Cardiovascular System

• Purpose
• Mammalian heart structures and function
• Blood Pressure
• Heart beat or rhythm
• Heart attacks and atherosclerosis
Cardiovascular System

• All cells need
  – Nutrients
  – Gas exchange
  – Removal of wastes

• Diffusion alone is inadequate for large and complex bodies

• Most animals use a circulatory system
  – Blood
  – Heart
  – Blood vessels
Diffusion of molecules

Capillary

Interstitial fluid

Tissue cell

Diffusion of molecules

https://www.youtube.com/watch?v=q0s-1MC1hcE
The mammalian heart

- Two thin-walled atria that pump blood to ventricles
- Thick-walled ventricles that pump blood to lungs and all other body regions

Flow through the Heart
https://www.youtube.com/watch?v=7XaftdE_h60
7.5 mins

Blood Anatomy and Circulation
http://www.youtube.com/watch?v=H04d3rJCLCE
3:29 mins
Blood pressure and velocity is a reflection of the heart and blood vessels function in blood circulation

Rhythmic heart contractions and relaxations

http://www.sumanasinc.com/webcontent/animations/content/bloodpressure.html

Blood pressure

- The force blood exerts on vessel walls
- Depends on
  - Cardiac output
  - Resistance of vessels
- Decreases as blood moves away from heart

Understanding Blood Pressure – Anatomy

http://www.youtube.com/watch?v=qWti317qb_w 2:48 mins
• Blood pressure is
  – Highest in arteries
  – Lowest in veins

• Blood pressure is measured as
  – **Systolic** pressure—pressure caused by contraction of ventricles
  – **Diastolic** Right and left ventricles relax

Lub Dub [https://www.youtube.com/watch?v=-4kGMI-qQ3I](https://www.youtube.com/watch?v=-4kGMI-qQ3I)
1. Heart is relaxed.

2. AV valves are open.

3. Ventricles contract.

0.1 sec 0.3 sec 0.4 sec

Systole

Diastole

Semilunar valves closed

Semilunar valves are open.

AV valves closed
An internal pacemaker sets the tempo of the heartbeat

The heart contracts and relaxes rhythmically under the effect of electrical signals received from specialized cardiac muscle cells and conducting fibers (not nervous tissue)

- **pacemaker (SA node)** which generates electrical signals in right atrium
- **AV node** then relays these signals to the ventricles

Cardiac conduction system and ECG.wmv
https://www.youtube.com/watch?v=RYZ4daFwMa8
1. Pacemaker generates signals to contract
2. Signals spread through atria and are delayed at AV node
3. Signals relayed to apex of heart
4. Signals spread through ventricle

ECG

Cardiac Conduction System
http://www.youtube.com/watch?v=Lt092HZCppo 1:03 mins
https://www.youtube.com/watch?v=RYZ4daFwMa8
Schematic illustration of the cardiac conduction system

http://emedicine.medscape.com/article/1922987-overview
depolarization of the heart’s atria

depolarization of the heart’s ventricles

Re-polarization of the ventricles

https://www.youtube.com/watch?v=lRHq7sMRWpU
What is a heart attack?

- A **heart attack** is damage to cardiac muscle typically from a blocked coronary artery.
- **Stroke** - Death of brain tissue from blocked arteries in the head.
What is a heart attack?

- **Atherosclerosis**
  - Plaques develop inside inner walls of blood vessels
  - Plaques narrow blood vessels
  - Blood flow is reduced
Mammalian Cardiovascular System Structure

Diagram of the mammalian cardiovascular system with labeled components.