Lecture notes for Monday & Wednesday November 4 & 6, 2002
Please bring Friday’s notes to class on Monday

Outline
- Cardiac Output
- Factors regulating stroke volume and heart rate
- Blood vessels

Cardiac Output (CO)
- \( CO = HR \times SV \)

Regulation of Stroke Volume
- Degree of stretch
- Forcefulness of contractions
- Pressure required to eject blood from ventricles

Regulation of Heart rate
- Autonomic innervation:
  - NE & ACh (due to stress; excitement; exercise; rest)
- Hormones: NE & epinephrine
- Drugs: caffeine & nicotine
  - SA node

Factors influencing CO
Exercise/excitement; Hemorrhage; stroke volume;
High blood pressure; Heart rate; sympathetic NS;
Contractility; venous return; Parasympathetic NS; increased blood volume

Blood vessels
- Be sure you know the definitions and functions of the following structures:
  - Arteries
  - Arterioles
  - Capillaries
  - Venules
  - Veins
  - Tunica interna
  - Tunica media
  - Tunica externa
  - lumen
• Be sure you understand the difference in structure between arteries, veins and capillaries and the direction of blood flow with in them relative to the heart.

Capillaries
• Function: exchange of nutrients/wastes O2/CO2
• Large surface area
• Movement of substances:
  1. Diffusion
  2. Bulk flow

Venous return
• Blood pressure in RIGHT ventricle = 0 mm Hg.
• Skeletal muscle pump
• Respiratory pump

NOTE: Increase in CO will => increase in blood pressure; decrease in CO => decrease in blood pressure.

Blood flow
= distribution of CO to tissues:

• Depends on:
  1. Blood Pressure (BP)
  2. Resistance

Blood pressure
= the pressure exerted by blood (fluid) enclosed within blood vessels (tubing)

• BP gradient:
  BP highest in aorta
  BP lowest in right ventricle

• The greater the difference in pressure, faster the flow of blood
• decrease in blood volume causes decrease in BP e.g. hemorrhage/ increase in blood volume => increase in BP e.g. water retention – edema.

Resistance
= force that opposes movement
• Friction between blood and vessel walls
• Diameter of lumen (changes: contraction & relaxation of smooth muscle/atherosclerosis)
• Blood viscosity
• Total length of blood vessel (constant) but e.g. obesity = increased length of vessels => increased BP
• Increase in resistance causes increase BP

**Regulation of BP & blood flow**
• Cardiovascular center in medulla oblongata
• Baroreceptors (monitor stretch & pressure of blood vessels)
• Chemoreceptors (monitor O2 & C02 levels in blood)

**Checking circulation**
• Pulse - reflects heart rate
• Measurement of BP
  sphygmomanometer
• Normal resting values:
  systolic BP = 120 mm Hg.
  diastolic BP = 80 mm Hg.

**Disorders**
• Hypertension = high BP  140/90
• Aneurysm
• Arteriosclerosis /atherosclerosis

**Preventing cardiovascular disease**
• SMOKING
• DIET
• Alcohol
• Exercise
• Gender; stress; genes