Physiology Review

Chapter 1: What is physiology?

Physiology: The science of biological function

Biological function is intimately related to structure.

Homeostasis: maintaining a constant internal environment in an organism
examples:

1. maintenance of body temperature despite changes in environmental
2. variations in heat production by the body
3. maintenance of blood glucose concentration despite changes in dietary composition

Pathophysiology: disease
The reason that physiological systems fail to work normally and fail to maintain homeostasis
Disease Research helps families monetarily and emotionally

Studying Pathophysiology and physiology together help us to better understand disease mechanisms and find cures for disease

Chapter 2: Blood

What system is blood apart of?
Circulatory system, particularly the cardiovascular system

Even though blood is a fluid, why can it be considered a connective tissue?
Connects cells throughout our body
Carries oxygen, glucose, or carbon dioxide to organs

Major cellular components of blood and their function
White blood cells, red blood cells, plasma, and platelets, but made up mostly of water.
Turns to a gel and clots up to limit blood loss from small wounds.

Red Blood Cells
1. RBC's are the most numerous cells in the blood.
2. They transport O2. O2 molecules move into and out of RBC's by diffusion, which is the net movement of molecules from regions of high concentration to regions of low concentration by the random motions of molecules colliding with other molecules.
3. Because RBC's do not have a nucleus, they cannot divide and reproduce.

White blood cells (leukocytes):
components of our immune system; there are many types of WBC (don't have to know them all)

How is CO2 transported in the body?
It's transported in red blood cells in the form of carbonic acid (H2CO3) and bicarbonate (HCO3); The CO2 is converted to H2CO3 by **hemoglobin**

Diffusion: The mechanism for transport between blood plasma and the cytoplasms of RBC's

Major components of blood plasma and their function
Mostly water, but contains many other types of ions and molecules

Hemoglobin: Accounts for most of the protein in red blood cells. Closely related to myoglobin

Myoglobin: Oxygen storage protein in the muscle

What is a cell? (general features)
A cell is the basic unit of life.

Hematocrit: The percentage of blood volume that occupies Red Blood Cells.
Typical values are 45% for males and 40% for females.

Plasma: makes up almost the rest of your blood that isn't RBC; if you're RBC is 42% then the plasma in your blood will make up almost 58% of your blood
Most abundant molecule in blood plasma is water, but also has electrolytes, small molecules, protein, lipids and antibodies.

Heat Transport and Regulation of Body Temperature
Blood retains heat when it's cold and allows heat to escape when it's hot, thus helping the body maintain the same body temperature regardless of the external environment

Sickle Cell Disease: Causes red blood cells to become crescent shaped and prevents them from changing shape as it passes through small blood vessels. It shortens the cells durability and life time

clicker question: Sickle cell disease is due to a mutation in HEMAGLOBIN which leads to clumping of that protein and a change of shape in RED BLOOD CELLS

Cancer: Occurs when cells multiply at an abnormally rapid rate

Leukemias: involve high numbers of white blood cells

Metastasis: When cancer starts in one area of the body but then cancer cells go through the blood and spread cancer to another part of the body

Lymph: Not blood and vice versa, but it is very closely related physiologically. Lymph is the fluid that collects in the lymphatic system as interstitial fluid and eventually turns into lymph as it flows through the lymphatic system which includes lymph nodes. (Lymph nodes are an important part of the immune system because they contain a lot of white blood cells.) And eventually the lymph is returned to mix with the blood in the cardiovascular system.

Chapter 3: Cardiovascular System

Circulatory System
Relationship between the cardiovascular system and the lymphatic system

The Heart
What does the right side do?
Pumps deoxygenated blood to the lungs where the blood is deoxygenated

What does the left side do?
Pumps oxygenated blood to all other parts of the body

What are the chambers of the heart?
There are 4, 2 atria (left and right) and 2 ventricles (left and right)
Left side is more muscular

The valves of the heart which are located at the exits and entrances of the ventricles are the reason that blood flows only in one direction.

Electrical Cardiac Cycle
The heart has it's own electrical timer; it can beat on its own, even outside of a body.
This signal initiates in the Sinoatrial node, which is a region of specialized cells of the right atrium. Essentially, the Sinotrial node is the hearts "pace maker."

Mechanical Cardiac Cycle
(physical pumping) Triggered by the Electrical Cardiac Cycle
There are two phases

1. diastole: the non contractile phase of the cardiac cycle when cardiac muscle is relaxed (when the heart fills with blood)
2. systole: when contraction occurs and blood is pumped

Stroke volume: The amount of blood pumped during each beat (depends on how much blood enters the heart during diastole)

Vasculature: All of the blood vessels in the body that carry blood. The 3 main types are arterial blood vessels, capillaries, and venous blood vessels.