PART I: MULTIPLE CHOICE

DIRECTIONS: Each of the numbered items or incomplete statements in this section is followed by answers or by completions of the statement. Select the ONE lettered answer or completion that is BEST in each case.

1. The vasa vasorum are nutrient vessels that are found in the:
   - A. Adventitia of large arteries and veins
   - B. Intima of large arteries and veins
   - C. Media of arterioles
   - D. Sinusoids of the bone marrow

2. Collagen and fenestrated sheets of elastin are features of the media of elastic arteries and are secreted primarily by:
   - A. Endothelial cells
   - B. Fibroblasts
   - C. Macrophages
   - D. Pericytes
   - E. Smooth muscle cells

3. A prominent and distinct internal elastic lamina is most characteristic of:
   - A. Elastic arteries
   - B. Large veins
   - C. Muscular arteries
   - D. Precapillary arterioles
   - E. Sinusoids

4. Simple squamous epithelium is a component of which of the following?
   - A. Continuous capillaries
   - B. Epicardium
   - C. Lymphatic capillaries
   - D. Tunica intima of the inferior vena cava
   - E. All of the above
   - F. None of the above

5. Which of the following consists of myofibers that have the largest diameter of any in the heart?
   - A. Chordae tendineae
   - B. Pectinate muscles of the right atrium
   - C. Purkinje fibers
   - D. Trabeculae carneae
6. The cardiac skeleton:
   A. Serves as an attachment site for the atrioventricular valves
   B. Is composed of hyaline cartilage
   C. Serves as an attachment site for the atrial myocytes, but not the ventricular myocytes
   D. All of the above

7. Lymphatic vessels are important in returning tissue fluid and large molecular weight proteins to the general circulation. Which of the following contributes to the high permeability of lymphatic vessels:
   A. There are no endothelial tight junctions
   B. The endothelium is fenestrated
   C. The basal lamina is incomplete
   D. Both A and C
   E. Both B and C

8. Cytokines:
   A. Are proteins whose sole function is to regulate inflammation
   B. Include growth factors that control the fate of stem cells and developing blood cells
   C. Are not present in the blood
   D. Are only made during fetal and embryonic life
   E. Are a type of antibody

9. Which of the following is most likely to be found in both the hematopoietic compartment and the vascular compartment of normal adult bone marrow:
   A. Adventitial reticular cells (stromal cells)
   B. Basophilic erythroblasts
   C. Megakaryocytes
   D. Neutrophilic band cells
   E. Nucleated erythrocytes

10. In which of the following items are stages of granulocyte development listed in the correct order from youngest to oldest:
    A. Myeloblast, CFU-GM, myelocyte, promyelocyte, metamyelocyte
    B. Myeloblast, CFU-GM, metamyelocyte, promyelocyte, myelocyte
    C. CFU-GM, myeloblast, promyelocyte, myelocyte, metamyelocyte
    D. CFU-GM, metamyelocyte, promyelocyte, myelocyte, myeloblast
11. Which of the following is the only stage of granulocyte maturation that contains azurophilic granules, contains specific granules, and is also capable of division:
   A. Band cell
   B. Metamyelocyte
   C. Myeloblast
   D. Myelocyte
   E. Promyelocyte

12. In a polychromatophilic erythroblast, the color of the cytoplasm is influenced by the presence of:
   A. Abundant rough endoplasmic reticulum
   B. Hemoglobin
   C. Many mitochondria
   D. Both A & B
   E. Both A & C

13. An inflamed area of skin is characteristically redder than normal skin due to local vasodilation. Mediators that contribute to this vasodilation include:
   A. Leukotrienes synthesized and released by activated basophils
   B. Major basic protein released by activated basophils
   C. Serotonin released by activated platelets
   D. Thromboxane A2 synthesized and released by activated platelets
   E. Lactoferrin synthesized and released by neutrophils

14. Which of the following is most likely to be involved in the activation of basophils:
   A. Contact between basophils and collagen
   B. Cross-linking of surface IgE on the basophil by antigen
   C. Opsonization of basophils by complement fragments such as C3b
   D. Release of specific granule contents from activated eosinophils
   E. Synthesis of IgE by basophils

15. A platelet:
   A. Can contract through the interaction of actin and myosin
   B. Has a cytoskeleton that is based on spectrin
   C. Is a megakaryocyte that has extruded its nucleus
   D. Leaves blood vessels by diapedesis
   E. Lives for approximately 120 days
16. The most abundant type of mature leukocyte in peripheral blood usually has:
   A. A highly heterochromatic nucleus and a very thin rim of basophilic cytoplasm
   B. A lacy chromatin pattern and a horseshoe-shaped nucleus
   C. An eccentric nucleus and a basophilic cytoplasm that lacks granules
   D. An S-shaped nucleus and large intensely stained specific granules
   E. Azurophilic granules and small specific granules that stain poorly

17. The majority of plasma proteins are produced by:
   A. Endothelial cells
   B. Granulocytes
   C. Hepatocytes of the liver
   D. Macrophages
   E. Plasma cells

18. Activation of platelets and some leukocytes results in cleavage of arachidonic acid from cell membranes by phospholipase A2. Among the many products that can be enzymatically derived from arachidonic acid are:
   A. Histamine
   B. Leukotrienes
   C. Myeloperoxidase
   D. Serotonin
   E. Von Willebrand factor

19. During an infection or inflammatory reaction, a "shift to the left" usually refers to an increase in the:
   A. Number of immature neutrophils in peripheral blood
   B. Number of mature neutrophils in peripheral blood
   C. Number of macrophages in the connective tissue at the site of the infection or inflammation
   D. Ratio of mature eosinophils to mature neutrophils in peripheral blood

20. Chediak-Higashi syndrome involves a defect in the targeting of proteins to azurophilic granules. In such a patient you would expect to find:
   A. Fewer large granules in the cytoplasm of eosinophils and basophils
   B. Decreased activity of NADPH oxidase, leading to a decreased or absent respiratory burst
   C. Decreased myeloperoxidase activity in neutrophils, resulting in a deficiency of hypochlorite
   D. Decreased production of nitric oxide by macrophages
21. The hematocrit is most likely to be increased in an individual who:
   A. Has a hemolytic anemia such as sickle cell anemia
   B. Has an acute bacterial infection
   C. Has been receiving therapeutic doses of erythropoietin for several weeks
   D. Has recently moved to a lower altitude where more oxygen is available in the atmosphere

Use the following scenario for questions 22 & 23.
A skin biopsy shows unusually large numbers of leukocytes in an area of the dermis. Most of these cells have a bi-lobed nucleus and large cytoplasmic granules that stain red with H&E.

22. The leukocytes described above are:
   A. Eosinophils
   B. Basophils
   C. Neutrophils
   D. Large lymphocytes
   E. Macrophages

23. This patient is most likely to be suffering from:
   A. A viral infection
   B. Chronic granulomatous disease
   C. Infection by parasitic worms
   D. The early stages of an acute bacterial infection
   E. The late stages of an acute bacterial infection

DIRECTIONS: Each of the numbered items or incomplete statements in this section is negatively phrased, as indicated by a capitalized word such as NOT, LEAST, or EXCEPT. Select the ONE lettered answer or completion that is BEST in each case.

24. All the following commonly occur in asthma EXCEPT:
   A. Increased permeability of postcapillary venules causes edema of the airway walls
   B. Histamine from basophils & mast cells causes contraction of bronchiolar smooth muscle
   C. Histamine causes increased mucus secretion by goblet cells
   D. Eosinophilis damage ciliated cells of the airways, leading to difficulty in clearing mucus from their lumens
   E. Basophils destroy many of the mediators released by eosinophils, and inhibit activation of additional eosinophils
25. Identify the **FALSE** statement. Megakaryocytes:
   A. Are derived from the pluripotent hematopoietic stem cell
   B. Are uninucleate
   C. Are polyploid
   D. **Form foreign body giant cells**
   E. Produce platelets

26. All of the following can play a role in the process of diapedesis **EXCEPT**:
   A. Chemokines produced by the endothelial cells
   B. Insertion of a neutrophil pseudopod between the adjacent endothelial cells
   C. Release of heparin and histamine from mast cells
   D. **Selectins on the surface of the neutrophil**
   E. Contraction of smooth muscle cells in the media of the blood vessel

27. Which of the following statements about embryonic/fetal hematopoiesis is **FALSE**:
   A. Formation of blood cells occurs at several different sites during development
   B. The hepatic phase is the first phase
   C. The splenic and hepatic phases overlap
   D. The mesoblastic phase occurs in the yolk sac

28. **GM-CSE** regulates the development of all the following cell lineages **EXCEPT**:
   A. Basophils
   B. Eosinophils
   C. Erythrocytes
   D. Monocytes
   E. Neutrophils

   [C, E]