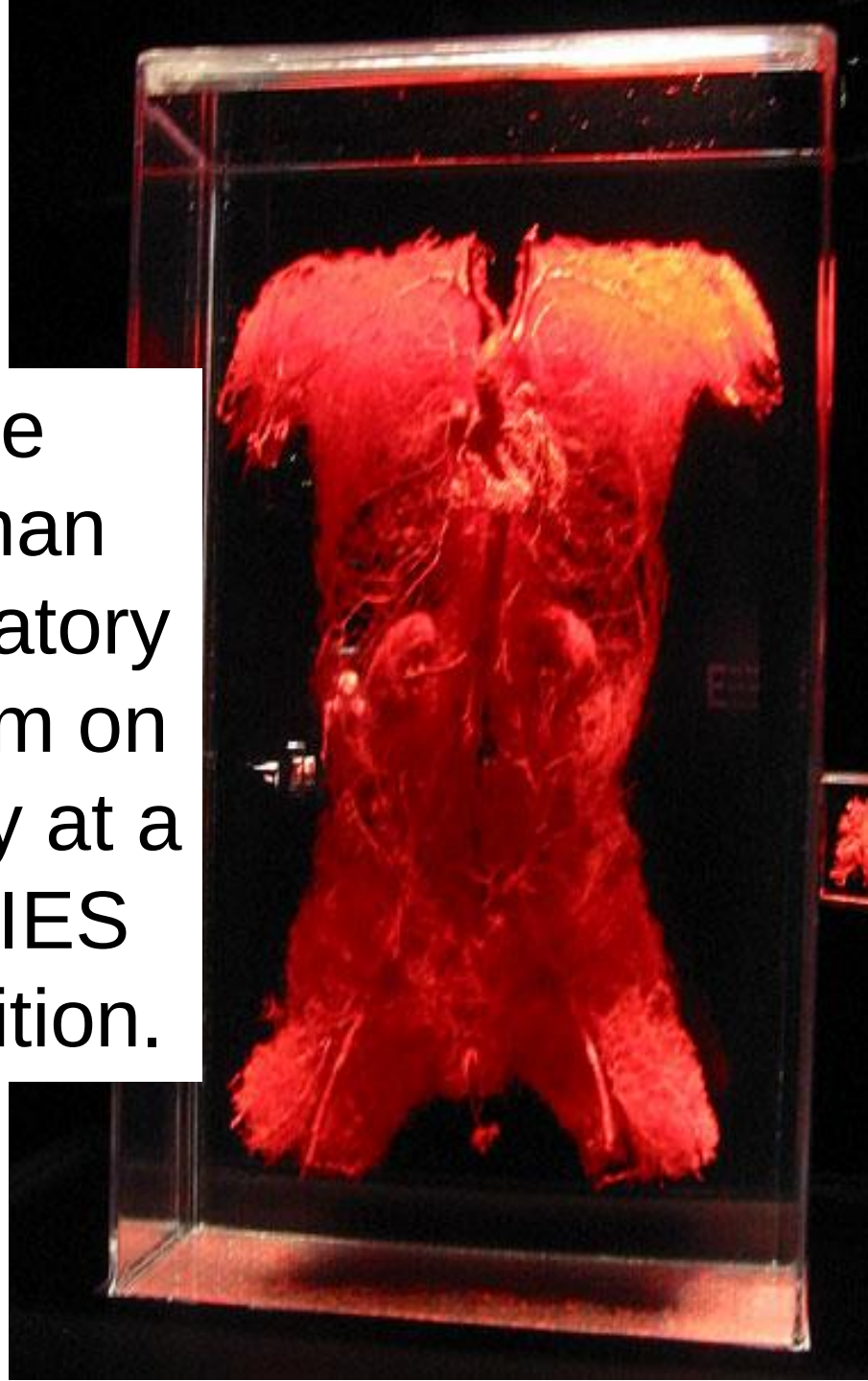
Lesson 1

- **Digestive System Quiz**
- **Begin Circulatory System**
  - **Types of Blood Vessels**

The Human Circulatory System on display at a BODIES Exhibition.

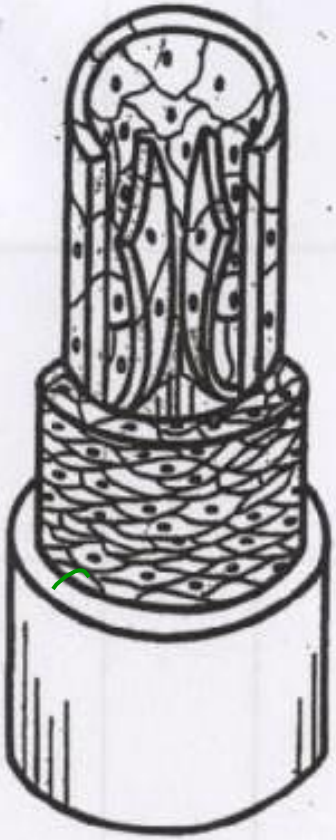


As blood flows through the circulatory system, it moves through three types of <u>blood vessels</u>

Artery

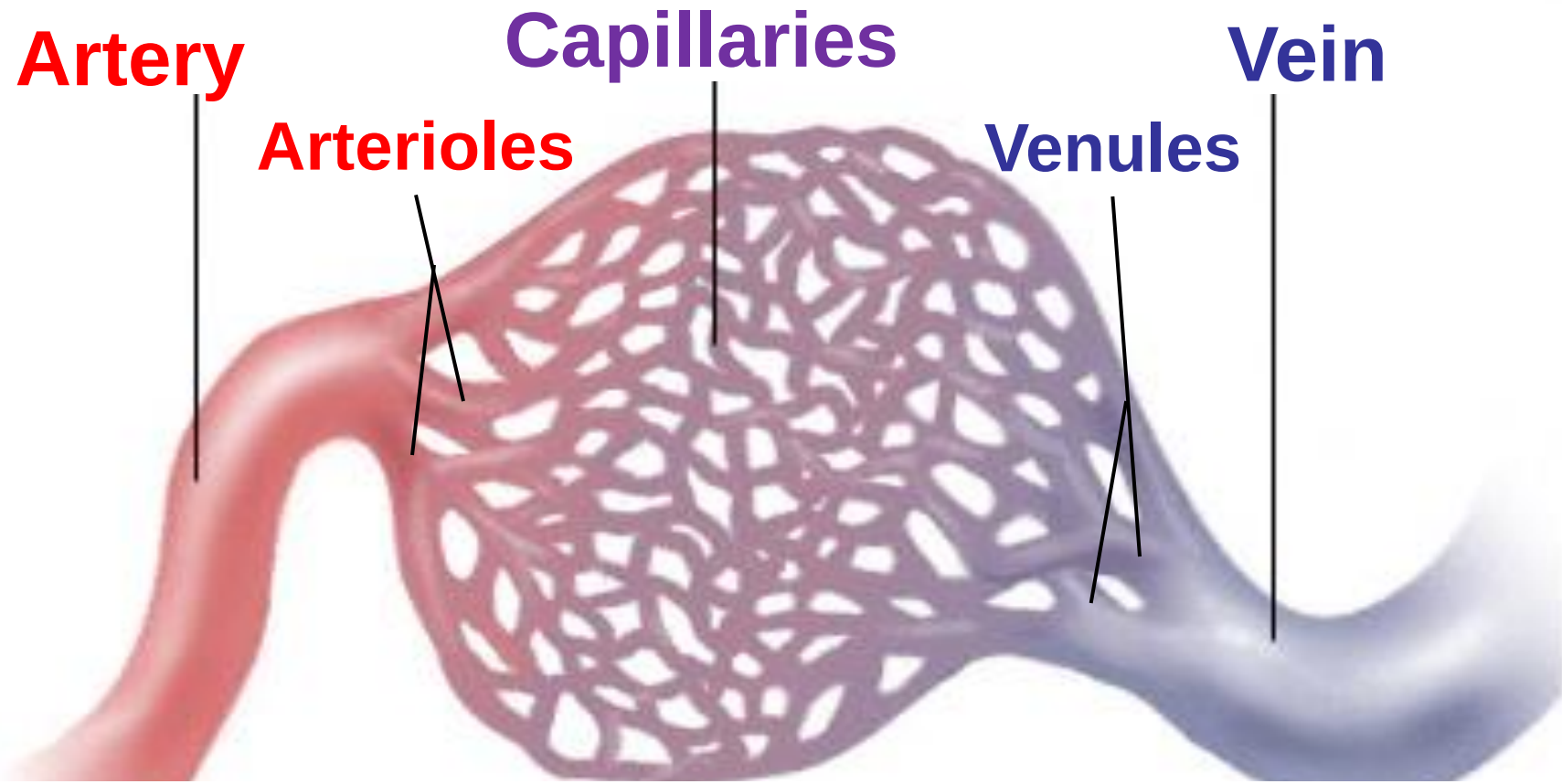
Vein

Capillary



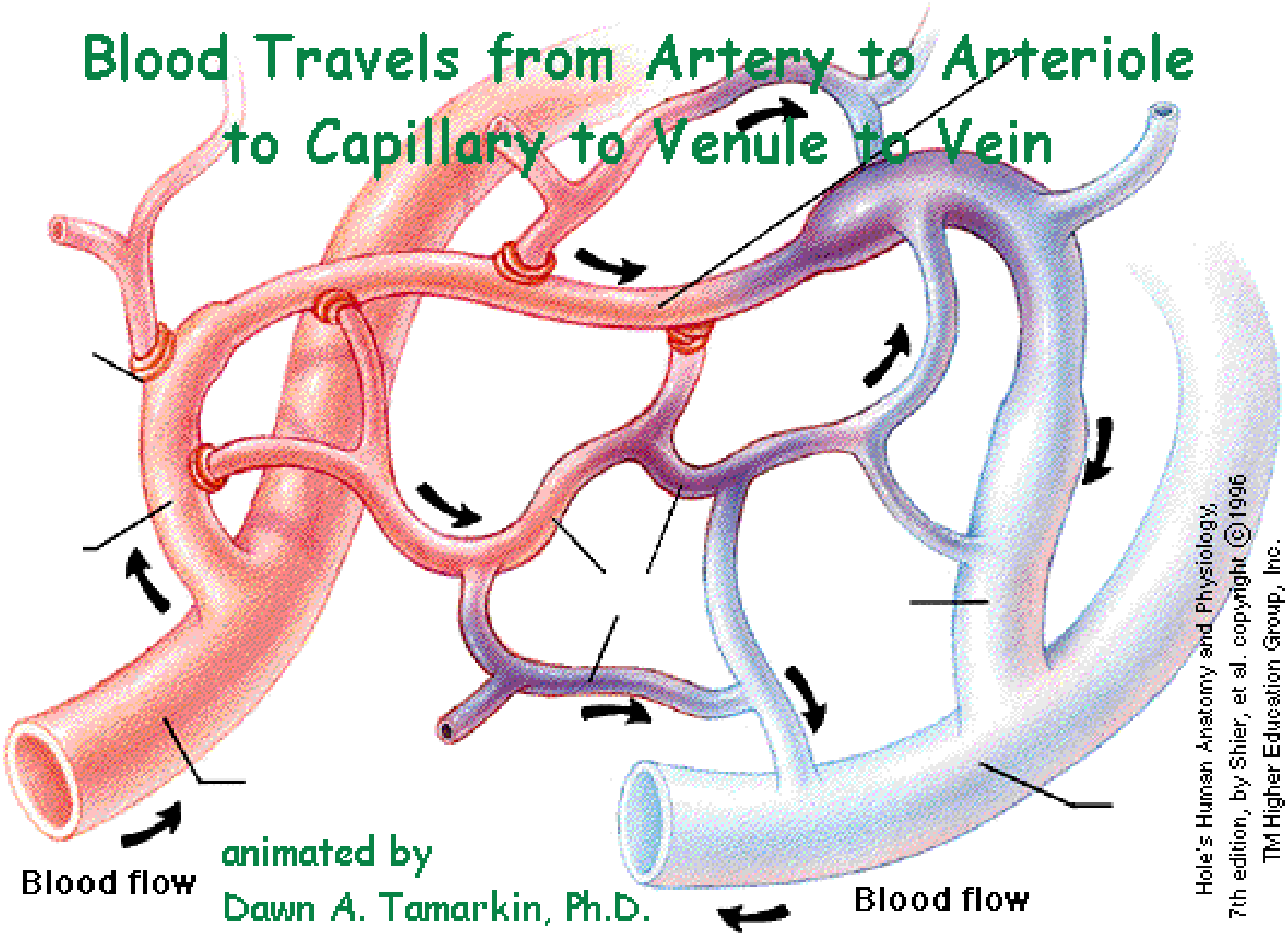
BRAINPOP

Figure 11–6

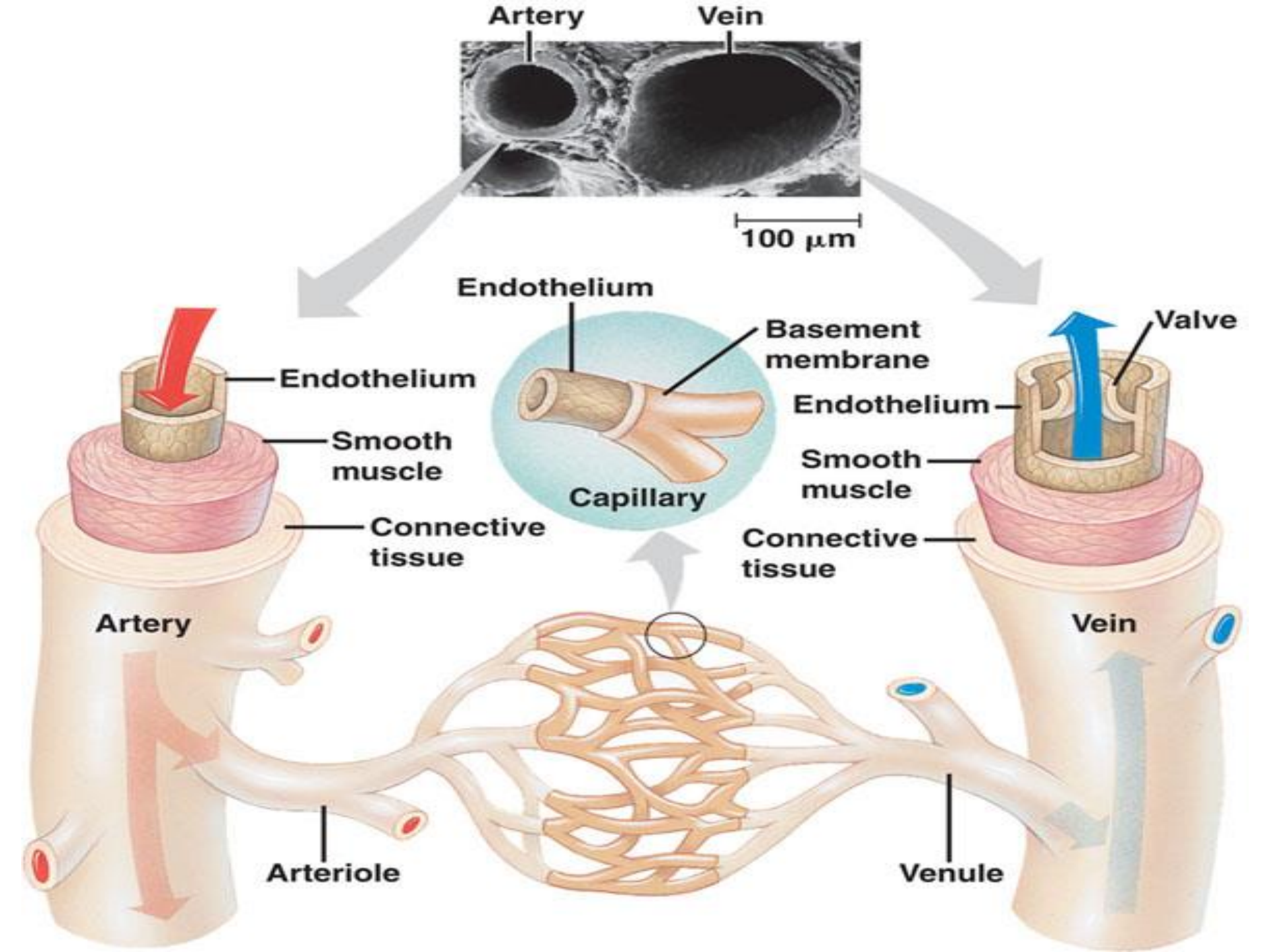


- **Arteries:** carry oxygen & nutrients AWAY from the heart toward the body tissues
- **Veins:** carry carbon dioxide & wastes back TOWARD the heart from the body tissues

Blood Travels from Artery to Arteriole to Capillary to Venule to Vein



animated by
Dawn A. Tamarkin, Ph.D.


Artery
Vein
100 μm
Endothelium
Basement membrane
Capillary
Endothelium
Smooth muscle
Connective tissue
Artery
Valve
Endothelium
Smooth muscle
Connective tissue
Vein
Arteriole
Venule

Artery

- carries blood AWAY from heart
- thick walled, muscular blood vessels
- withstand powerful blood pressure from heart contracting
- pulse detected here

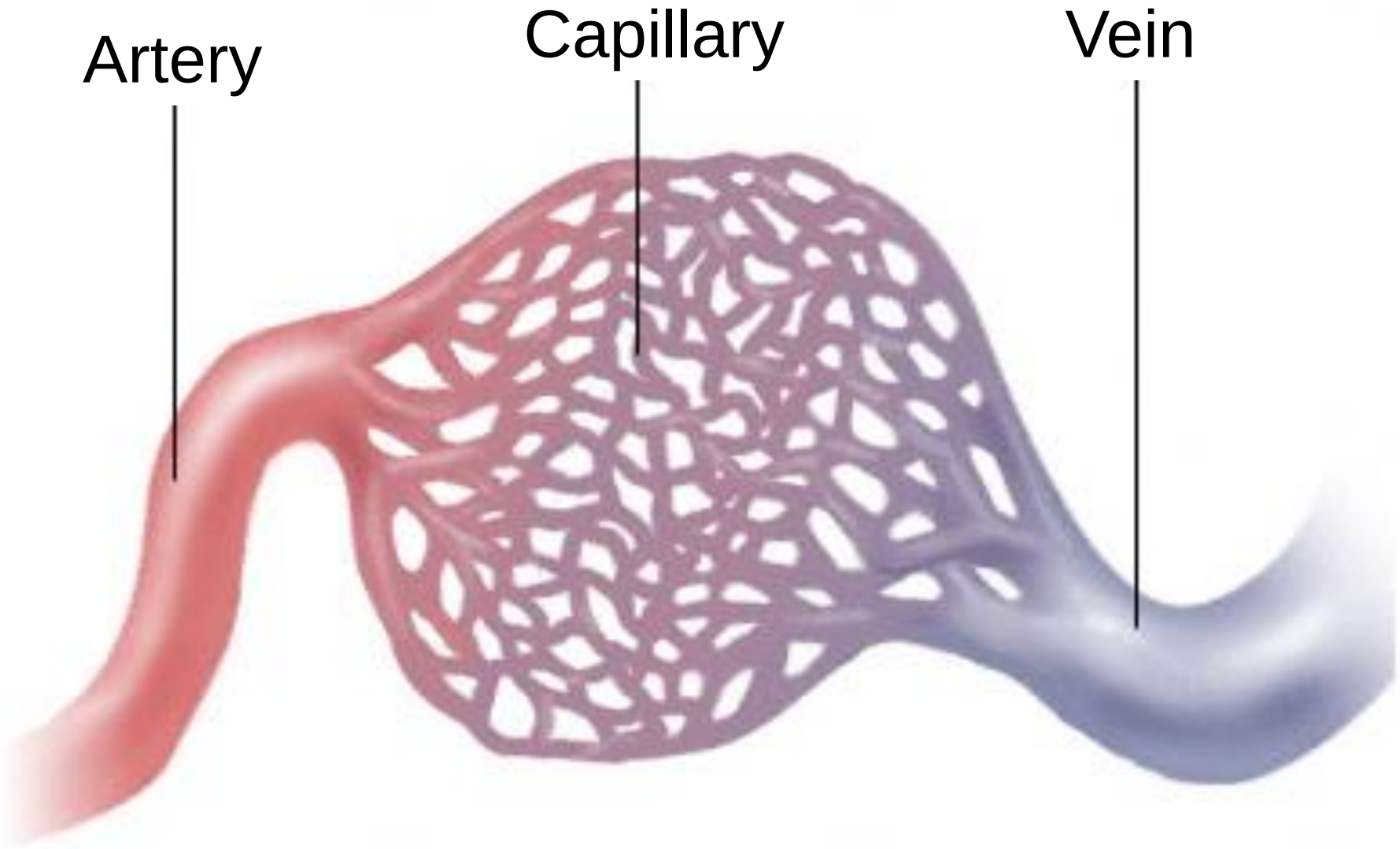
Vein

- carries blood back TO the heart from the body
- have VALVES to prevent backflow of blood
- located near skeletal muscles to squeeze vein pushing blood

Capillary

- smallest (only one cell thick)
- connect arterioles to venules
- site where gases, nutrients & wastes are exchanged between blood & body tissues (diffusion)

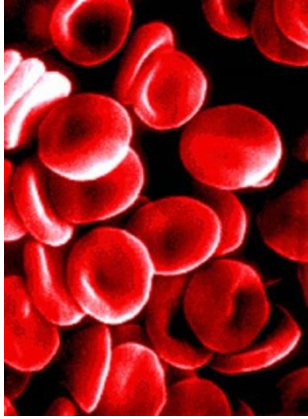
Let's Review Blood Vessels!



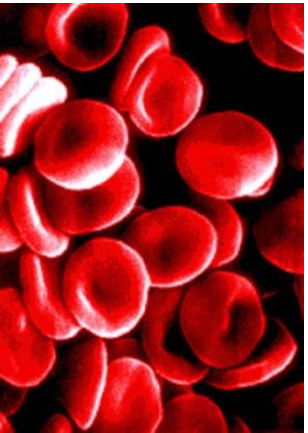
YMCA song

Lesson 2

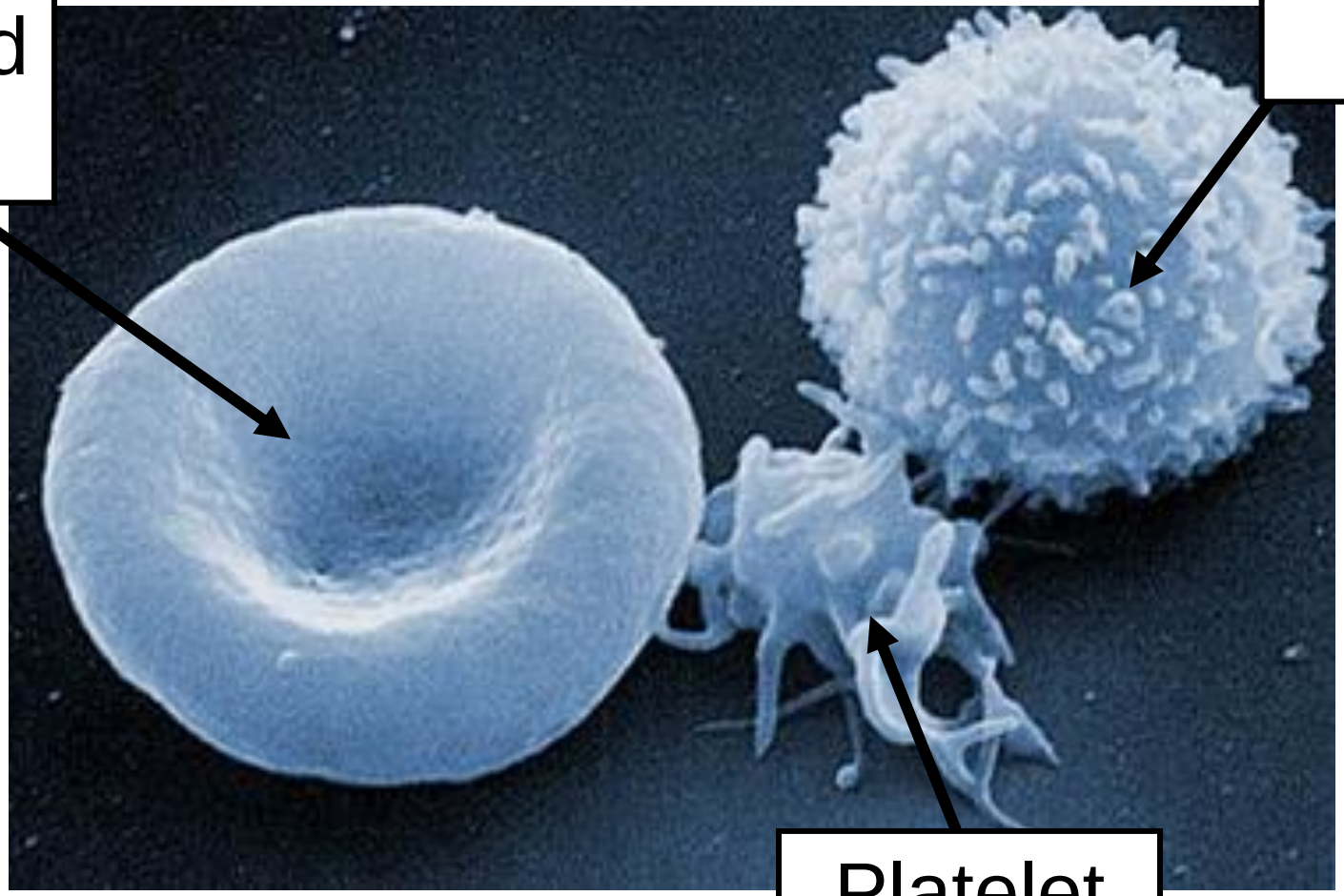
- **Blood**
  - **RBC**
  - **WBC**
  - **Platelets**
  - **Plasma**



The Circulatory System



Blood Components



Human Blood

BRAINPOP

Blood is not Blue Video

Major Components:

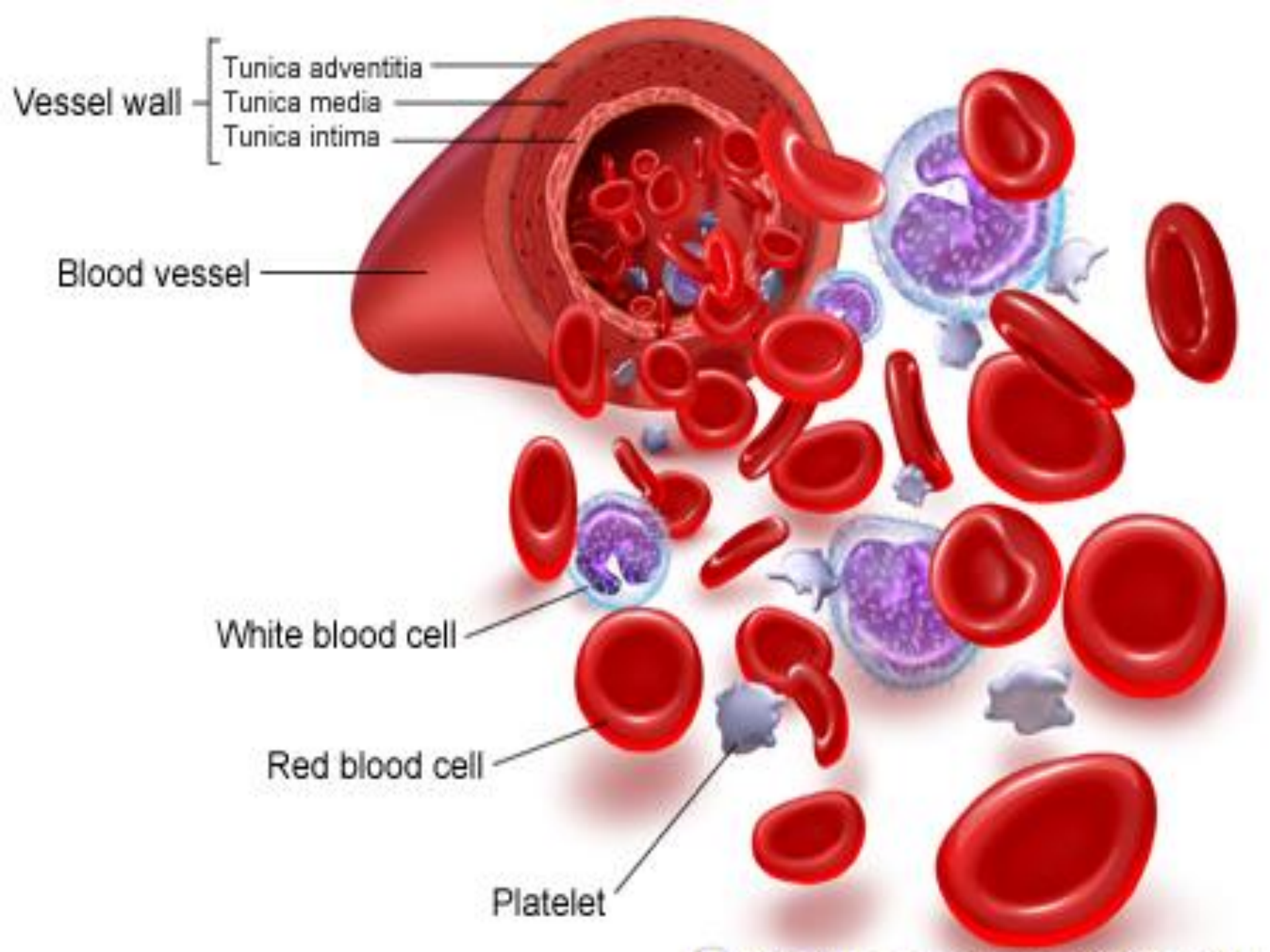
1) Plasma
   - 90% water, contains other components

2) Platelets

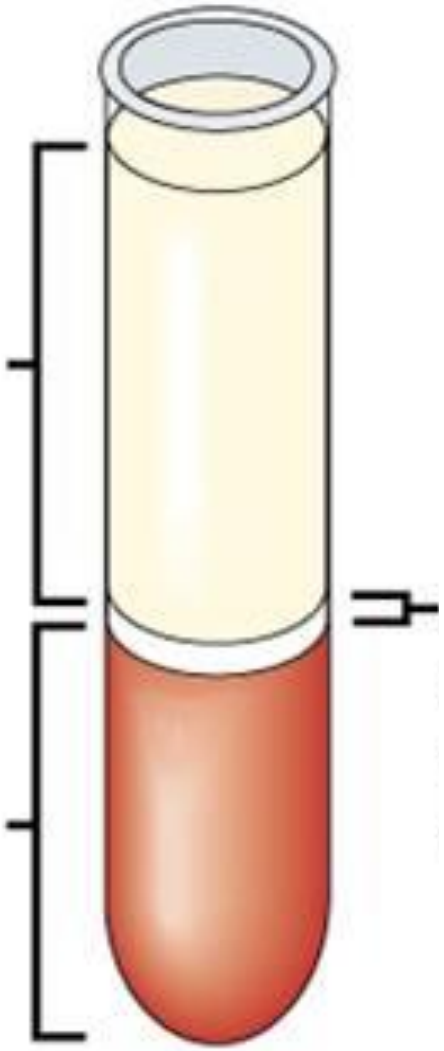
3) White Blood Cells

4) Red Blood Cells

} Produced in bone marrow


Vessel wall
Tunica adventitia
Tunica media
Tunica intima
Blood vessel
White blood cell
Red blood cell
Platelet

Blood Components



Suspended Materials in Plasma

- Dissolved gases (CO_2)
- Salt
- Glucose
- Amino acids
- Hormones
- Urea (wastes)
- Medications

Cell Type	Physical Characteristics	Functions
RED Blood Cells AKA Erythrocytes	• Bi-concave discs • no nucleus • Smaller than WBC • 5 million per ml (most numerous!) • Produced in bone marrow • Live for 120 days	• Contain iron rich protein hemoglobin which carries oxygen! (forms oxyhemoglobin) • Responsible for blood type

Cell Type	Malfunction
RED Blood Cells	Anemia (many types) - Low oxygen transport ability

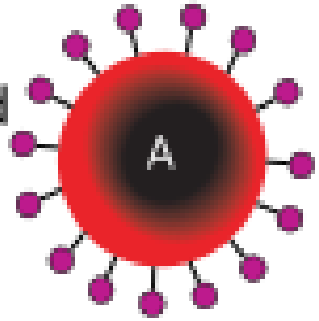
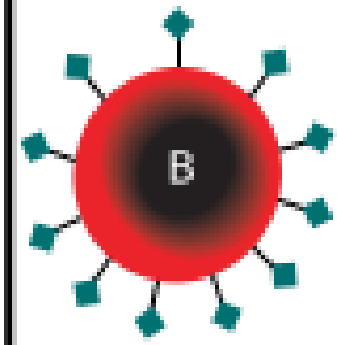
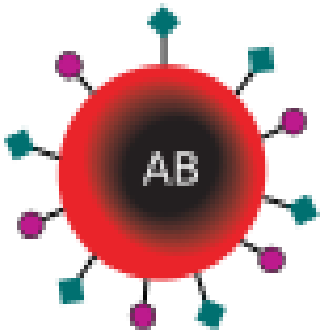
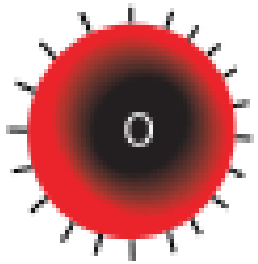
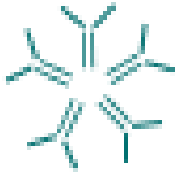
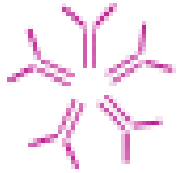
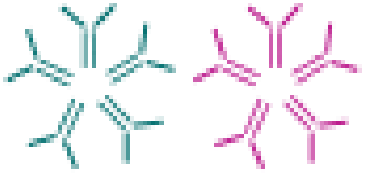
Cell Type	Physical Characteristics	Functions
WHITE BLOOD CELLS **AKA Leukocytes**	• **Fewest in number** • **Produced in bone marrow** • **Have a nucleus** • **Largest** • **Most only live for a few days**	• **The "army" of the circulatory system** • **Fights foreign invaders (infection, viruses, allergens, bacteria)**

Cell Type	Malfunction
White Blood Cells	Leukemia - Cancer of bone marrow

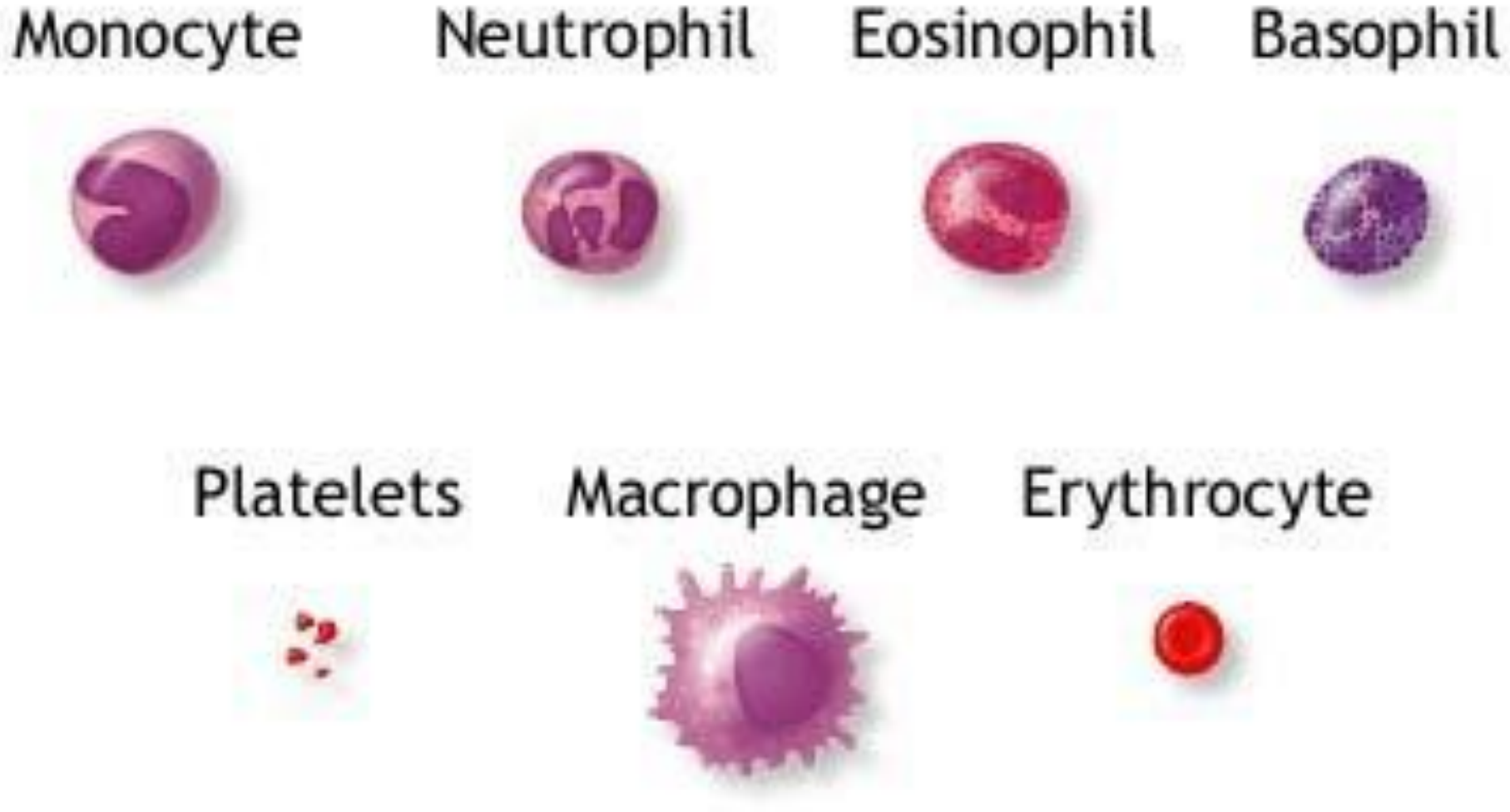
Cell Type	Physical Characteristics	Functions
Platelets AKA Thrombocytes	• Very small • Irregular shaped fragments • Not as many as RBCs	• Needed for blood clotting • Release clotting factors (proteins) and forms fibrin to produce a scab to stop bleeding

Cell Type	Malfunction
Platelets	Hemophilia - Difficulty clotting blood

Blood Types

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies present	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens present	A antigen	B antigen	 A and B antigens	None

Blood Cell Types



FUNCTION	Red Blood Cells	White Blood Cells	Platelets	Plasma
Carries oxygen to body cells				
Engulfs foreign invaders				
Needed for blood clotting				
Carries CO_2 away from body cells toward lungs				
Contains hemoglobin on the cell surface				
The liquid portion of the blood				
Make antibodies				
A malfunction of this component may result in excessive bleeding				
Transports cell wastes, nutrients, salts, and hormones				
Gives blood its color				
DNA is found here				

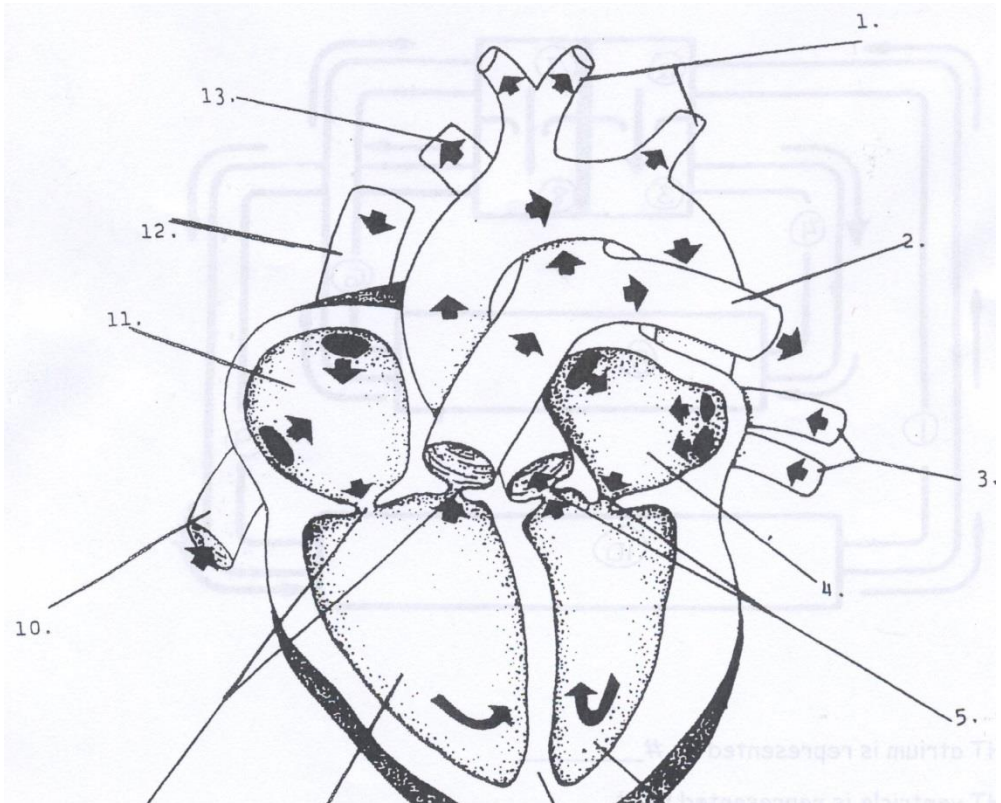
Why is blood considered a tissue?

Lesson 3

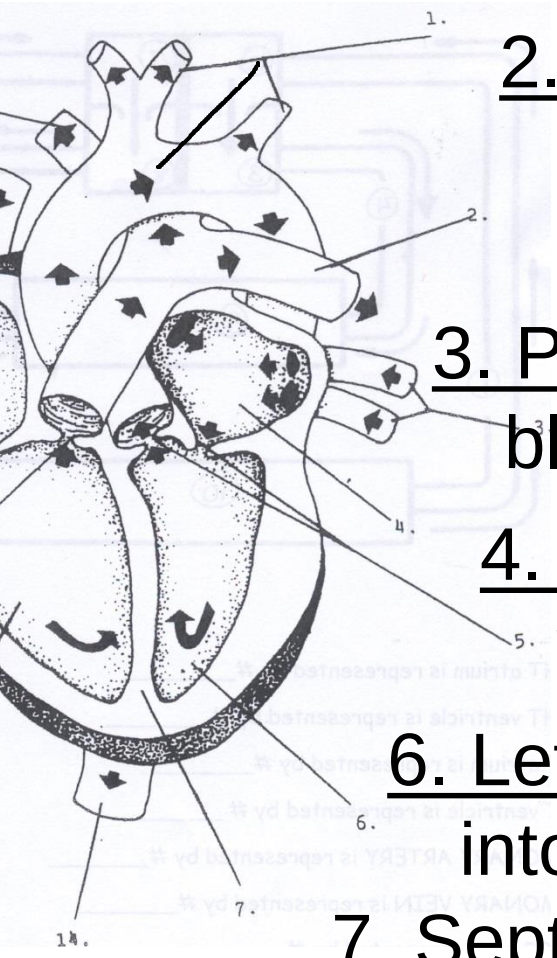
- **Heart Structure**

The Human Heart

- Muscular organ that contracts to pump blood
- 4 chambers
  - 2 atria (top)
  - 2 ventricles (bottom)



Structure of the Human Heart



1. AORTA (largest artery – pumps oxygenated blood to body tissues)

2. PULMONARY ARTERY (pumps deoxygenated blood to lungs to get oxygenated)

3. PULMONARY VEINS (pumps oxygenated blood from lungs to left atrium)

4. Left Atrium (pumps oxygenated blood received from lungs to left ventricle

6. Left Ventricle (pumps oxygenated blood into aorta)

7. Septum (divides the 2 sides of heart (prevents mixing of blood)

Structure of the Human Heart

13. Pulmonary Artery (“Pulmonary =Lungs”) same as 2.

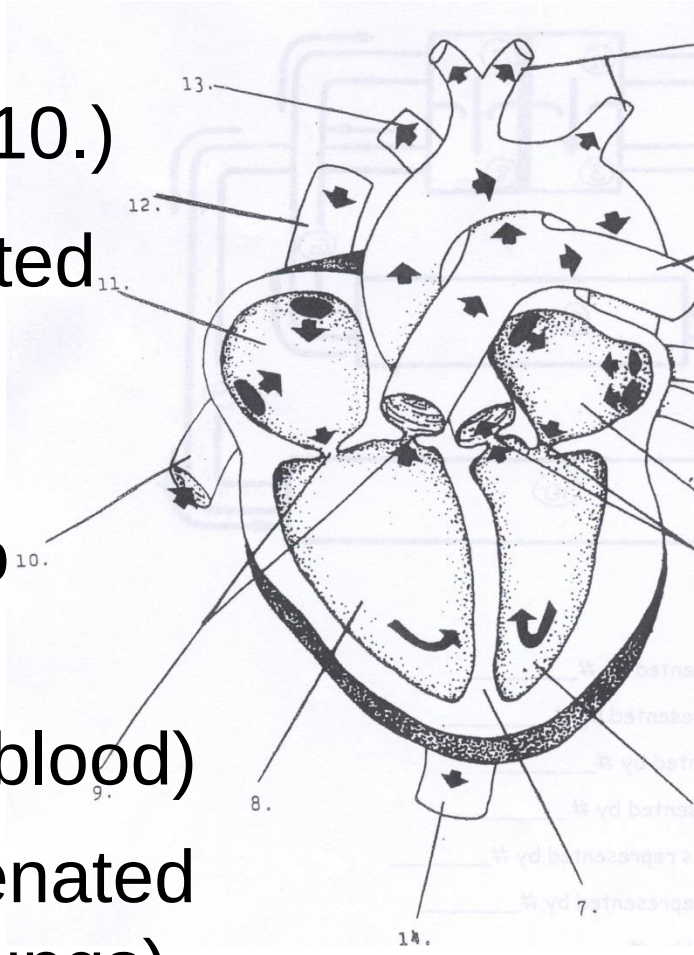
12. Superior Vena Cava (same as 10.)

11. Right Atrium (pumps deoxygenated blood into right ventricle)

10. Inferior Vena Cava (returns deoxygenated blood from body to right atrium)

9 & 5. Valves (prevent backflow of blood)

8. Right Ventricle (pumps deoxygenated blood into Pulmonary Artery to lungs)



14. AORTA

Color code your heart

- **RED = oxygenated blood**
  - **Pulmonary veins (left & right)**
  - **Left atrium**
  - **Left ventricle**
  - **Aorta**
- **Blue = deoxygenated blood**
  - **Superior & inferior vena cavae**
  - **Right atrium**
  - **Right ventricle**
  - **Pulmonary arteries (right and left) & trunk**

Structure of the Human Heart

13. Pulmonary Artery ("Pulmonary =Lungs") same as 2.

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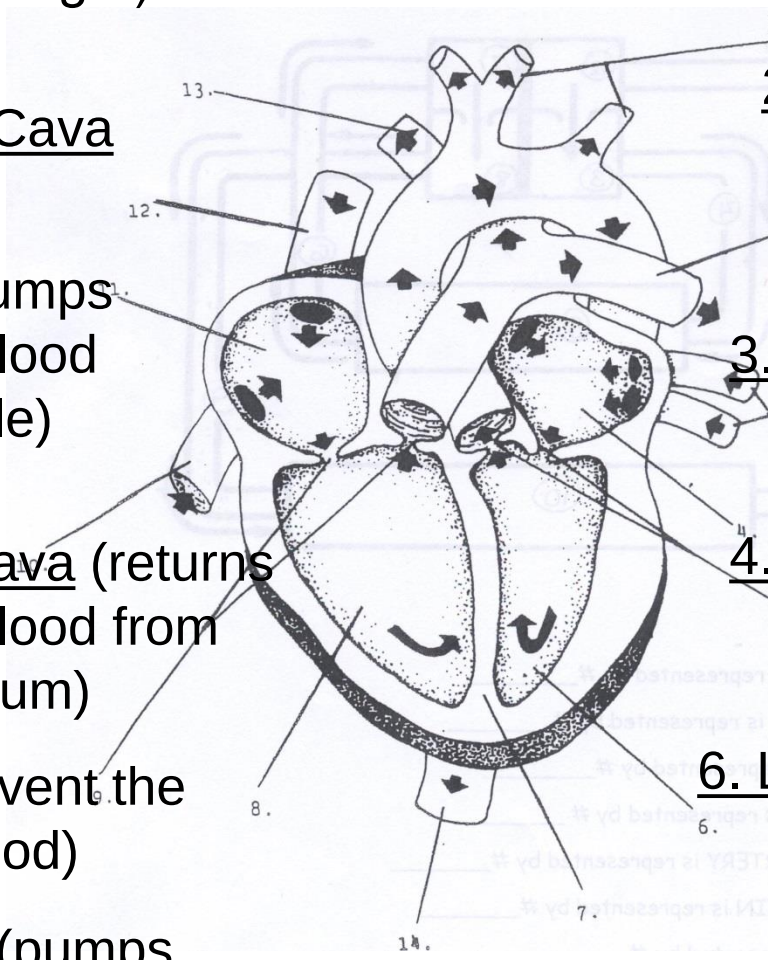

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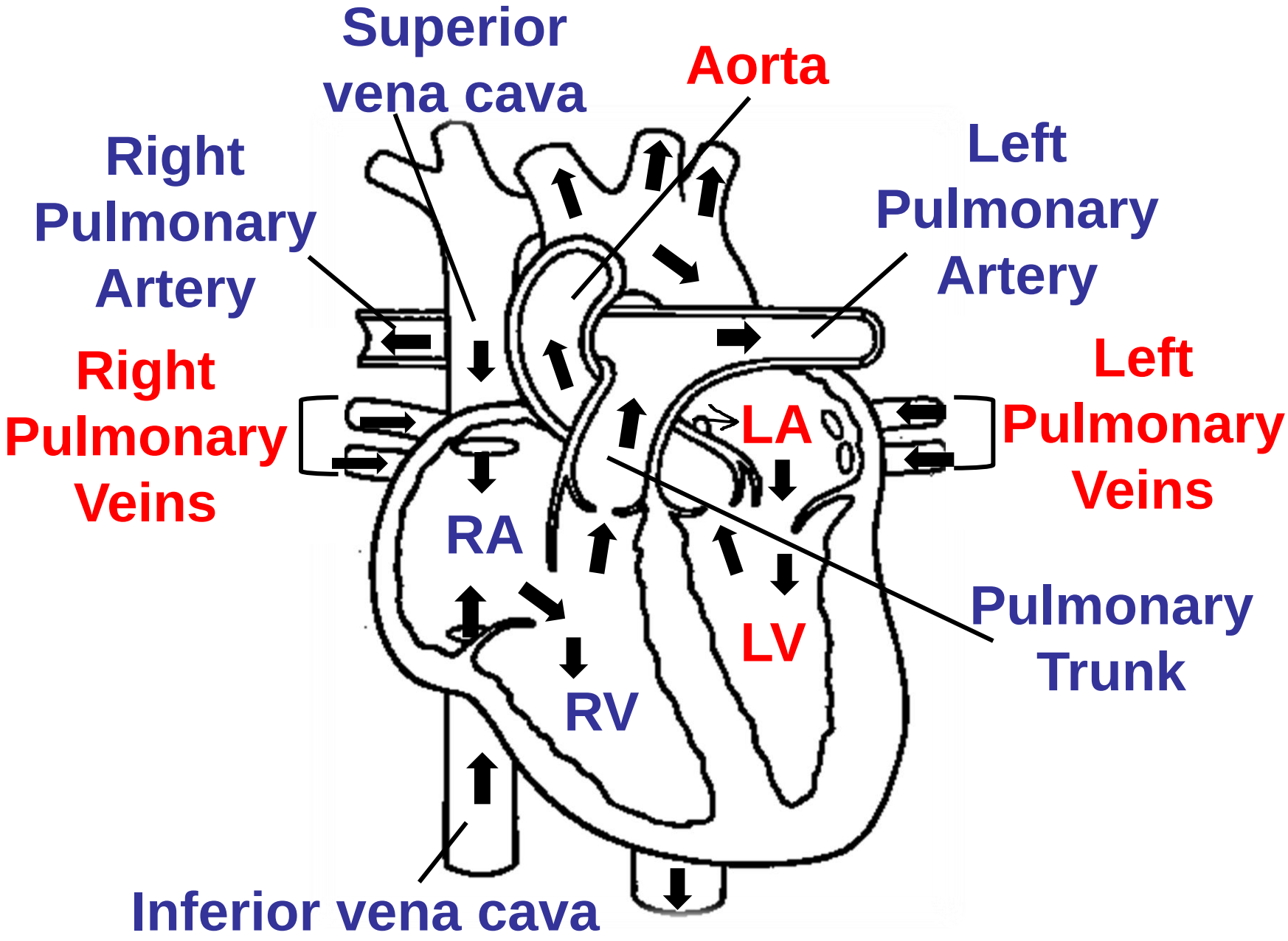
14. AORTA

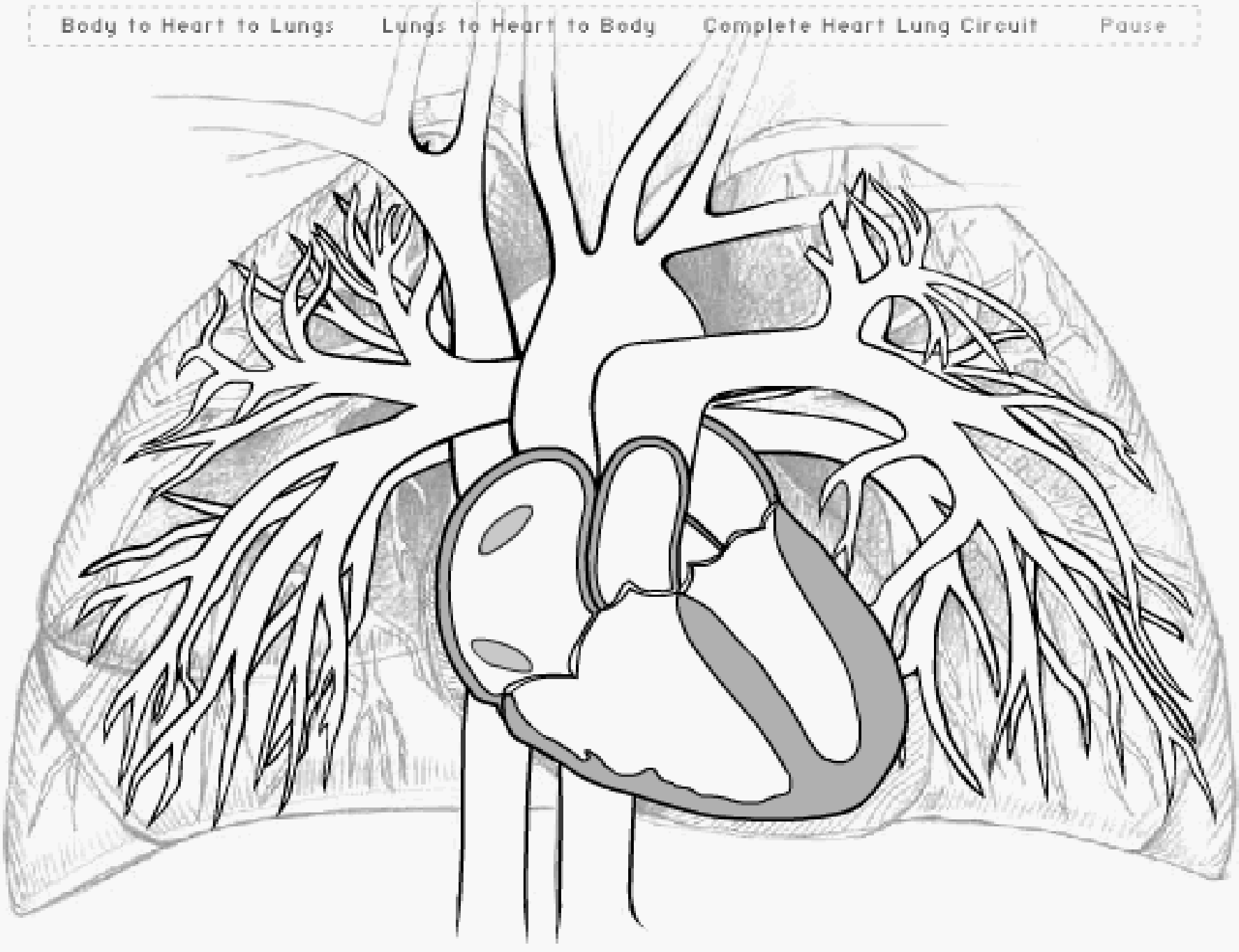
7. Septum (divides the 2 sides of heart (prevents mixing of blood)

Lesson 4

- **Circulation Pathways**
- **Heartbeat / contractions**


Superior vena cava
Aorta
Right Pulmonary Artery
Left Pulmonary Artery
Right Pulmonary Veins
Left Pulmonary Veins
LA
RA
LV
RV
Pulmonary Trunk
Inferior vena cava

Body to Heart to Lungs Lungs to Heart to Body Complete Heart Lung Circuit Pause

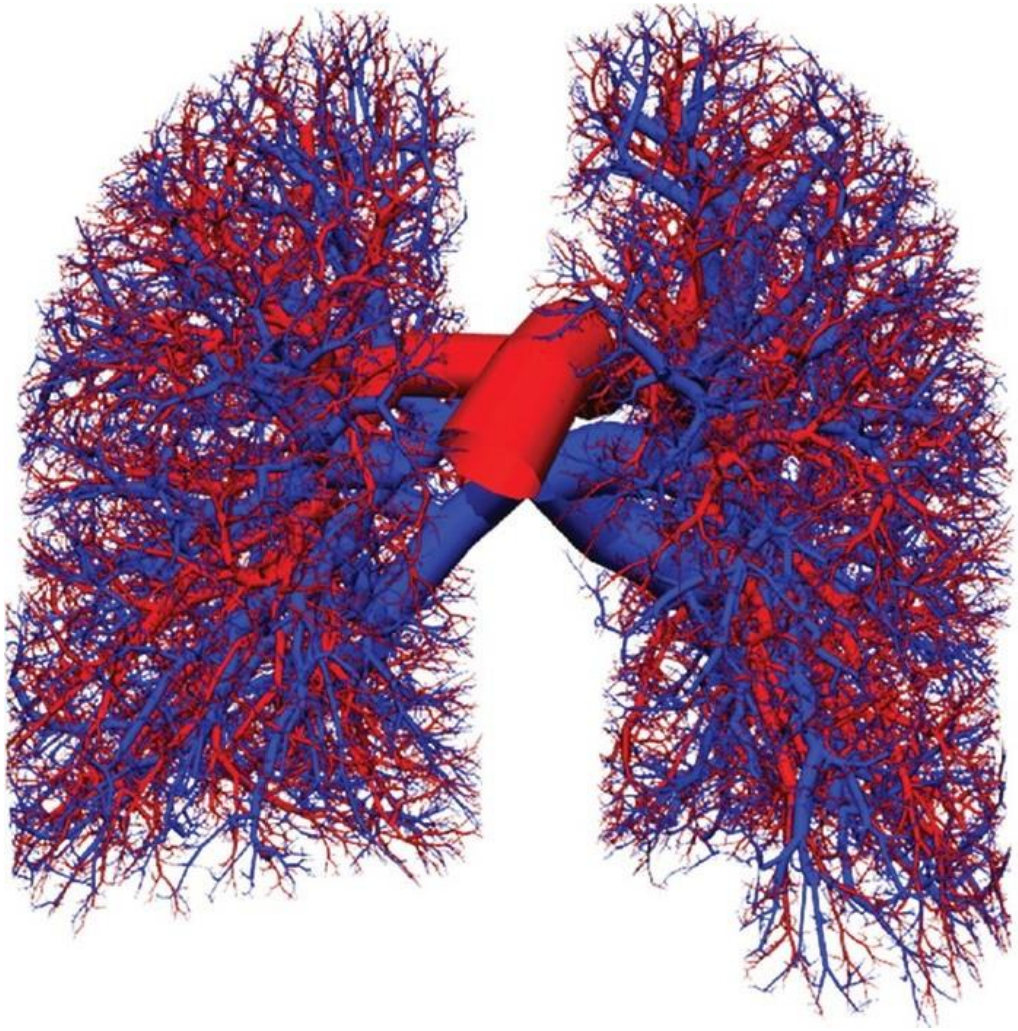


Types of Circulation

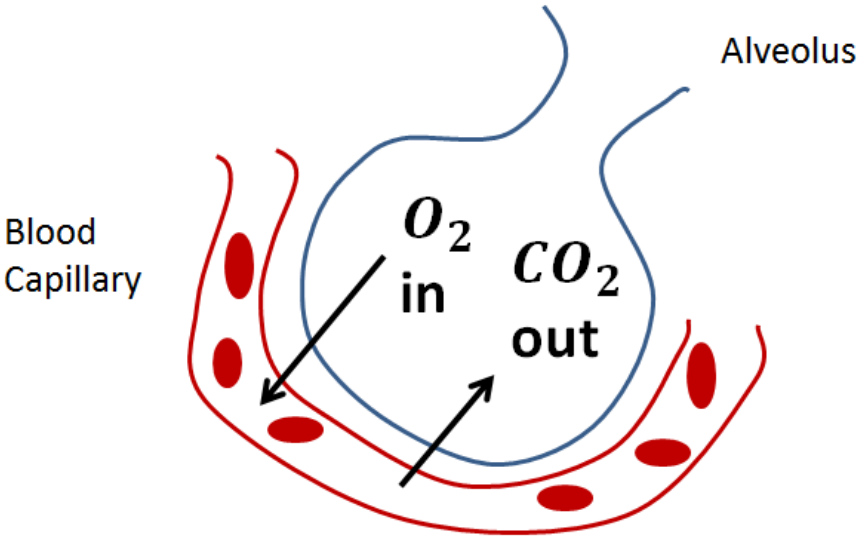
– the heart functions as 2 separate pumps

1. Pulmonary Circulation:

- right ventricle pumps deoxygenated blood to the lungs via the pulmonary arteries
- Inhaled O_2 diffuses INTO the blood
- CO_2 diffuses OUT of the blood to be exhaled
- Oxygenated blood returns to the heart through the pulmonary veins



Blood Vessels of the LUNGS

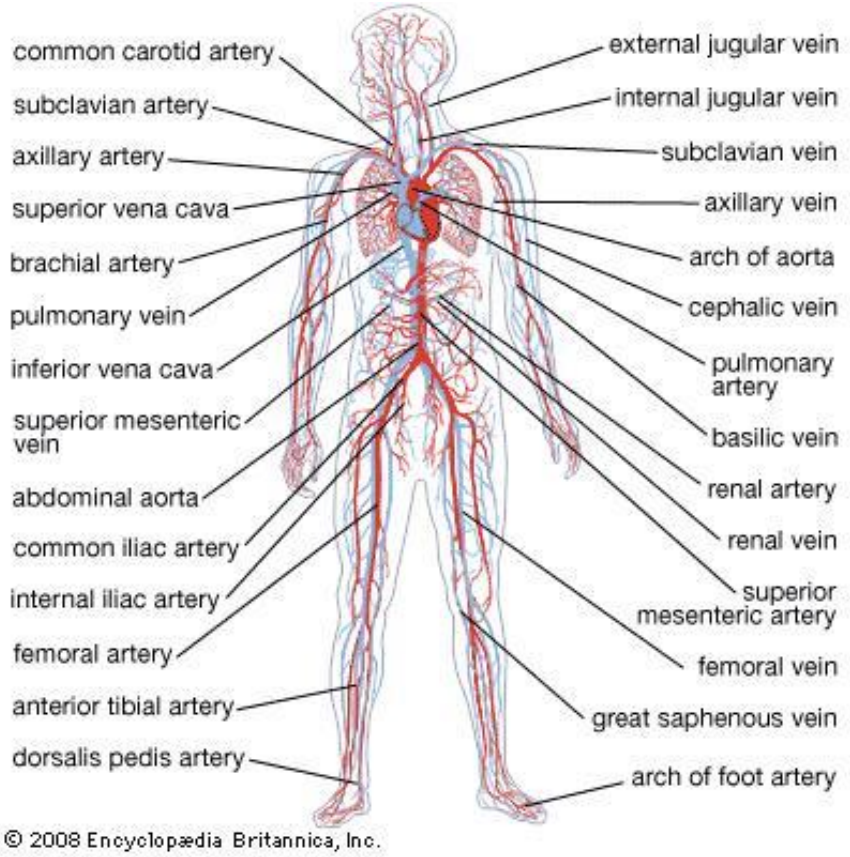


Exchange of gases at the air sacs of the lungs

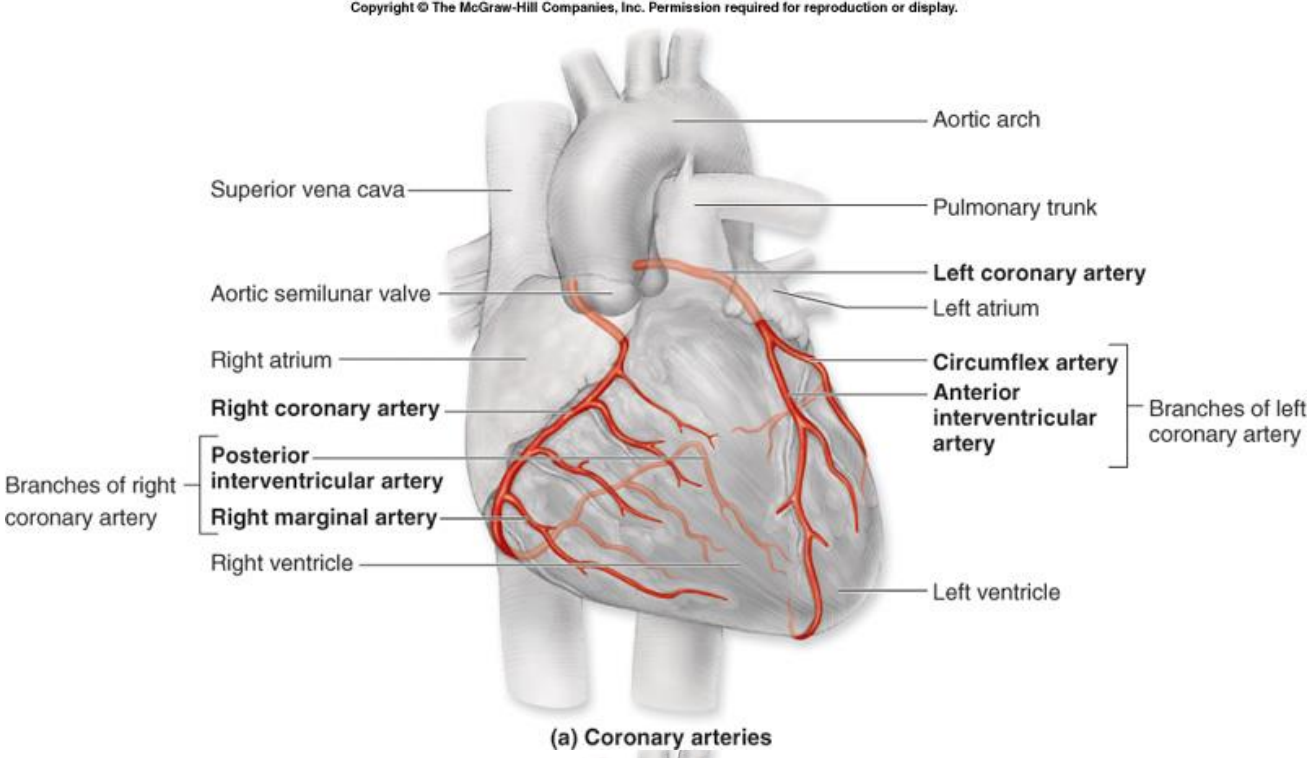
Types of Circulation (con't.)

2. *Systemic Circulation*:

- left ventricle pumps oxygenated blood into the Aorta to the rest of the body tissues
  - Blood pumped from the left ventricle through the vessels serving the heart muscle itself (coronary arteries) is *coronary circulation*

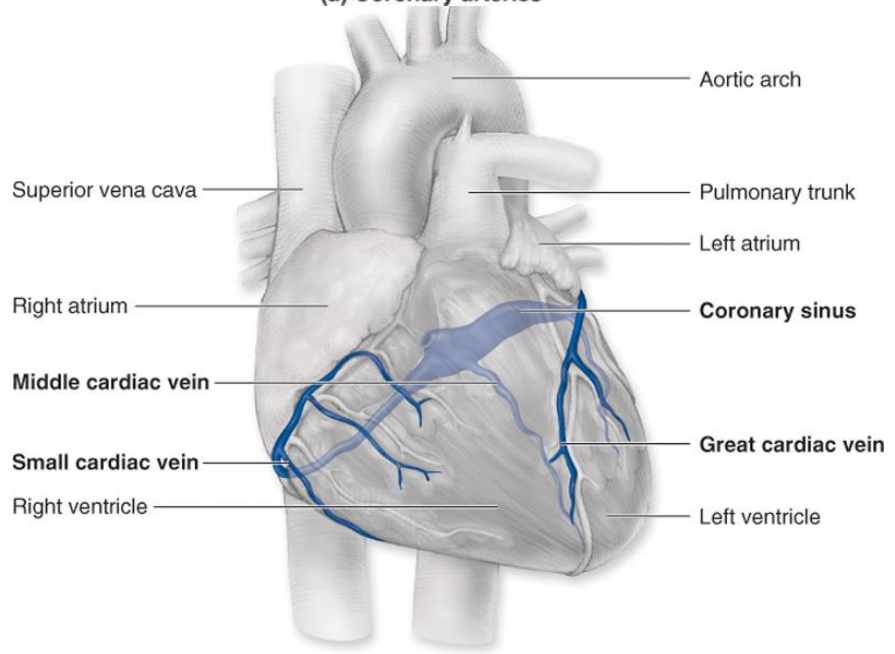


Coronary arteries



(a) Coronary arteries

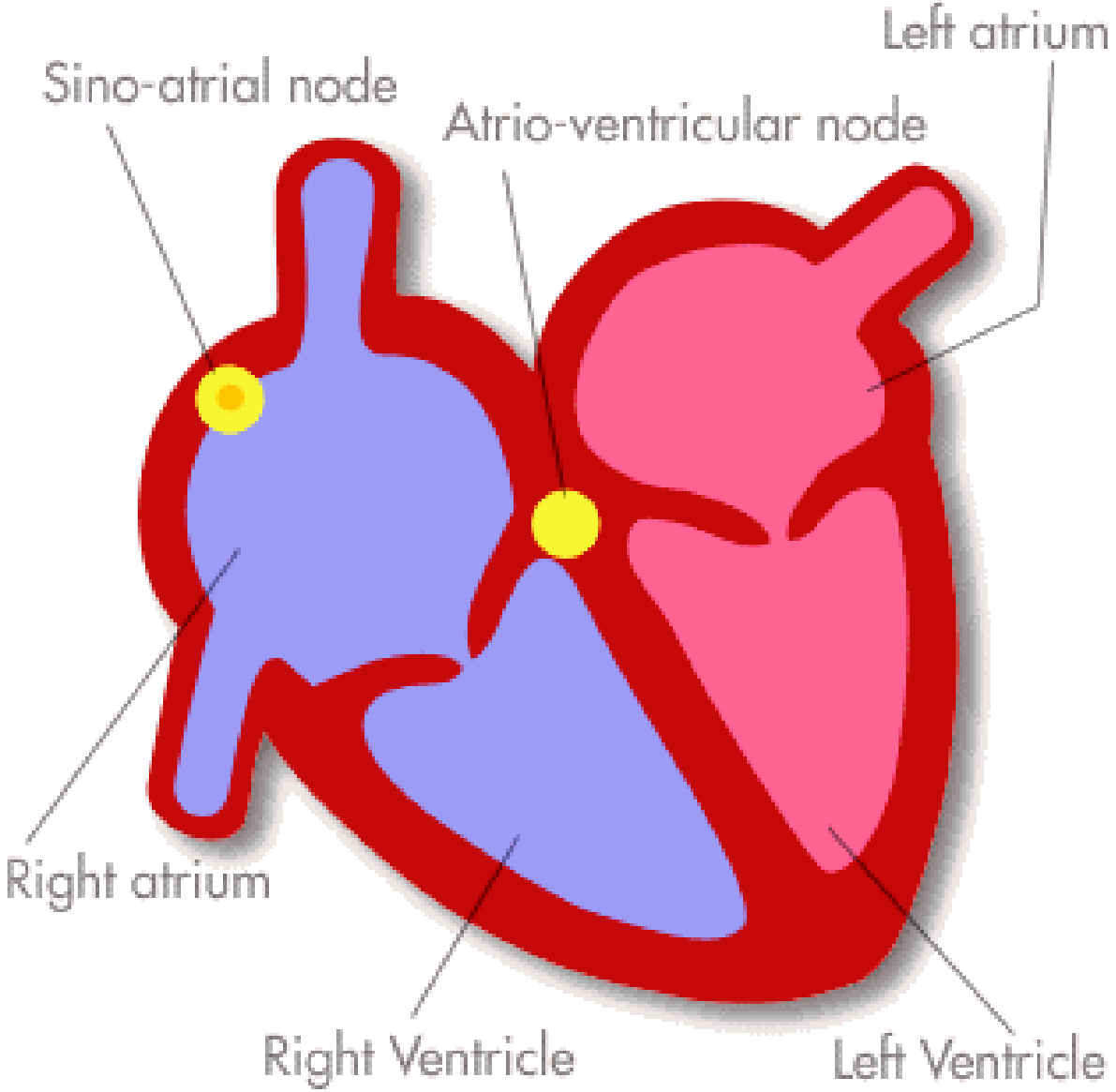
Coronary veins



(b) Coronary veins

Video - How the Heart Works 3D

Heartbeat / Contractions



Heartbeat / Contractions

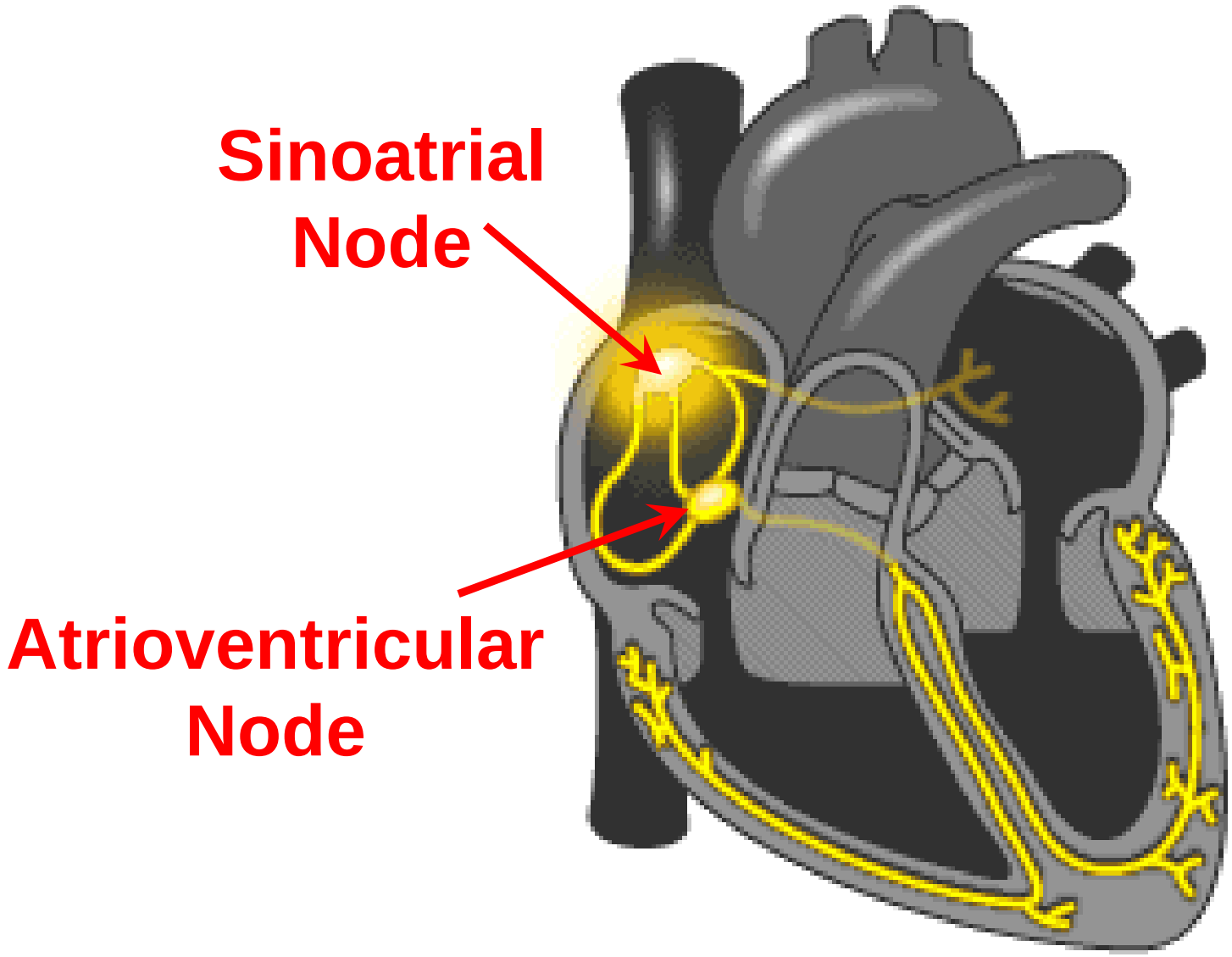
Sinoatrial (SA) node

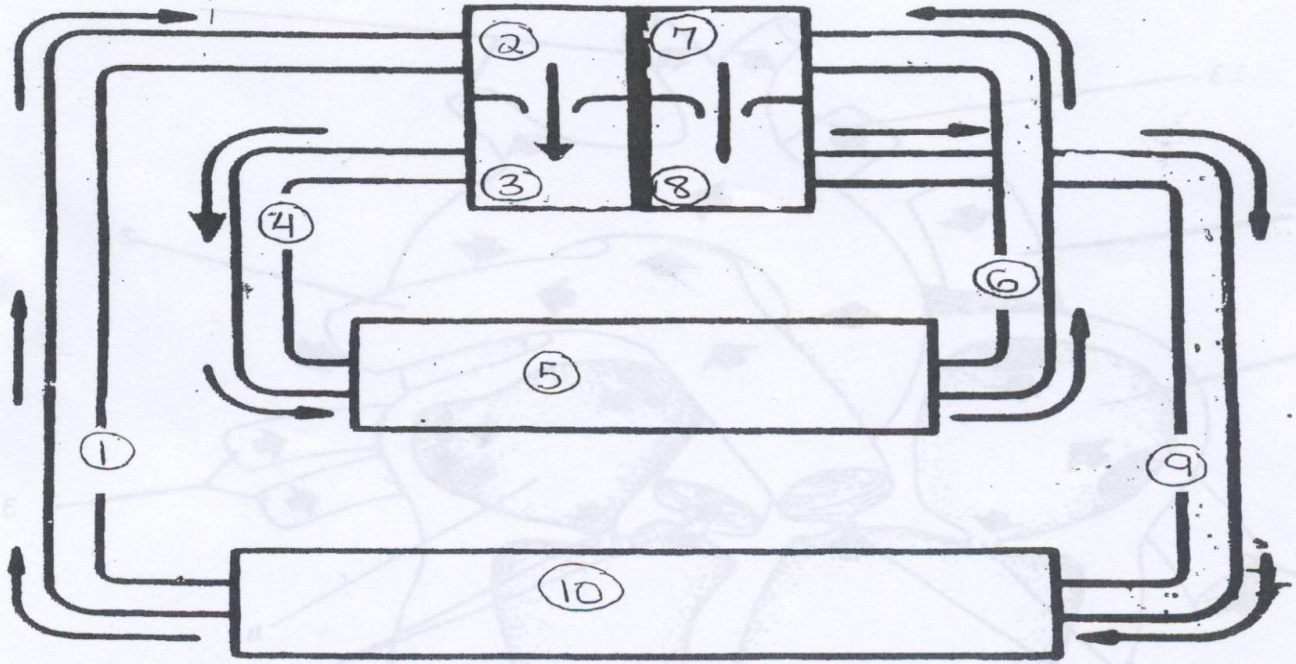
- Small region of muscle cells in the top of the right atrium
- Acts as a pacemaker
- Sends electrical signal to the

Atrioventricular (AV) node

- Located in bottom of right atrium
- Transmits signal throughout ventricle muscle walls, causing them to contract

Heartbeat / Contractions





The RIGHT atrium is represented by #2

The RIGHT ventricle is represented by #3

The LEFT atrium is represented by #7

The LEFT ventricle is represented by #8

The PULMONARY ARTERY is represented by #4

The PULMONARY VEIN is represented by #6

The LUNGS are represented by #5

The BODY TISSUES are represented by #10

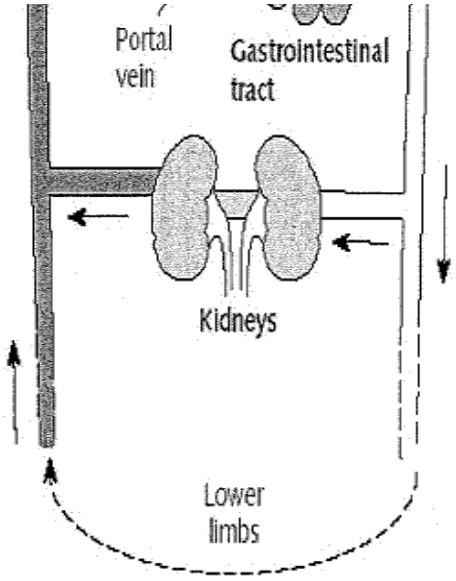
The AORTA is represented by #9

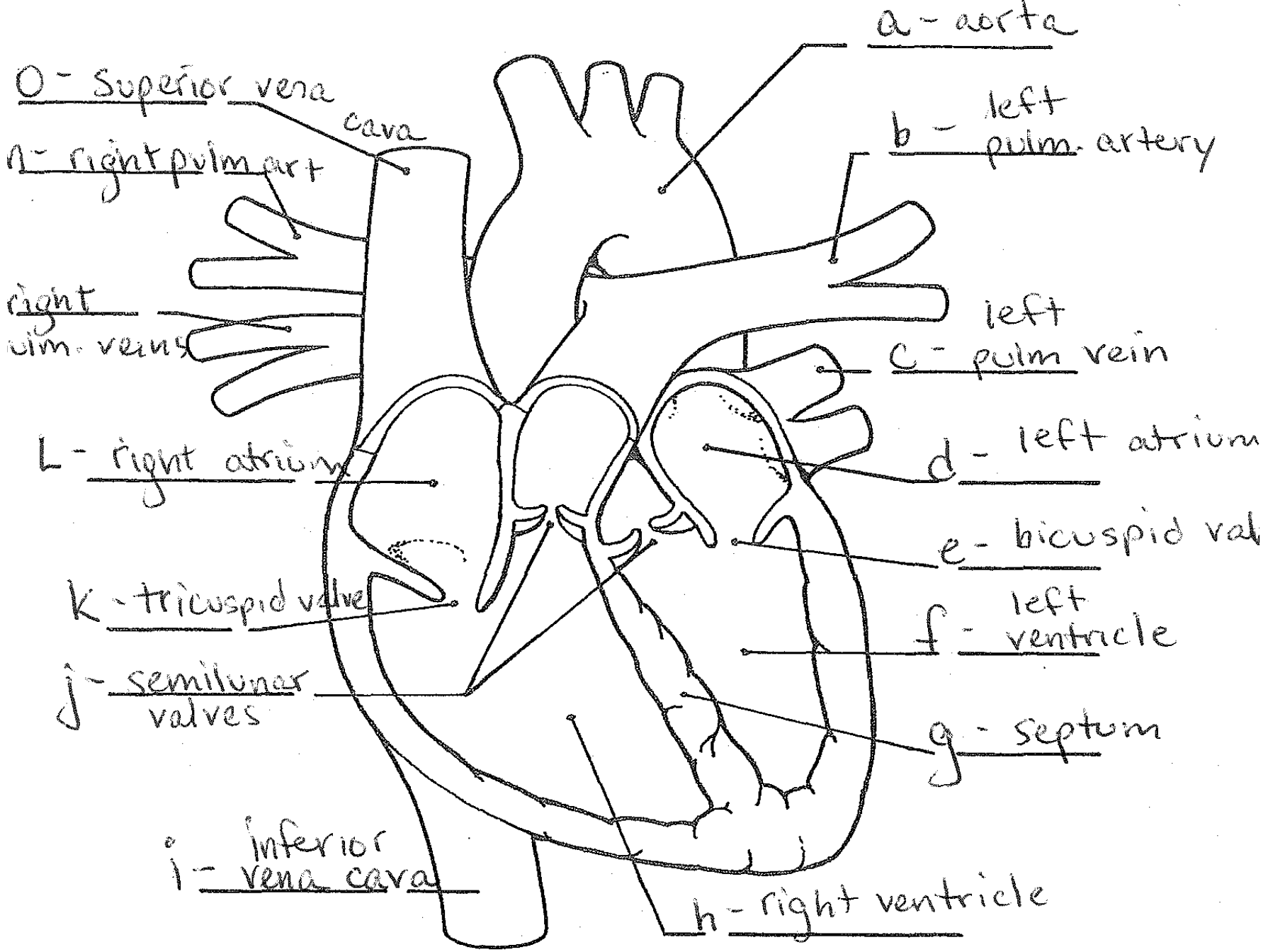
The VENA CAVA is represented by #1

Pathway of Human Circulation

Blood enters the heart from the superior and inferior vena cavae at the right atrium. This blood returning from the body cells is deoxygenated. From the right atrium, the blood is pumped into the right ventricle by passing through the tricuspid, or right atrioventricular valve. At this point the blood is still deoxygenated. From the right ventricle, the blood is pumped into the pulmonary artery to the lungs. Arteries carry blood away from the heart. The pulmonary artery is the only artery to carry deoxygenated blood. At the lungs, the blood exchanges carbon dioxide for oxygen. From the lungs, the freshly oxygenated blood returns to the heart via the pulmonary veins. These vessels carry blood toward the heart. The pulmonary vein is the only vein to

carry **oxygenated** blood. Oxygenated blood enters the heart at the left **atruim** and passes into the left **ventricle** via the left atrioventricular or **bicuspid** valve. From the left ventricle, the blood is pumped out of the heart into the **aorta**, a major artery which transports the blood to the rest of the body. Blood is pumped by the **heart** first into blood vessels called **arteries**, then to arterioles, and then to the tiny tubes called **capillaries**. Once the blood reaches the capillaries, it will exchange **oxygen** and **nutrients** fo **carbon dioxide** other wastes. At this point, the blood has b **deoxygenated** Deoxygenated blood will then travel from the capillaries, through the venuoles, into the **veins**, which contain valves to prevent the backflow of blood. The veins transpor **deoxygenated** blood back to the heart where it enters the right atrium. At this point the path begins all over again!

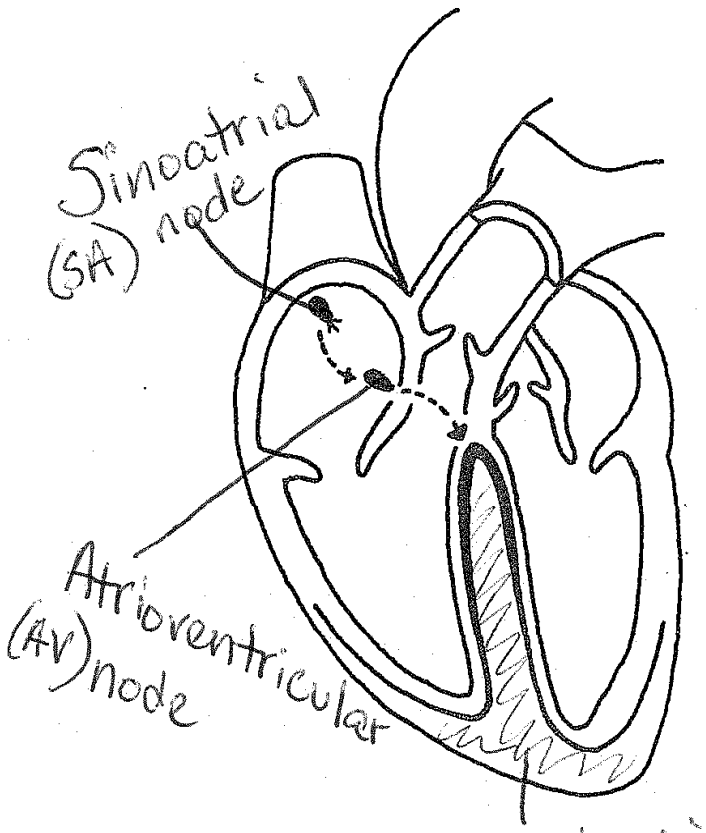



a - aorta
O - Superior vena cava
b - left pulm. artery
n - right pulm art
right pulm. veins
left
c - pulm vein
L - right atrium
d - left atrium
e - bicuspid val
K - tricuspid valve
left
f - ventricle
j - semilunar valves
g - septum
i - inferior vena cava
h - right ventricle

Heartbeat

Fill in the blanks with the correct answers.
Then, label the nodes in the diagram to the right.

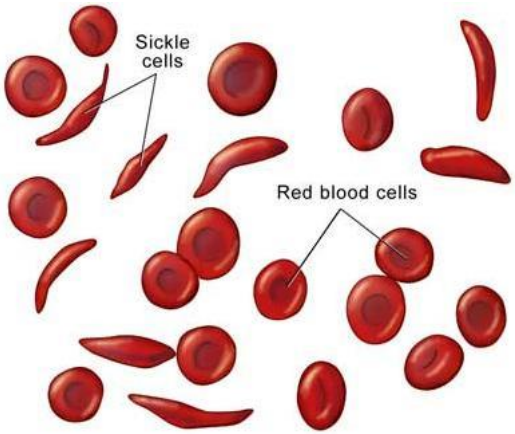
The heart beats regularly because it has its own pacemaker. The pacemaker is a small region of muscle called the sinoatrial, or SA, node. It is in the upper back wall of the right atrium.
The sinoatrial (SA) node triggers an impulse that causes both atria to contract.
Very quickly, the impulse reaches the atrioventricular, or AV, node at the bottom of the right atrium. Immediately, the atrioventricular (AV) node triggers an impulse that causes both ventricles to contract.

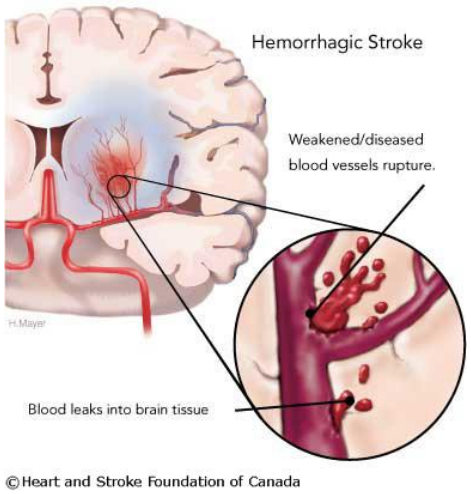


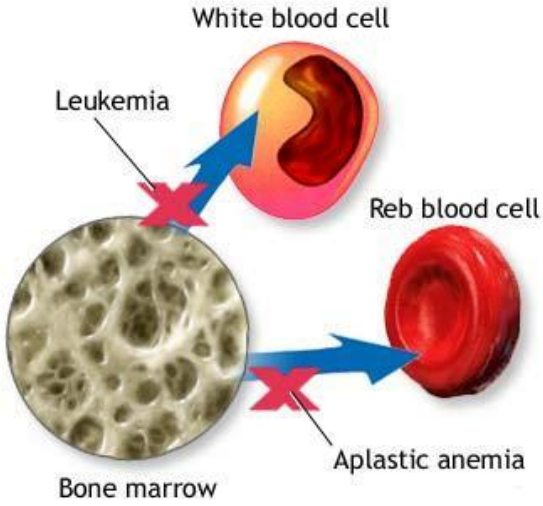
Lesson 5

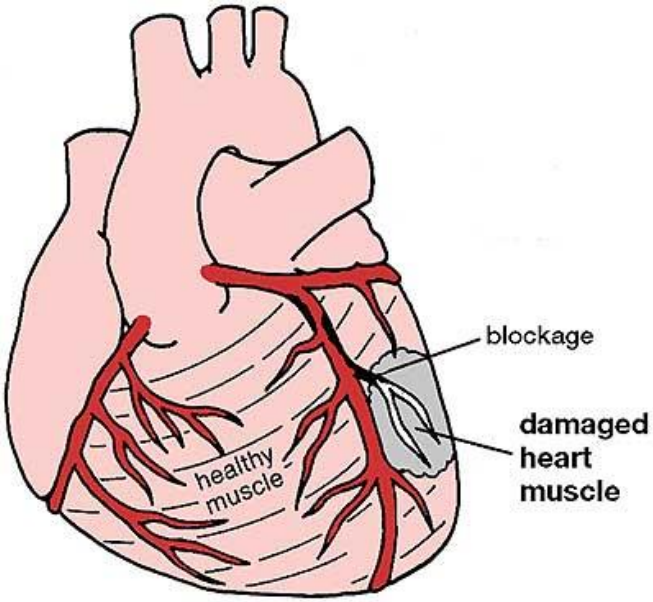
- **Malfunctions of the Circulatory System**
  - **Hypertension**
  - **Heart attack**
  - **Stroke**
  - **Leukemia**
  - **Anemia (2 types)**
  - **Hemophilia**

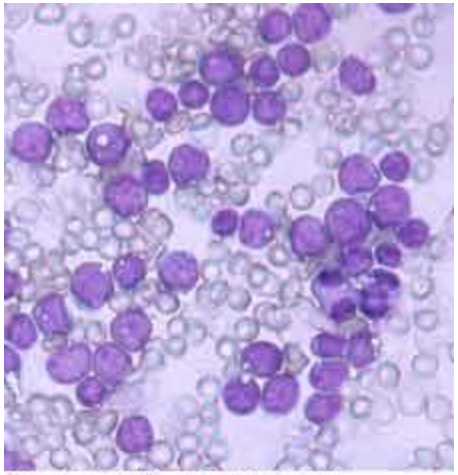
Disorders of the circulatory system





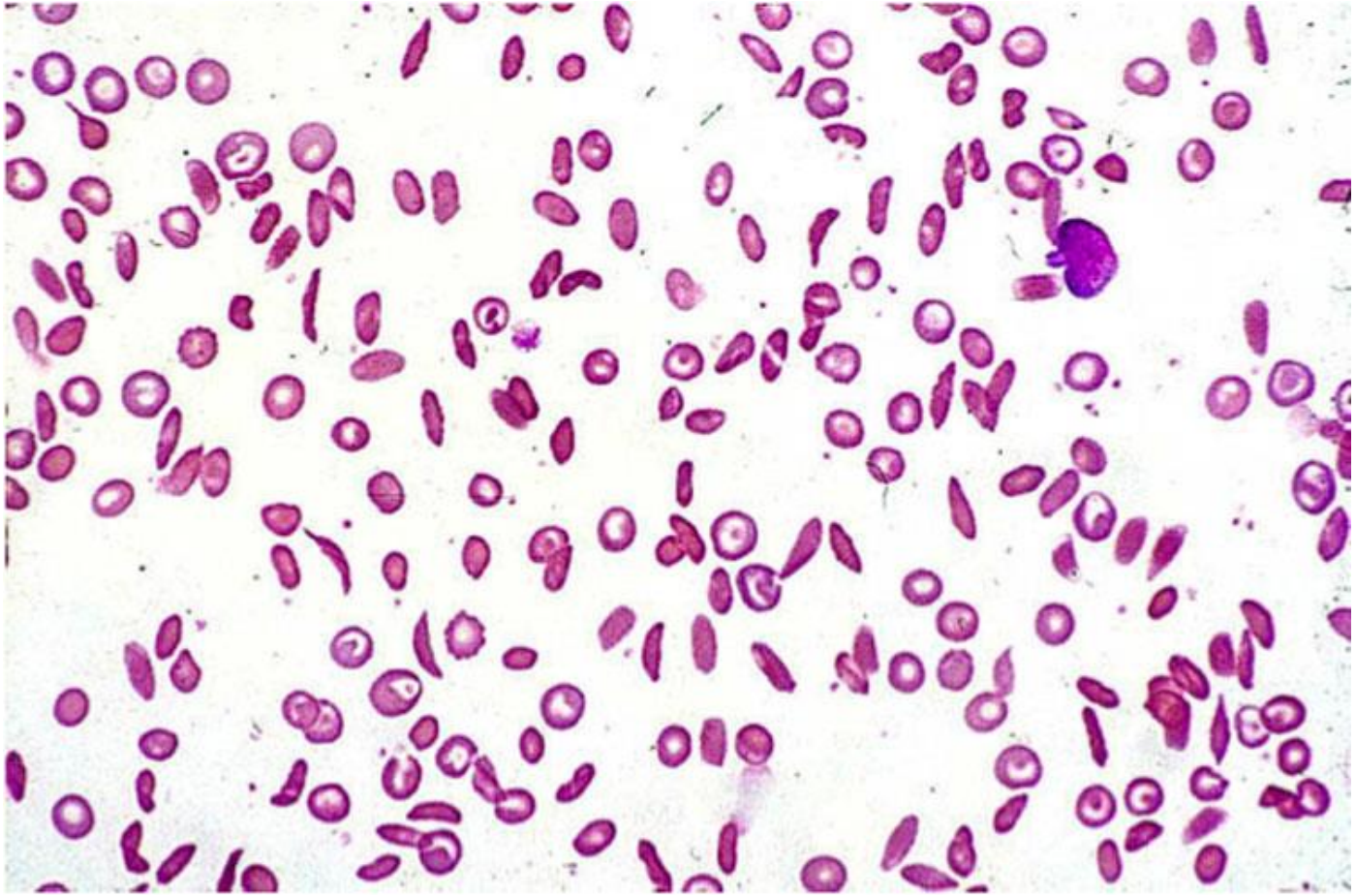





Courtesy of Stanford University

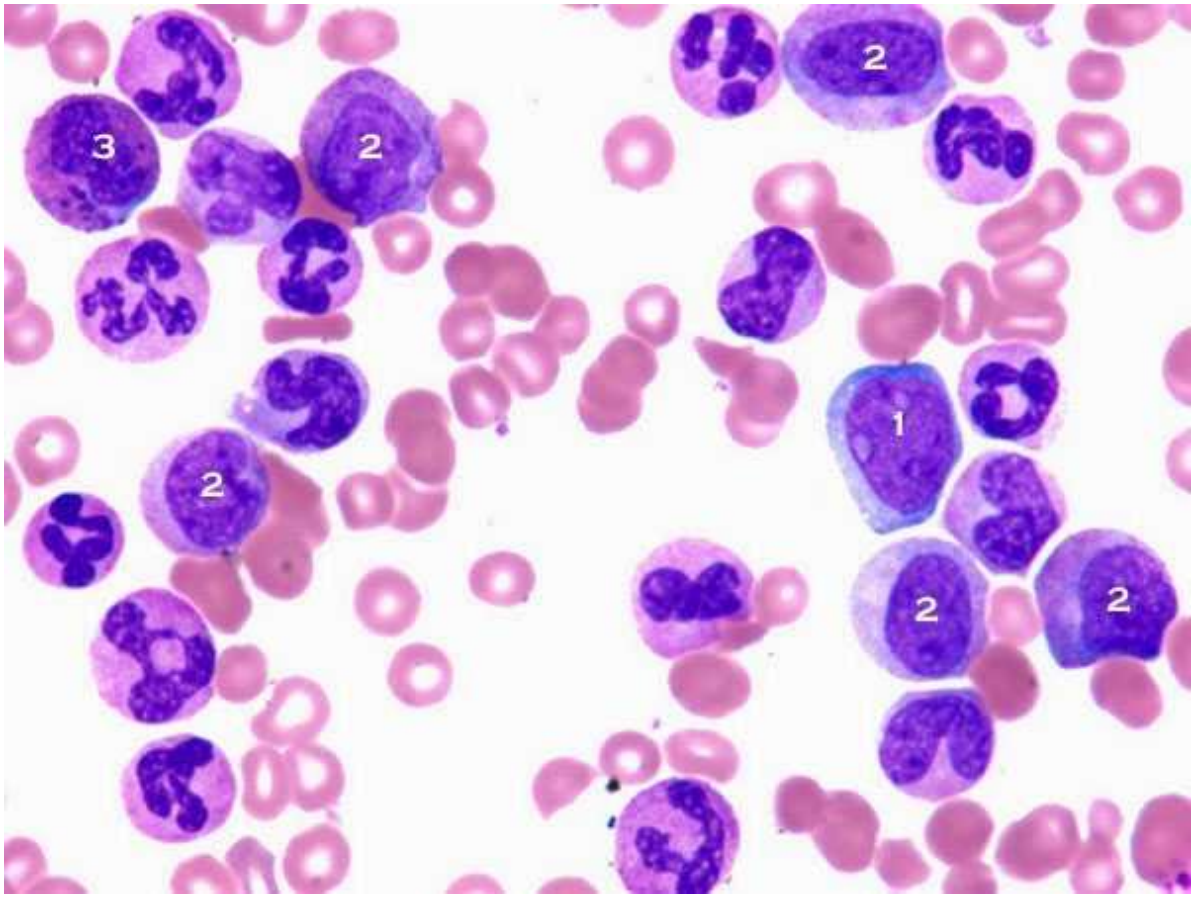
#1 Healthy or unhealthy?

#2 Healthy or Unhealthy?



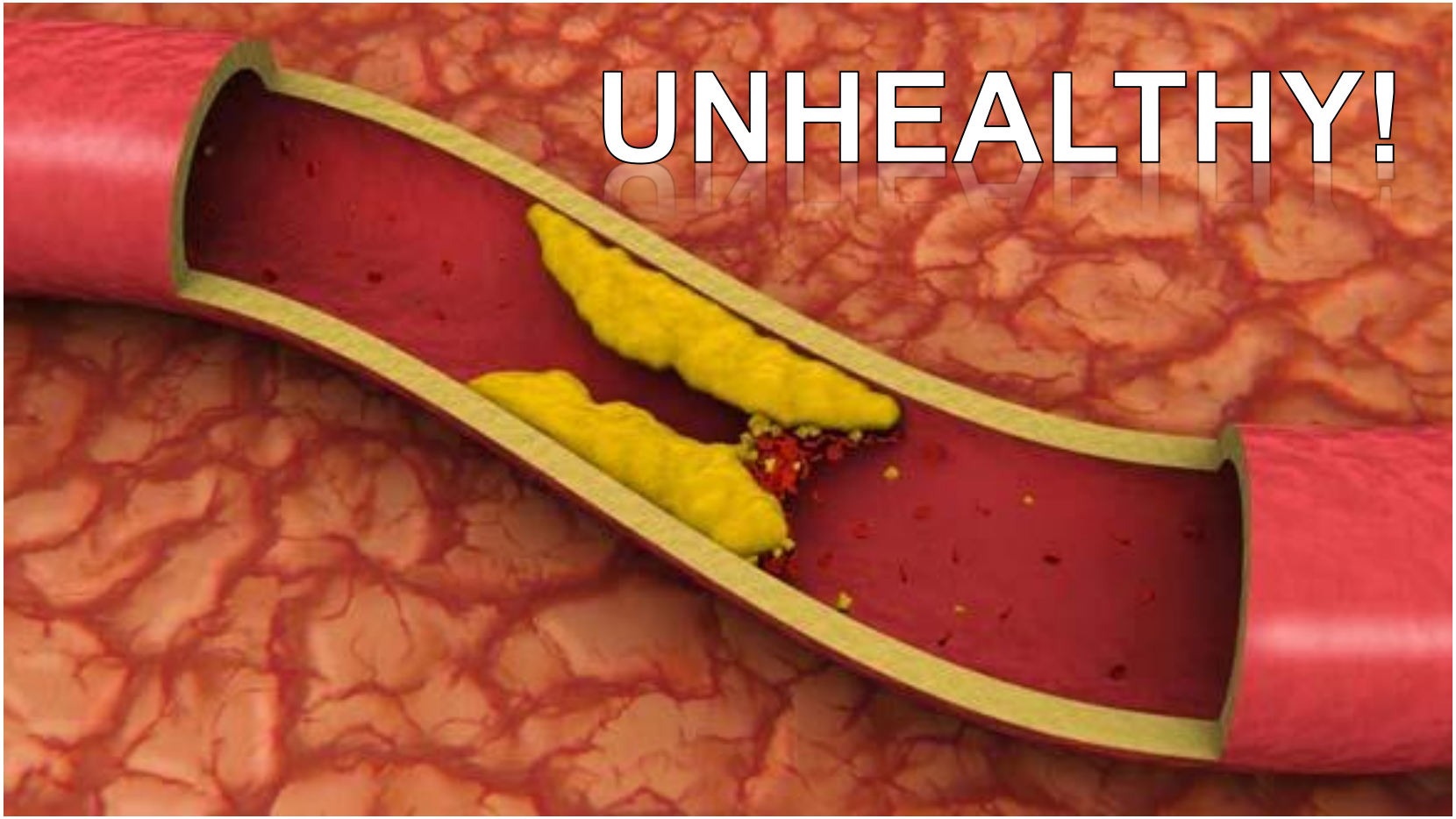
UNHEALTHY!

#3 Healthy or Unhealthy?



UNHEALTHY!

#4 Healthy or Unhealthy?



Hypertension (high blood pressure)

Description

- Excessive force of blood against artery walls
- Damages arteries (heart, kidneys)
- Leads to arteriosclerosis (hardening & narrowing of arteries) & stroke

Causes

- Obesity
- High salt intake

Treatment/Prevention

- Healthy diet & exercise, medication to treat

Heart Attack

What is ANGIOPLASTY and STENTING? - YouTube

Description

- Blockage of coronary artery (serves heart muscle)

Causes

- Plaque (build up) in arteries (atherosclerosis)
- High cholesterol, high blood pressure, smoking, can cause plaque build up

Treatment/Prevention

- Eat healthy diet, don't smoke, medication/surgery may treat, may be fatal

Stroke

Description

- Blockage or rupture of blood vessel serving the brain

Causes

- Blood clots
- Plaque build up of cholesterol deposits
- Smoking

Treatment/Prevention

- Increase physical activity, don’t smoke (constricts blood vessels)
- Healthy diet

Leukemia

Description

- Cancer of white blood cells
- Bone marrow produces too many non-functional WBC

Causes

- Unknown
- One type may be acquired from radiation

Treatment/Prevention

- No prevention, chemotherapy, bone marrow transplant may treat

Anemia (2 Types)

1) Sickle Cell Anemia

Description

- RBC shaped like crescent moons (sickles)
- Can get stuck in vessels, cells can't get enough O_2

Causes

- Genetic (inherited)

Treatment/Prevention

- No prevention, blood transfusion & lifestyle change

Anemia (2 Types) con't.

2) Iron-Deficiency Anemia

Description

- Produce fewer or smaller RBC
- Difficulty transporting O_2

Causes

- Lack of iron in diet or poor absorption ability

Treatment/Prevention

- Eat iron rich foods or take iron supplement (pill)

Hemophilia

Description

- Bleeding disorder
- Difficulty clotting blood due to lack of clotting factor proteins

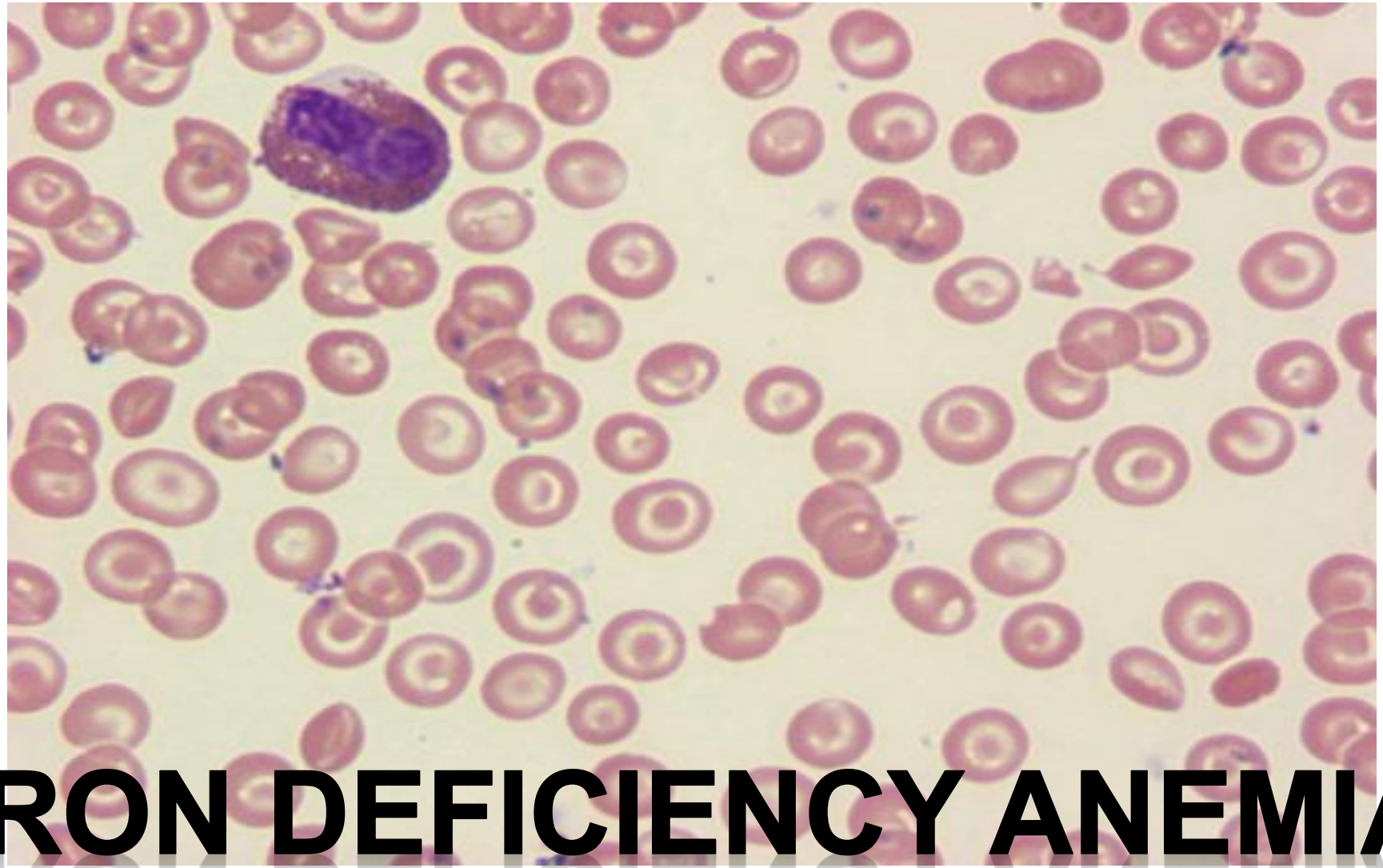
Causes

- Genetic

Treatment/Prevention

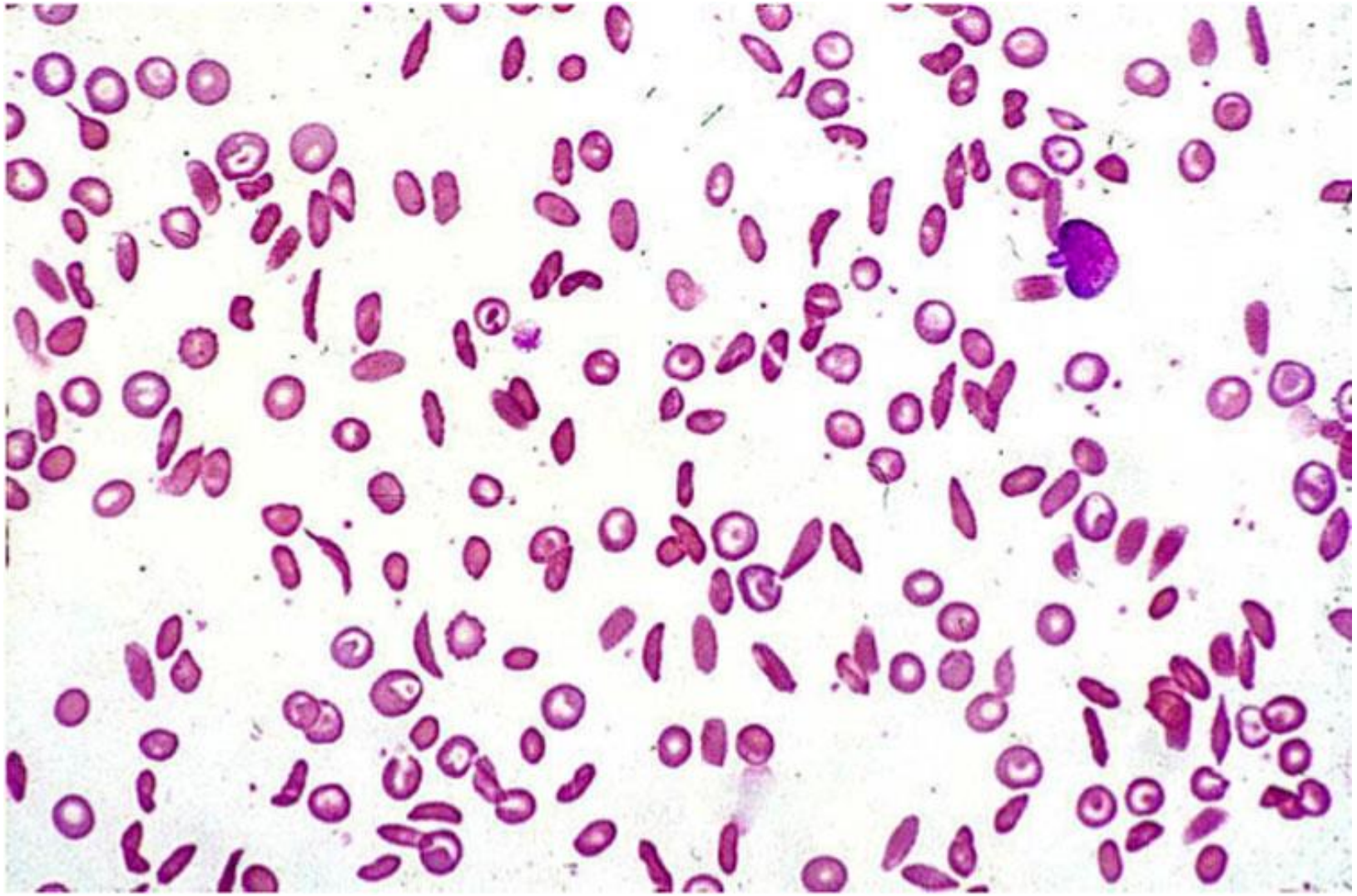
- No prevention, transfusion to replace missing clotting factors

Disorder?



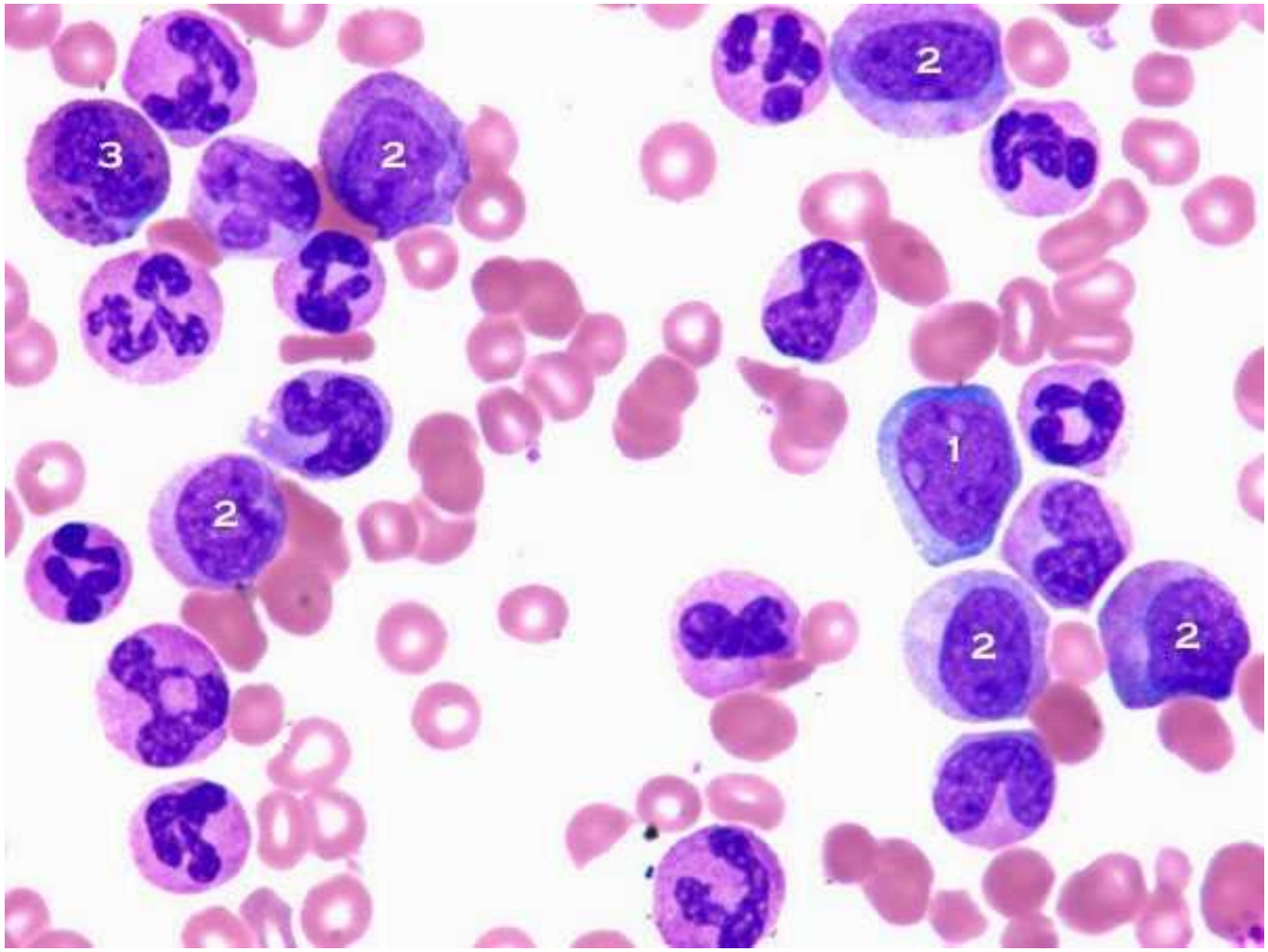
IRON DEFICIENCY ANEMIA

Disorder?



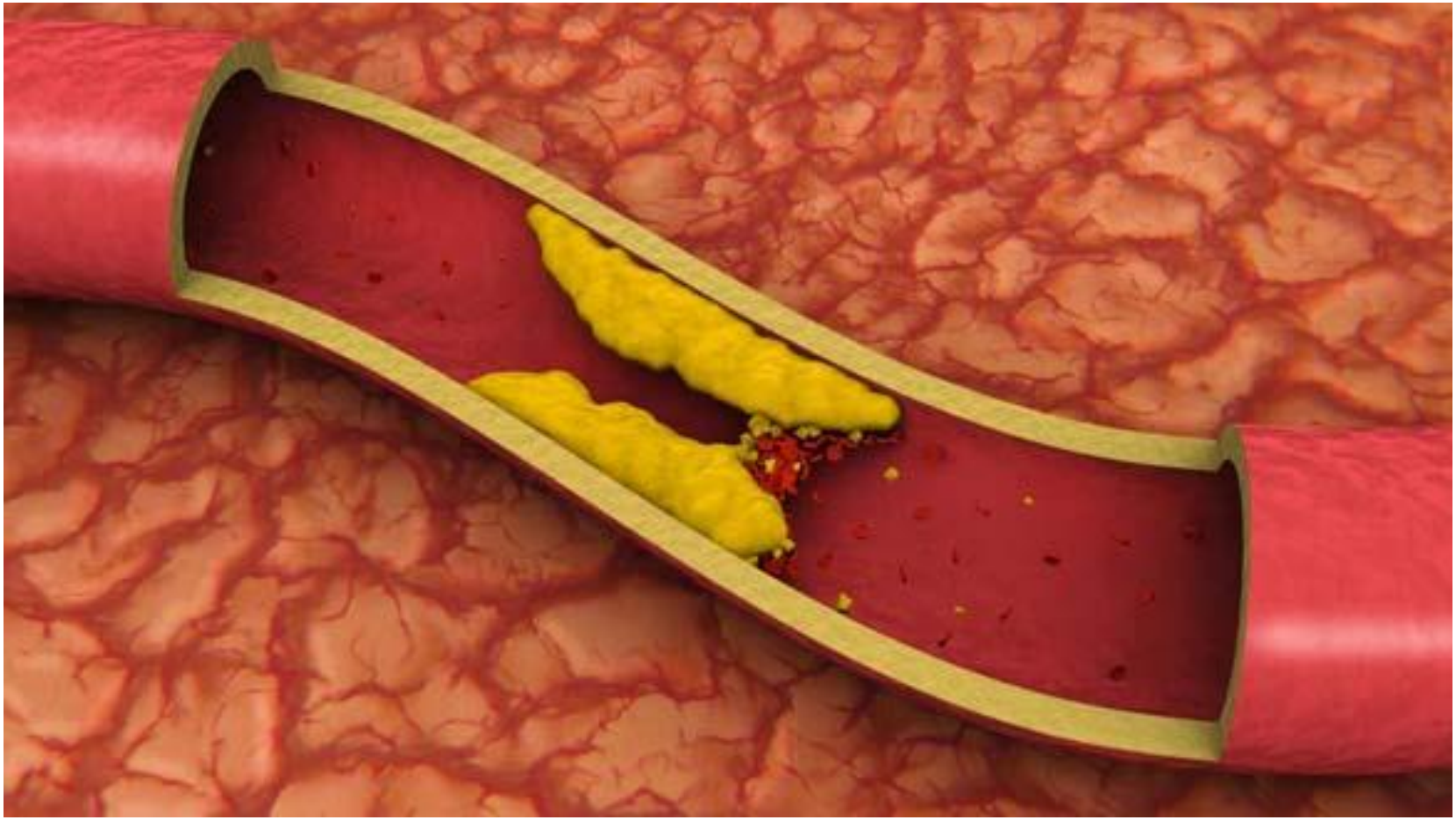
SICKLE CELL ANEMIA

Disorder?



LEUKEMIA

Disorder?



STROKE OR HEART ATTACK