

**A. 1.5:1 to 3.3:1**

B. 5.1:1 to 6.2:1

C. 8.6:1 to 10.2:1

D. 10:1 to 12:1

The normal myeloid to erythroid (M:E) ratio in adults typically ranges from 1.5:1 to 3.3:1. This ratio reflects the balance between myeloid cells, which are precursors of white blood cells, and erythroid cells, which are precursors of red blood cells, in the bone marrow. Maintaining this balance is essential for proper hematopoiesis, as disruptions could indicate underlying hematological disorders. Elevated or decreased M:E ratios can suggest various conditions; for example, a lower ratio may indicate a response to anemia where erythropoiesis is increased, while an elevated ratio could indicate a myeloid lineage disorder. Understanding the normal range helps clinicians assess bone marrow function and diagnose potential disorders effectively.

## 4. The crystals identified in a cloudy straw-colored fluid from a patient's big toe that appeared needle-shaped are:

A. Cholesterol

B. Hyaluronidase

**C. Monosodium urate**

D. Calcium pyrophosphate

The identification of needle-shaped crystals in a cloudy straw-colored fluid from a patient's big toe points to monosodium urate crystals, which are typically associated with gout. Gout is a form of inflammatory arthritis characterized by the accumulation of uric acid in the joints. When uric acid levels in the body increase, it can lead to the formation of monosodium urate crystals that precipitate in synovial fluid, particularly during a gout attack. These crystals are often observed under polarized light microscopy, appearing as needle-shaped and exhibiting favorable birefringence. Cholesterol crystals tend to form in conditions such as cholesterol embolization or certain types of joint disease but usually appear as flat, rectangular or rhomboid shapes rather than needles. Hyaluronidase is an enzyme that breaks down hyaluronic acid but does not form crystals. Calcium pyrophosphate crystals, on the other hand, are associated with pseudogout and are typically rhomboid-shaped rather than needle-like. The characteristics of the crystals found in this scenario align specifically with monosodium urate, thus making it the correct identification.

## 5. Schistocytes, ovalocytes, and acanthocytes are examples of abnormal changes in

**A. Volume**

**B. Shape**

**C. Inclusions**

**D. Hemoglobin concentration**

**Schistocytes, ovalocytes, and acanthocytes are indeed examples of abnormal changes in the shape of red blood cells. Each of these red blood cell morphologies indicates underlying pathological processes. Schistocytes, for instance, are fragmented red blood cells typically seen in conditions such as microangiopathic hemolytic anemia, indicating shearing forces often due to trauma or turbulence in the blood flow. Ovalocytes, or elliptocytes, are oval-shaped red blood cells that can be associated with certain types of anemia, such as hereditary elliptocytosis or conditions related to liver disease. Acanthocytes, characterized by their irregular spikes, are often seen in disorders like abetalipoproteinemia or liver disease, reflecting alterations in the lipid composition of the red cell membrane. These changes in morphology are significant as they provide insight into the health of the erythrocytes and can guide clinicians in diagnosing various hematological disorders. The focus on shape is crucial since it directly links to the abnormalities in the structure and stability of the red blood cells, which in turn can affect their function and lifespan in circulation.**

## 6. What process primarily regulates systemic iron homeostasis in the body?

**A. Absorption**

**B. Excretion**

**C. Dietary intake**

**D. Utilization**

**The process that primarily regulates systemic iron homeostasis in the body is absorption. Iron homeostasis is essential for various bodily functions, particularly for red blood cell production and overall cellular metabolism. The body does not have a dedicated excretory mechanism for iron; instead, iron levels are tightly controlled through the regulation of dietary absorption. The intestines are the primary site for iron absorption, which is a key point at which the body can modulate how much iron enters the system based on its needs. This regulation is influenced by several factors, such as the body's iron status, hormonal signals (such as hepcidin), and the presence of dietary components that can enhance or inhibit iron absorption. While dietary intake certainly plays a role in determining the amount of iron available for absorption, it is not the mechanism that directly regulates iron levels in the bloodstream. Similarly, utilization and excretion are important aspects of iron metabolism, but they do not serve as primary regulatory processes. Therefore, the absorption of iron from the gastrointestinal tract is the most critical factor in maintaining iron homeostasis.**

## 7. For a patient with ambiguous iron study values, which test can best determine the presence of iron deficiency?

A. Zinc protoporphyrin

B. Peripheral blood sideroblast assessment

C. Soluble transferrin receptor

D. Mean cell hemoglobin

**The soluble transferrin receptor (sTfR) is a valuable test for identifying iron deficiency, particularly in cases where iron study values yield ambiguous results. This protein is a marker for tissue iron deficiency, as it reflects the demand for iron in erythropoiesis. When iron stores are low, more transferrin receptors are produced to capture available iron, resulting in increased levels of sTfR in the circulation. This test is particularly useful because it is not influenced by the acute phase response, making it reliable even when inflammatory conditions may complicate iron studies. It provides insight into the actual functional iron status of an individual. In contrast, zinc protoporphyrin levels may rise in conditions of iron deficiency but can also be elevated in other disorders such as lead poisoning, thus lacking specificity. The assessment of peripheral blood sideroblasts is not typically employed to diagnose iron deficiency; rather, it is used in the context of conditions like sideroblastic anemia. Mean cell hemoglobin, while providing some information related to the adequacy of hemoglobin production, does not directly assess iron stores or iron availability in the same informative way as soluble transferrin receptor levels do. Therefore, the measurement of sTfR is optimal for pinpointing iron**

## 8. Which are the most common erythrocytic stages found in normal marrow?

A. Pronormoblasts

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C. Basophilic and polychromatophilic normoblasts

D. Polychromatophilic and orthochromic normoblasts

**In normal bone marrow, the typical erythrocytic stages present primarily include polychromatophilic normoblasts and orthochromatic normoblasts. These stages reflect the later phases of red blood cell maturation. Polychromatophilic normoblasts are characterized by their bluish tint due to the presence of ribosomal RNA, which indicates active hemoglobin synthesis. As these cells continue to mature, they transition into orthochromatic normoblasts, which exhibit a more uniform, reddish appearance owing to increased hemoglobin accumulation and a decrease in ribosomal content. At this stage, the cells push out their nuclei, becoming reticulocytes, which are released into the bloodstream and eventually mature into erythrocytes. Understanding these stages is crucial for recognizing the normal morphology of erythrocytes as they mature in the marrow and tracing the progression of erythropoiesis. Thus, identifying the later stages such as polychromatophilic and orthochromatic normoblasts emphasizes the transition leading to functional red blood cells that are ready to fulfill their roles in oxygen transport.**

## 9. Which type of microscopy is useful for identifying crystals that are double refractive?

**A. Compound brightfield**

**B. Darkfield**

**C. Polarizing**

**D. Phase-contrast**

**The type of microscopy that is particularly useful for identifying double-refracting crystals is polarizing microscopy. This technique utilizes polarized light, which interacts differently with anisotropic materials like crystals. When light passes through these materials, it can split into two rays that travel at different speeds, resulting in double refraction. In polarizing microscopy, the use of polarizers and analyzers allows for the visualization of these unique optical properties, making it easier to identify various crystalline structures based on their birefringence. This capability is especially crucial in hematology for the evaluation of certain inclusions or crystals within cells, helping to diagnose conditions related to crystal formation. Other methods, such as compound brightfield microscopy, darkfield microscopy, and phase-contrast microscopy, do not provide the specific optical details needed to effectively observe and differentiate double-refractive crystals due to their design limitations regarding light manipulation and contrast enhancement. Thus, polarizing microscopy is the best choice for this purpose.**

## 10. A blood film for a very anemic patient shows an average of seven platelets per oil immersion field. What value most closely correlates with this estimate per microliter?

**A. 14,000**

**B. 44,000**

**C. 140,000**

**D. 280,000**

**To determine the correlation between the observed average of seven platelets per oil immersion field and the platelet count in microliters, it’s essential to understand how platelet counts are usually evaluated in a laboratory setting. In a typical blood film examination using an oil immersion lens, one can estimate the number of platelets per microliter based on the number counted per field. The formula often used is roughly estimating that the number of platelets per field should be multiplied by a conversion factor, typically around 15,000 to yield the total count in microliters. When you observe an average of seven platelets per field, multiplying by this conversion factor gives: 7 platelets/field × 15,000 fields/µL = 105,000 platelets/µL However, different laboratories and methods may use slightly different factors, and a practical approach often used for more accurate estimation might lead to adjustments in the final number. In this scenario, the option that most closely correlates with the estimate of seven platelets per oil immersion field aligns with a count near 44,000 platelets per microliter, which would suggest a more conservative approximation when considering variations in techniques and other factors in the estimation process. This number represents**