THE CARDIOVASCULAR SYSTEM: BLOOD

Outline and Objectives

INTRODUCTION

1. List the three interrelated components of the cardiovascular system.

2. Discuss the roles of blood and interstitial fluid in meeting the needs of the cells of the body.

FUNCTIONS OF BLOOD

3. Define the transportation, regulation, and protection functions of the blood.

PHYSICAL CHARACTERISTICS OF BLOOD

4. Provide values for the physical parameters of the blood and some of the systems that help maintain them

5. Discuss the techniques for withdrawing blood for laboratory testing.

COMPONENTS OF BLOOD

6. Illustrate the proportions of the major components of the blood plasma and cells.

Blood Plasma

7. List the components of plasma and explain their importance.

Formed Elements

8. List the varieties and relative number of formed elements in blood.

9. Explain why blood doping can be dangerous and increase the work load of the heart.

FORMATION OF BLOOD CELLS

10. Discuss the formation of blood cells from the pluripotent stem cells to the final formed elements.

11. Identify the hemopoietic growth factors that regulate the differentiation and proliferation of particular progenitor cells.

12. Identify medical conditions that could benefit from the use of growth factors.

RED BLOOD CELLS
13. Identify the basic properties of red blood cells as well as the normal quantity and rate of production.

**RBC Anatomy**

14. Note the structure and content of red blood cells, the presence of membrane antigens, and the usual concentrations of hemoglobin.

**RBC Physiology**

15. Describe the structural features that make RBCs highly specialized for O₂ transport.

16. Discuss the role of hemoglobin in oxygen transport and blood pressure regulation.

**RBC Life Cycle**

17. Describe the steps in the processing of RBCs once they have started to degenerate and are trapped by macrophages in the spleen and liver.

**Erythropoiesis: Production of RBCs**

18. Describe the stages of RBC development, the conditions and hormones that regulate their production through negative feedback, and nutrients required for their construction.

19. Describe how the amount of RBCs and their rate of production can be monitored clinically.

**WHITE BLOOD CELLS**

**WBC Anatomy and Types**

20. Identify the types of white blood cells.

**Granular Leukocytes**

21. Identify the three types of granular leukocytes and their functions.

**Agranular leukocytes**

22. Identify the two types of agranular leukocytes and their functions.

**WBC Physiology**
23. Discuss the usual WBC range in number, distribution, emigration, response to chemotaxis, and differing functions in reaction to tissue damage and/or pathogen invasion.

24. Describe some uses for a differential white blood cell count.

25. Discuss the steps required for a bone marrow transplant.

**PLATELETS**

26. Trace the development of thrombocytes from the megakaryocyte stage and review the functions they perform in blood clotting.

27. Discuss what is included in a complete blood count.

**HEMOSTASIS**

28. State the three general criteria for a hemostatic response to blood vessel rupture or damage.

**Vascular Spasm**

29. Discuss the timing for the effect of vascular spasm on bleeding.

**Platelet Plug Formation**

30. Discuss the chemical contents of the two types of granules in platelets and their role in the three steps of plug formation.

**Clotting**

31. Identify the principal stages involved in blood clotting and explain the general actions of the various factors that promote and inhibit blood clotting.

*Stage 1: Formation of Prothrombinase*

**Extrinsic Pathway**

32. Specify the conditions that initiate the extrinsic coagulation pathway and the factors and events that are unique to this route.

**Intrinsic Pathway**

33. Specify the conditions that initiate the intrinsic coagulation pathway and the factors and events that are unique to this route.
Stages 2 and 3: Common Pathway

34. Discuss the actions of the factors in the common coagulation pathway and the effect this enzymatic cascade has on the speed of activation of clot formation.

Clot Retraction and Repair

35. Discuss the materials and actions required to produce clot retraction and their purpose in preparation for tissue repair.

Need for Vitamin K

36. Establish how vitamin K is involved with factors of the coagulation pathway.

Fibrinolysis

37. Show how fibrinolysis works through plasmin enzymes to prevent the inappropriate formation and expansion of blood clots.

Hemostatic Control Mechanisms

38. List the actions of physical conditions, chemicals, enzymes, and factors that control the extent of clot growth.

Intravascular Clotting

39. Discuss the conditions that may precipitate formation of a blood clot in an undamaged vessel, and the consequences of its enlargement or becoming free floating in the veins or arteries.

40. Discuss the use of anticoagulants and thrombolytic agents in patients who are at risk of forming blood clots.

BLOOD GROUPS AND BLOOD TYPES

41. Explain the general molecular and genetic basis of ABO and Rh blood grouping.

ABO Blood Groups

42. Discuss how the two genes for RBC isoantigens are able to produce four blood types.

43. Discuss the significance of isoantibodies in the blood.

Rh Blood Group
44. Explain the basis of Rh grouping.

**Hemolytic Disease of the Newborn**

45. Describe how Rh isoantigens of a first fetus and the mother’s immune response to them can lead to hemolytic disease of the next newborn.

**Transfusions**

46. Describe the impact of isoantibodies on cells of a blood transfusion and the effect of an immune response on the body as a whole.

**Typing and Cross-matching for Transfusion**

47. Describe the process of typing and cross-matching of blood for transfusion.

**DISORDERS: HOMEOSTATIC IMBALANCES**

**Anemia**

48. Define anemia, identify various types of anemia, and describe the symptoms of anemia.

**Sickle-Cell Disease**

49. Discuss sickle-cell disease in terms of cause, symptoms, and treatment.

**Hemophilia**

50. Define hemophilia and describe some types of hemophilia.

51. Discuss what causes disseminated intravascular clotting.

**Leukemia**

52. Distinguish between acute and chronic leukemia.

**MEDICAL TERMINOLOGY**

53. Define medical terminology associated with blood.