

Animal Anatomy & Physiology – ASC171
Semester 2

Topic 6: Blood

Learning Objectives:

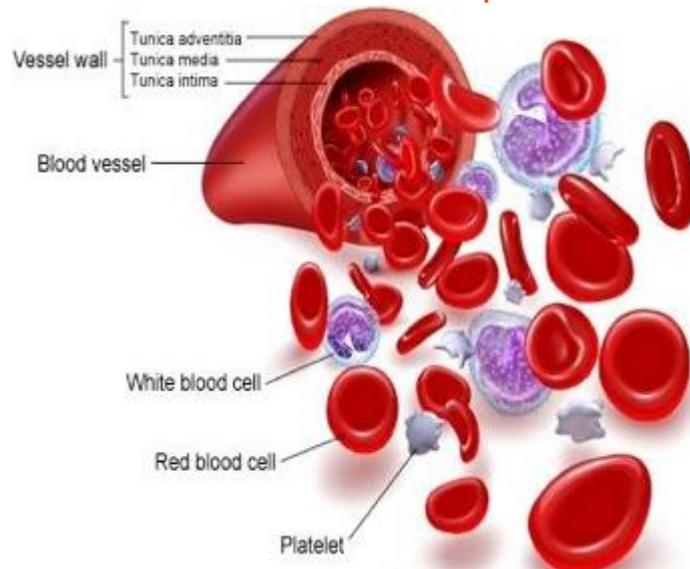
1. list the major components of blood and describe their functions;
2. explain how haemoglobin and carbonic anhydrase facilitate movement of respiratory gases (O₂ and CO₂);
3. explain the production of red blood cells, including the roles of the kidney, liver and spleen
4. explain the process of red blood cell turnover
5. describe the mechanism of clot formation
6. list the major blood groups and explain how different blood groups arise.

Introduction and Functions of Blood

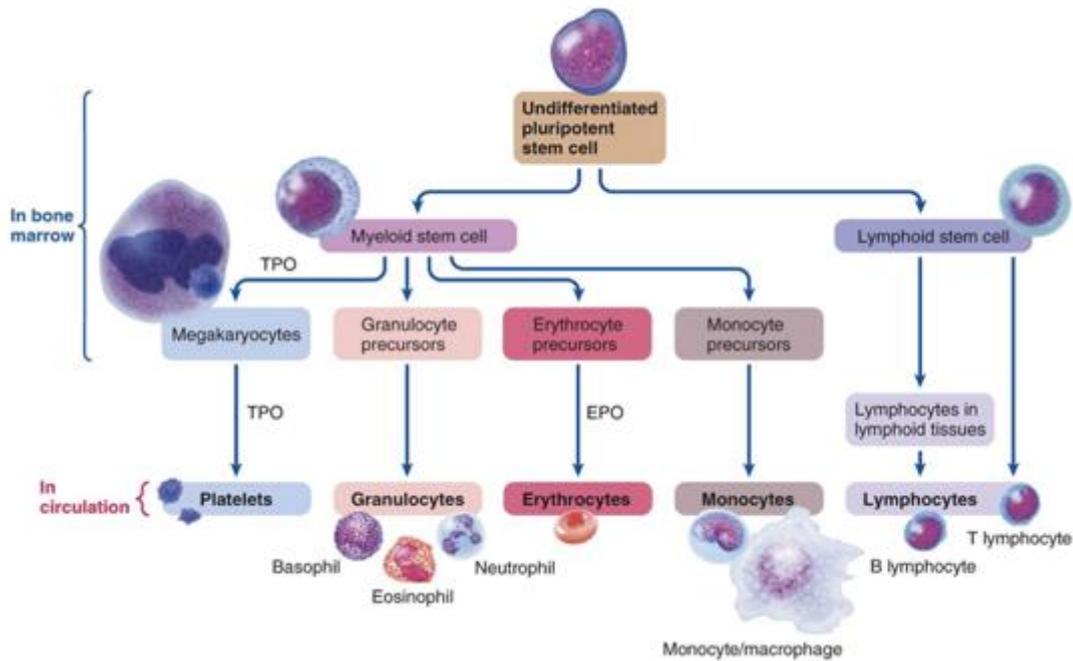
Circulatory fluids are divided into two components - a liquid called plasma, which is primarily water, (and thus the reason why the concept of body water and the different compartments of body water were introduced earlier in the session) plus some other solutes and proteins; and the formed elements of blood which include **erythrocytes** (red blood cells, RBC), **leukocytes** (white blood cells, WBC) and **platelets** (thrombocytes). Each of the formed elements have specific roles in maintaining homeostasis.

Plasma is involved in the transport of proteins, hormones, electrolytes, organic nutrients and waste products. Red blood cells are involved in the transport of oxygen (and carbon dioxide), white blood cells in immunity (see also the later topic on body protection systems) and platelets are involved in the important process of blood clotting.

Formed Elements of Blood & Haematopoiesis



- Formed elements:
 - Erythrocytes (lack nuclei)
 - Leucocytes (genuine cells)
 - Platelets (lack nuclei)
- **Haematopoiesis** = formation and development of all formed elements
 - Blood cells produced by and mature from stem cells in bone marrow - highly regulated process
 - Chemical messengers in blood regulate stem cells to cause specific blood cells to develop in response to need:
 - Increase Erythropoietin causes increase in erythrocytes in response to haemorrhage or other loss of RBCs



Functions of Blood:

- Transportation of dissolved gases, nutrients, hormones and metabolic wastes
 - O₂ from lungs to peripheral tissues
 - CO₂ from peripheral tissues to lungs
 - Nutrients from digestive tract or those released from adipose tissue or liver
 - Hormones from endocrine glands to target cells
 - Metabolic wastes to kidneys for excretion
- Regulation of the pH and ion composition of interstitial fluids
 - Diffusion eliminates local deficiencies or excesses of specific ions
 - Neutralises acids e.g. lactic acid
- Restriction of fluid losses at injury sites
 - Clot factors and clot formation
- Defence against toxins and pathogens
 - White blood cells (WBC) which fight infections
 - Antibodies (proteins)
- Stabilisation of body temperature
 - Redistributes heat to other tissues e.g. skin

The Haematocrit (Packed Cell Volume, PCV)

The components of whole blood can be separated for analytical or clinical purposes. The **haematocrit** is a measure of the relative proportion of cells in the blood to plasma, and it will give a good indication of the oxygen delivery capacity of the animal, as the majority of 'packed cells' in a haematocrit are red blood cells.

The sample of blood is treated to prevent clotting and then a column of the blood is centrifuged, which allows the division of the components according to their relative specific gravity (i.e. heavier cellular elements move to the bottom, lighter plasma moves to the top).

The **packed cell volume (PCV)** is a measure of the number of erythrocytes in the blood stream and it is usually presented as a percentage. The PCV occupies the lower layer.