Cross Section of Capillary

- Oxygen and Nutrients
- Carbon Dioxide and Waste
- Thin Endothelial cell wall, only one cell thick
- Lumen
- Red Blood Cell
- Endothelium
- Lumen (small - only big enough to let 1 red blood cell through at a time)
WHAT IS BLOOD?
A COUPLE QUESTIONS FIRST...
WHAT % OF YOUR BODY WEIGHT IS MADE UP BY YOUR BLOOD?

A) 4-5%
B) 7-8%
C) 15-16%
D) 32-33%
HOW LONG IS THE LIFE SPAN OF A RED BLOOD CELL?

A) 4 HOURS
B) 4 DAYS
C) 4 MONTHS
D) 4 YEARS
HOW MANY LITRES OF BLOOD ARE CONTAINED IN THE HUMAN BODY?

A) 1 L
B) 2-3 L
C) 3-4 L
D) 4-5 L
VIDEO: COMPONENTS OF BLOOD AND THEIR FUNCTION
WHY IS BLOOD IMPORTANT?

• Transport oxygen and nutrients to our cells
• Remove carbon dioxide, ammonia, other waste products
• Regulate temperature
• Plays a role in immune system
• Transports sugars, fats, proteins, amino acids, hormones
• Specialized tissue composed of more than 4,000 different kinds of components
• Four of the most important ones are red cells, white cells, platelets, and plasma
RED BLOOD CELLS

• Also called erythrocytes → relatively large microscopic cells without nuclei
• Biconcave disks – concave on both sides
• Make up 40-50% of the total blood volume
• Produced continuously in our bone marrow at a rate of 2-3 million/second
• Transport oxygen from lungs to body cells and carry away carbon dioxide to be expelled in lungs
• Oxygen attaches to hemoglobin
  – gas transporting protein molecule that makes up 95% of a red cell
• Each red cell has about 270,000,000 iron-rich hemoglobin molecules
WHITE BLOOD CELLS

• Also called leukocytes
• Exist in variable numbers and types, all have nuclei
• Make up a very small part of blood's volume—normally only about 1%
• They occur elsewhere in the body as well i.e. spleen, liver, and lymph glands
• Most are produced in our bone marrow from the same kind of stem cells that produce red blood cells
• Others are produced in the thymus gland, which is at the base of the neck
• 2 Categories: granular and agranular
  – granules (small particles/grains) in cytoplasm contain chemicals that attack foreign material and microorganisms that are brought into the cells
  – Agranular: specialized for engulfing bacteria and other microorganisms
PLATELETS

• Also called thrombocytes
• Small cell fragments without nuclei that are essential for blood clotting/coagulation
• Formed in bone marrow
• Adhere to the walls of blood vessels to form clots
• A clot that becomes dislodged from the site of an injury can move through the blood vessels and block the flow of blood in some other part of the body
  – Consequences?
VIDEO: HOW DOES BLOOD CLOT?
PLASMA

• Protein-rich liquid in which blood cells and platelets are suspended
• Over 90% water
• Dissolved/suspended in it:
  – Glucose
  – Vitamins
  – Proteins
  – Minerals
  – Electrolytes
  – O2 and CO2 and other wastes
• Relatively clear, yellow tinted
• Carries the red cells, white cells, and platelets
• As the heart pumps blood to cells throughout the body, plasma brings nourishment to them and removes the waste products of metabolism
• Sodium ions create an osmotic pressure gradient and causes water to enter the bloodstream → increase blood pressure
CAN YOU THINK OF ANY BLOOD DISORDERS/CONDITIONS?

• Bleeding disorders
  – Hemophilia
  – Blood clots

• Blood cancers
  – leukemia, lymphoma, and myeloma

• Anemia
  – Iron Deficient
  – Sickle Cell

Anemia can occur if:

- Your body doesn't make enough red blood cells
- Bleeding causes you to lose red blood cells more quickly than they can be replaced
- Your body destroys red blood cells
BLOOD DISORDERS: SICKLE CELLS

- Sickle Cell Disease: group of inherited red blood cell disorders
- When a person has two hemoglobin S genes, the disease is called sickle cell anemia
- Sickle hemoglobin can form stiff rods within the red cell, changing it into a crescent, or sickle shape → not flexible, can stick to vessel walls, causing blockages to blood flow
- The lack of tissue oxygen can cause attacks of sudden, severe pain or organ damage
- Tend to burst apart/hemolyze → cells usually last only 10-20 days
- Number of red blood cells is usually lower than normal → anemia
- Hematopoietic stem cell transplantation (HSCT) is the only cure
- Certain treatments can reduce symptoms and prolong life