

Biology 323

Human Anatomy for Biology Majors

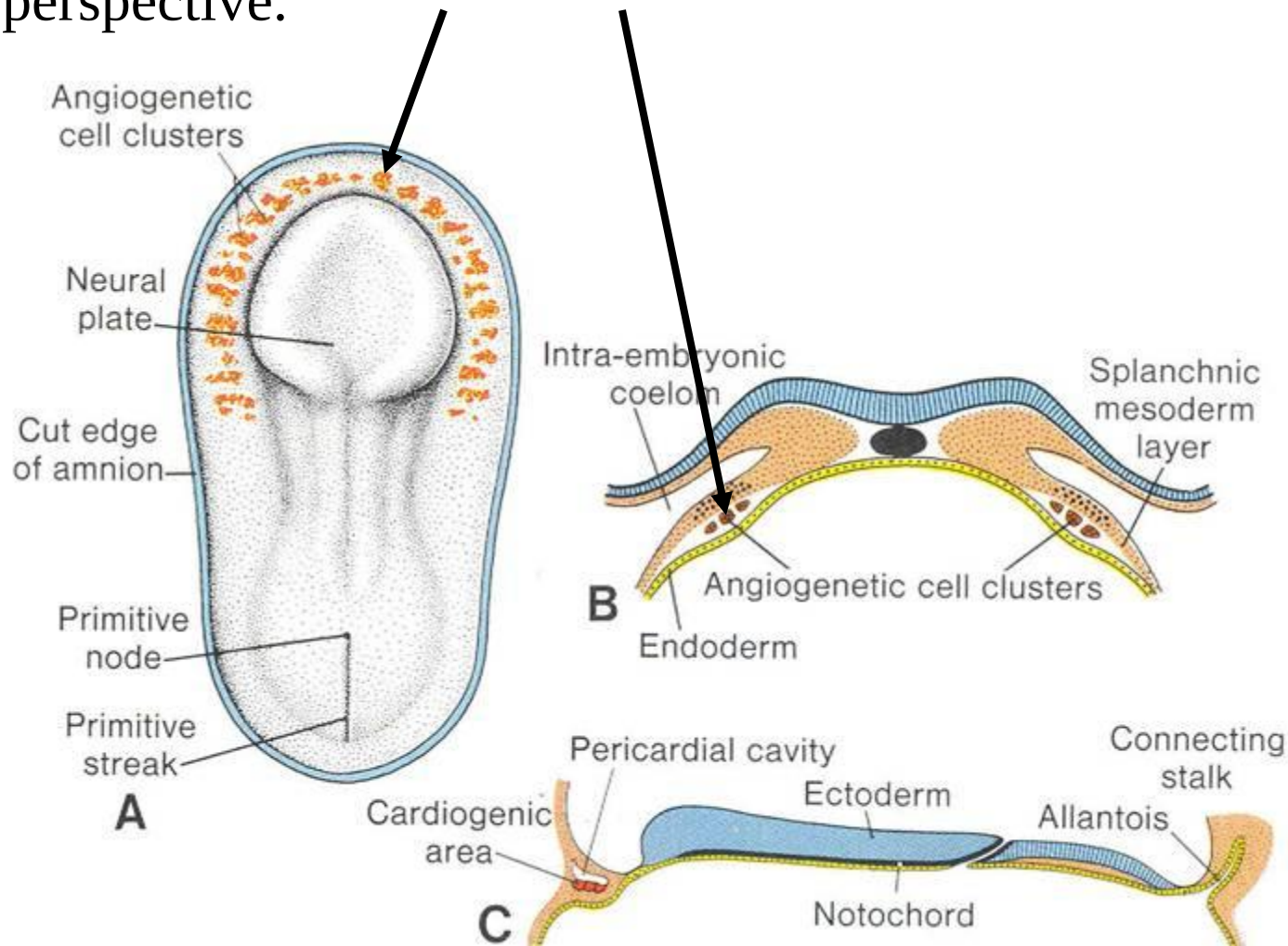
Lecture 10

Dr. Stuart S. Sumida

Heart: Structure, Function, Development

The first blood vessels of the embryo form inside the embryonic disc even before somites appear. They form near the edge of the yolk sac (a primitive condition inherited from macrolecithal organisms that stored yolk for food).

Angiogenetic cell clusters extend in an arc around the head end of the ventral opening of the yolk sac. Initially, this means that the angiogenetic cell clusters (and the blood vessel that forms from them) have the pattern of a "horseshoe" if viewed from a dorsal or ventral perspective.



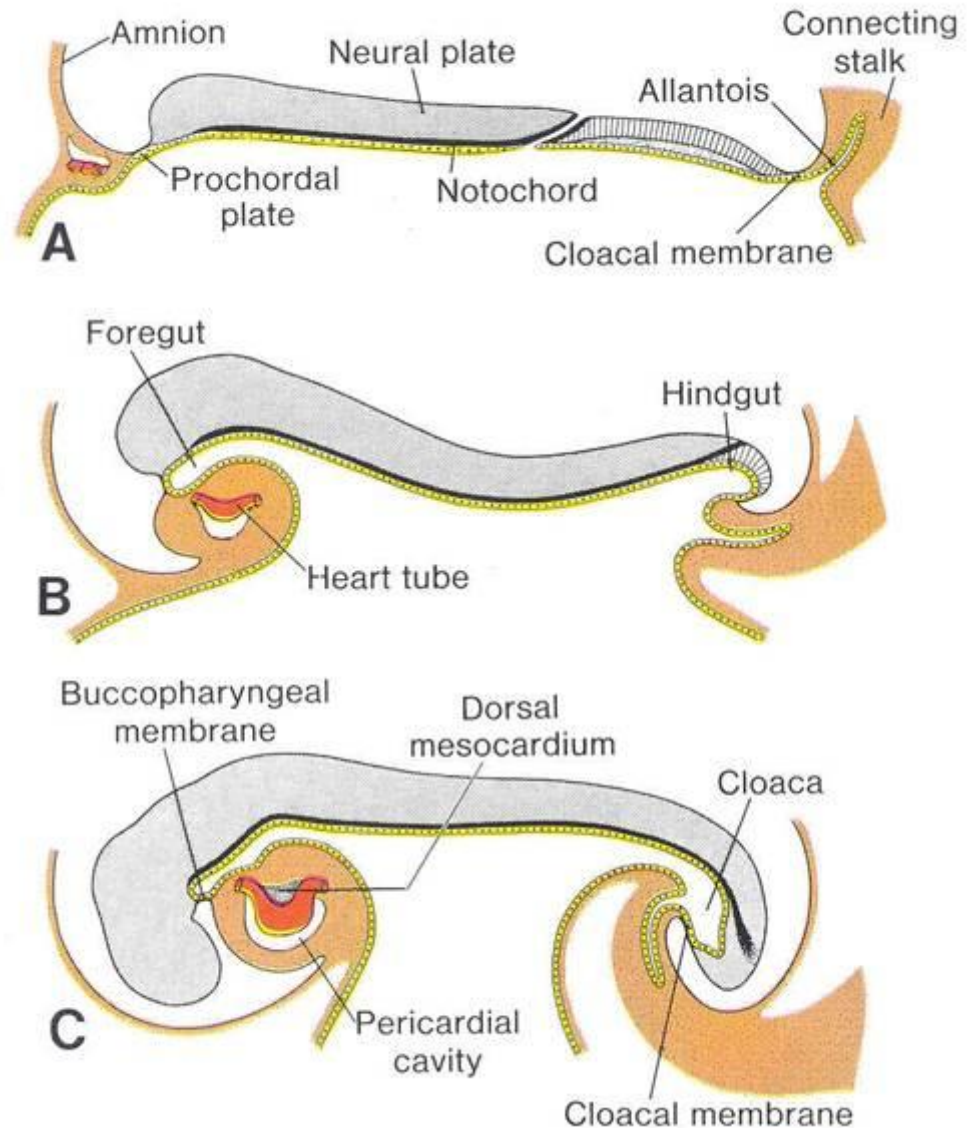
An important point to understand is that the coelom runs up and down either side of the body.

At the head end, right underneath the developing pharynx, the coelom on the left communicates with the coelom on the right.

Thus, the coelom **cuts across the midline** here.

The brain grows at an incredible rate. It grows so fast that it makes the head bend around under the embryo's body.

This is why the heart winds up on the **VENTRAL SIDE** of the body.



The part of the heart ventral to the gut tube is a single tube itself.

The tube exiting the heart at its cranial end is the ventral aorta.

However, the heart cannot remain a simple tube (like a fish), so it must be subdivided into a right and left side.

A septum subdivides the heart into a left and right side.

The tube exiting the heart at its cranial end is the ventral aorta.

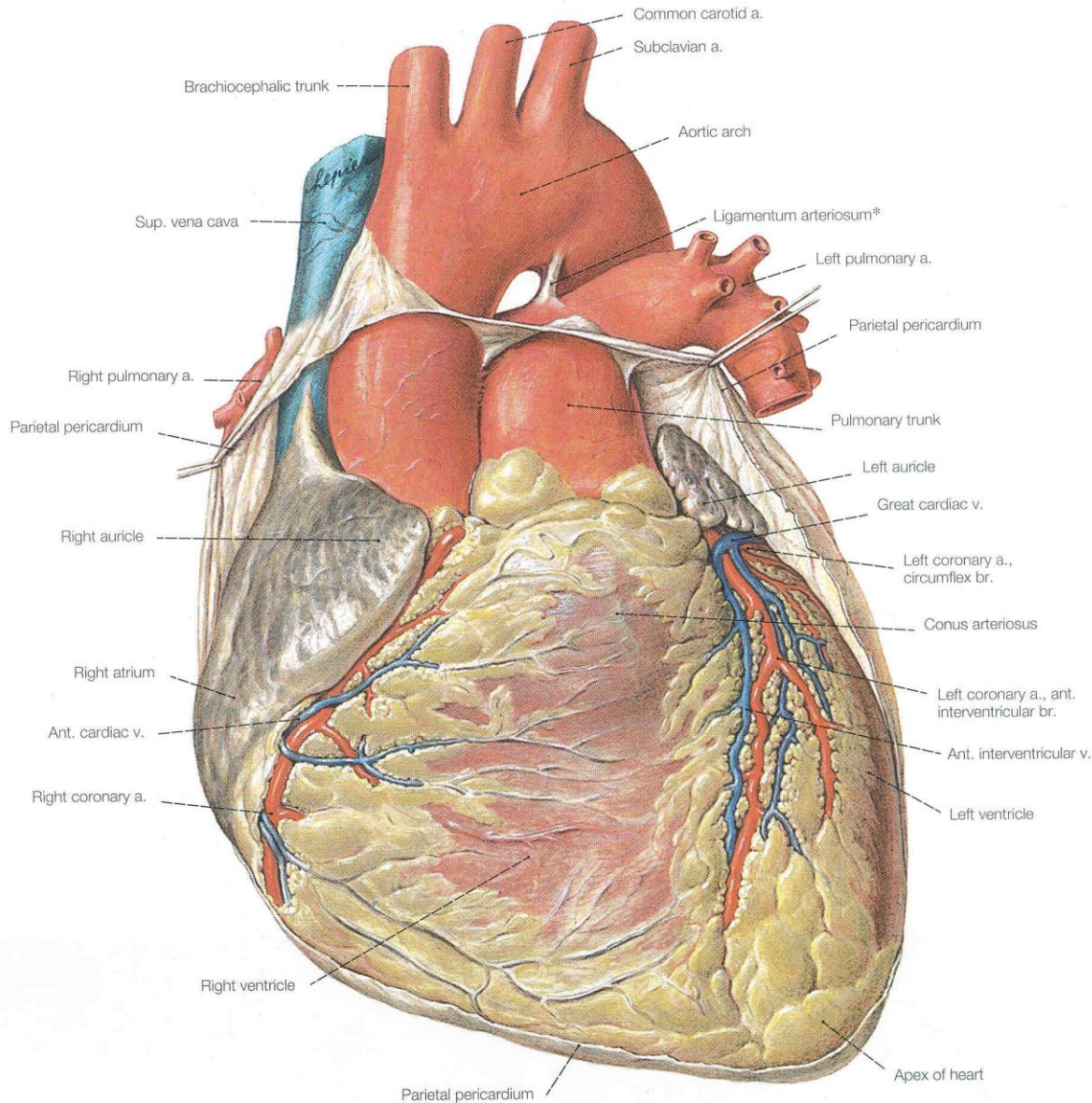
It also subdivides:

The right side connects with the lungs.

The left side supplies the body.

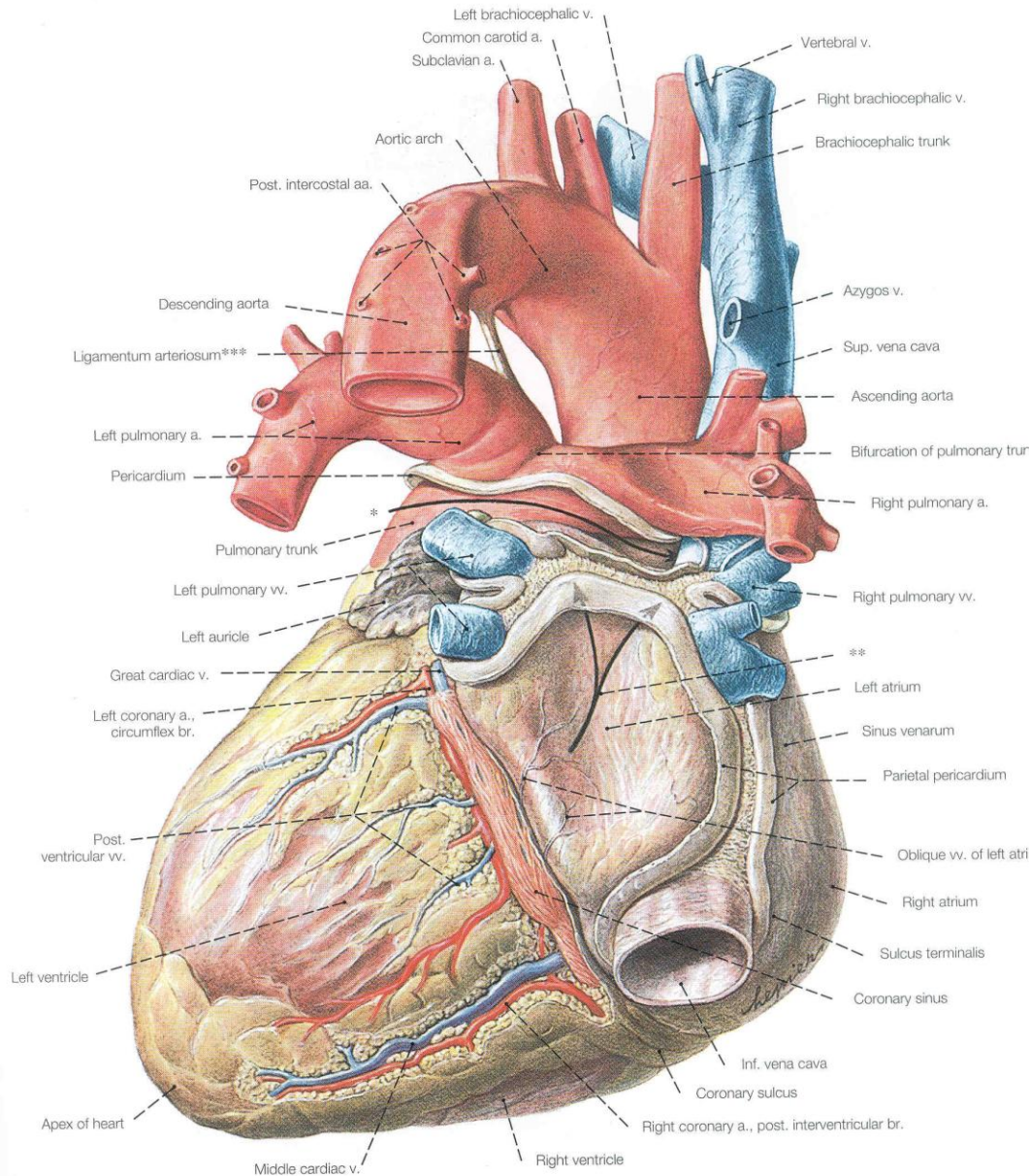
(More later...)

Anatomy of the Postnatal Heart



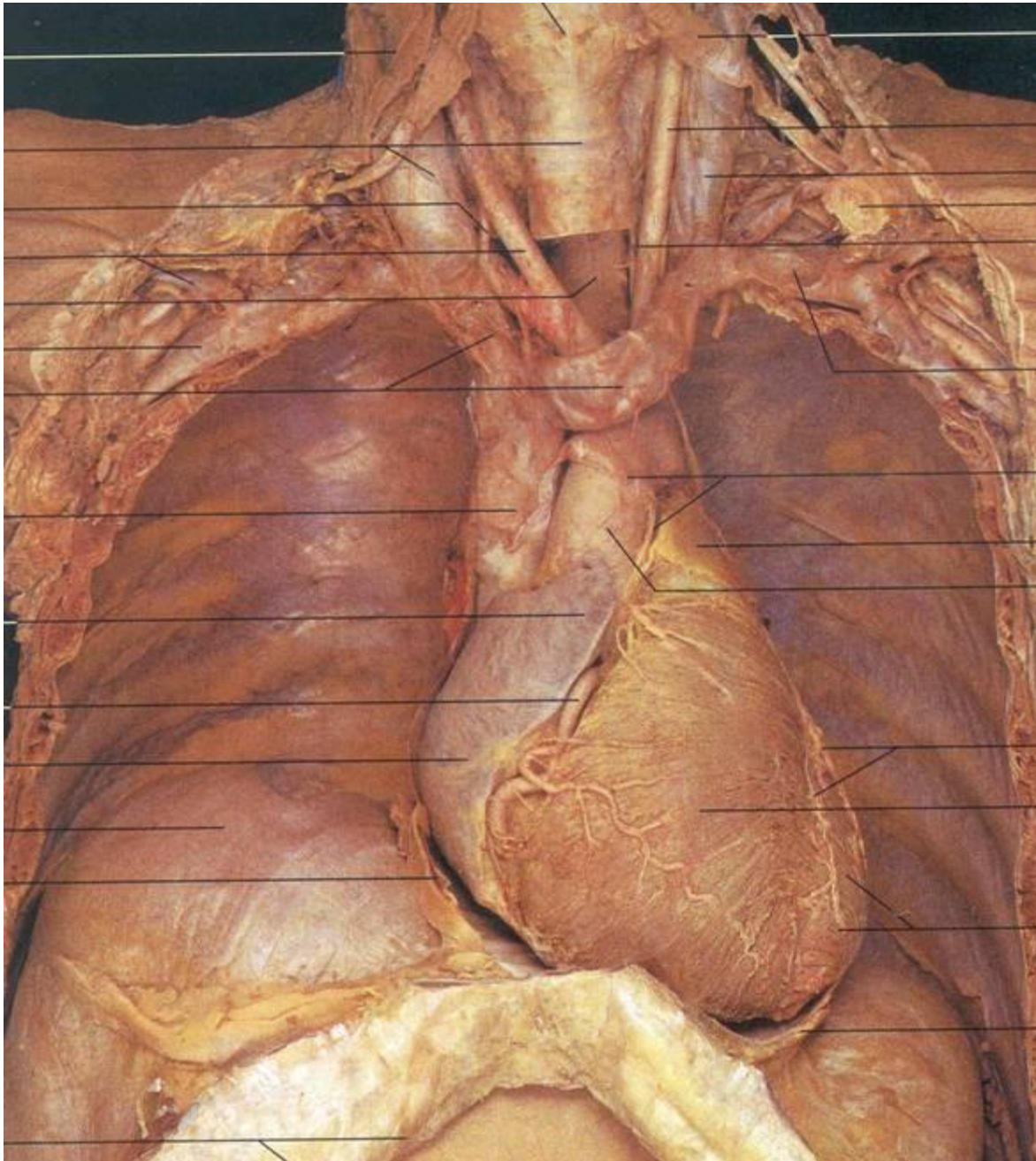
**Heart in
VENTRAL
view.**

**(You see
mostly
right
ventricle!)**



**Heart in
DORSAL
view.**

**(You see
mostly left
ventricle.)**



HEART

The real
thing in
ventral
view.

Lungs have
been
removed.

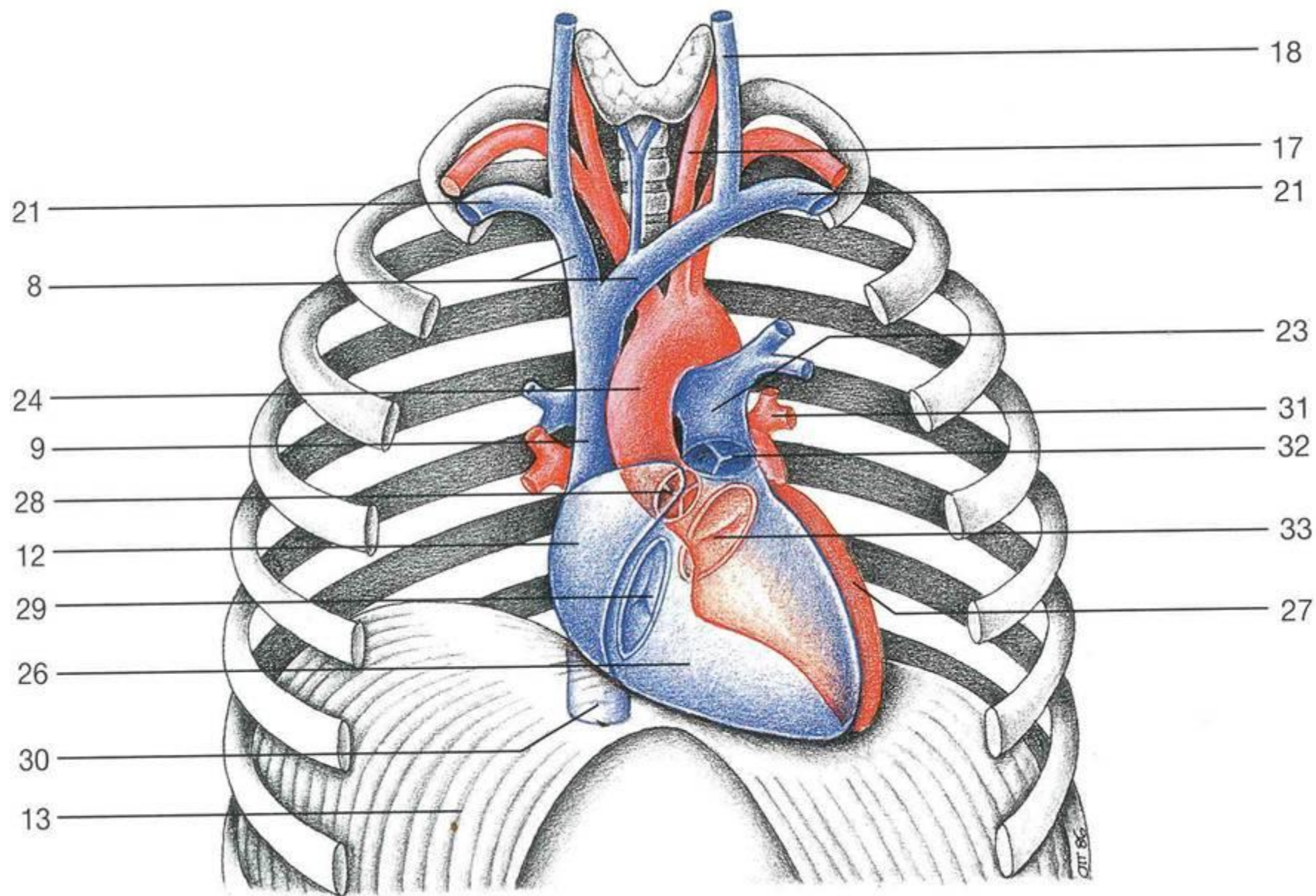
Gross Anatomy of Heart

Right Atrium: Receives deoxygenated blood from body.

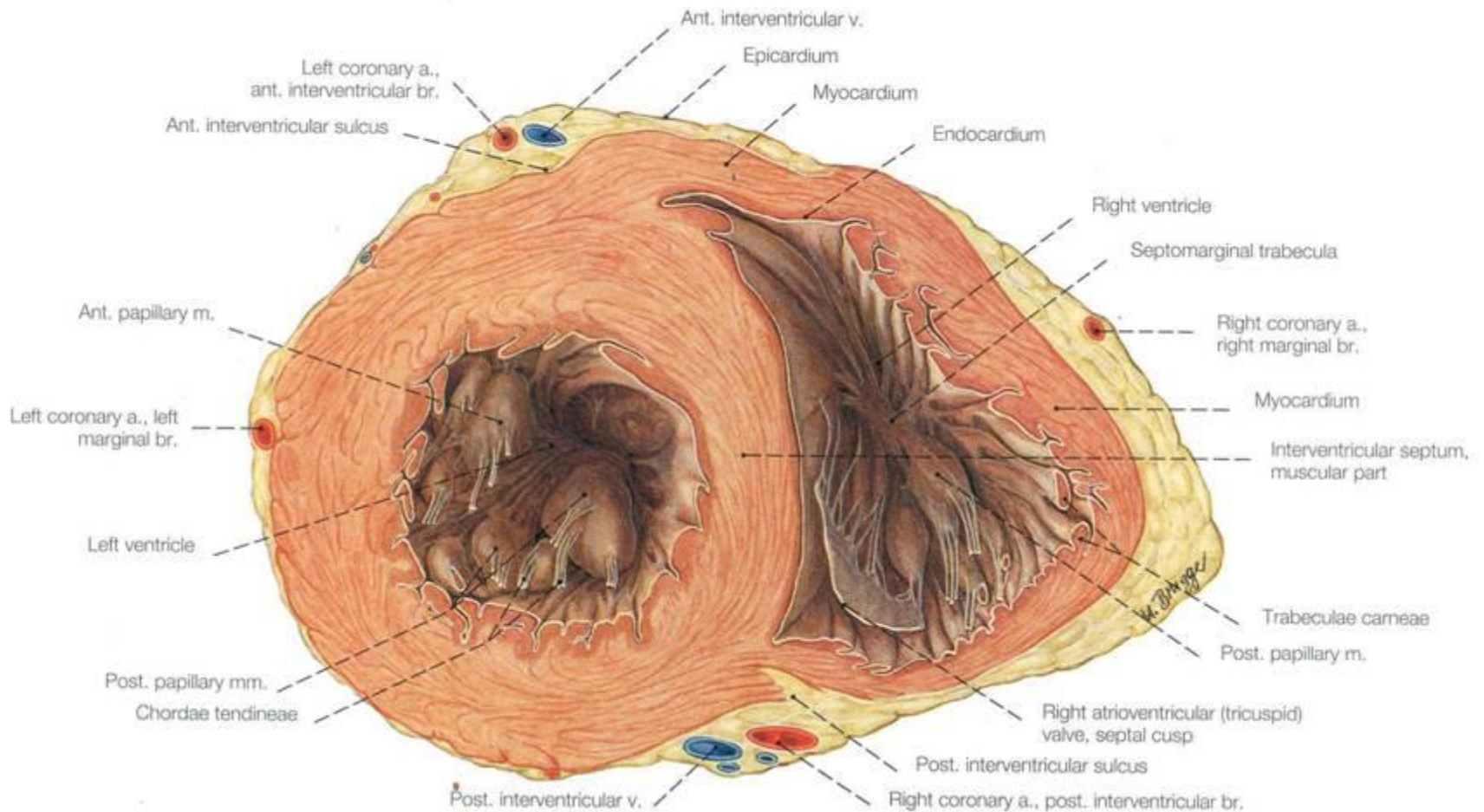
Left Atrium: Receives oxygenated blood from lungs.

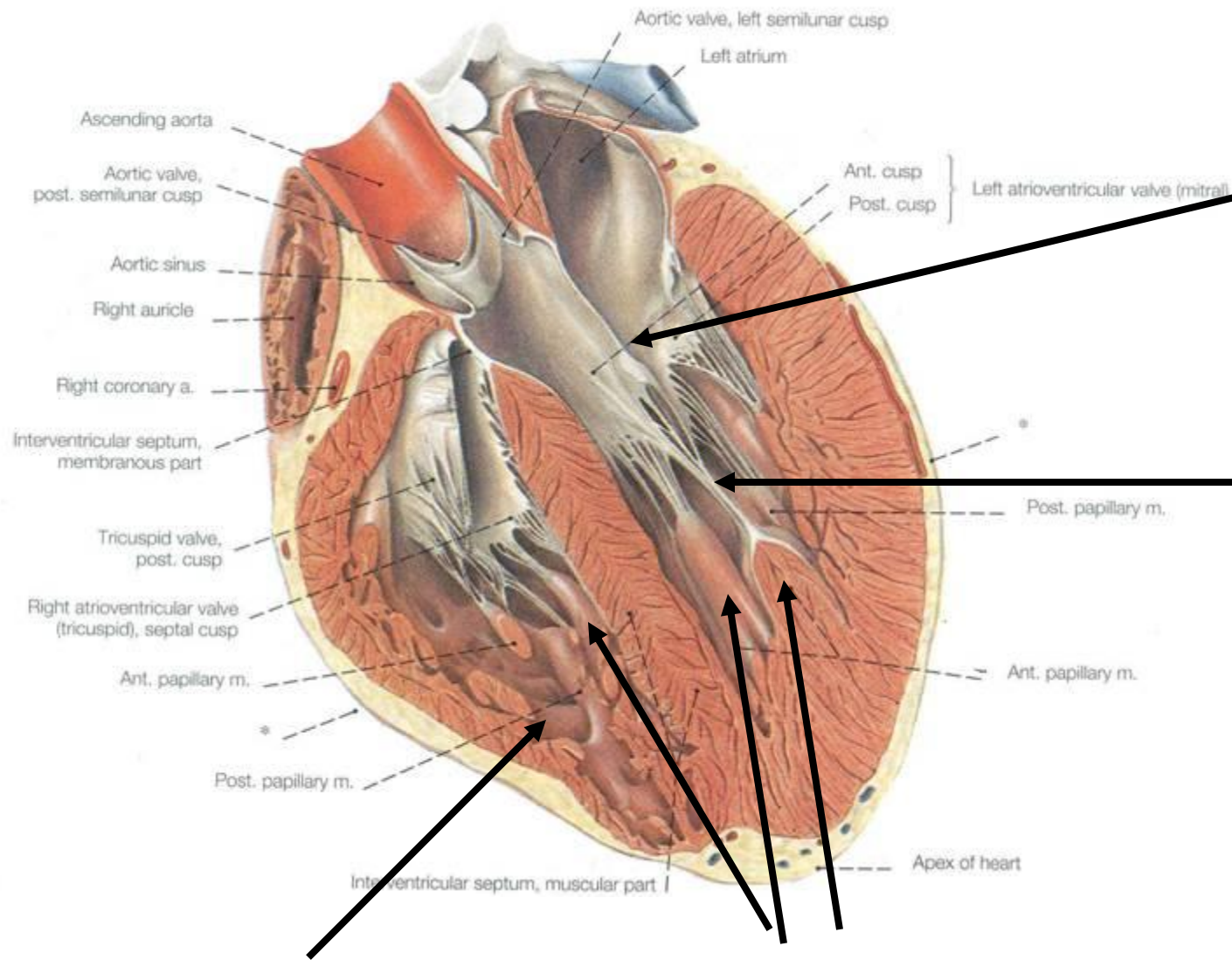
Right Ventricle: Receives deoxygenated blood from right atrium and sends it to lungs.

Left Ventricle: Receives oxygenated blood from left atrium and sends it to body.



Walls of the ventricles: Left wall is thicker!



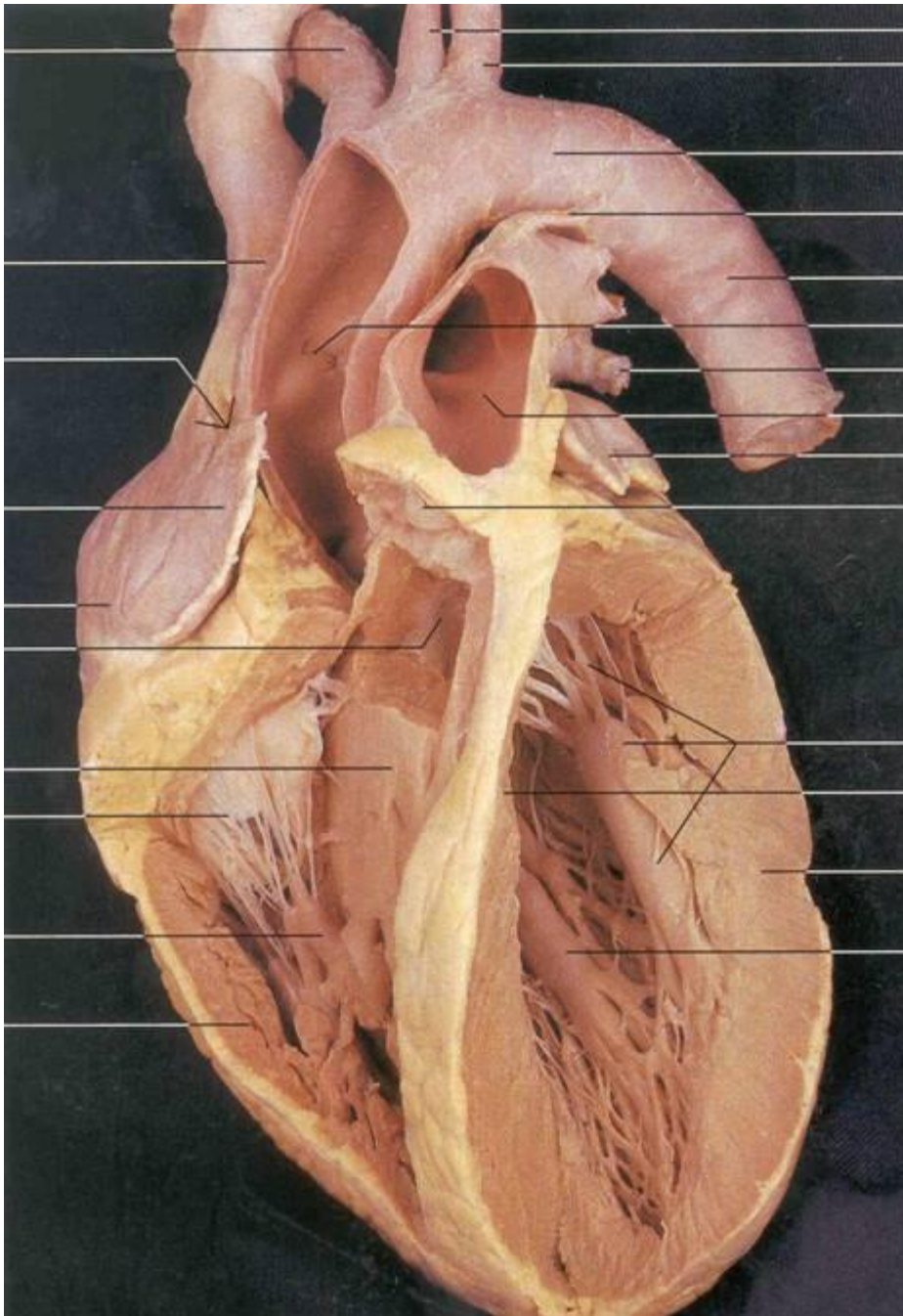


Bicuspid valve

Chordae
Tendoneae

Trabeculae carnae

Papillary muscles



Find:

1. Walls of the ventricles
2. Auricles
3. Inner walls of the atria
4. Fossa ovalis
5. Trabeculae carneae
6. Atrioventricular valve
 - (a) "Bicuspid valve"
 - (b) "Tricuspid valve"
7. Chordae tendoneae
8. Papillary muscles
9. Aortic & pulmonary valves

Blood Supply of the Heart Wall

1. Coronary arteries

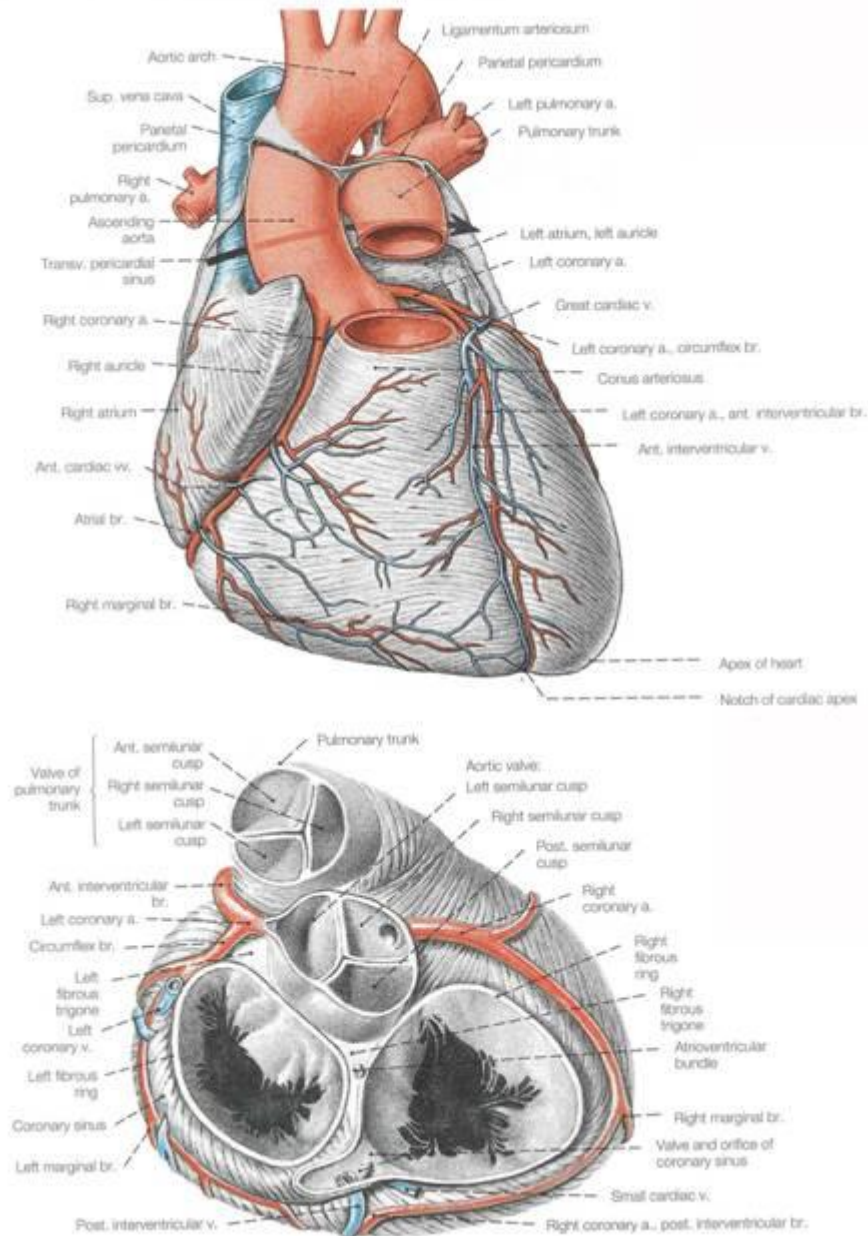
- (a) Left coronary artery
- (b) Right coronary artery
- (c) Interventricular branches
- (d) Right marginal branch

2. Cardiac veins

Coronary arteries are the **FIRST** branches of the **aorta!**

1. Coronary arteries

- (a) Left coronary artery
- (b) Right coronary artery
- (c) Interventricular branches
- (d) Right marginal branch



2. Cardiac veins

Function of the Heart & Control of Heartbeat

1. Contracts spontaneously; does not need nervous stimulation to contract.
2. Motor nerves that supply the human heart = modulate heart rate.
3. Sympathetic motor impulses speed up heart rate & parasympathetic motor impulses slow it down.

SYMPATHETIC: UPPER THORACIC SEGMENTS (T3-T4) GO UP TO THE NECK, AND COME BACK DOWN TO THE HEART.

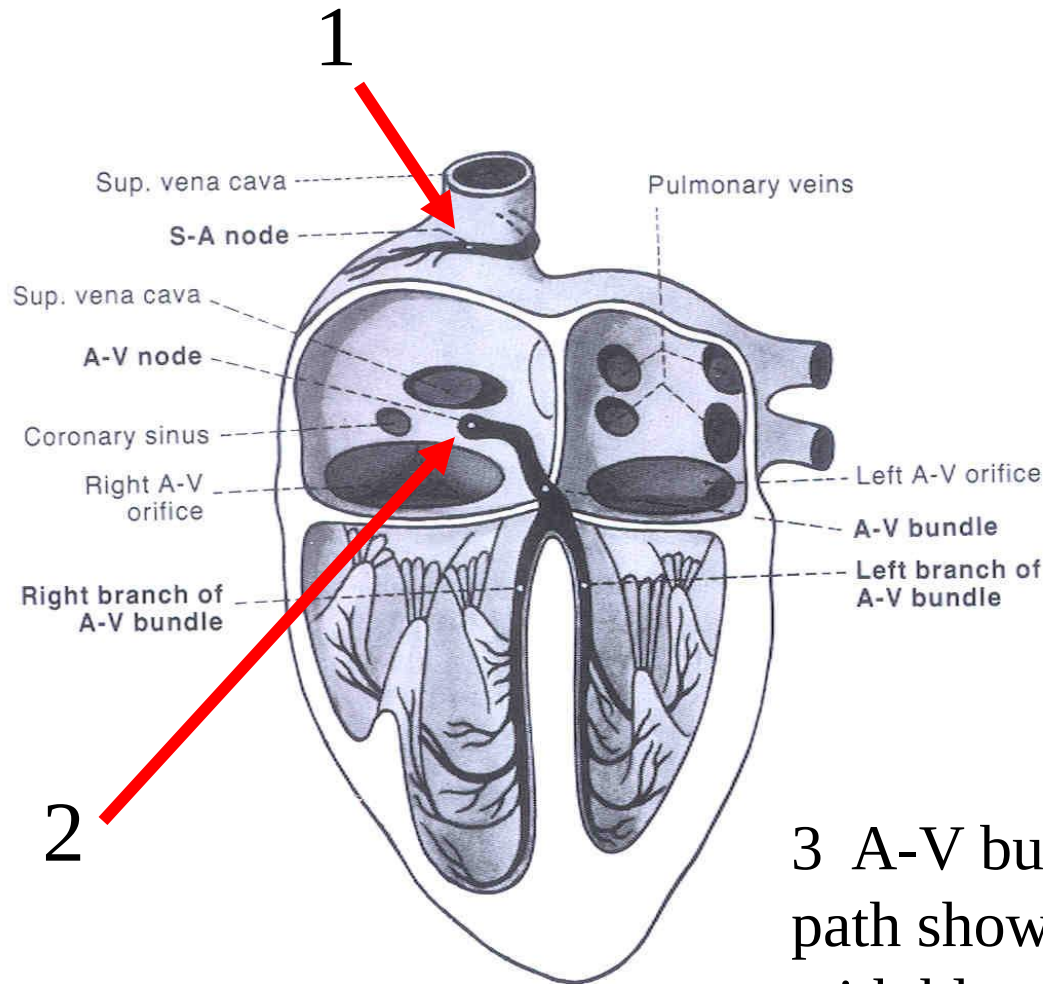
Why would it do this?!?

PARASYMPATHETIC: VAGUS NERVE (X)

Intrinsic regulation of heart beat

- System made up of cells called Purkinje fibers (insulated from surrounding cells of heart).
- **Sinoatrial node** is PACEMAKER OF HEART, and beginning of process. Generates periodic impulses that initiate contraction of right atrium.
- Signal then runs to **Atrioventricular node**. Message is passed along a track of Purkinje fibers called the...
- **Atrioventricular bundle**. Atrioventricular bundle then splits into right and left limbs/branches that pass to individual inner ventricular walls on right and left.

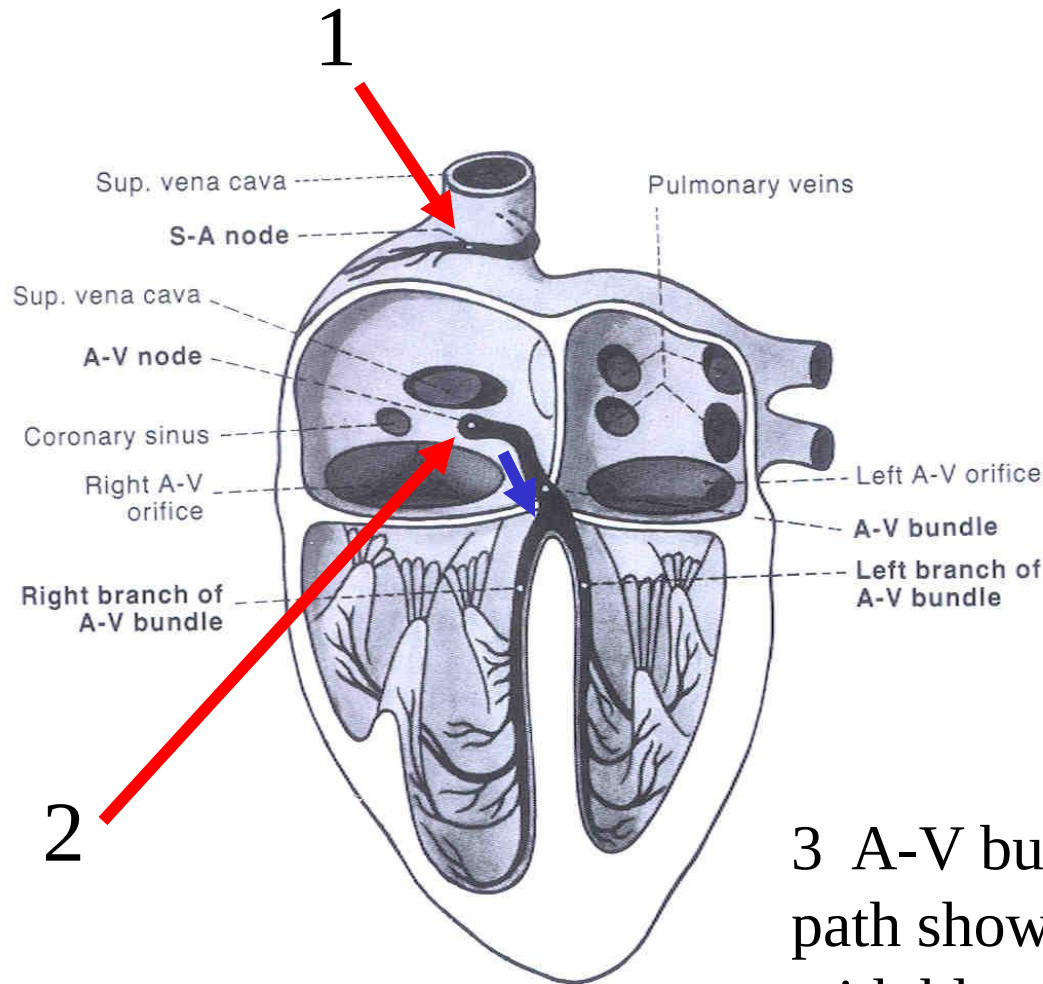
Intrinsic regulation of heart beat



A-V bundle path shown with blue arrows

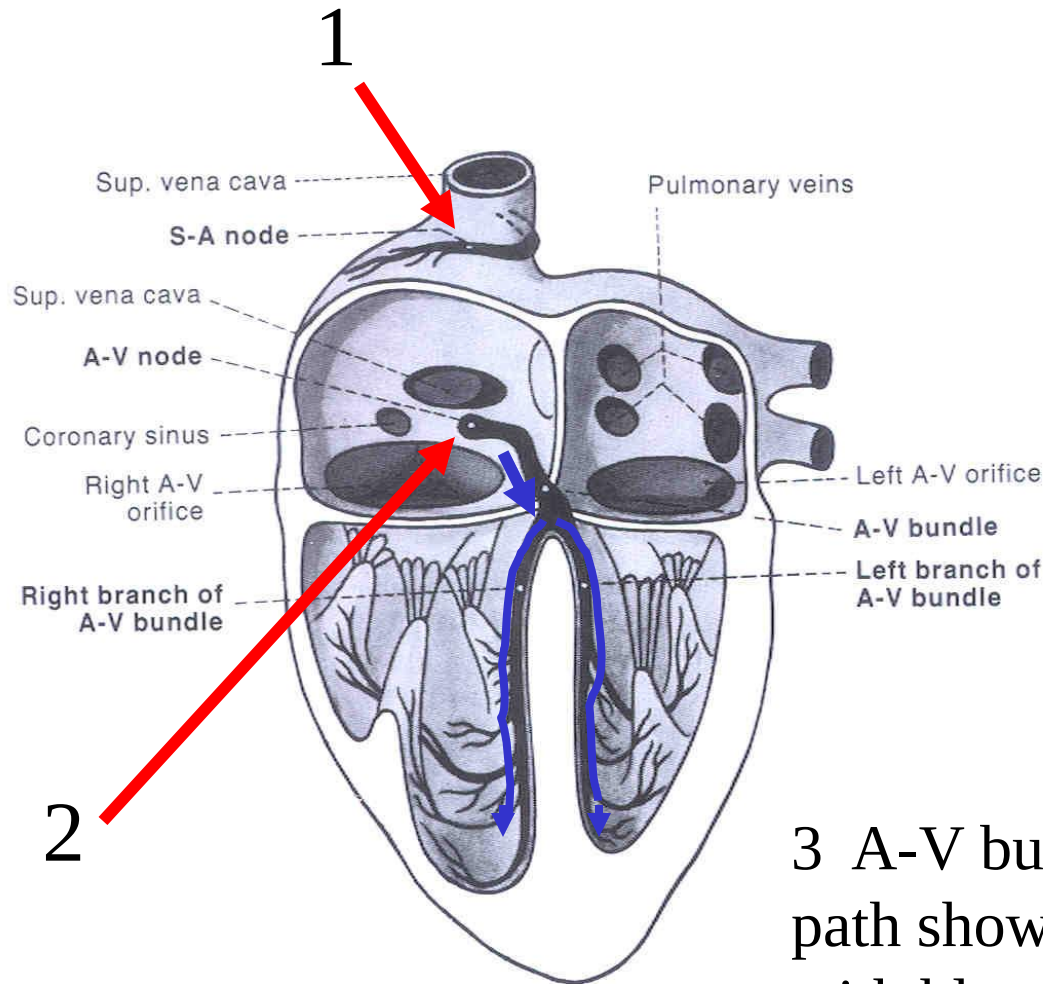
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Intrinsic regulation of heart beat



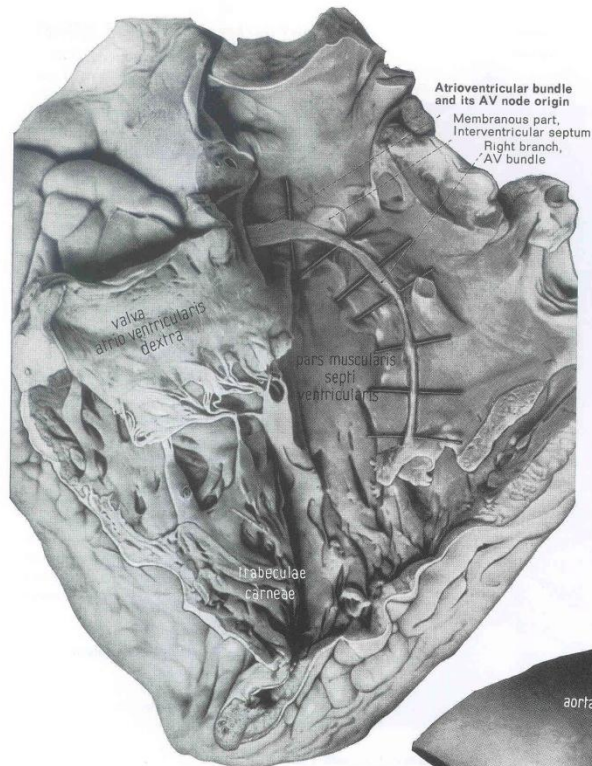
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Intrinsic regulation of heart beat



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3 A-V bundle path shown with blue arrows



The Atrioventricular Bundle Dissected in the Right Ventricle

NOTE: 1) the atrioventricular (AV) bundle forms a part of the conduction system of the heart and is composed of modified cardiac muscle fibers called Purkinje fibers. This AV bundle commences at the AV node in the interatrial septum near the opening of the coronary sinus of the right atrium.

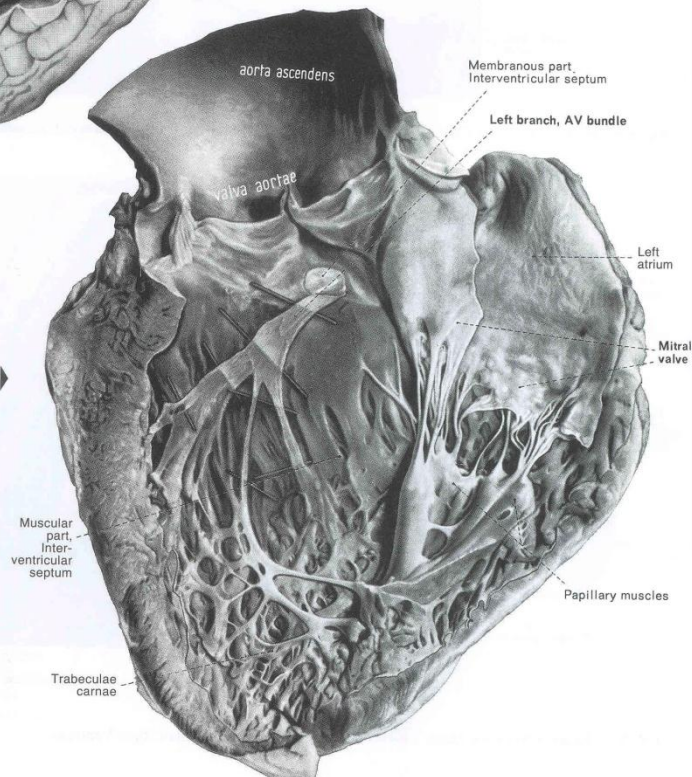
2) the AV bundle is then directed toward the membranous part of the interventricular septum where it divides into right and left branches. The right branch, which is dissected in this figure, courses in the wall of the right ventricle and is distributed toward the apex.

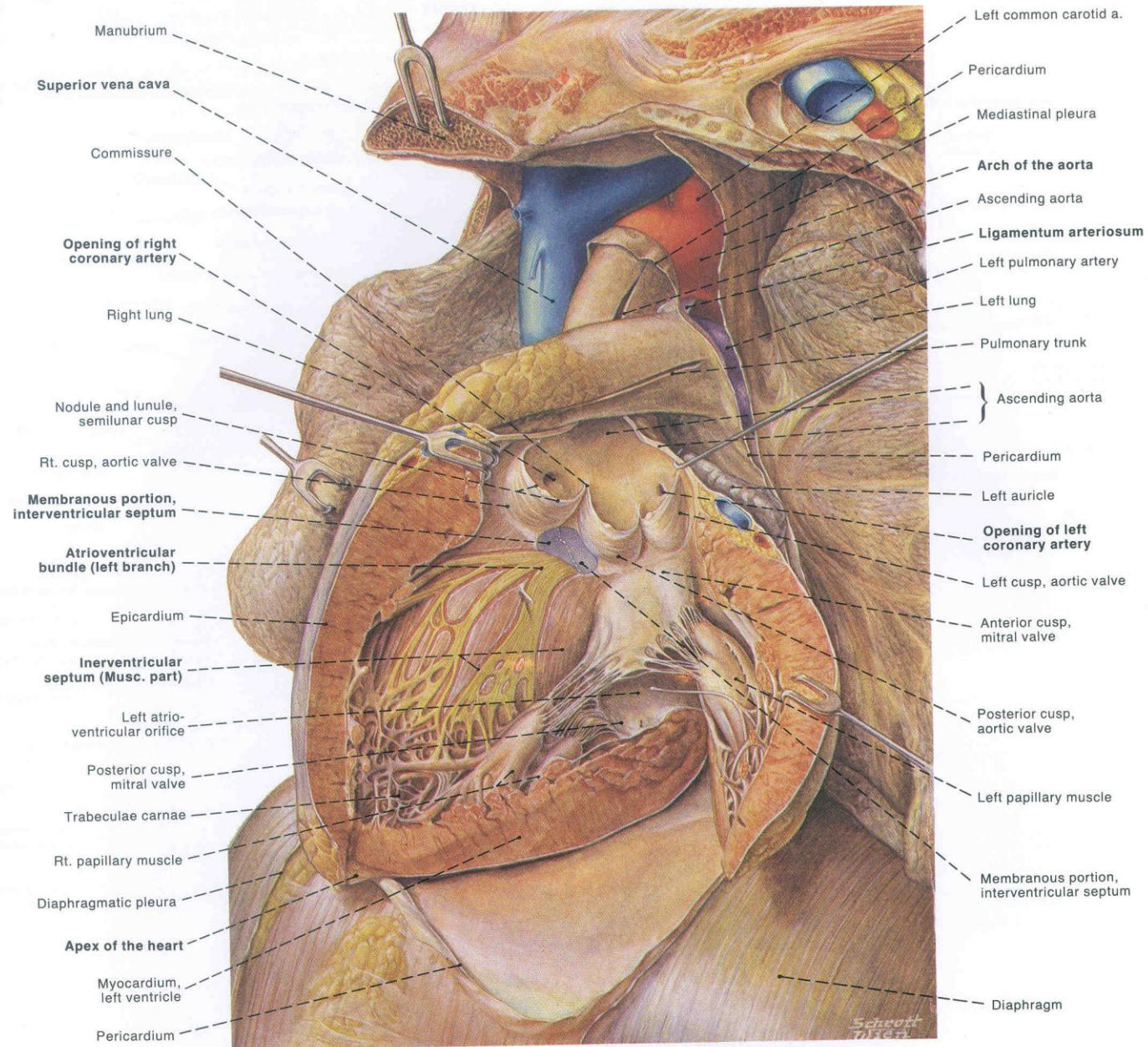
3) in this dissection the bundle was severed at its site of entrance into the anterior papillary muscle.

The Atrioventricular Bundle Dissected in the Left Ventricle

NOTE: 1) the left branch of the atrioventricular bundle is dissected on the left side of the interventricular wall. It is seen to commence as a rather wide band of tissue and soon it divides into several strands. These fan out to become distributed among the papillary muscles and trabeculae carneae of the inner left ventricle and ramify among the cardiac muscle fibers.

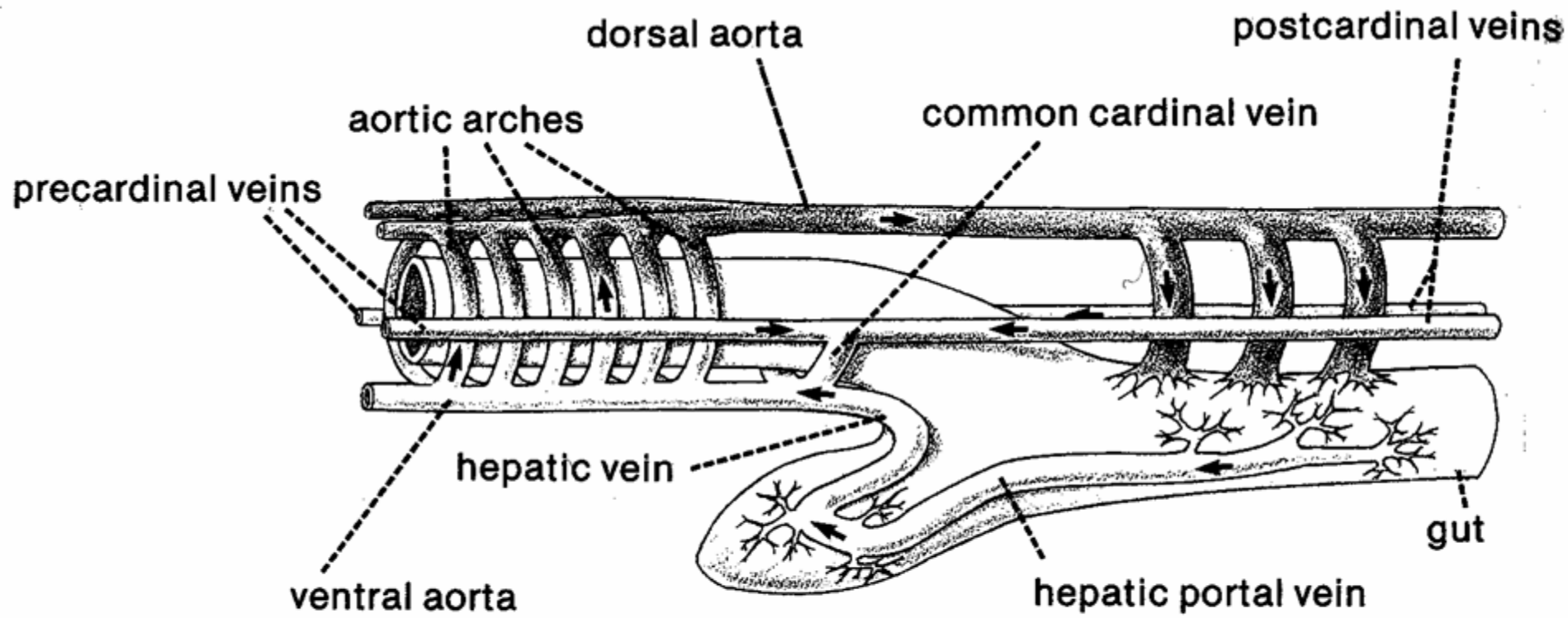
2) the conduction system of the heart transmits to the cardiac musculature the rhythmic impulses characteristic of the rate of heart beat. This rhythm is superimposed on the natural contractile property of cardiac musculature, and the rate responds to regulation by the cardiac nerves which innervate the heart.

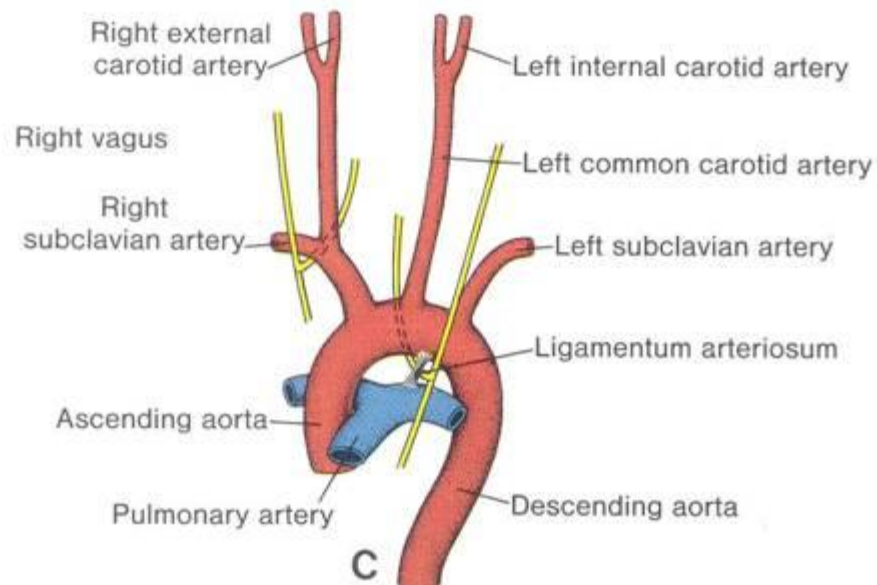
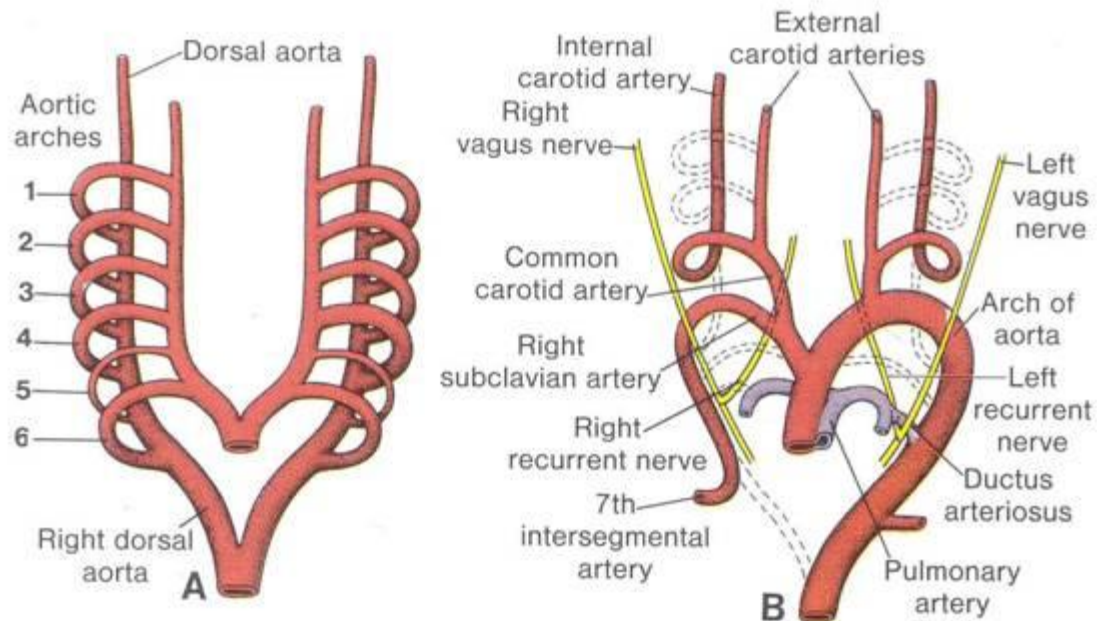


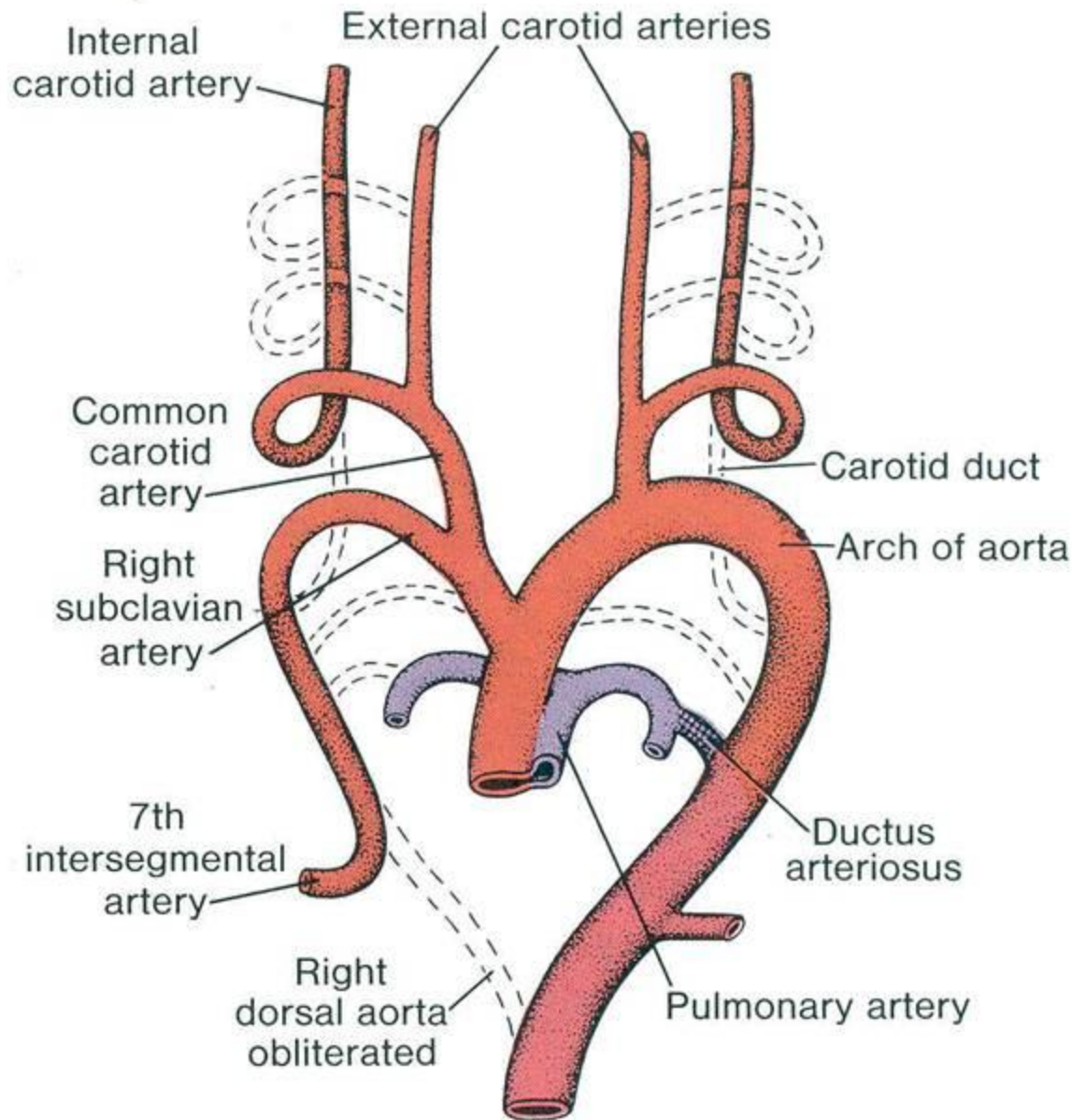


The Great Vessels of the thorax are a logical extension of the heart

Embryonic Origin of Great Vessels: They are derivatives of the aortic arches.







This is in
your lab
manual!

Aortic Arch Summary:

Arch I: Mostly disappears
(a small part becomes a
bit of the maxillary
artery).

Aortic Arch Summary:

Arch II: DISAPPEARS

Aortic Arch Summary:

Arch III: CAROTID

ARCH – becomes part of
carotid arteries.

Aortic Arch Summary:

Arch IV: AORTIC ARCH
-- Right side disappears.
Left side becomes ARCH
OF AORTA.

Aortic Arch Summary:

Arch v: DISAPPEARS

Aortic Arch Summary:

Arch VI: PULMONARY
ARCH – Becomes
pulmonary artery to lungs.

Great Veins of the Thorax

1. Venous blood dumps in the right atrium of the heart.
 - (a) Blood from the cranial region enters via superior vena cava
 - (b) Body blood enters via inferior vena cava
2. Inferior vena cava - passes through the diaphragm after receiving blood from the abdominal gut.
3. Superior vena cave & its 3 tributaries:
 - (a) Azygous vein
 - (b) Right brachiocephalic vein
 - (c) Left brachiocephalic vein

The embryological Cardinal Veins look like a big letter “H”.

Head

Right anterior cardinal

Left anterior cardinal



Right common cardinal

Sinus
venosus

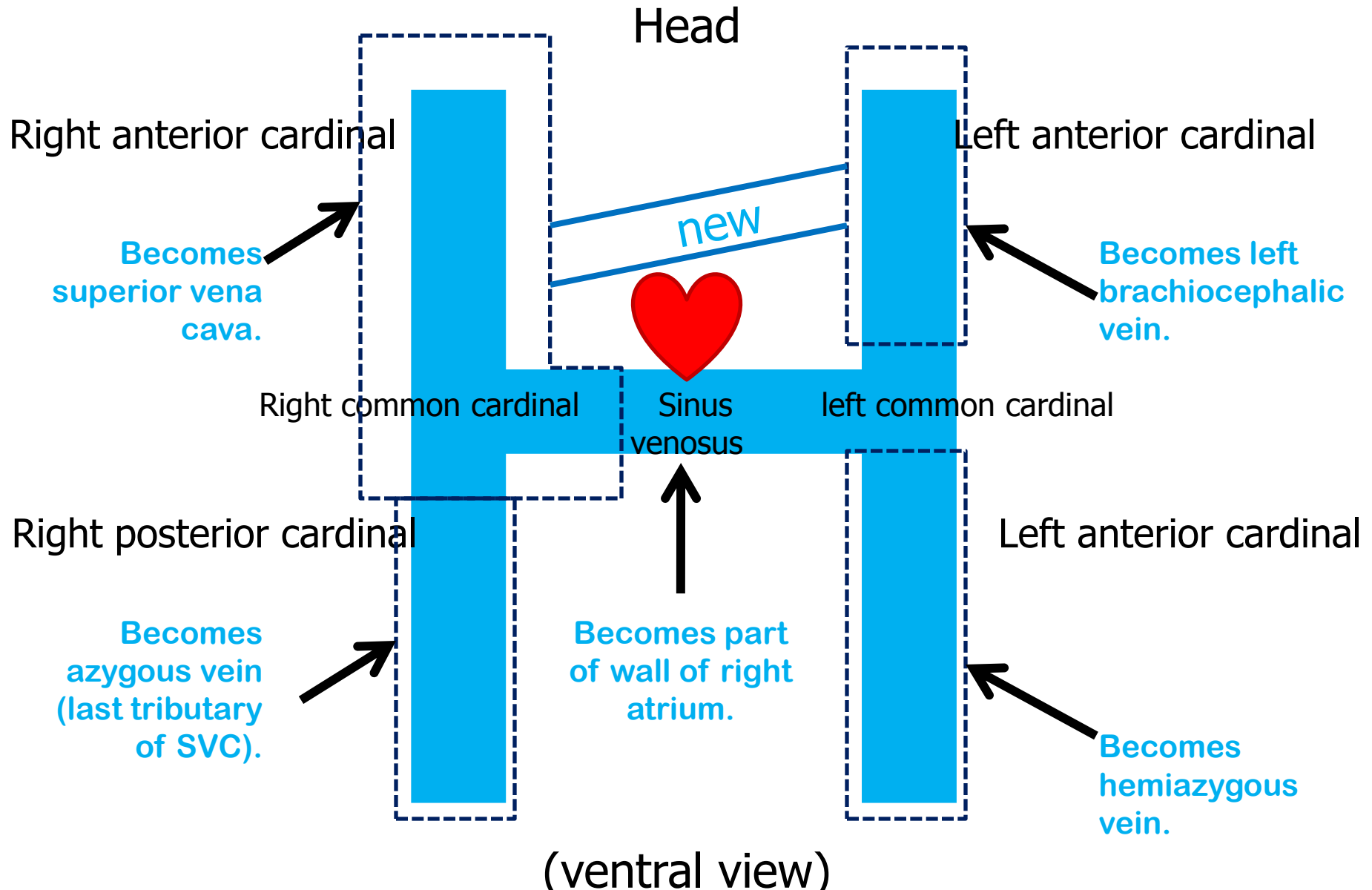
left common cardinal

Right posterior cardinal

Left posterior cardinal

(ventral view)

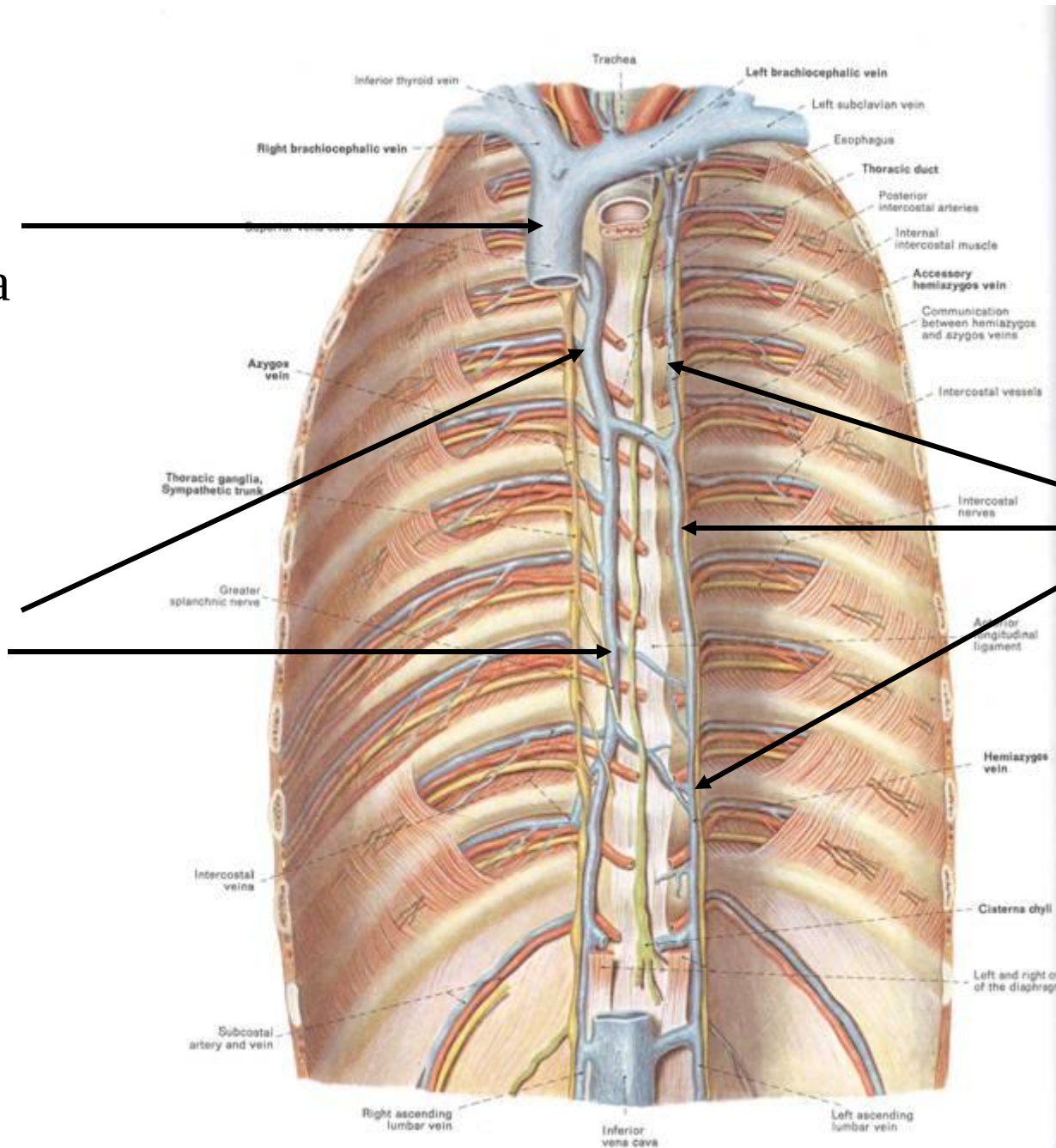
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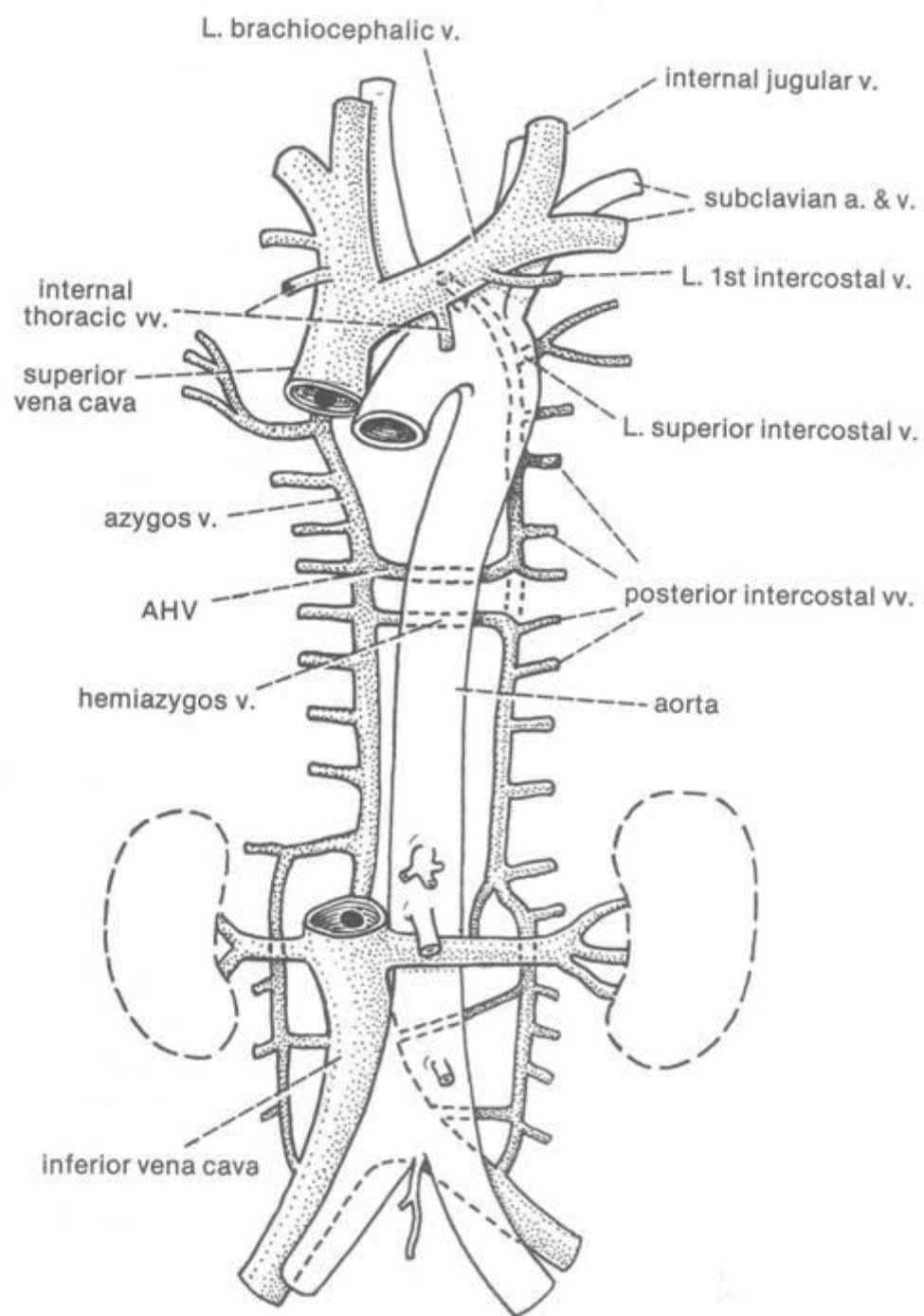


Superior
Vena Cava

Azygous
Vein

Hemiazygous
Vein





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