Animal Circulation

A. Organismal Circulation

**Transport vs. cellular exchange** – Consider the functions of circulatory mechanisms in animals and the issues of bulk transfer vs. cellular function.

**Open vs. Closed Circulatory Systems** – Using FIG. 42.2, consider the form and function of open and closed circulatory systems.

What makes open, open and closed, closed ?

Nature of fluids involved and where they reside (vessels / sinuses, etc…)

B. Structure and Function of Circulatory Systems (emphasis on vertebrates)

**Concept of Systemic and Respiratory Circuits** – Using FIG. 42.3, consider the major patterns of vertebrate circulatory systems.

What major factor effects the patterns of these circuits ?

**Structure of Blood Vessels** – Using FIG. 42.8, consider the similarities and differences in the anatomy of blood vessels.

Large arteries ➔ Smaller arteries ➔ Arterioles

Heart

Large veins ➔ Smaller veins ➔ Venules

Capillaries
Blood Flow in relation to Vessels – Using FIG. 42.10, consider how blood flow (velocity) varies in different vessels.

How does cross-sectional area of a pipe effect blood flow?

Why doesn’t this seem to happen as we go from arteries to capillaries?

Where the action is -- Capillaries – Using FIG. 42.11, consider the form and function of capillaries.

What cellular and molecular functions occur within capillaries?

C. The Nature of Blood

Blood is a connective tissue – Using FIG. 42.13, consider the constituents of blood and their functions.

Blood clotting is an important function – Using FIG 42.15, review a typical blood clotting process.

How does this represent a normal and critical function of blood?
Animal Respiration

A. Organismal Respiration

**Bulk Transport vs. cellular exchange** — Consider the functions of respiratory mechanisms in animals and the issues of bulk transfer vs. cellular function.

What is **ventilation**?

The role of respiration in bioenergetics is summarized in **FIG. 42.17**. Note how respiration is **linked to nutrition**!!!

B. Respiratory Mechanisms in Aquatic Environments

**The Physical Environment** — Important features of respiring in water are —

- Respiratory surfaces (gills) are constantly moist
- Temperature and other factors are stable
- Water holds less oxygen than Air
- Transfer of gases are slower (need ventilation mech.)

**Gills** — Review the forms and functions of gills — refer to **FIG.s. 42.19 and 42.20**

- Special ventilation mechanisms
- High Surface area to volume
- Countercurrent Systems
C. Respiratory Mechanisms in Terrestrial Environments

**The Physical Environment** – Important features of resiping in water are –

Respiratory surfaces would be desicated (must be internalized)

Temperature and other factors are unstable or extreme

Air holds more oxygen than Water

Transfer of gases is quick and ventilation easy

**Tracheal Systems** – Consider insects, which have tracheal systems rather than lungs. Refer to FIG. 42.21

**Cutaneous Systems** – Many vertebrates, especially those living at land / water interfaces, can use their skin capillaries for respiration. See HANDOUT.

**Lungs** – Most terrestrial vertebrates, as well as some invertebrates (spiders) have internal lungs. (Mammalian Example – FIGS. 42.22 to 42.26)

Overview of a respiratory system (vessels and sacs)
- Mammals
- Birds and Reptiles

What is ventilation (breathing) – the role of negative pressure
- Mammals
- Birds and Reptiles

Nervous / Endocrine control of breathing – it’s (almost) automatic
- Mammals
Respiration at the Cell and Tissue Level – how does it work?

Respiratory pigments (hemocyanin and hemoglobin) and their roles.

Partial pressures of oxygen and carbon dioxide in tissues/organs

Oxygen binding by hemoglobin – oxygen dissociation curves

Carbon dioxide binding by hemoglobin – conversion to other C-molecules