

## CIRCULATION

### Parts of circulatory systems

1. Fluid that circulates (blood)
2. Channel (vessels) that fluid circulates through
3. Pump (heart) to keep fluid moving

### Types of circulatory systems

1. Open circulatory systems (insects)
  - Blood flows freely through the body
2. Closed circulatory systems (animals & humans)
  - Blood is **contained** in vessels

### Functions of the vertebrate circulatory system

1. Carry oxygen (needed to produce ATP), nutrients (make DNA, RNA, & ATP), and waste
2. Distribute hormones
3. Regulate body temperature
4. Prevent blood loss
5. Defend against disease (B cells, T cells, white blood cells)

### Vertebrate Hearts

- 2 chambers – fish (1 atria & 1 ventricle)
- 3 chambers – amphibians, most reptiles (2 atria & 1 ventricle)
- 4 chambers – birds, animals (2 atria & 2 ventricles)

### 4-chamberd heart

- 2 chambers for deoxygenated blood
- 2 chambers for oxygenated blood
- Valves prevent blood from going the wrong way (4 of them)
  - o In between chambers
- Atrioventricular valve \*

o In between atrium & ventricle

-Blood leaves heart in arteries & comes back in veins

**-Unxygenated blood is on the right & oxygenated is on the left**

**-Heart → (deox) lungs, → (ox) heart = pulmonary circulatory loop**

**-Systemic circulation = heart → (ox) body → (unox) heart**

**-Oxygenated blood also goes to the outside of the lungs**

Flow of blood through body: (label parts of the heart on the exam)

**Pulmonary circulatory loop (becoming oxygenated):** Body → right atrium → right ventricle → leaves through arteries → lungs → comes back through veins → left atrium → left ventricle → aorta → body

**Systemic circulation loop (becoming deoxygenated):** Body → left atria → left ventricle → leaves through veins → lungs → comes back through arteries → right atria → right ventricle → body

Heart pumping action

1. **Atria contracts → both at same time**
2. Ventricles contracts → both at same time
3. Both relax

Semi-lunar valves are in between ventricles & blood vessels

-Other valves in body help blood flow more against gravity because they only go one way

\*Electrocardiogram

Blood

1. **Plasma - MAJOR component; MOST VOLUME in blood**

- Mostly water
- Proteins, hormones, nutrients, gases, ions, wastes – all can be carried in plasma
- Wastes can be CO<sub>2</sub>
- 2. Cells – **major cellular component = red blood cells**
  - Hemoglobin makes blood cells red because of iron
  - No nuclei** – lost before it grows up
  - Produced in bone marrow
  - They comprise 99% of all blood cells
  - 1 ml of blood has over 5 billion **RBCs**
  - Limited lifetime** because they **don't have nuclei**
    - Die in 90 days, so body constantly produces them
  - When at high altitudes with low oxygen, more RBCs & hemoglobin are produced
    - Blood doping
  - In diabetics, glucose sticks to RBCs too much & sugar levels of blood get too high
  - Hemoglobin (iron containing) is inside RBCs
    - Low iron leads to anemic disorder because you don't produce as many RBCs
  - In sickle cell anemia, hemoglobin sticks together & decreases oxygen

### Hemoglobin

- 2 alpha & 2 beta
- 4 oxygen molecules, unless there's low iron
- Alpha & beta have different polypeptide chains – polypeptide = protein (amino acids)
- rRNA, mRNA, tRNA, are needed to make protein
- DNA is needed to make RNA & all 3 types are used to make polypeptides (alpha & beta)
- Alpha is made by 1 gene & beta is made by another
- Malfunctions (mutations) in genes can stop the protein from functioning