Diploma Review Questions:

Sample Diploma Questions

1. The main function of a heart ventricle is to

A. separate oxygenated blood from deoxygenated blood — septum

B. pump blood away from the heart — Ventricle pumps blood out to either lungs or body

C. direct blood toward the heart — Blood enters the atrium from either the vena cava or pulmonary veins

D. receive blood from the body — Atrium received blood from lungs and body

Heartbeat & Blood pressure

Science 30

Unit A

curriculum

- describe the rhythmic contraction of the heart and its function in the general circulation of blood through pulmonary and systemic pathways

- describe the structure and function of blood vessels and the flow of blood through arteries, arterioles, venules, veins and capillaries

Cardiac output

- The amount of blood that flows from each side of the heart per minute
- Two factors affect this output:
  - Stroke volume: quantity of blood pumped with each beat of the heart (~ 70mL).
  - Heart rate: # of times heart beats/minute.

Normal resting heart beat is 60 -100 bpm
Average is 72bpm

Example

If your heart rate is 72 beats/minute, then how many liters of blood does your heart pump every minute (assuming 70mL/beat)

Heartbeat sounds

- **“lub-dub”** sound caused by closing of heart valves.
- “lub”= AV valves close (ventricles contract) is louder
- “dub”= Semi lunar valves close (atria contract) softer sound

- “gurgle” = heart murmur (valves do not close properly).

- **Diastole** = ventricular relaxation (“dub”).
- **Systole** = Ventricular contraction (“lub”).

Heartbeat

- The heart is made up mostly of muscle cells that contract on their own and in unison (myogenic tissue)
- Specialized nerve tissue helps to coordinate the muscle contraction

Electrocardiograms (ECG or EKG) are machines used to monitor the heart

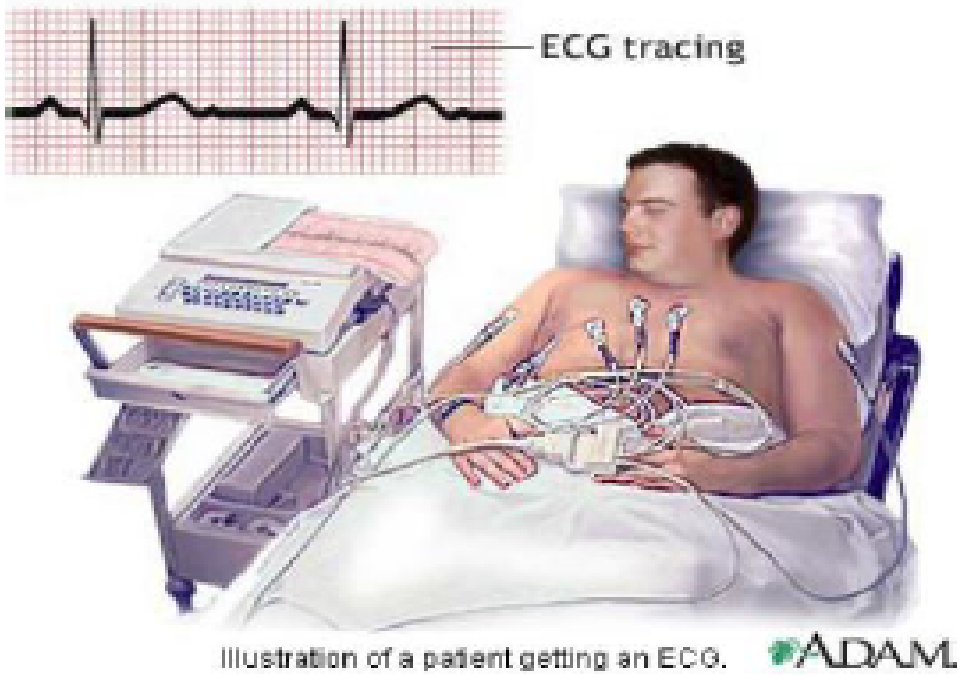
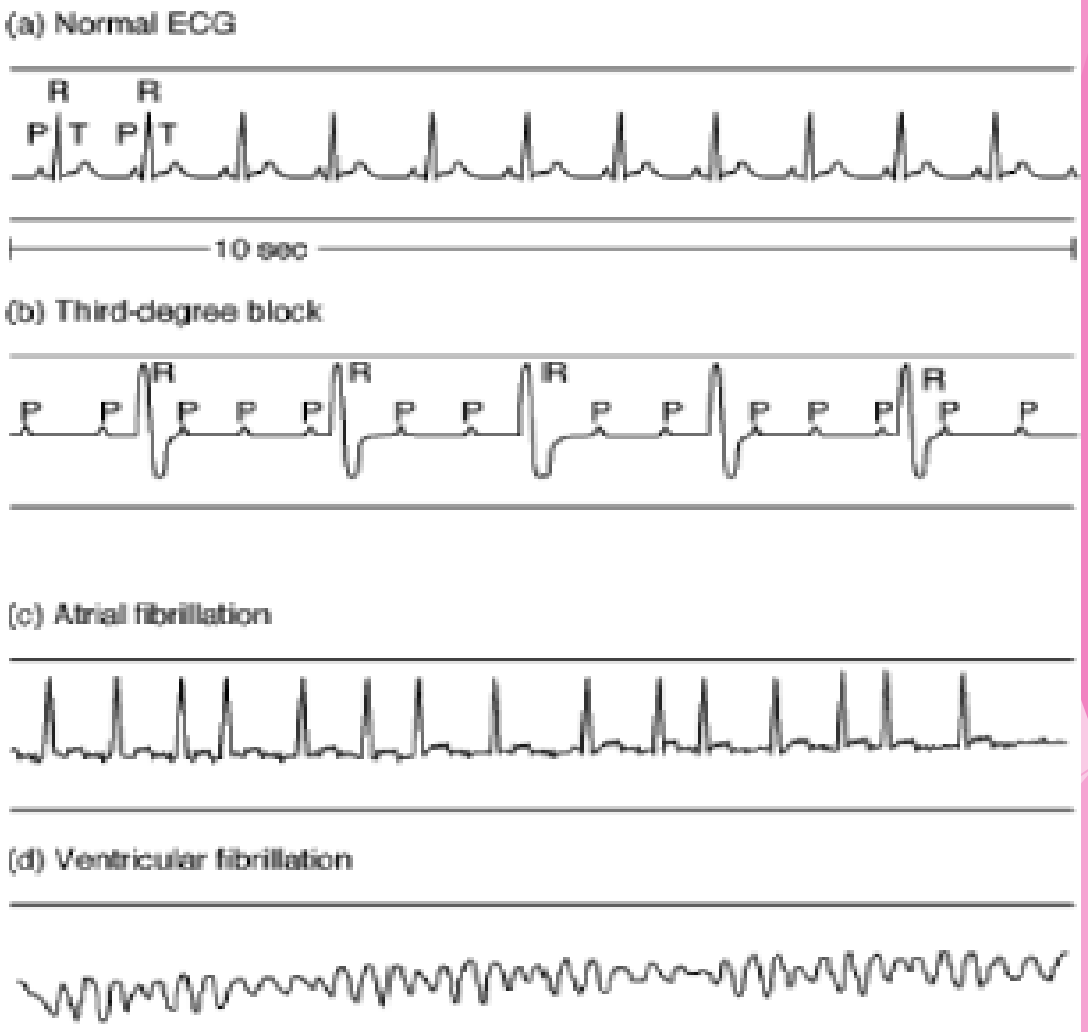
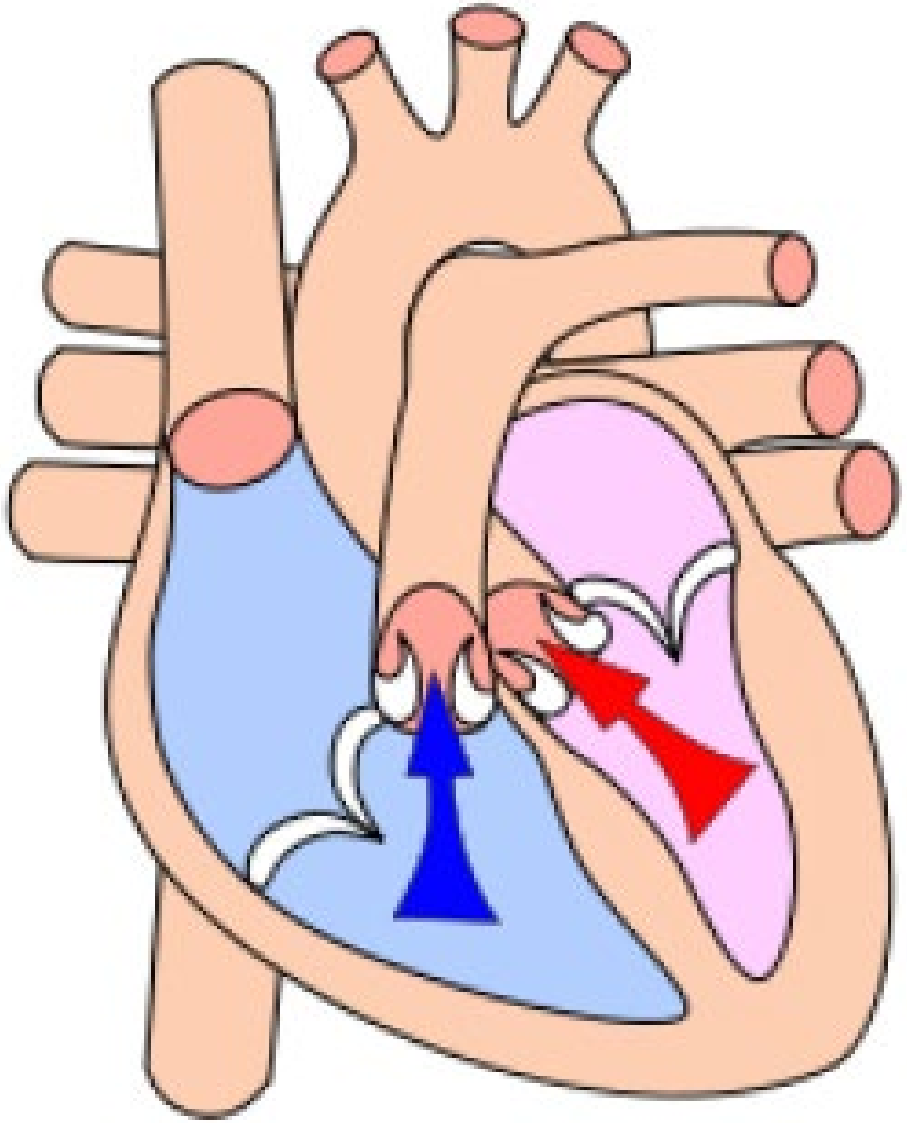


Illustration of a patient getting an ECG. ADAM.



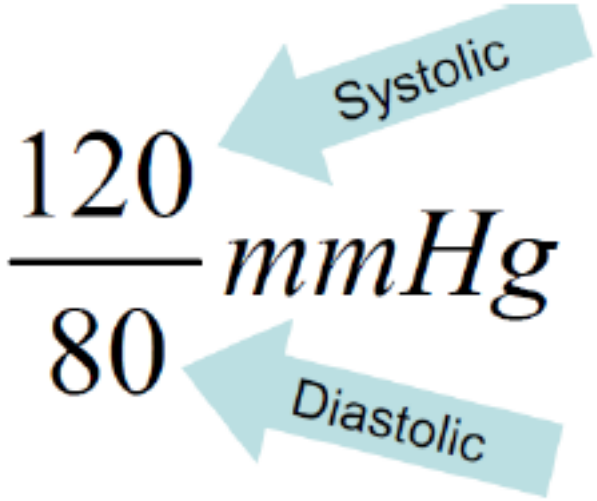
- The heart has two phases
- 1) Systolic: the ventricles are *contracting*
- 2) Diastolic: the ventricles are *relaxing*

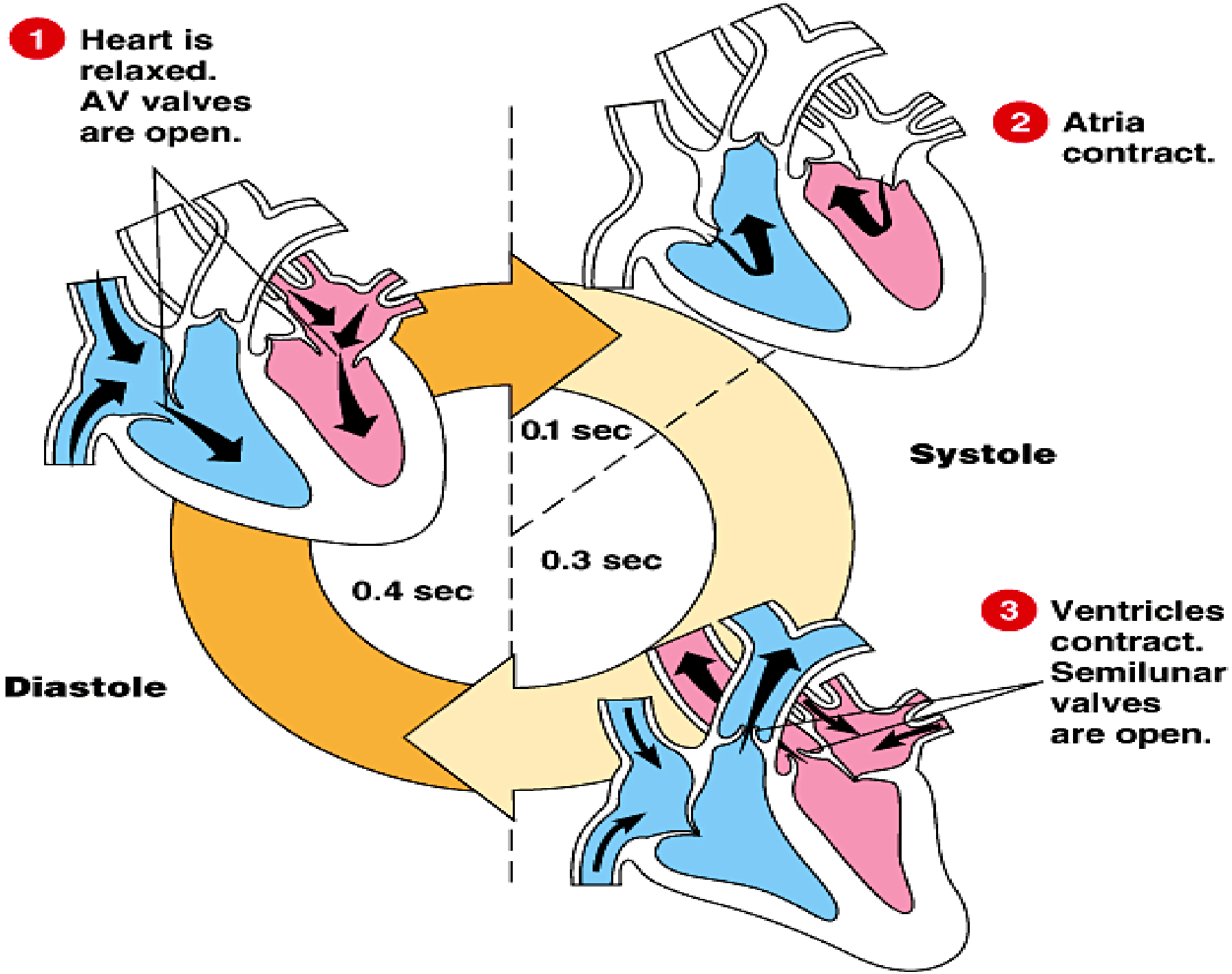


- The force per unit area that blood exerts on the walls of blood vessels

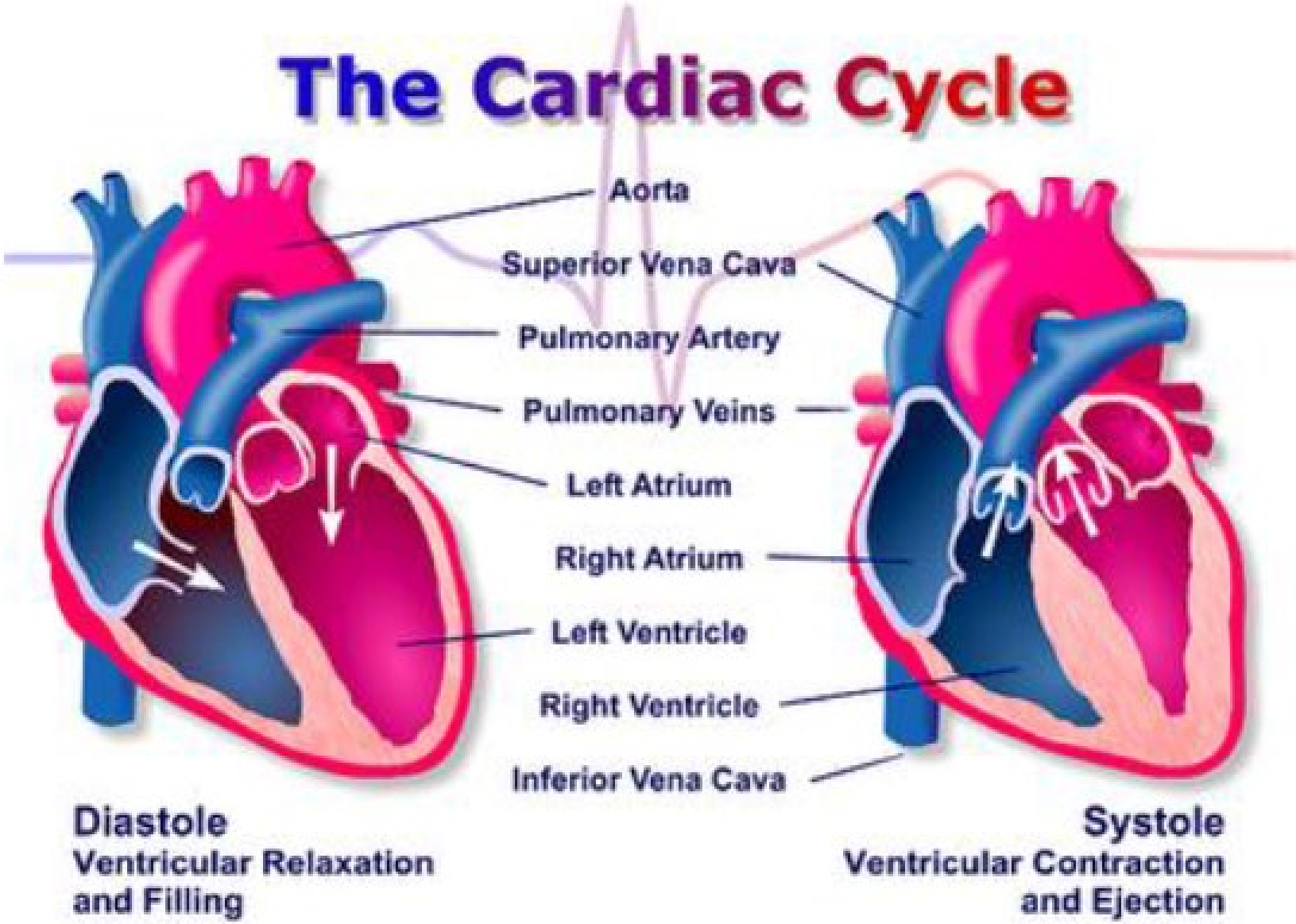
- Blood pressure is often measured in millimeters of mercury (mm Hg) and is given systolic over diastolic pressure

- Diastole is most important because it determines the pressure on arteries when ventricles are relaxed.

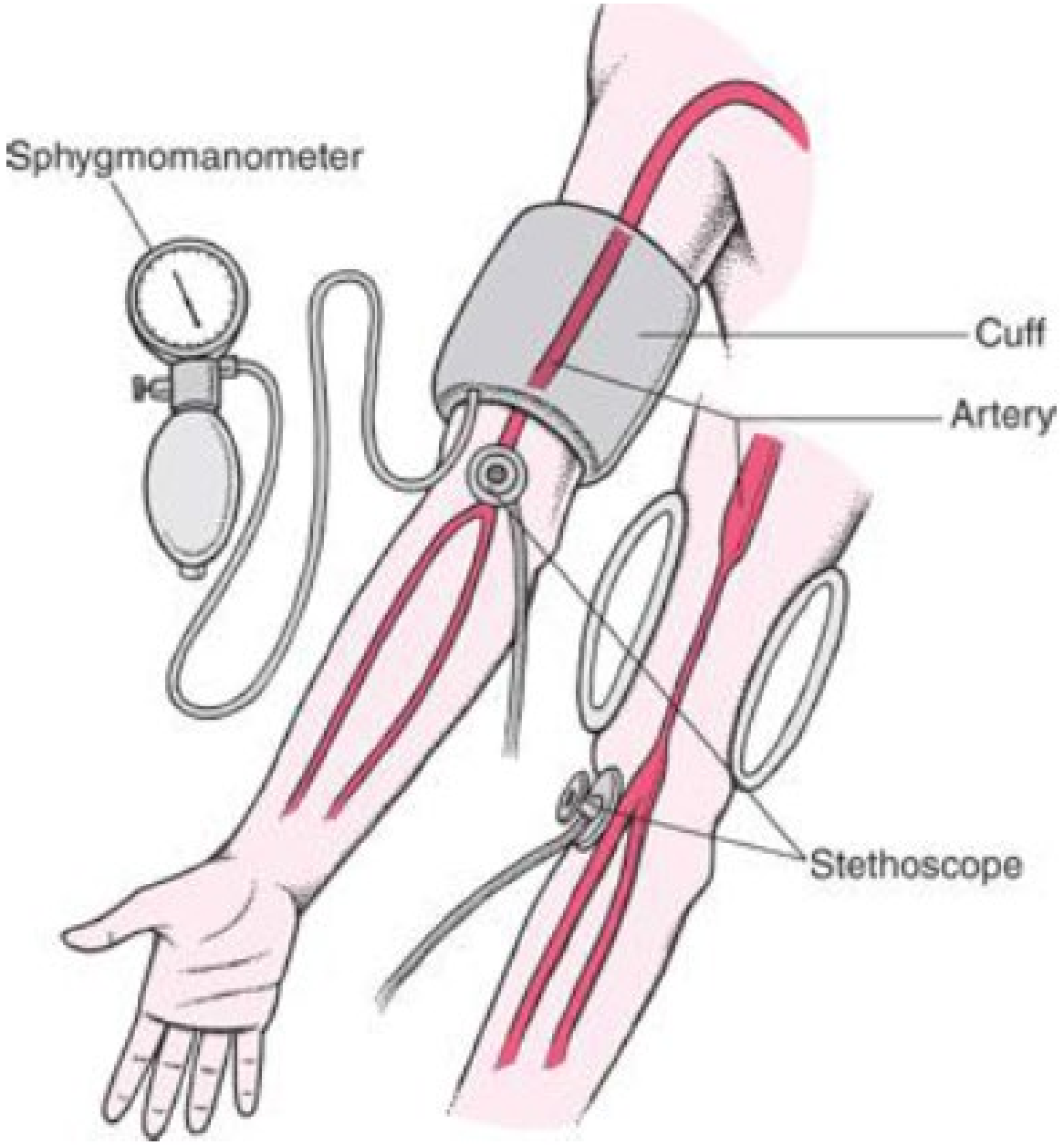



1 Heart is relaxed. AV valves are open.
2 Atria contract.
0.1 sec
Systole
0.3 sec
0.4 sec
3 Ventricles contract. Semilunar valves are open.
Diastole

The Cardiac Cycle



Blood pressure is measured using a **sphygmomanometer** (sfig.mow.muh.naa.muh.tr)


Sphygmomanometer
Cuff
Artery
Stethoscope

Sphygmomanometer

- An inflatable cuff is placed around the upper arm
- Inflates to a pressure around 145 – 160 mm Hg. The flow of blood in the major artery in the arm at this point will be blocked
- A stethoscope is used to listen for the sound of the blood in the artery. As the pressure in the cuff is slowly reduced, blood forcing its way through the artery will be heard. The **FIRST SOUND** heard (faint tapping or thumping) is pressure recorded as the systolic value

- When the sound is no longer heard, the pressure value is recorded. This is the diastolic pressure.

- The sound disappears because the blood no longer has to force its way past an blocked artery.

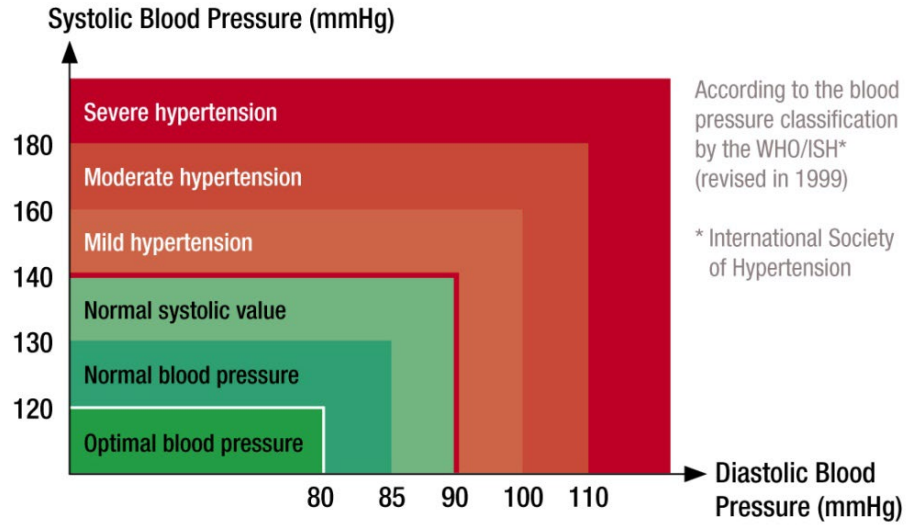
- Normal range for blood pressure:
  - **90 to 135 systolic**
  - **50 to 90 diastolic**
  - 120/80 is the “textbook” normal pressure
    - Hypertension is chronic abnormally high pressure about *140/90*

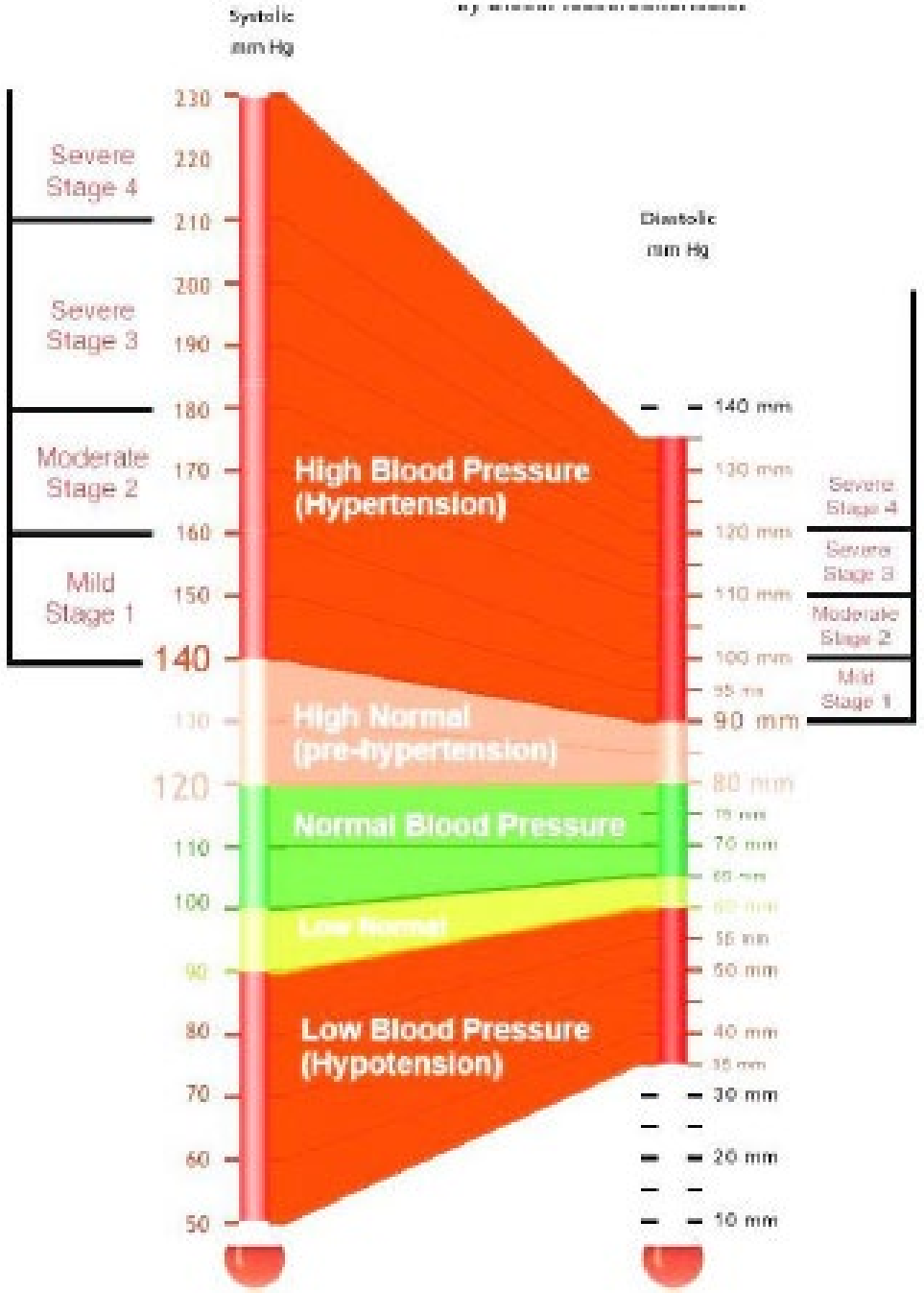
Hypertension

- Caused by increased resistance to blood flow
- Blood vessels weaken and may rupture
- Body compensates by increasing support provided by connective tissues which can lead to arteries become hard
- Caused by
  - Heredity
  - Diet (too many salts and fats)

Factors that affect Blood Pressure (BP)

- Heart rate (HR): High HR = high BP.
- Blood vessel size: narrower = high BP.
- Blood volume: High volume = high BP.
- Stroke volume: High volume = high BP.



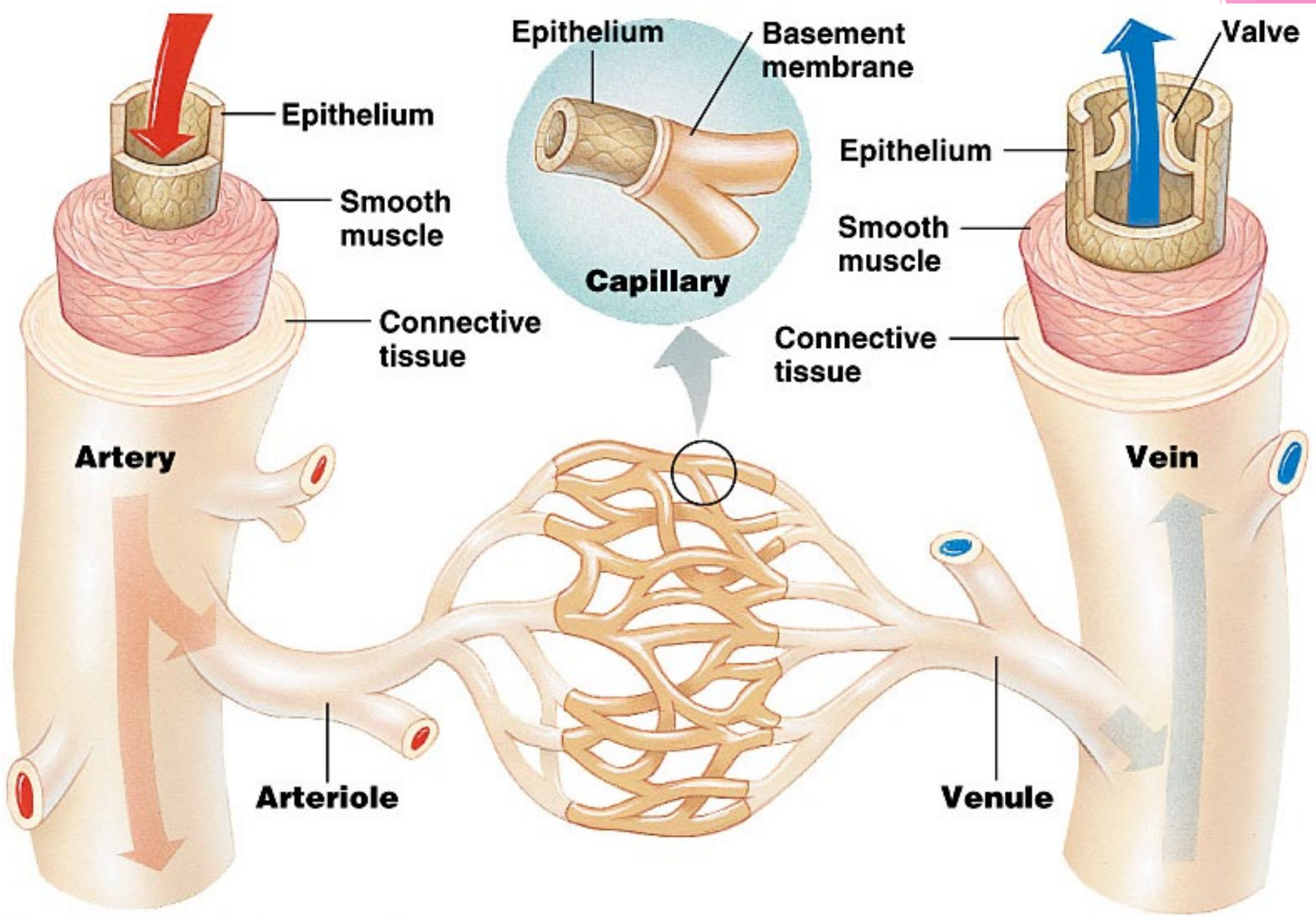

Systolic
mm Hg
230
220
210
200
190
180
170
160
150
140
120
110
100
90
80
70
60
50
Severe
Stage 4
Severe
Stage 3
Moderate
Stage 2
Mild
Stage 1
High Blood Pressure
(Hypertension)
High Normal
(pre-hypertension)
Normal Blood Pressure
Low Normal
Low Blood Pressure
(Hypotension)
Diastolic
mm Hg
140 mm
120 mm
110 mm
100 mm
90 mm
80 mm
70 mm
60 mm
40 mm
30 mm
20 mm
10 mm
Severe
Stage 4
Severe
Stage 3
Moderate
Stage 2
Mild
Stage 1

Regulation of Blood Pressure (BP)

- Low BP = difficulty transporting blood to tissues (especially head).
- High BP = weaken artery, ruptures blood vessels.
- Baroreceptors (in aorta and carotid arteries) detect changes in BP. Brain receives message and either speeds up (sympathetic) or slows down (parasympathetic) impulses.

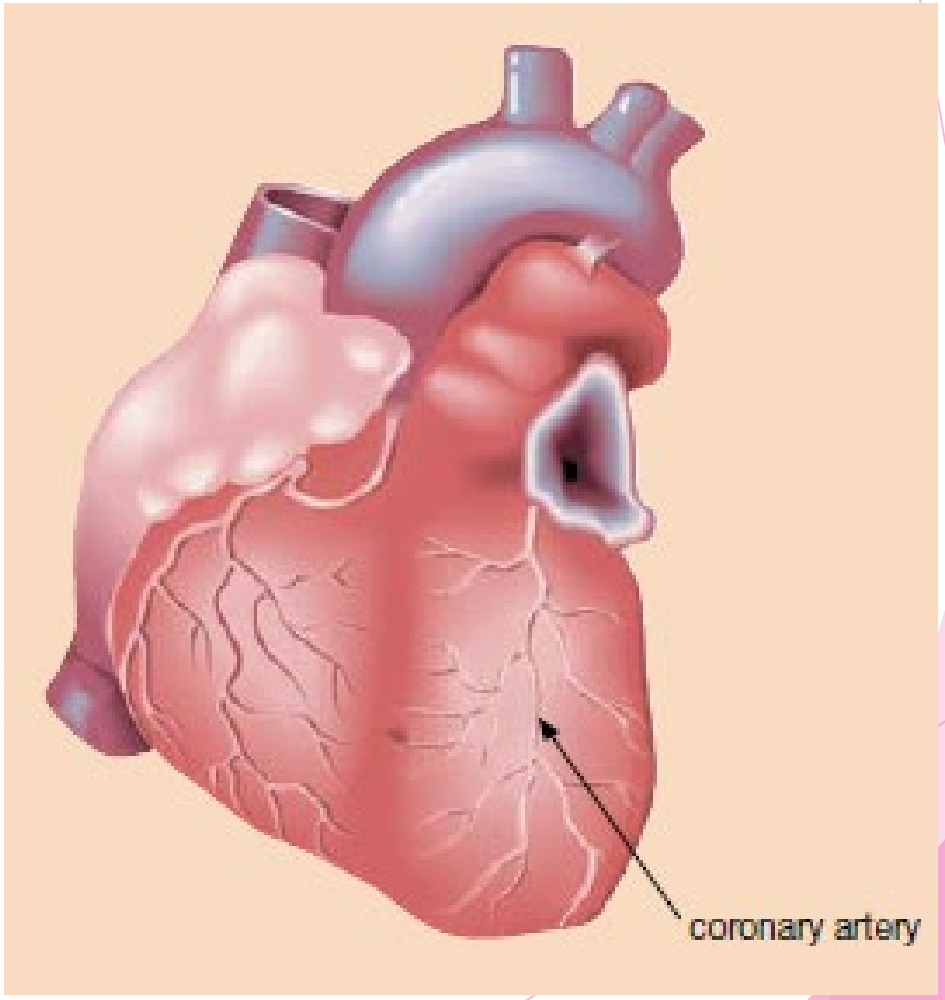
Blood vessels

- **Arteries** are blood vessels that transport blood *away* from the heart
- **Veins** are blood vessels that transport blood *toward* the heart
- **Capillaries** are tiny microscopic tubes that connect arteries to veins
- They are thin walled, porous vessels that allow gases and fluids to be exchanged with the body's cells.


Epithelium
Smooth muscle
Connective tissue
Artery
Epithelium
Basement membrane
Capillary
Arteriole
Venule
Valve
Epithelium
Smooth muscle
Connective tissue
Vein

Coronary Artery

- Your heart needs a supply of oxygen and nutrients
- **Coronary arteries** supply the heart muscle with blood

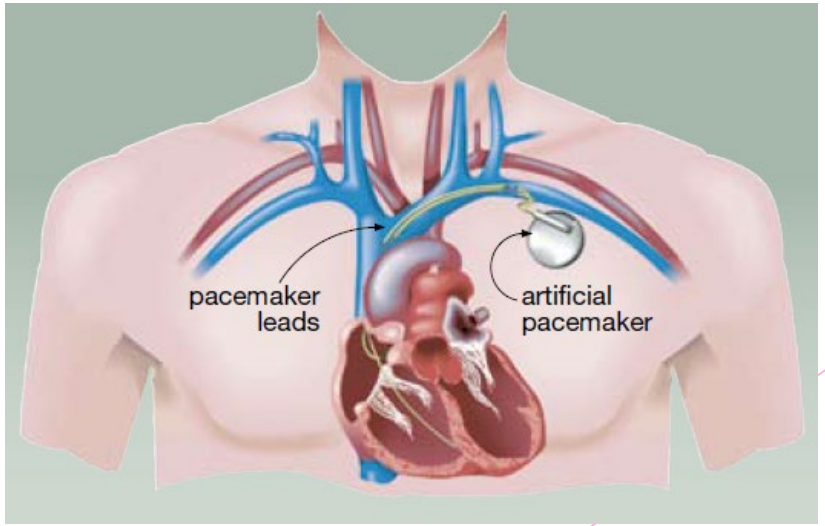


Pacemaker

- Our hearts have a small region of muscle tissue that sets the tempo of the heartbeat called a **pacemaker**

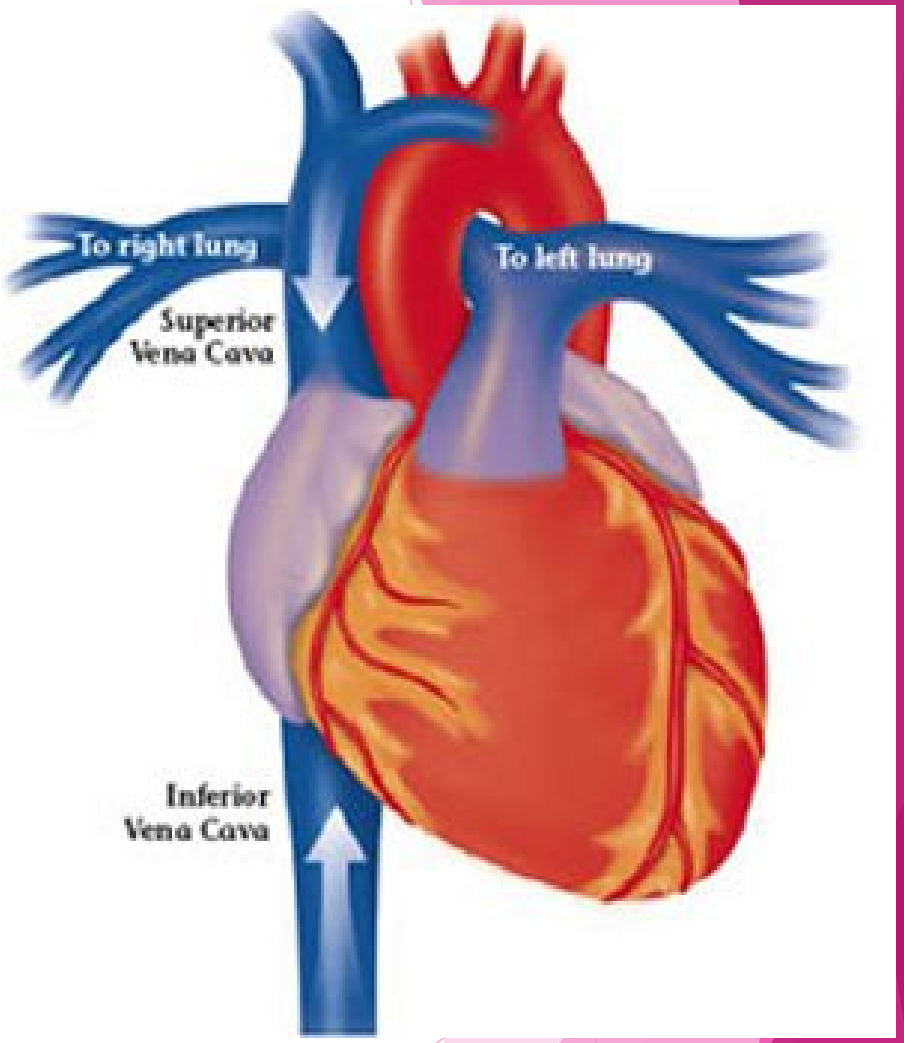
- It generates an electrical signal to coordinate the contractions of the heart chambers

- If this fails, an artificial pacemaker must be installed

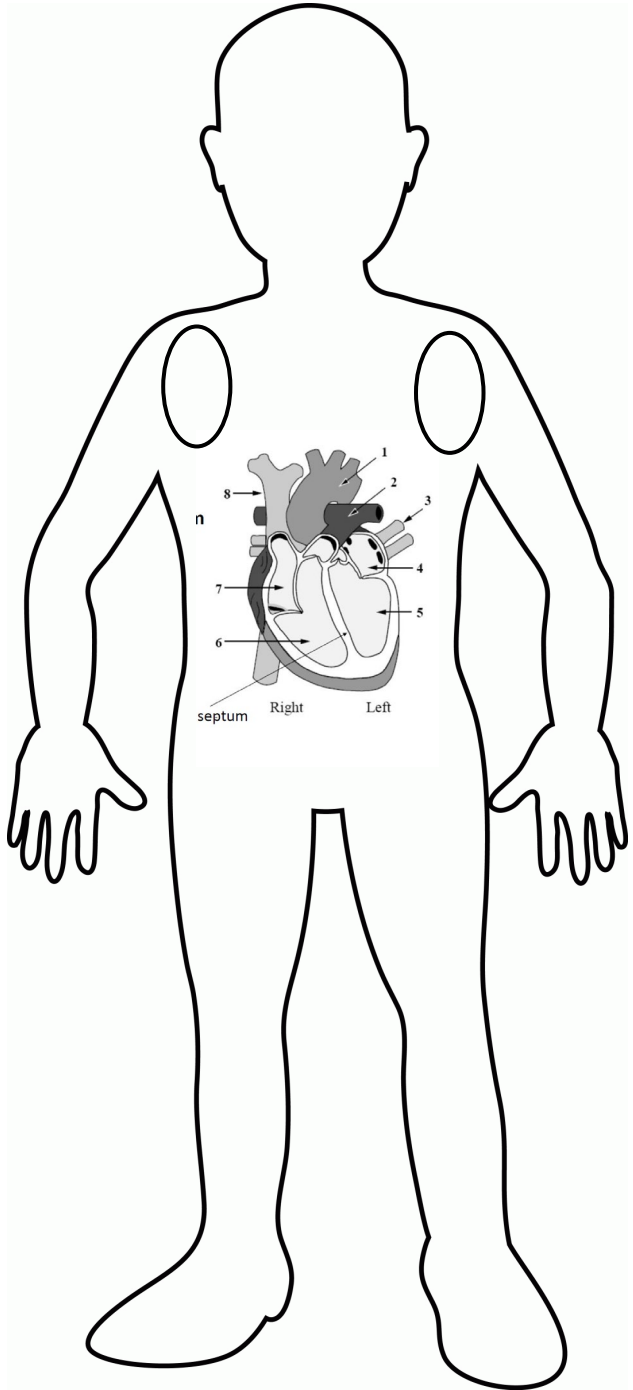


Vena Cava

- The largest vein in the body. There are 2 branches of the vena cava:
  - **Superior Vena Cava** (receives blood from the diaphragm up)
  - **Inferior Vena Cava** (receives blood from below the diaphragm



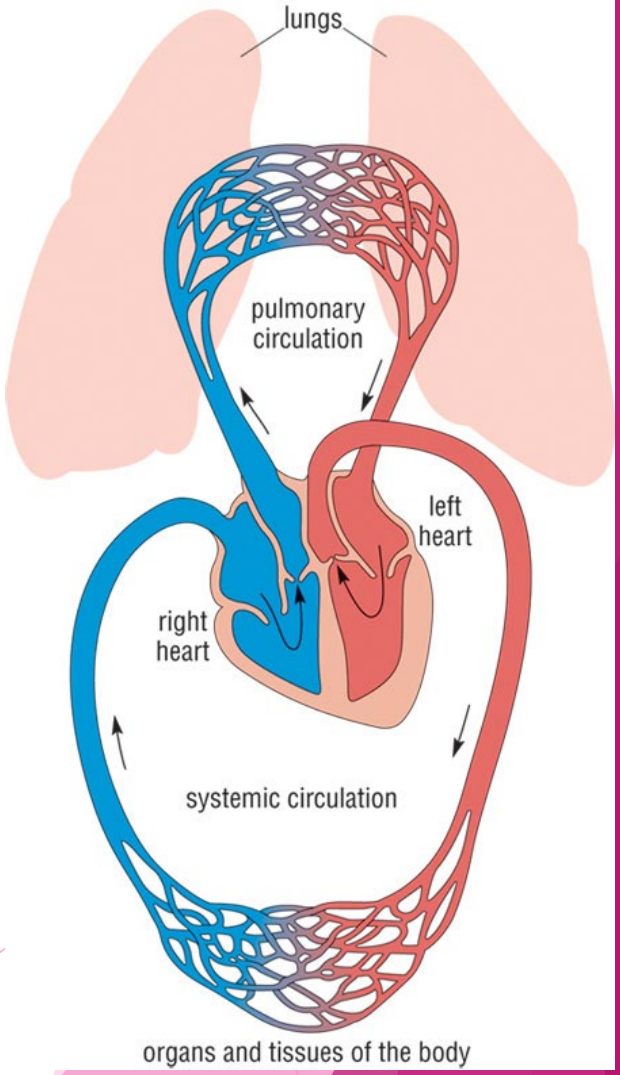
Pulmonary and Systemic Pathways



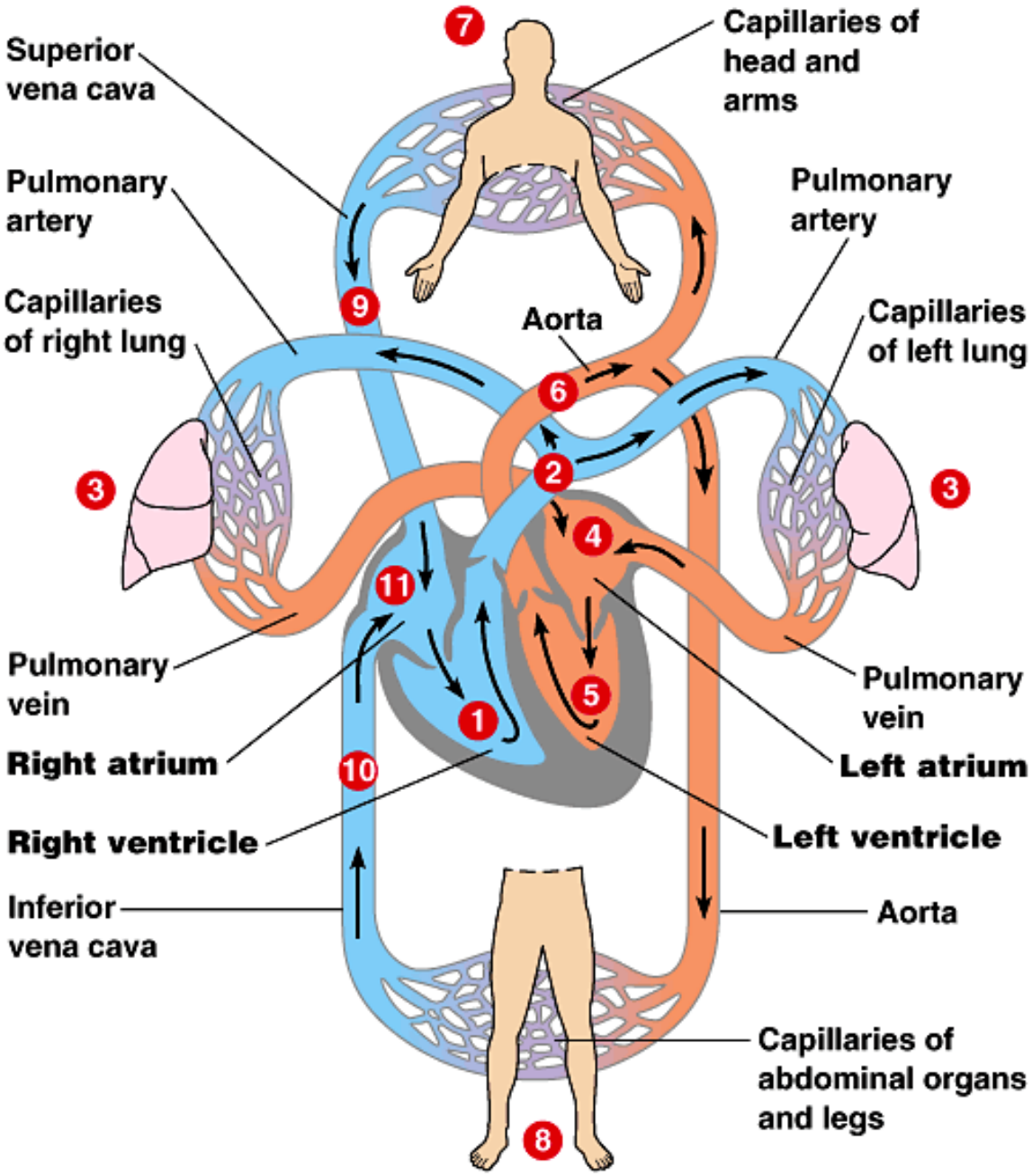
Pulmonary and Systemic Pathways

- The **Pulmonary loop** transports blood from the heart to the lungs and back
  - In the pulmonary loop deoxygenated blood is given oxygen from the lungs and pumped back to the heart

- The **Systemic loop** transports blood to the rest of the body and back to the heart
  - In the systemic loop oxygen and nutrients are transferred to the cells and carbon dioxide and other wastes are given back to the blood



Systemic pathway video (1 minute)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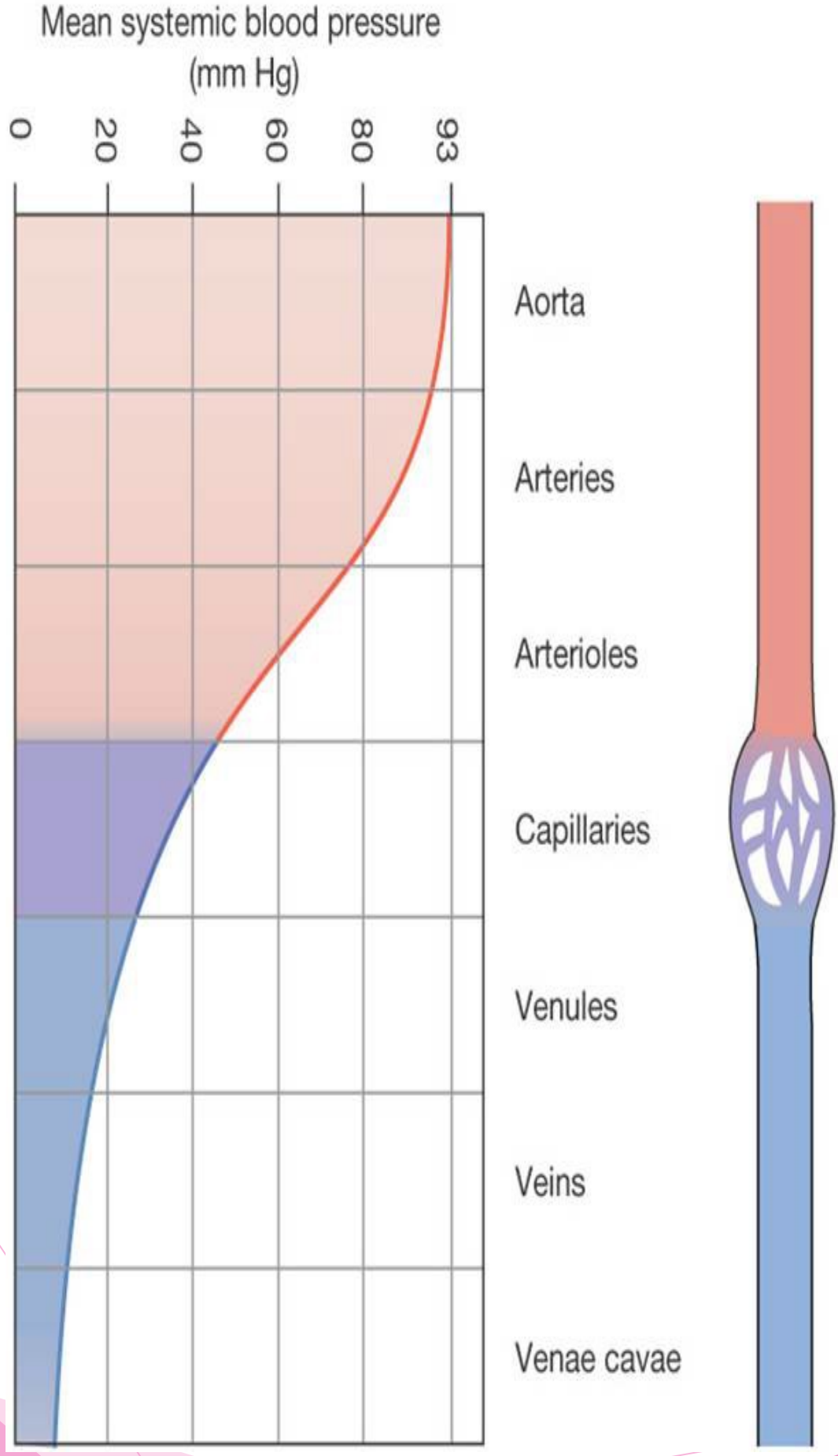
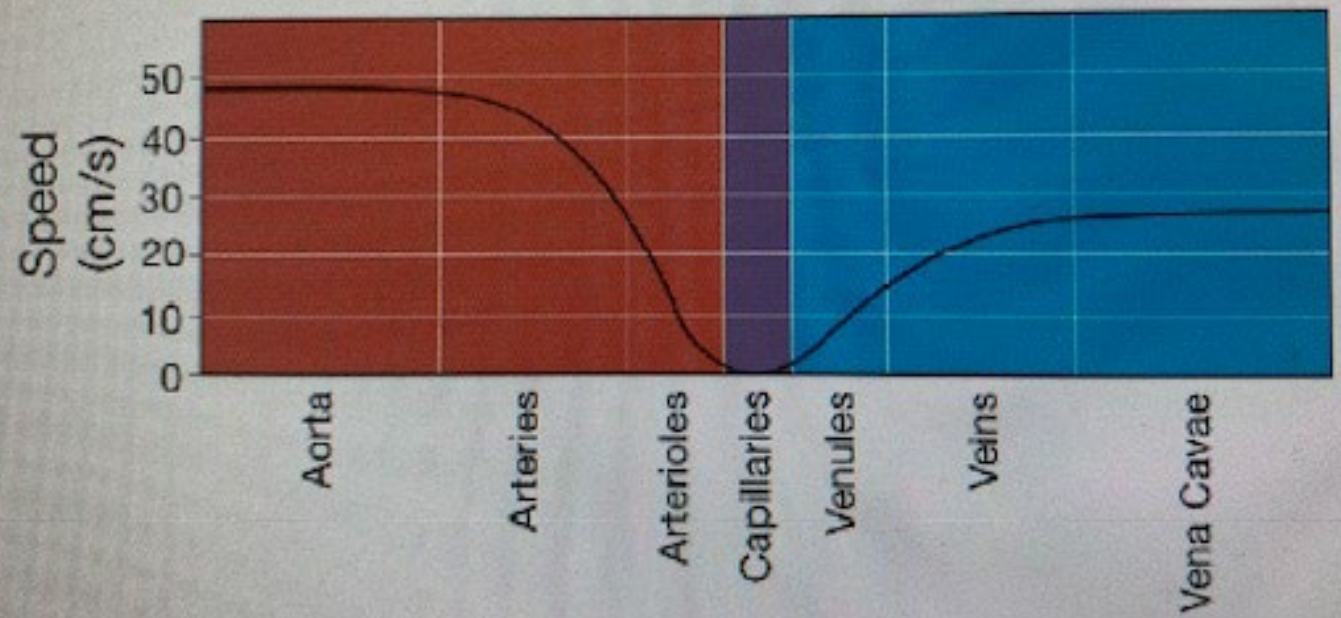
Capillaries of head and arms
Superior vena cava
Pulmonary artery
Pulmonary artery
Capillaries of right lung
9
Aorta
Capillaries of left lung
6
3
2
3
4
11
Pulmonary vein
Pulmonary vein
5
1
Right atrium
Left atrium
10
Right ventricle
Left ventricle
Inferior vena cava
Aorta
Capillaries of abdominal organs and legs
8

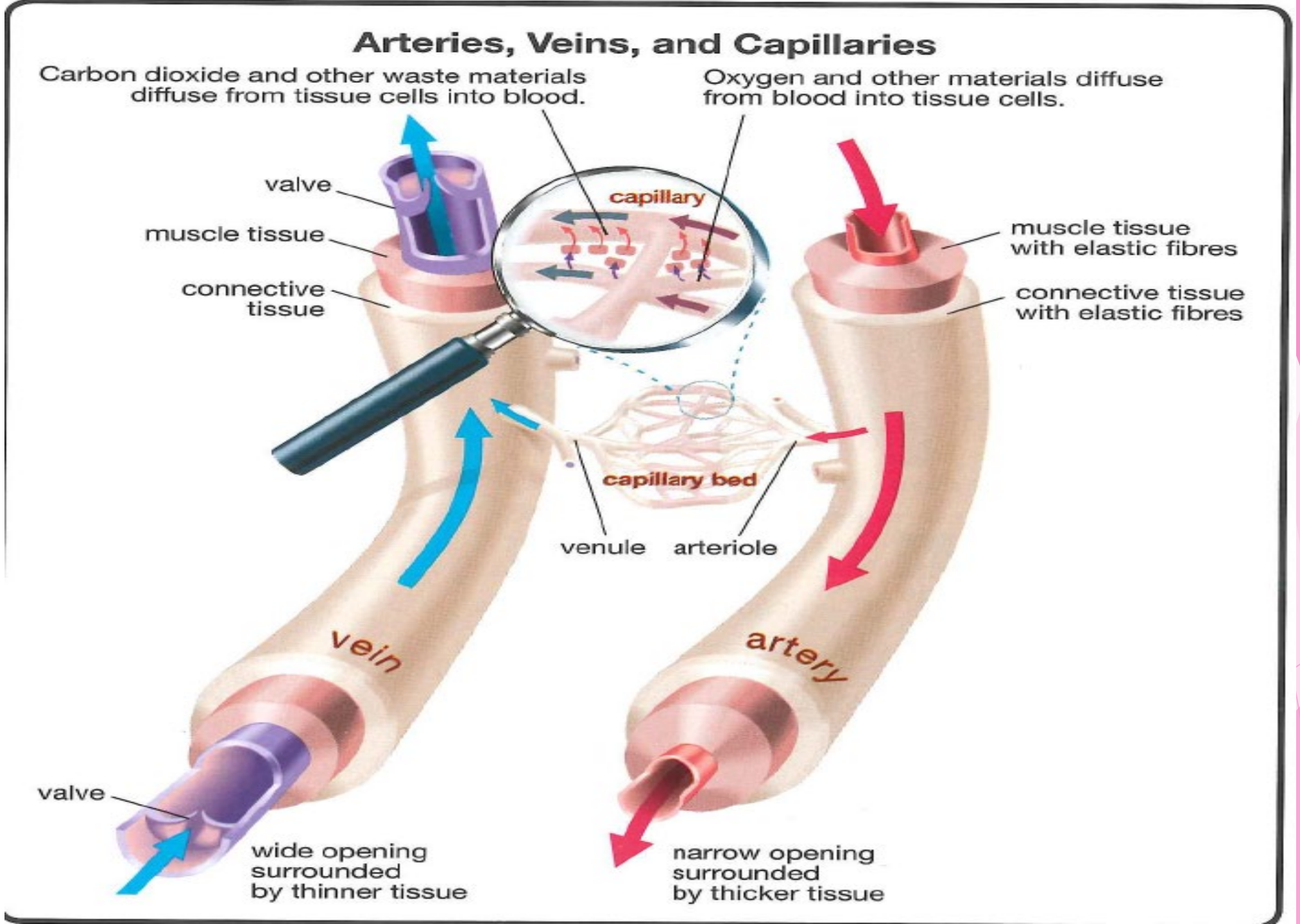
Specialized Blood Vessels

- Blood moves through the body because of the pressure created from your heart beating
- The closer blood is to the heart, the more pressure it receives
- Arteries are much thicker than veins to withstand the pressure of the pumping heart
- As the blood gets further from the heart, they branch and move through smaller blood vessels called **arterioles**
- They then move into the capillary bed which is a web of **capillaries**
- The blood then moves into **venules** which are smaller veins


Mean systemic blood pressure
(mm Hg)
0
20
40
60
80
93
Aorta
Arteries
Arterioles
Capillaries
Venules
Veins
Venae cavae

Blood speed in vessels




Arteries, Veins, and Capillaries
Carbon dioxide and other waste materials diffuse from tissue cells into blood.
Oxygen and other materials diffuse from blood into tissue cells.
valve
muscle tissue
connective tissue
capillary
muscle tissue with elastic fibres
connective tissue with elastic fibres
capillary bed
venule
arteriole
vein
artery
valve
wide opening surrounded by thinner tissue
narrow opening surrounded by thicker tissue

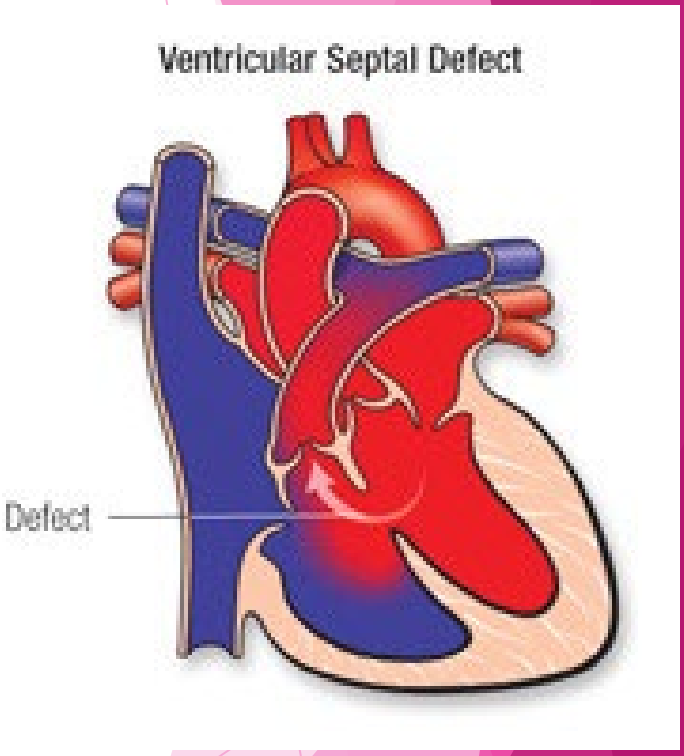
Video (5 min)

Varicose veins

- Blood moves through one way valves to prevent it from moving backwards
- If veins become stretched or damaged, blood can pool in a vein and become raised which is a varicose vein

What can happen to you

- **Aneurysm:** widening or bulging of blood vessel due to weakening of vessel wall
  - Stretching weakens a blood vessel
  - occurs most often in aorta
  - Could be due to injury sometimes or naturally occurs
  - If it happens in the brain the brain it can lead to a stroke
  - Need surgery to repair the aneurysm area if caught early enough



Pressure and Blood Flow

- Blood pressure is highest in the arteries as it moves away from the heart
- Why would it need to be the highest here?
  - Comes from heart and needs to travel through body
- What do our veins have to protect against low blood pressure?
  - They can narrow
- Blood travels the slowest through the capillaries; allows for all nutrients to be picked up

Assignment:

Assignment

Characteristic	Arteries	Veins	Capillaries
description of vessel walls	Thick walled (muscular)	Thin wall	Thin walled (1 cell)
direction of vessel blood flow in relation to heart	Away from heart	Toward the heart	Away bridge gap
blood oxygen level in vessel	Oxygen rich blood (High)	Oxygen poor blood (low)	Depleted oxygen level (high to low)
colour in a circulatory system diagram	Bright red	blue	Red → blue
blood pressure in vessel	High blood pressure	low blood pressure	Low blood pressure
valves present	no	yes	no
pulse present	yes	no	No

Assignment

1. What is the difference between the pulmonary loop and the systemic loop?

Pulmonary loop→ transport blood from heart to lungs and back

Systematic → transport blood to the rest of the body and back

2. What does a coronary artery do?

Supply heart muscle with blood

3. List the order that blood moves through circulatory system starting with aorta using the following terms:

- Arteriole
- Artery
- Capillary
- Vein
- Vena Cava
- Venuole

- Aorta, arteries, arterioles, capillaries, venules, veins, vena cava,