Key

Hematology

1) Blood is considered to be a type of connective tissue. Because it...
   1) Derived from Mesenchymal Stem Cell (→ Hematopoietic Stem Cell → Blood cells)
   2) Cellular (highly)
   3) Connects, Protects, & Supports
   4) Vascular
   5) Extracellular Fibers
   6) Ground substance [plasma]

2) What are the functions of blood?
   - Transport & distribution
     - Nutrients, CO_2/O_2, Waste, Hormones (Chemical Messengers), etc
   - Assists in maintenance of body temp & pH
   - Prevention of excessive blood loss (platelets)
   - Immune defense (WBC)

3) What are the components of blood?

   Cells
   - Erythrocytes (RBCs) → Carry O_2
   - Leukocytes (WBCs) → Immune Defense
   - Platelets → Clotting

   Plasma (carries solubles)
   - Fluid component (mostly H_2O)
   - Suspension of cells & other substances
     - Nutrients, proteins, hormones, electrolytes

4) The normal pH of blood is 7.35 - 7.45. A higher or lower pH can lead to death. The acidity of blood found in veins is higher than the pH of blood in arteries because dissolved CO_2 forms carbonic acid. pH buffers help to maintain a neutral pH by not allowing excessive hydrogen (H^+) or hydroxyl (OH^-) ions to accumulate. The lungs helps maintain pH by removing CO_2 and the kidneys help through the excretion of H^+ in the form of NH^+. pH that is too low is called acidosis while a pH that is too high is called alkalosis.

5) What bones contain high concentration of red bone marrow?
   - Skull
   - Ribs
   - Sternum
   - Vertebral column
   - Pelvis
   - Femurs

6) What does red bone narrow produce?

   Blood

7) What is hemostasis?
   - ↳ constant process
   - * Homeostasis in the blood

Prefix: Hemato = Blood

8) What cell turns into blood cells?

Hematopoietic Stem Cells
↳ Erythropoiesis
↳ Leukopoiesis
↳ Thrombopoiesis

9) Erythropoiesis is Red Blood Cell formation

10) Leukopoiesis is White Blood Cell formation

11) Thrombopoiesis is Platelet formation

12) The most plentiful type of blood cell is the RBCs. The main function if this type of blood cell is to oxygenate tissues (hemoglobin) and remove CO_2 from tissues.

13) The primary intracellular component in RBCs is hemoglobin. It is composed of four amino acid groups and a heme group. The heme group contains iron. Why is iron important to the function of RBCs?

- Binds to O_2 to carry it to tissues
- Without iron: Anemia
  - Hemoglobin can't be made
  - RBC count decreases

14) What is hemoglobin bound to O_2 and CO_2 called?

↙ Oxyhemoglobin
↘ Carbaminohemoglobin

15) 1 % of blood cells are removed daily. Senescence is the process of aging. The spleen is a non-vital organ that removes RBCs from circulation using macrophages. RBCs are broken down into amino acids, iron, and heme. Where do each of these products go?

- iron ↓ Back to red bone marrow ↳ Recycled during erythropoiesis
- heme ↓ Broken down
- amino acids ↓ Back to the liver ↳ Makes more protein

16) Where do extravascular and intravascular hemolysis occur?

↙ Outside of the vascular system (spleen)
↳ Inside the vascular system

17) What is thrombopoietin and what does it do?

Hormone produced by the liver; Regulates number of platelets in circulation

18) How do thrombin, fibrinogen, and fibrin work together to form a blood clot?

Thrombin converts fibrinogen into fibrin to form a blood clot

19) Fibrinolysis dissolves the clot after a blood vessel has healed.

20) Leukocytes are generally larger than RBCs and have a role in immune function. There are two types of them granulocytes and agranulocytes. What are two characteristics of each type?

granulocytes:
- Contain granules
- Innate immunity

agranulocytes:
- Mononuclear
- Adaptive Immunity

21) There are 5 types of leukocytes. What do they look like, what type of immunity is associated with, and what is important to know about each one?

Granulocytes

a. Neutrophils → Mostly transparent with highly visible, multi-segmented nucleus
- Innate Immunity
- Phagocytosis
  - ↳ Degraded during immune response [pus]
- Primary granulocyte (largest number)

b. Basophils → Dark blue or purple granules with barely visible nucleus
- Innate Immunity
- Found during allergic responses (indicator of inflamation)
  - ↳ Modulate inflammation
  - ↳ Histamine (vasodialation) → increases bloodflow & fluid production
  - ↳ Heparin (blood thinner) → faster, more efficient blood flow
- Not normally found in high quantities

c. Eosinophils → Pink or Red granules with visible nucleus
- Innate Immunity
- Found during allergy responses (inflamatory response)
  - ↳ Parasites (increase in # of eosinophils = parasite/allergic response)
- Not normally found in large quantities

Agranulocytes (A- = without)

d. Monocytes → Kidney bean shaped nucleus with no granules (Largest WBC)
- Phagocytosis of foregin substances & dead (or dying) cells
- Innate Immunity
- Monocyte v. Macrophage [Monocyte = baby Macrophage]
  - Found in circulation (blood stream)
  - Resident to lymphoid tissues (spleen, lungs, tonsils, kidneys, etc)

e. Lymphocytes → Very large, round nucleus with a halo of cytoplasam
- Cellular & Humoral Immunity
- Only Adaptive WBC
- Part of the "memory response"
- 3 types:
  1) B cells
  2) T cells
  3) NK cells