Blood

Part 1 of the circulatory system
Introduction

- Blood cannot be reproduced
- Every two seconds someone needs a transfusion
- Comes in 8 different types
- Is a type of connective tissue
- Blood is 8% of your entire body weight
Blood is connective tissue

“Living cells suspended in a non-living matrix”

- Plasma is the non-living part
Main functions of blood...

To transport oxygen, nutrients, waste products, and hormones throughout the body.

- Also helps control temperature and protects from infections.
3 Main Parts in the Blood

- When you attend a blood drive they extract a lot of your blood and then send it to a lab. There it is spun around very fast and separated into 3 main parts.
  1. Erythrocytes
  2. White blood cells and platelets
  3. Plasma
1. Erythrocytes

- Red blood cells
- Carry carbon dioxide and water and make up 45% of the blood volume
- In their mature stage, blood cells do not have a nucleus or most types of organelles. They are composed of mostly water and protein so they are very flexible. This helps them squeeze through tiny capillaries.
- They start with a nucleus and then ditch it later
- Only live 120 (four months) days so they are always being replaced
Erythrocyte (Hemoglobin)

- Blood is made primarily of hemoglobin which absorbs and carries oxygen
- Each big structure is a globin and the little blue disc is a heme
- One molecule of oxygen can bind to each heme. Heme has iron in it which makes the blood red.
- Each red blood cell has 250 million hemoglobin
- That means that over 1 Billion molecules of oxygen can bind to each blood cell
How does your oxygen balance in your body stay at normal levels?

- There is a hormone sensor in the kidneys called Hypoxia (low oxygen) inducible factor that is always being released.
- Oxygen breaks it down
- It triggers the bone marrow to create a ton of extra blood cells
- If there is little oxygen it will continue to be released until enough oxygen is present to break it down again
- If there is too much blood you can be poisoned if there is not enough, you are deprived of oxygen
Doping is increasing the blood content in your body. More cells = more oxygen which leads to less muscle fatigue

- This is done by injecting the body with EPO hormone
- Enhances endurance not strength
- Too much blood can poison you or it makes it thick and hard for the heart to pump it
The Buffy Coat (Middle layer)

- Contains Leukocytes
  - **white blood cells** that help destroy foreign invaders and clean up dead red blood cells
- Also has platelets which help in blood clotting
Steps of Hemostasis (Blood Clotting)

1. After you cut yourself, the vessel constricts which restricts blood flow
2. Platelets dam the breach by reacting to severed collagen from the skin and prevent it from leaking
3. Finally a protein called fibrin seals the platelets and makes it stronger. Eventually the skin forms over it.

See next slide to see images of this process!
Step 1. Vascular spasm
- Smooth muscle contracts, causing vasoconstriction.

Step 2. Platelet plug formation
- Injury to lining of vessel exposes collagen fibers; platelets adhere.
- Platelets release chemicals that make nearby platelets sticky; platelet plug forms.

Step 3. Coagulation
- Fibrin forms a mesh that traps red blood cells and platelets, forming the clot.
- Remember plasma is non-living
- **90% Water**
- Also contains waste products, proteins, gases, electrolytes, and hormones
- The most abundant are electrolytes which include sodium, calcium, potassium, phosphate, bicarbonate, etc.
  - These are used in everything we have covered in the past modules!
- The proteins make up the most weight and contain many important things including **fibrin** and immune system helpers.