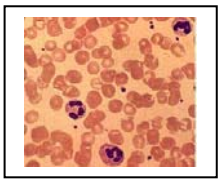
4. Cardiovascular System (9 lectures)



4.1. Blood

4.2. The Heart

- 4.2.1. Describe the internal and external anatomy of the heart
  - 4.2.1.1. Describe the size, location and orientation of the heart in the thoracic cavity
  - 4.2.1.2. From external to internal, list the 3 coverings of the heart and describe their tissue composition and functions
  - 4.2.1.3. Locate the following on diagrams that show both the external and internal anatomy of the heart: left & right atria and ventricles, aortic arch, superior and inferior venae cavae, pulmonary trunk, left & right arteries and veins, coronary sinus, atrioventricular groove, anterior-posterior interventricular sulcus, pectinate muscles, fossa ovalis, trabeculae careae, papillary muscles
- 4.2.2. Trace the pathway followed by the blood in both the pulmonary and systemic circuits
  - 4.2.2.1. Trace the pathway followed by a red blood cell from its entry into the heart via the inferior vena cava to its exit from the heart via the aorta; this pathway should include all of the valves in the order in which they are encountered
  - 4.2.2.2. Distinguish between the pathways followed for the pulmonary and systemic circuits in terms of oxygenation of the blood, workload and its effect on the structure of the ventricular wall
- 4.2.3. Describe the organization of the coronary circulation
  - 4.2.3.1. Identify the main arterial and venous components of the coronary circulation and indicate those areas of the heart which they supply or drain
  - 4.2.3.2. Define anastomosis and justify the presence of anastomoses in the coronary circulation
- 4.2.4. Compare the physiological properties of cardiac muscle cells with those of skeletal muscle cells
  - 4.2.4.1. Compare and contrast cardiac versus skeletal muscle in terms of morphology, function, energy requirements and metabolism
  - 4.2.4.2. Describe intercalated discs and relate 2 aspects of their structure to the support of cardiac function
- 4.2.5. Compare the electrical properties of **contractile** cardiac muscle cells with those of **autorhythmic** cardiac muscle cells
  - 4.2.5.1. Trace a cardiac muscle cell action potential and identify the ion movements and resultant changes in membrane potential that are responsible for phase 0 to phase 4 of this tracing
  - 4.2.5.2. Relate each of the following characteristics of cardiac muscle to the ability of the heart to function as a pump: all-or-none law; autorhythmicity of some cardiac muscle cells, duration of the absolute refractory period
  - 4.2.5.3. Define “autorhythmic cell”; describe those properties of cardiac autorhythmic cells that allow them to spontaneously depolarize
  - 4.2.5.4. Define “sinus rhythm” and indicate why the SA node is the pacemaker of the heart
- 4.2.6. Explain how the intrinsic conduction system of the heart allows it to function as a pump
  - 4.2.6.1. Trace the pathway followed by a cardiac action potential from the SA node to the Purkinje fibers
  - 4.2.6.2. Indicate the site of the bottleneck in this pathway and its relevance to the ability of the heart to function as a pump
  - 4.2.6.3. Delineate the extrinsic innervation of the heart and contrast the influences of the parasympathetic versus the sympathetic nervous systems on heart rate
- 4.2.7. Explain what is an ECG tracing and the nature of the information it is providing

4.2.7.1. Identify the P wave, QRS complex & T wave on a normal electrocardiogram (ECG) tracing
4.2.7.2. Specify the electrical information conveyed by each component of an ECG tracing and the inferences that are made regarding cardiac muscle contraction
4.2.7.3. Show how the ECG tracing would be altered in the event of a nonfunctional SA node, second degree heart block and ventricular fibrillation

4.2.8. Explain the events occurring during each phase of the cardiac cycle
4.2.8.1. Describe the pressure changes that are responsible for valve opening and closing and link these pressure changes with resultant volume changes during the cardiac cycle
4.2.8.2. Demonstrate your understanding of the following terms when outlining a single cardiac cycle: systole, diastole, isovolumetric contraction, isovolumetric relaxation, dicrotic notch
4.2.8.3. Indicate the physiological significance of the first and second heart sounds
4.2.8.4. Describe 2 physiological causes for heart murmurs

4.2.9. Define cardiac output in terms of heart rate and stroke volume
4.2.9.1. Be aware of the average cardiac output for a resting, healthy male
4.2.9.2. Express stroke volume as a function of end diastolic and end systolic volumes
4.2.9.3. Indicate the influences of exercise on heart rate and stroke volume

4.2.10. Describe in detail the mechanisms for the regulation of heart rate and stroke volume
4.2.10.1. Delineate the effects of each of the following on the rate of SA node deplolarization: autonomic nervous system (which branch dominant under resting conditions?), adrenal medulla-derived epinephrine, plasma electrolytes (Ca^{++}, Na^{+}, K^{+}, H^{+}), body temperature
4.2.10.2. Apply the Frank Starling Law of the Heart to the intrinsic regulation of stroke volume (define preload)
4.2.10.3. Define afterload and describe its influence on stroke volume
4.2.10.4. Describe two types of extrinsic influences on stroke volume