Module Objectives

1. List the major functional classes of cells (leukocytes, erythrocytes, and megakaryocytes) in the blood and the general function of each.
2. Outline the major sites of hematopoiesis during fetal development through adulthood.
3. Describe the general structural characteristics of hematopoietic tissue in the bone marrow.
4. Describe the structural and functional changes that occur during erythropoiesis, granulopoiesis, and megakaryopoiesis.
5. Describe the role and properties of the pluripotent hematopoietic stem cell.
6. List the role of cytokines such as erythropoietin, G-CSF, GM-CSF, IL-6, IL-11, thrombopoietin on precursor cells.
7. Interpret the CBC and list the steps in diagnosis of a disorder of leukocytes, erythrocytes or platelets.
8. Describe the difference in the quaternary structural arrangement of Hemoglobin (Hb) vs. Myoglobin (Mb).
9. Describe the difference in O$_2$ binding activity between Hb and Mb that allows Hb to be an excellent O$_2$ transporter while Mb functions as an O$_2$ storage protein.
10. Explain the induced fit change in Hb structure that occurs when oxygen binds to heme.
11. Explain how the oxygen induced fit change in one subunit transmits an allosteric conformational change to other Hb subunits.
12. Explain how intersubunit interactions in Hb modulate conformational changes that occur when oxygen binds to allow Hb to function as an efficient O$_2$ transporter.
13. Explain the effect of CO and pH on Hb-O$_2$ transport (Bohr effect).
14. Connect Hb mutations to its impaired structure and function. In particular, the molecular basis of sickle cell anemia and thalassemia.
15. Explain how 2,3-bisphosphoglycerate (2,3-BPG or just BPG) can enhance O$_2$ transport by Hb (Note: sometimes BPG is called diphosphoglycerate or DPG.)
16. Explain the connection between BPG and Hb.
17. Explain CO poisoning with respect to how CO affects the Hb-O$_2$ binding curve.
18. Describe the pathway for heme degradation to bilirubin diglucuronide.
19. Explain the regulation of heme synthesis in both erythroid and non-erythroid cells.
20. Explain the biology of the porphyrias.
21. Describe the role of the heme synthesis regulation in the etiology of porphyria.
22. Describe the role of various enzymes in the metabolism of bilirubin.
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24. Recognize the various types of abnormal RBC.
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26. Understand the significance of specific types of abnormal RBC.
27. Understand the RBC parameters of a complete blood cell count and how they are utilized in the work-up of anemia.
28. Differentiate the various types of anemia.
29. Recognize macrocytic anemia with appropriate CBC data;
30. List a differential diagnosis for causes of macrocytic anemia;
31. Be able to distinguish megaloblastic anemia from non-megaloblastic macrocytic anemia;
32. Be able to distinguish each cause of macrocytic anemia and discuss the pathogenesis, clinical findings and appropriate lab studies;
33. Recognize macrocytic anemia with appropriate complete blood count (CBC) data;
34. List a differential diagnosis for causes of macrocytic anemia;
35. Discuss the normal metabolism of iron and causes of iron deficiency;
36. Distinguish between iron deficiency anemia and anemia of chronic disease, and discuss the pathogenesis, clinical findings and appropriate lab studies in each;
37. Recognize macrocytic anemia with appropriate CBC data;
38. List a differential diagnosis for causes of macrocytic anemia;
39. Be able to distinguish each cause of macrocytic anemia and discuss the pathogenesis, clinical findings and appropriate lab studies;
40. Recognize macrocytic anemia with appropriate CBC data;
41. List a differential diagnosis for causes of macrocytic anemia;
42. Be able to distinguish each cause of macrocytic anemia and discuss the pathogenesis, clinical findings and appropriate lab studies.

Instructional Method Summary