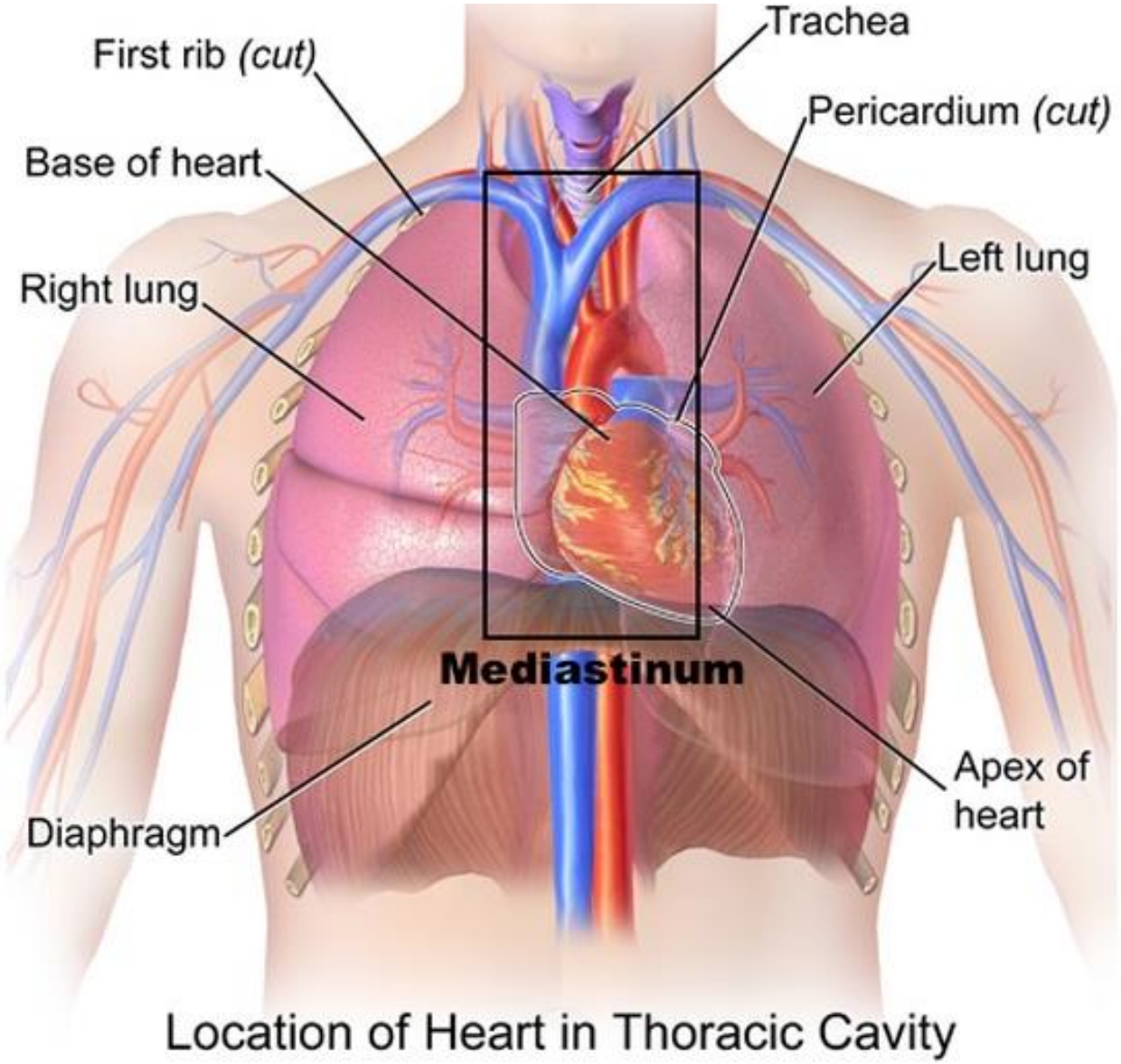
ANATOMY AND PHYSIOLOGY (C.I.)

HUMAN ANATOMY
(Mod. A)

THE CARDIOVASCULAR SYSTEM

THE HEART



Location of Heart in Thoracic Cavity

LOCATION OF THE HEART

The heart is located within the **thoracic cavity**, medially between the lungs in the space known as the **mediastinum**.

It lies posteriorly to the sternum and costal cartilages, and rests on the superior surface of the diaphragm.

MEDIASTINUM:

space located **in the central portion** of the thoracic cavity

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Together with the **heart**, other organs are located within the mediastinum: the **great veins and arteries**, the **trachea** and the **esophagus**

PLEURO-PULMONARY SPACES:

lateral spaces, on the right and left lateral portions of the thoracic cavity

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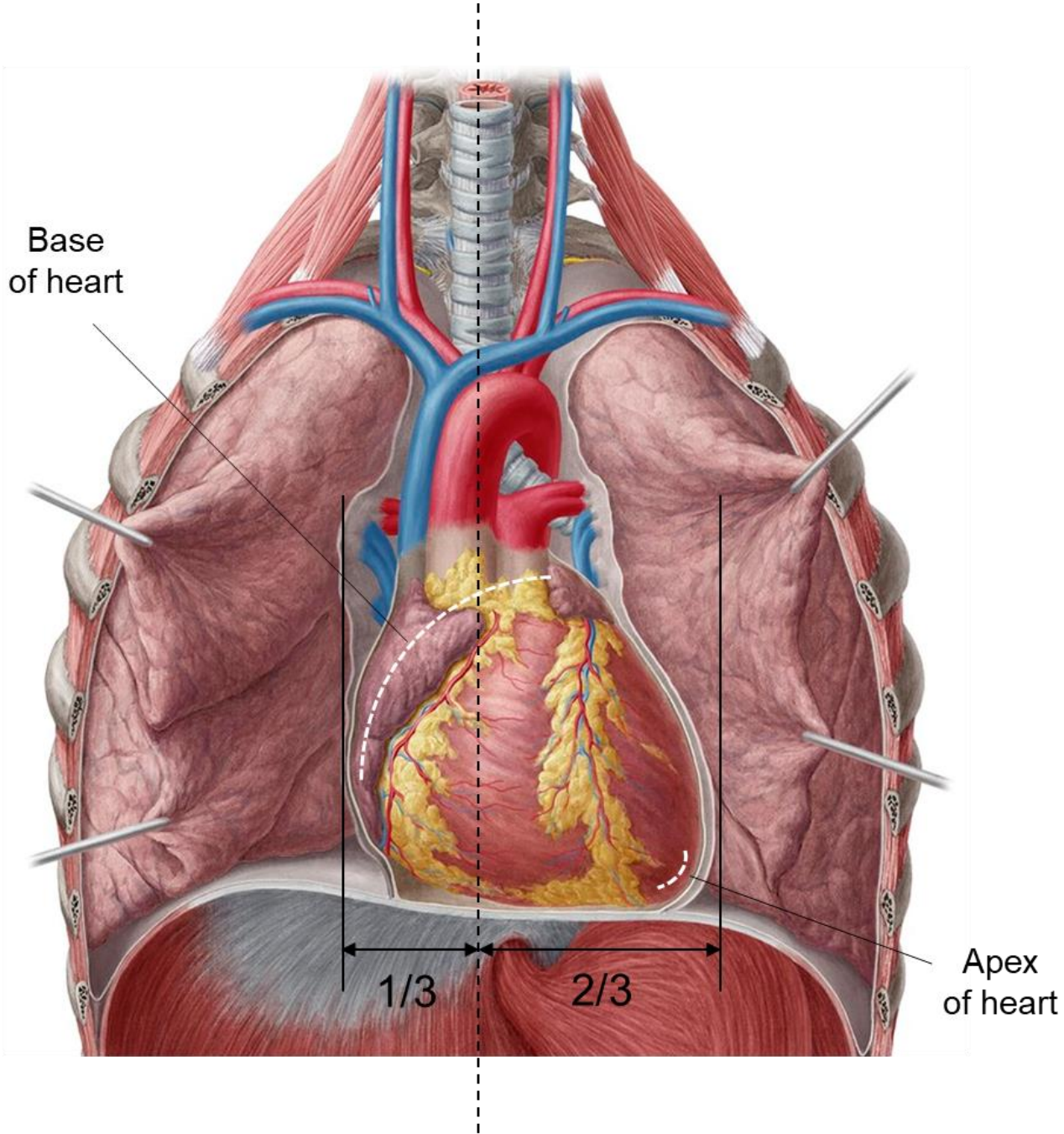
They host the lungs and pleurae (= serous membranes of the lungs)

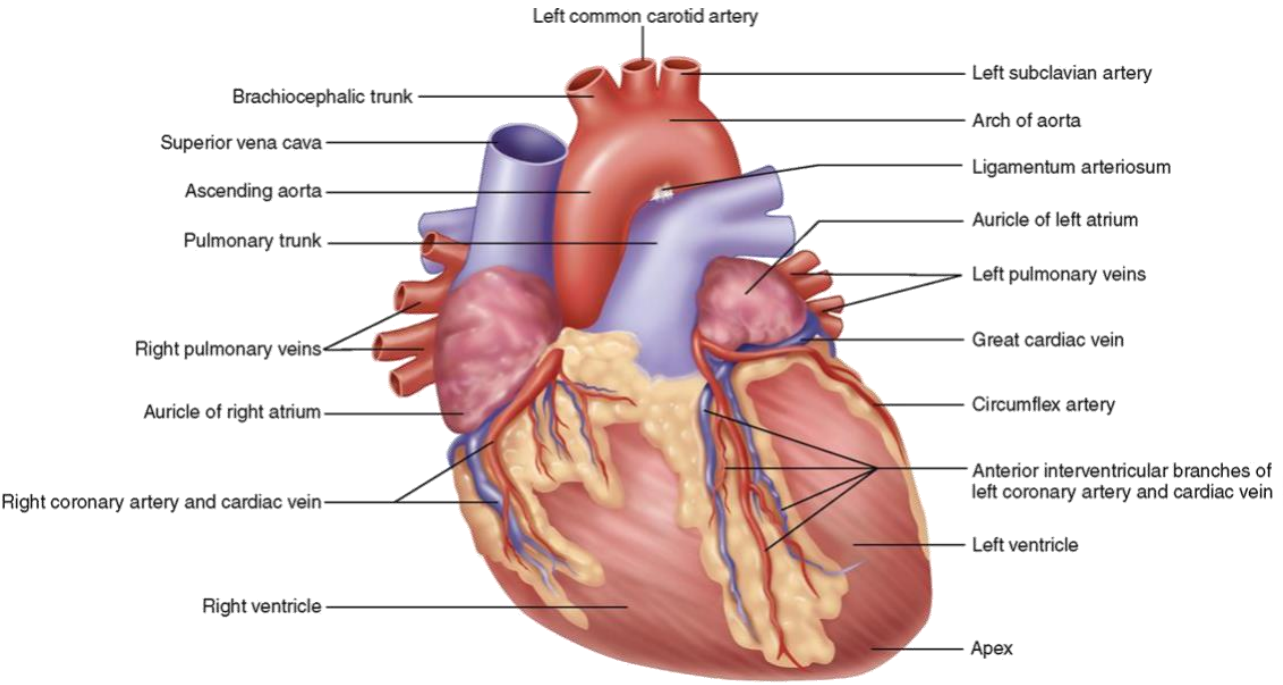


The heart is located with **two-thirds** of its volume **on the left of the midline**

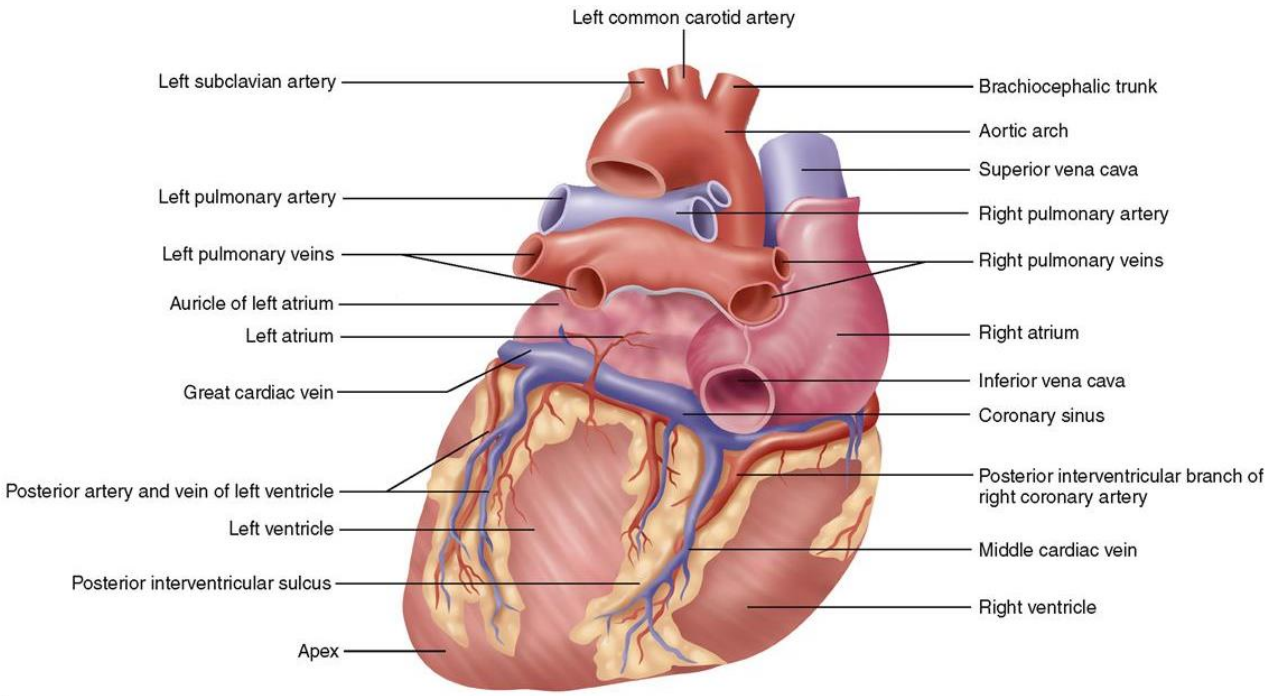
This means that, imagining the sagittal plane that divides the body into two symmetric portions, the heart is located with 2/3 of its volume on the left and only with 1/3 on the right.

It is shaped like an **inverted cone**, where we identify:

- an APEX
- a BASE
- 2 main SURFACES
- 2 MARGINS (= the lines between 2 surfaces)



1) STERNOCOSTAL SURFACE

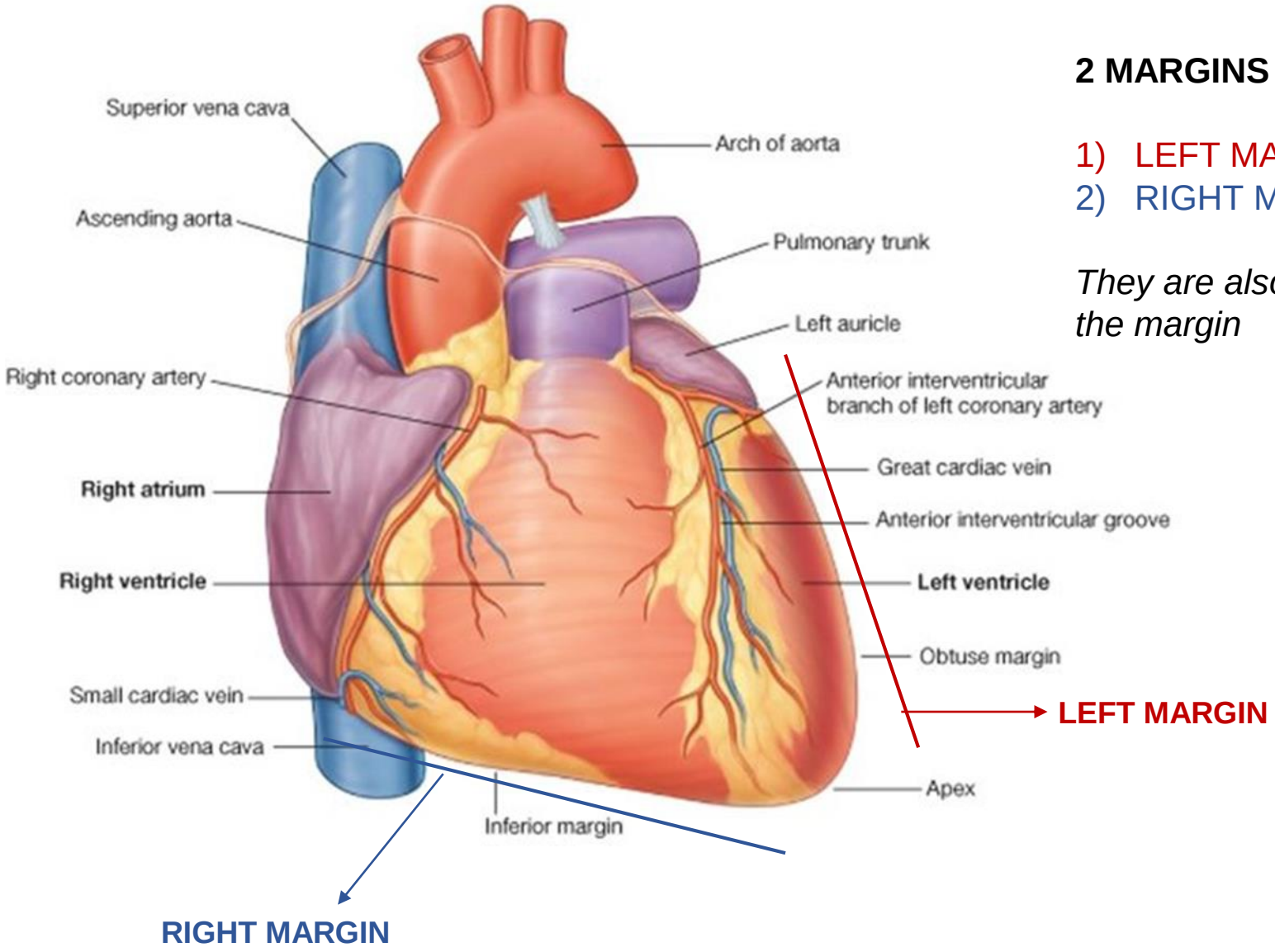


2) DIAPHRAGMATIC SURFACE

2 SURFACES:

1) ANTERIOR or STERNOCOSTAL surface:
it is located posteriorly to the sternum and the ribs, or specifically the costal cartilages

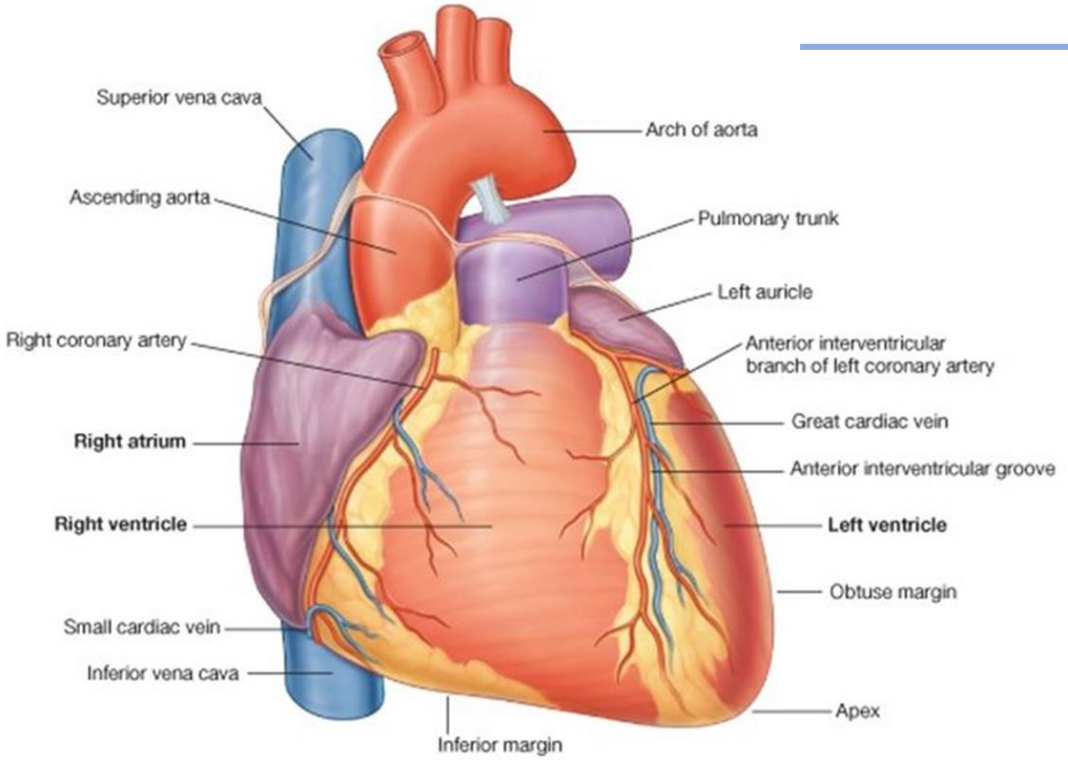
2) POSTERO-INFERIOR or DIAPHRAGMATIC surface: it lies on the diaphragmatic muscle



2 MARGINS (= the lines between 2 surfaces)

1) LEFT MARGIN
2) RIGHT MARGIN

They are also named based on the way the two faces approach the margin



2 MARGINS (= the lines between 2 surfaces)

1) OBTUSE MARGIN

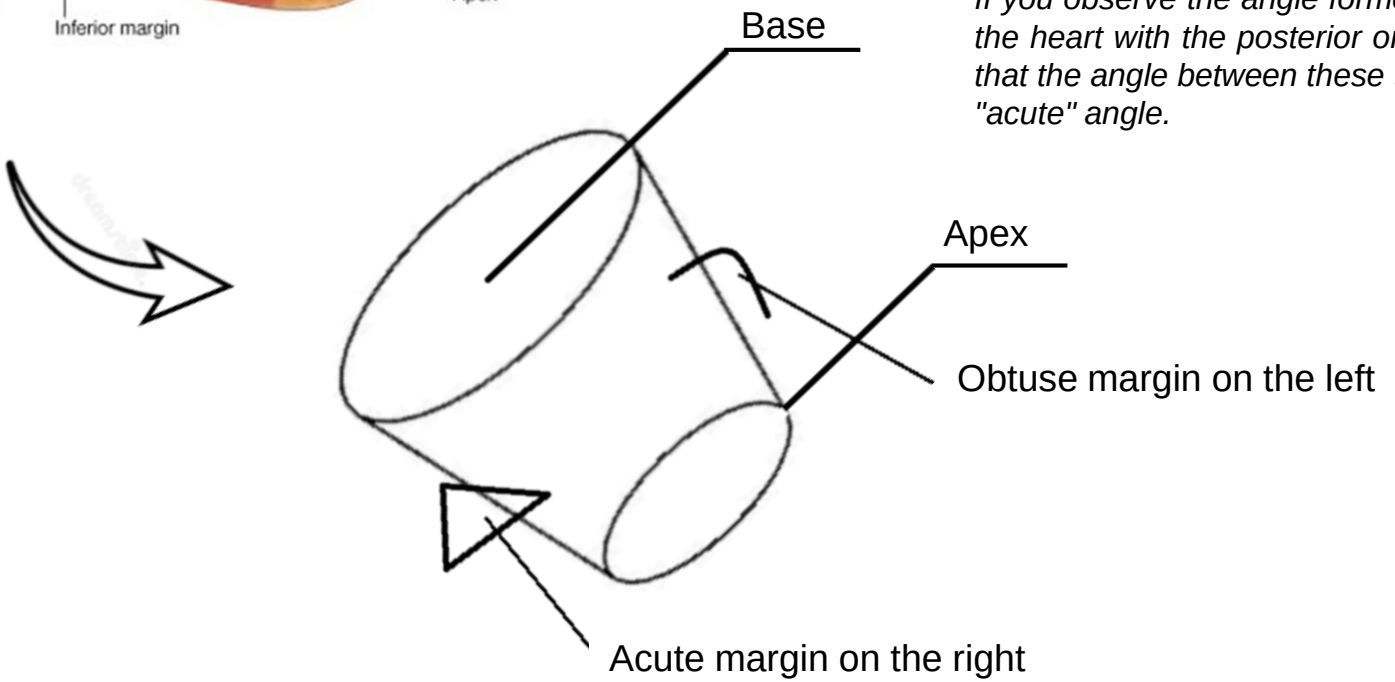
It is the rounded LEFT margin of the heart, formed mainly by the left ventricle to the left of the sternocostal surface

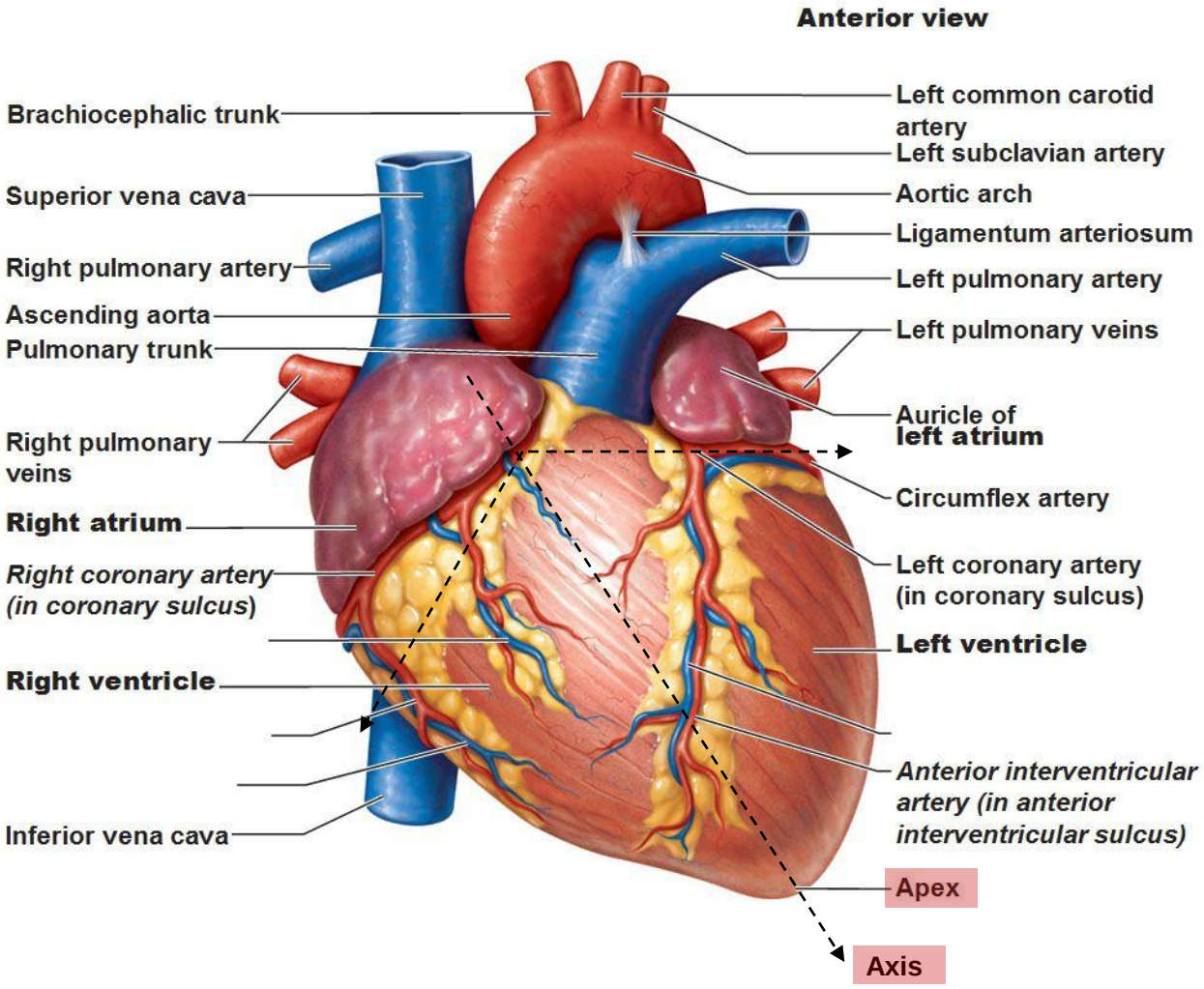
It is called the 'obtuse' margin because of the obtuse angle (>90 degrees) created between the anterior part of the heart and the left side, which is formed from the rounded lateral wall of the left ventricle.

2) ACUTE MARGIN

It is the sharp angle formed mainly by the RIGHT ventricle and occupying the lower heart border

If you observe the angle formed between the anterior or sternocostal surface of the heart with the posterior or diaphragmatic surface of the heart, you can see that the angle between these two surfaces is less than 90 degrees, therefore an "acute" angle.





Orientation of the heart in the mediastinum

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It is defined based on the apex or axis of the heart

APEX of the HEART

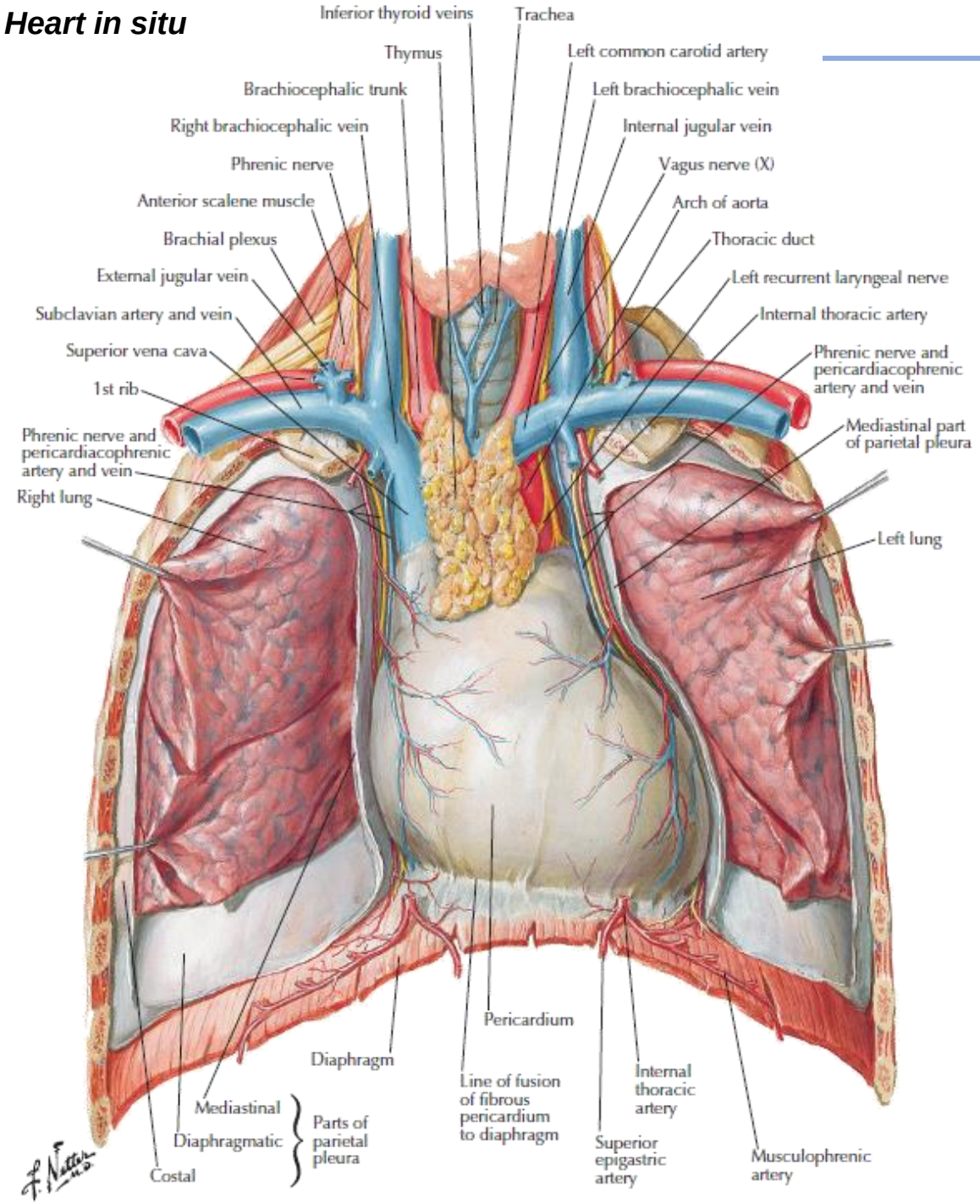
Facing: anteriorly
downward
and to the left

HEART AXIS (from the apex to the center of the base)

Directed: from back to front
from the top to bottom
from the right to the left

PERICARDIUM

Heart in situ

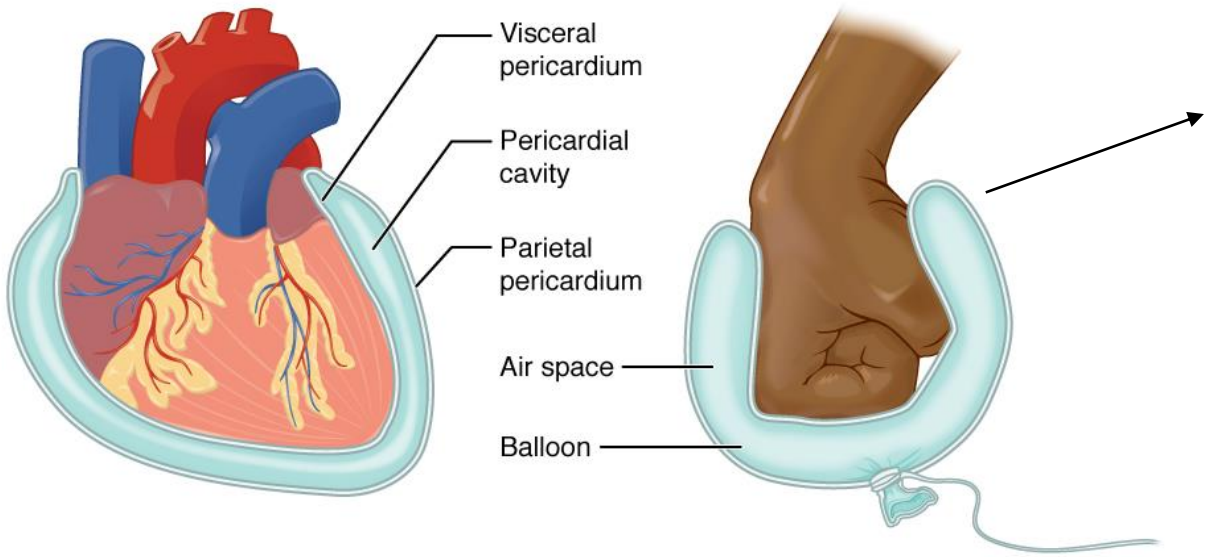


The image represents the heart located immediately behind the sternum, in the so-called anterior mediastinum

In this image, the heart is represented still surrounded by the MEMBRANE that covers it, the PERICARDIUM

PERICARDIUM: **serous membrane** of the body
(together with the pleurae, the peritoneum and the tunica vaginalis that covers the testicles)

A serous membrane (also referred to a serosa) is one of the thin membranes that cover the walls and organs in the thoracic and abdominopelvic cavities.
The parietal layers of the membranes line the walls of the body cavity (parietal refers to a cavity wall). The visceral layer of the membrane covers the organs (the viscera). Between the parietal and visceral layers is a very thin, fluid-filled serous space, or cavity



The serous membranes behave like a CLOSED and EMPTY nylon bag that covers the entire fist, leaving the wrist free

The pericardium is a closed, empty serous membrane that covers the heart from the outside

The heart has a part of its surface that is in direct contact with a part of the pericardium

▼

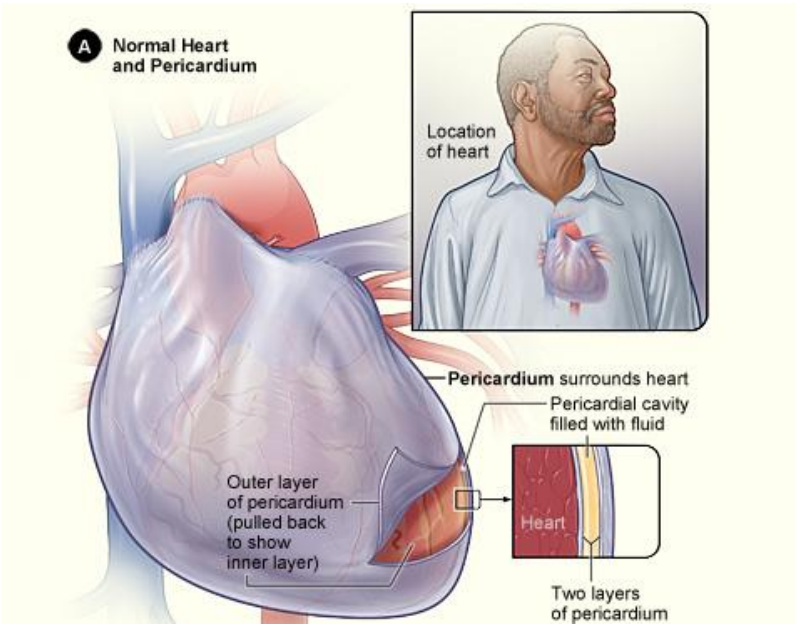
VISCERAL LAYER of PERICARDIUM
or VISCERAL PERICARDIUM

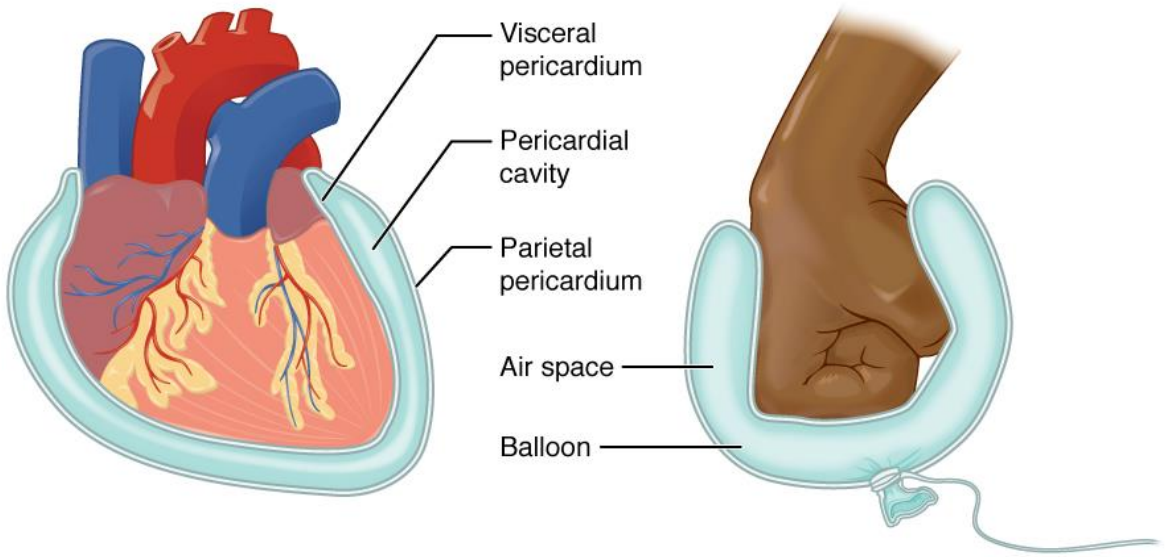
Tthe visceral layer turns on itself and returns to cover the heart, but on a more external plane,

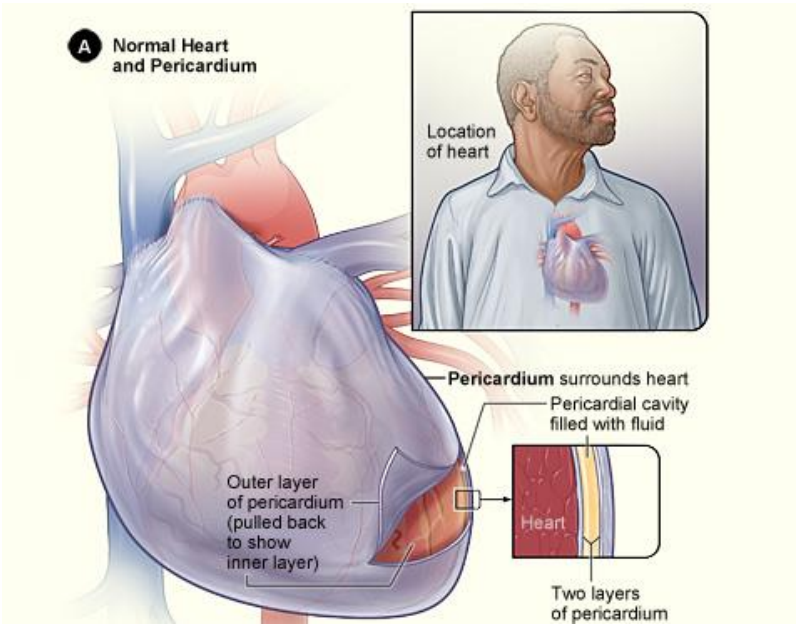
▼

PARIETAL LAYER of PERICARDIUM
or PARIETAL PERICARDIUM

The pericardium is a SINGLE membrane, with a VISCERAL portion and a PARIETAL portion







The space between the parietal and the visceral layers of the pericardium:

PERICARDIAL CAVITY

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It contains a minimum quantity of serous liquid which allows the sliding of the two pericardial layers, and the heart to pulsate and move without friction.

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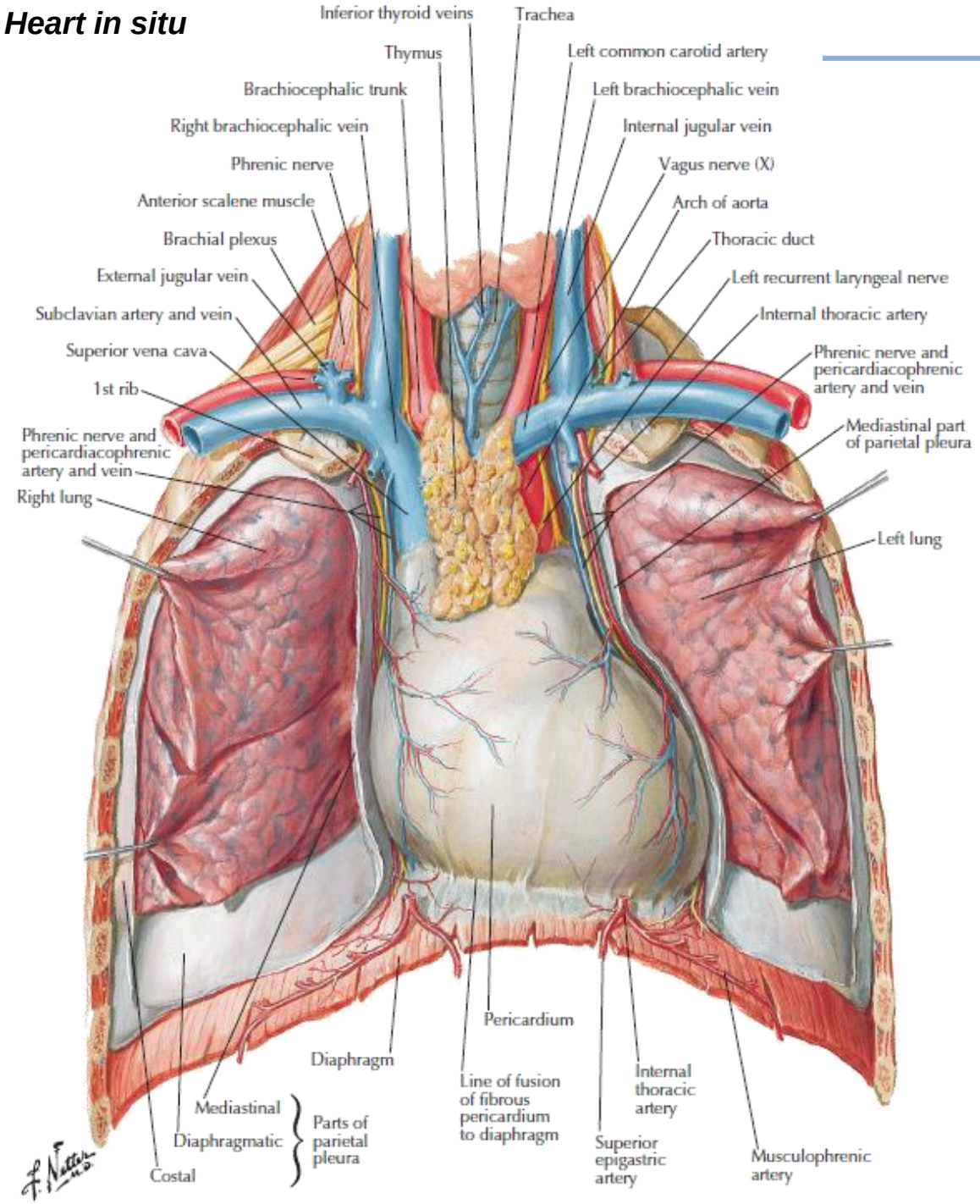
It's basically an EMPTY CAVITY

Heart in situ



In the image you can see the
OUTER – PARIETAL – LAYER of the PERICARDIUM,
seen from the outside

- It is a thicker layer with a greater consistency

- It is NOT transparent, but it is OPAQUE

- Cutting the parietal pericardium
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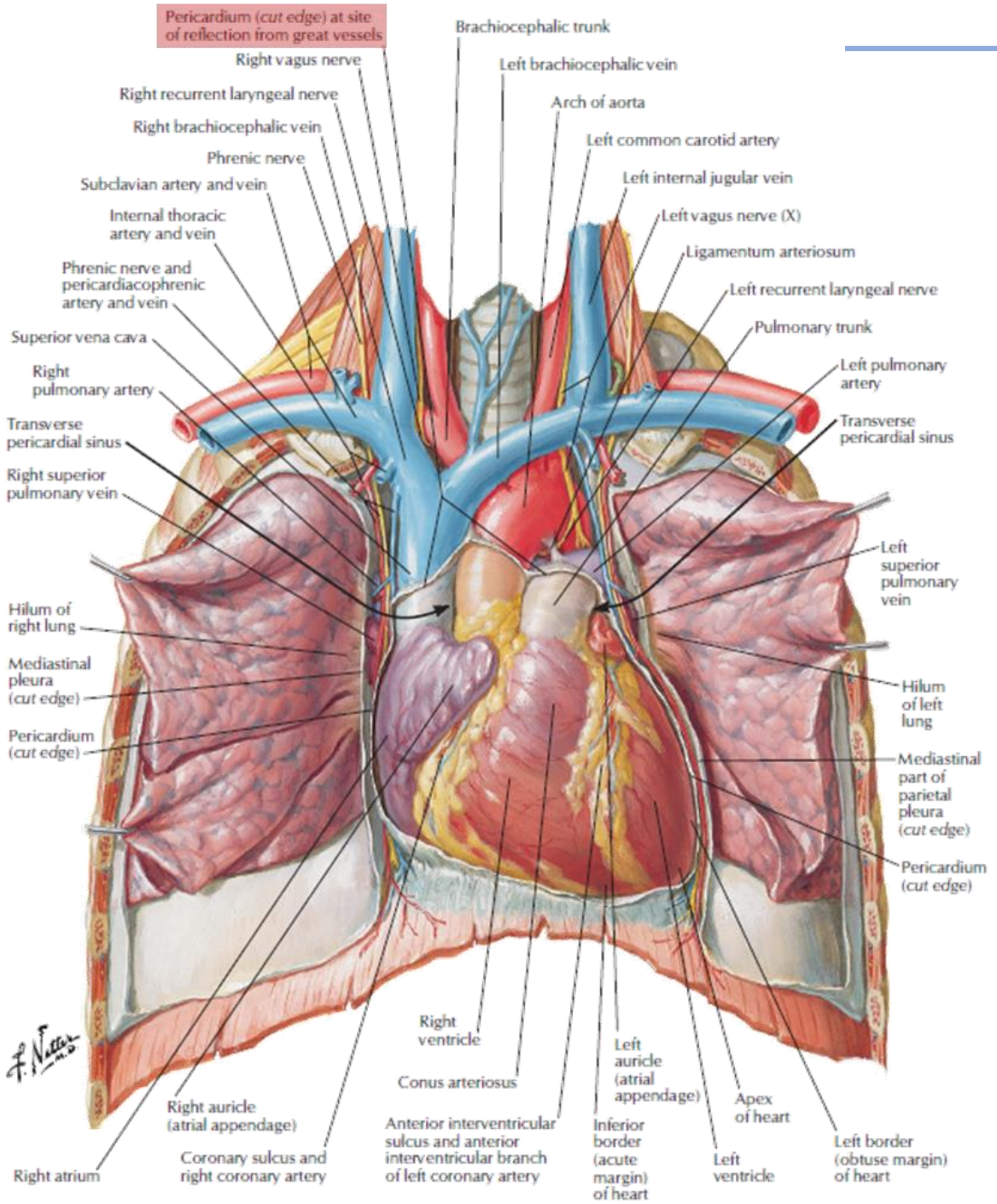
we enter the pericardial cavity and observe:



The **REFLECTION**
of the visceral pericardium to form the parietal pericardium

VISCERAL PERICARDIUM: is a thin layer that directly covers the heart

The image represents the heart, which maintains its visceral pericardium layer → the heart can be observed through this layer which, unlike the parietal pericardium, is a transparent layer

In fact, the visceral layer of the pericardium is part of the heart wall

It is the thin, tightly attached outermost layer of the heart

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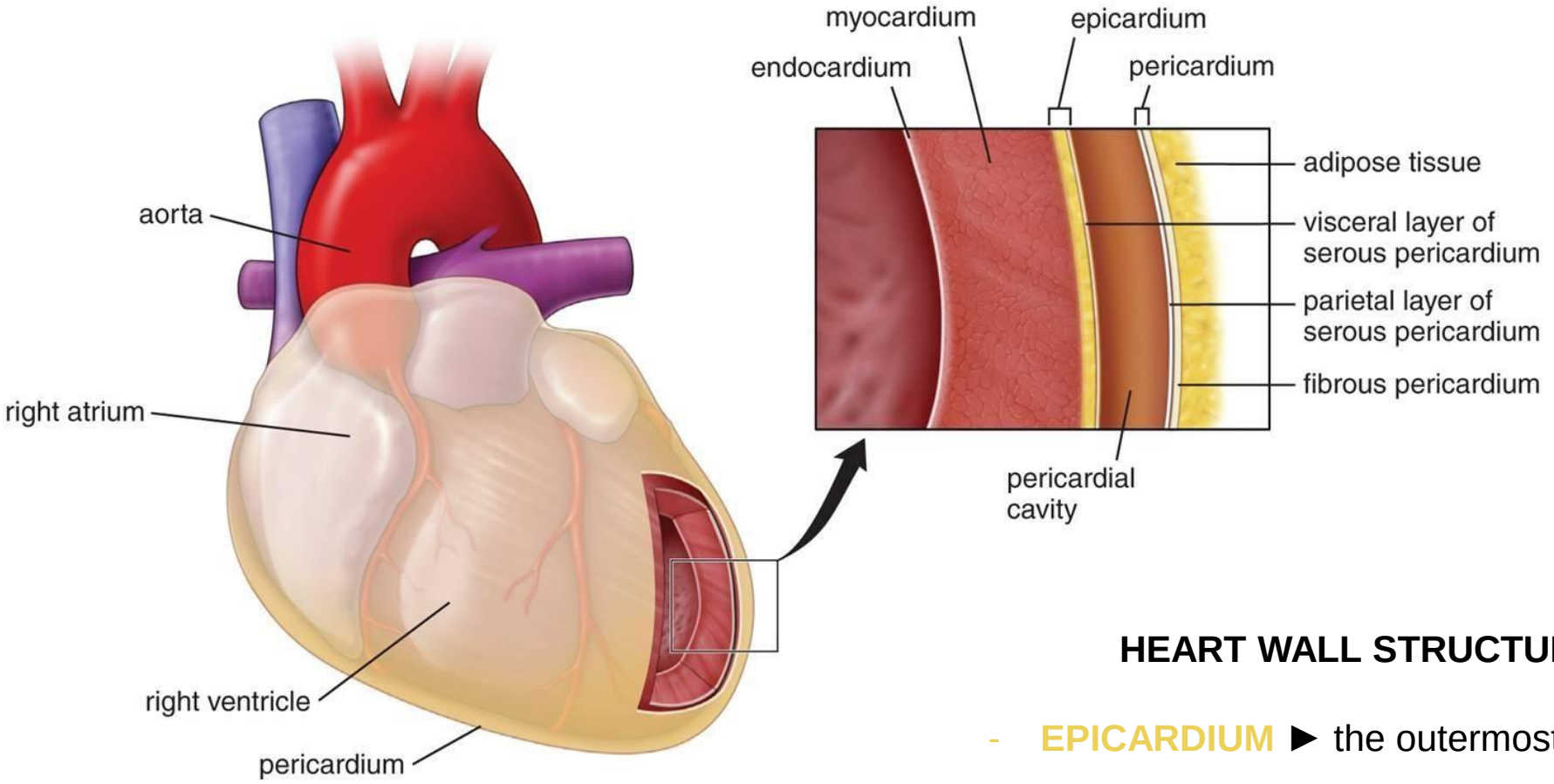
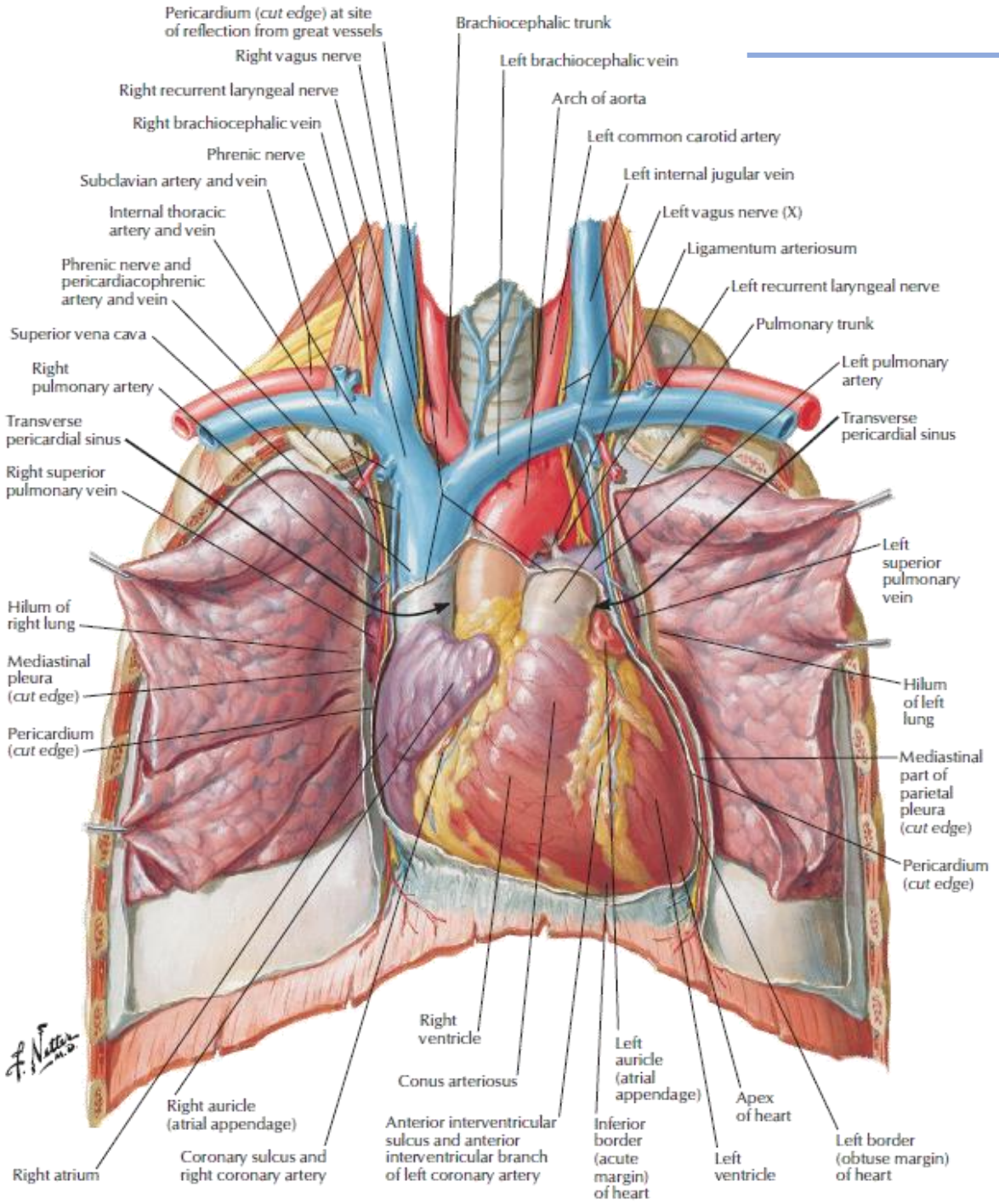
also called **EPICARDIUM** = outermost layer of the heart



HEART WALL STRUCTURE (from outside to inside):

- **EPICARDIUM** ► the outermost layer (= visceral pericardium)
- **MYOCARDIUM** ► the main layer, it is the CARDIAC MUSCLE
- **ENDOCARDIUM** ► the innermost layer of tissue that lines the chambers of the heart

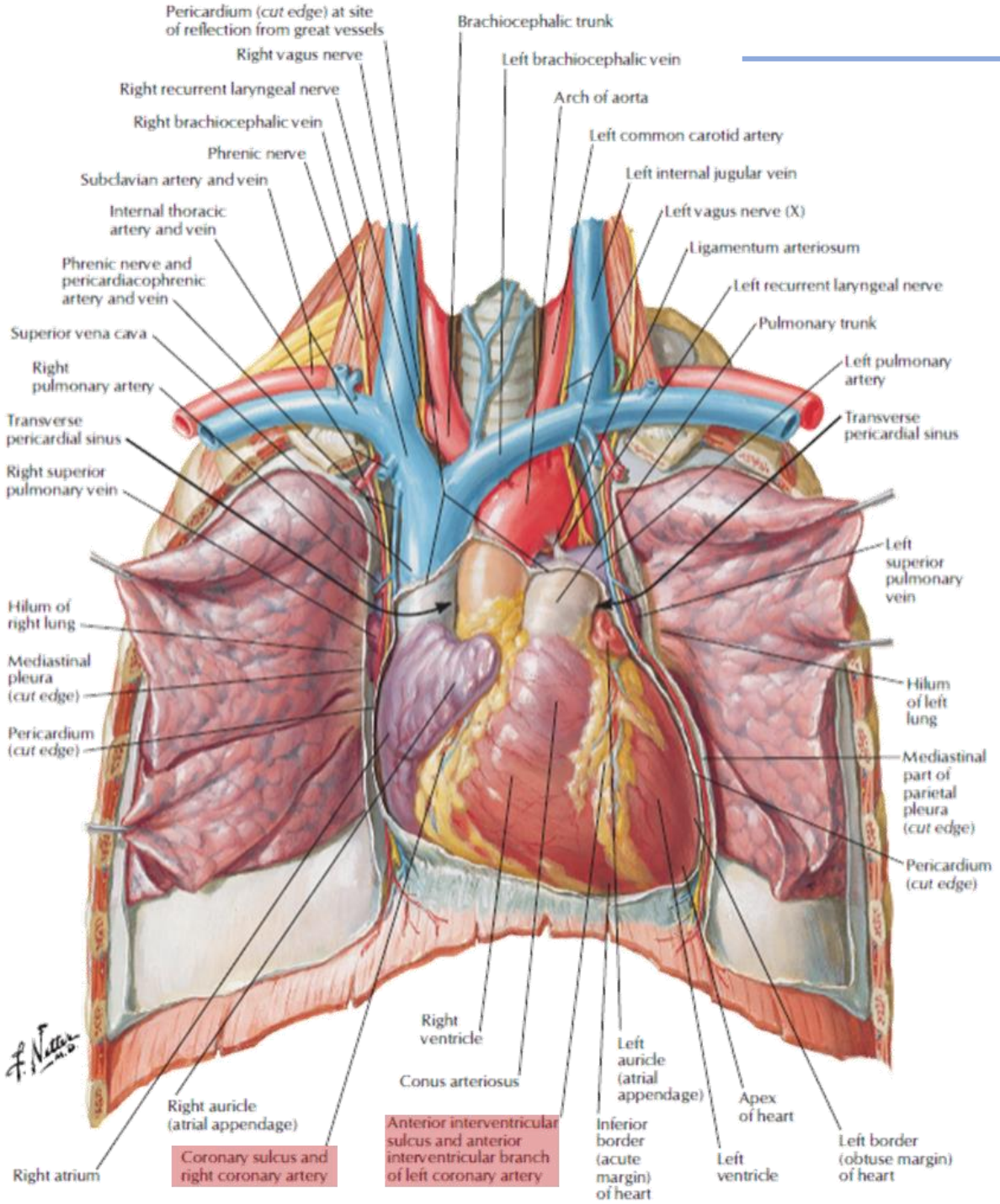
HEART: EXTERNAL EXAMINATION



EXTERNAL EXAMINATION OF THE HEART
with the the visceral pericardium layer

STERNOCOSTAL SURFACE

1. Superficial SUBDIVISION of the heart INTO THE 4 DIFFERENT CARDIAC CHAMBERS:
- it is possible to identify, even on external examination, the grooves/depressions that separate the cardiac cavities
- these grooves contain blood vessels (i.e., branches of the coronary arteries and veins) and adipose tissue

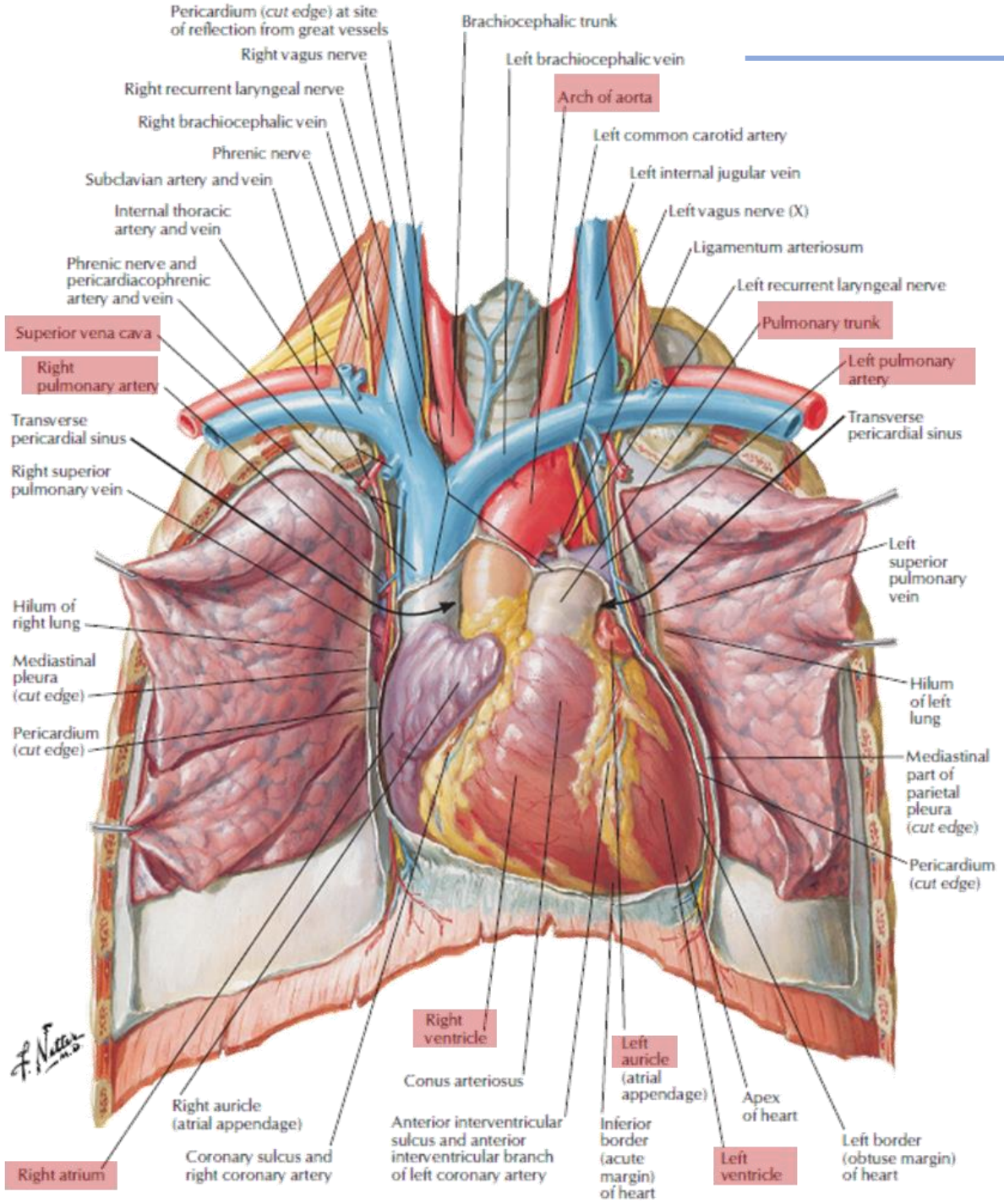


STERNOCOSTAL SURFACE

Identify:

- the **atrioventricular sulcus** (or **coronary sulcus**) → it separates atria from ventricles
- the **anterior interventricular sulcus** → it separates the right and left ventricles

There is also an interatrial sulcus, which however is of lesser importance as the two atria are actually separated by the great vessels



STERNOCOSTAL SURFACE

2. Identification of the RIGHT and LEFT ATRIA

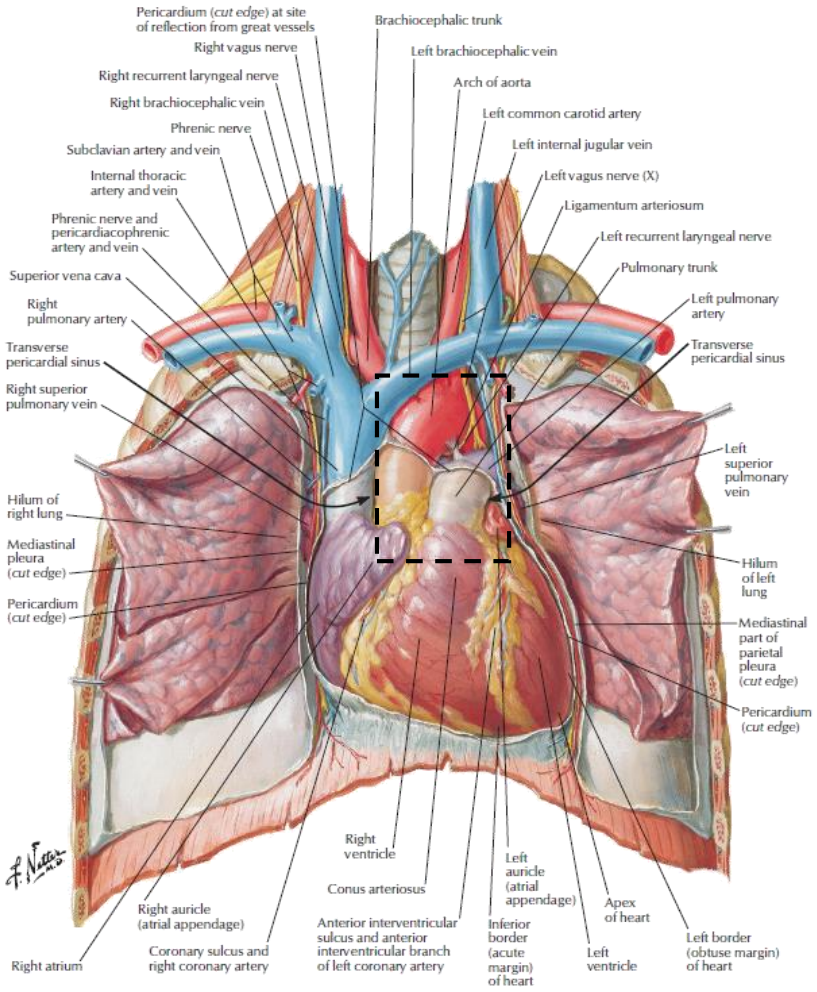
3. Identification of the RIGHT and LEFT VENTRICLES, separated by the interventricular sulcus

4. Identification of the GREAT VESSELS on the superior side:

- the **superior vena cava**, which opens into the right atrium
- the two **great arteries** that originate from the ventricles

→ the **aorta** and the **pulmonary trunk**, which will divide into the right and left **pulmonary arteries**

Both ventricles are identifiable with their arteries, while the atria are partly hidden by the great arteries.



STERNOCOSTAL SURFACE

The aorta, which originates from the left ventricle, is located to the right of the pulmonary trunk, which is located to the left of the aorta

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THE RIGHT AND LEFT OUTFLOW TRACTS ARE CROSSING OVER

The right and left ventricle, when exiting and giving rise to the two arteries, cross each other

The pulmonary trunk passes to the left of the aorta

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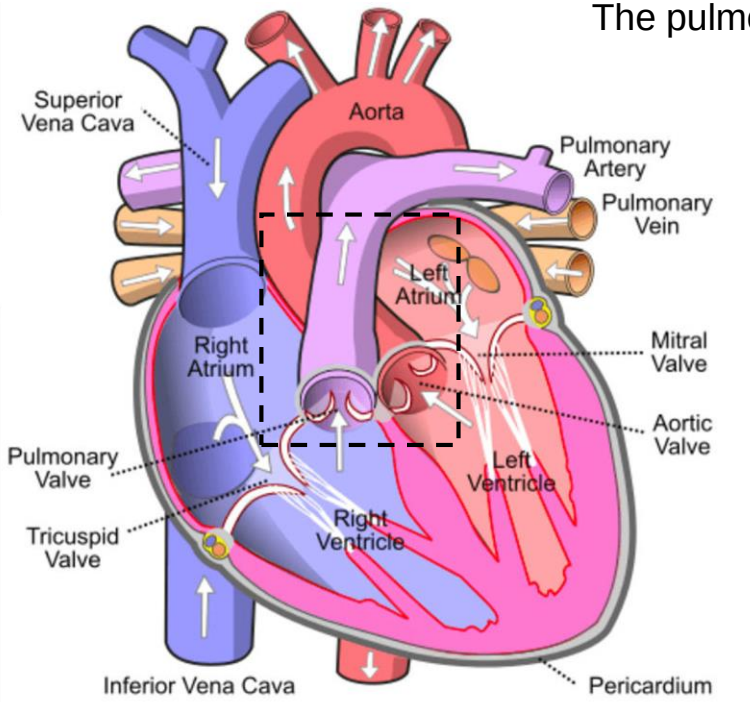
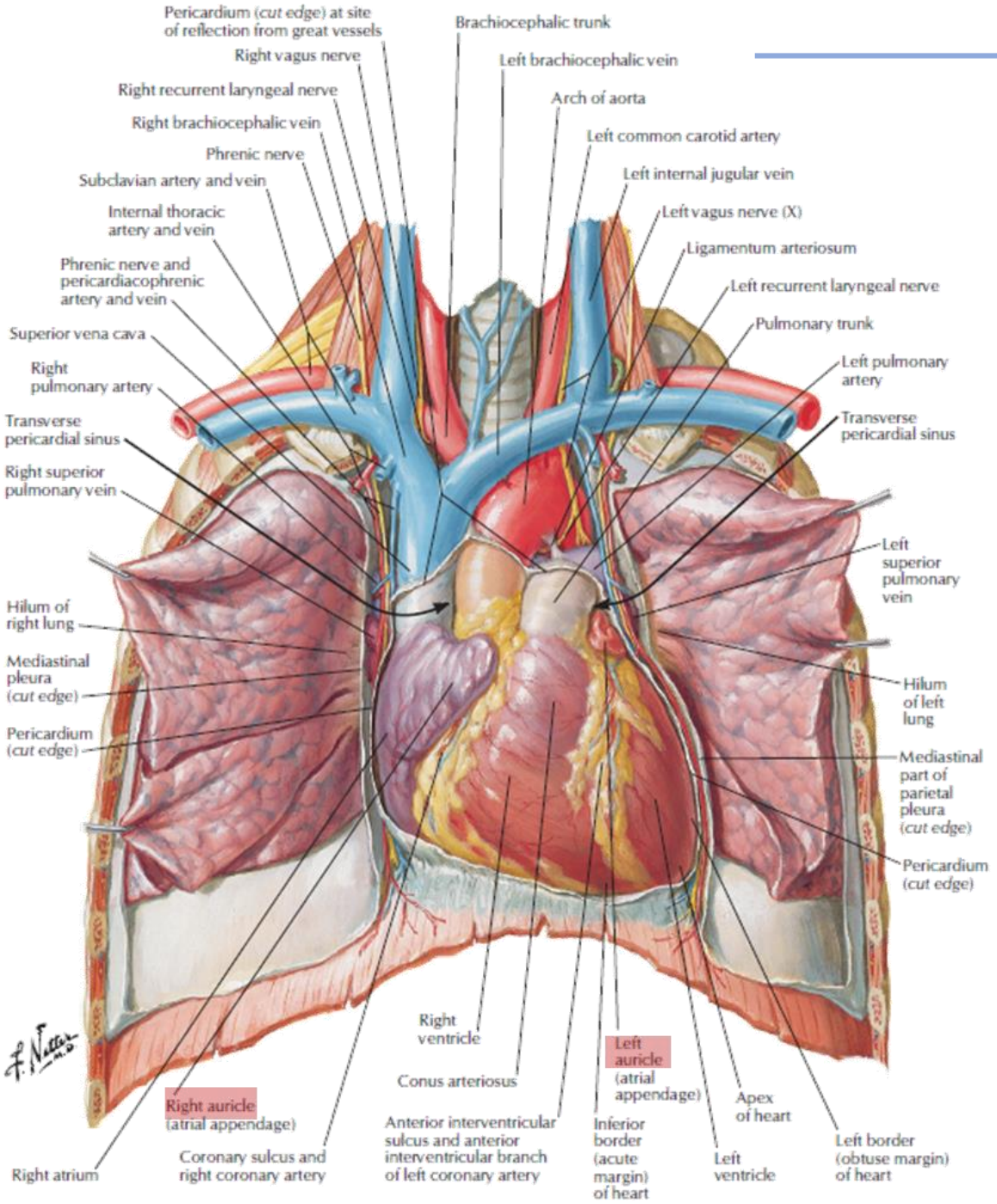
The pulmonary trunk and the aorta cross each other





STERNOCOSTAL SURFACE

The right atrium presents a leaf-like portion wich extends anteriorly towards the aorta origin

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AURICLE of the right atrium

On the left side there is a similar structure, narrower and S-shaped; it extends towards the pulmonary trunk

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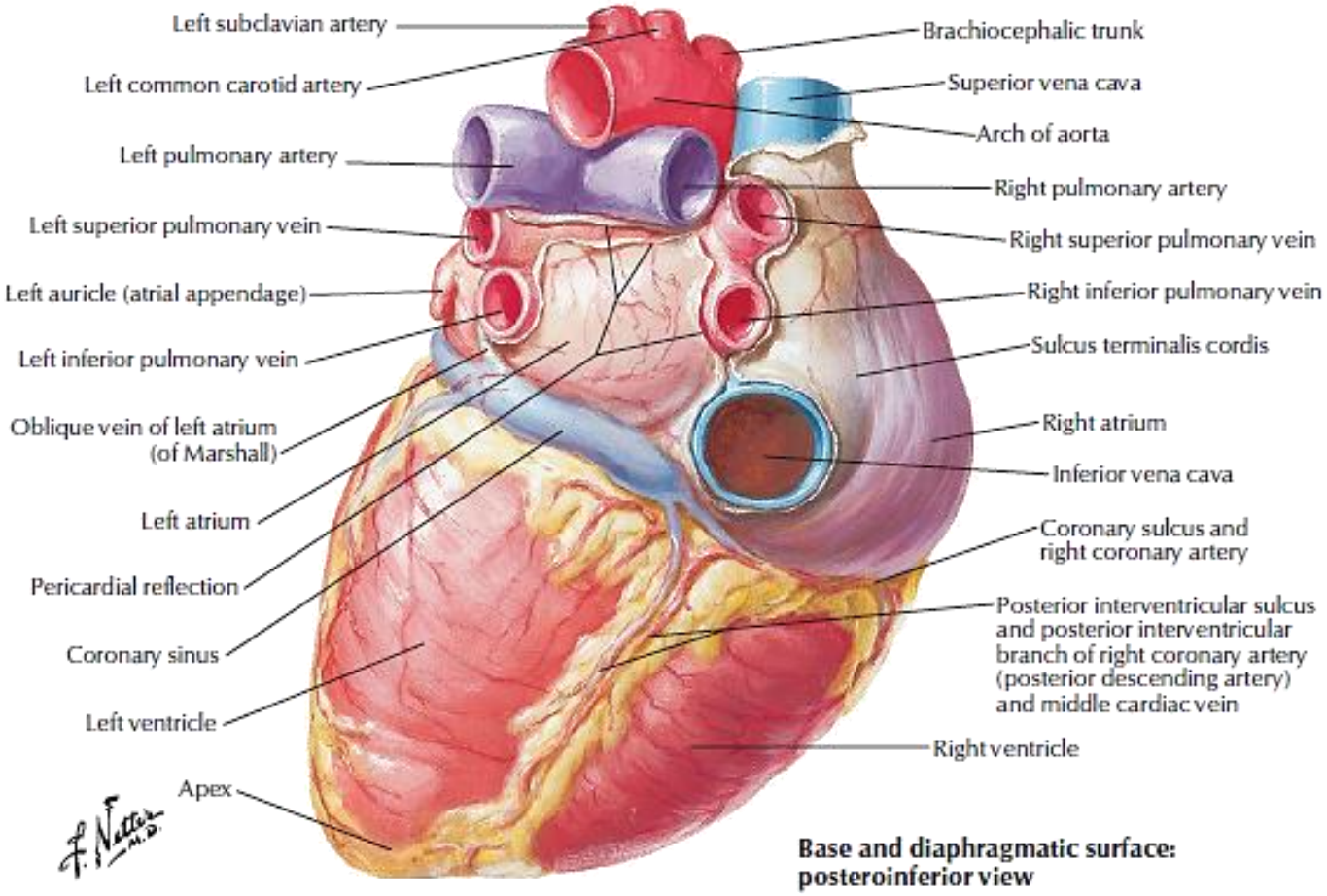
AURICLE of the left atrium

The term auricle means "ear like" - because its shape resembles the external ear of a human



Base and diaphragmatic surface: posteroinferior view

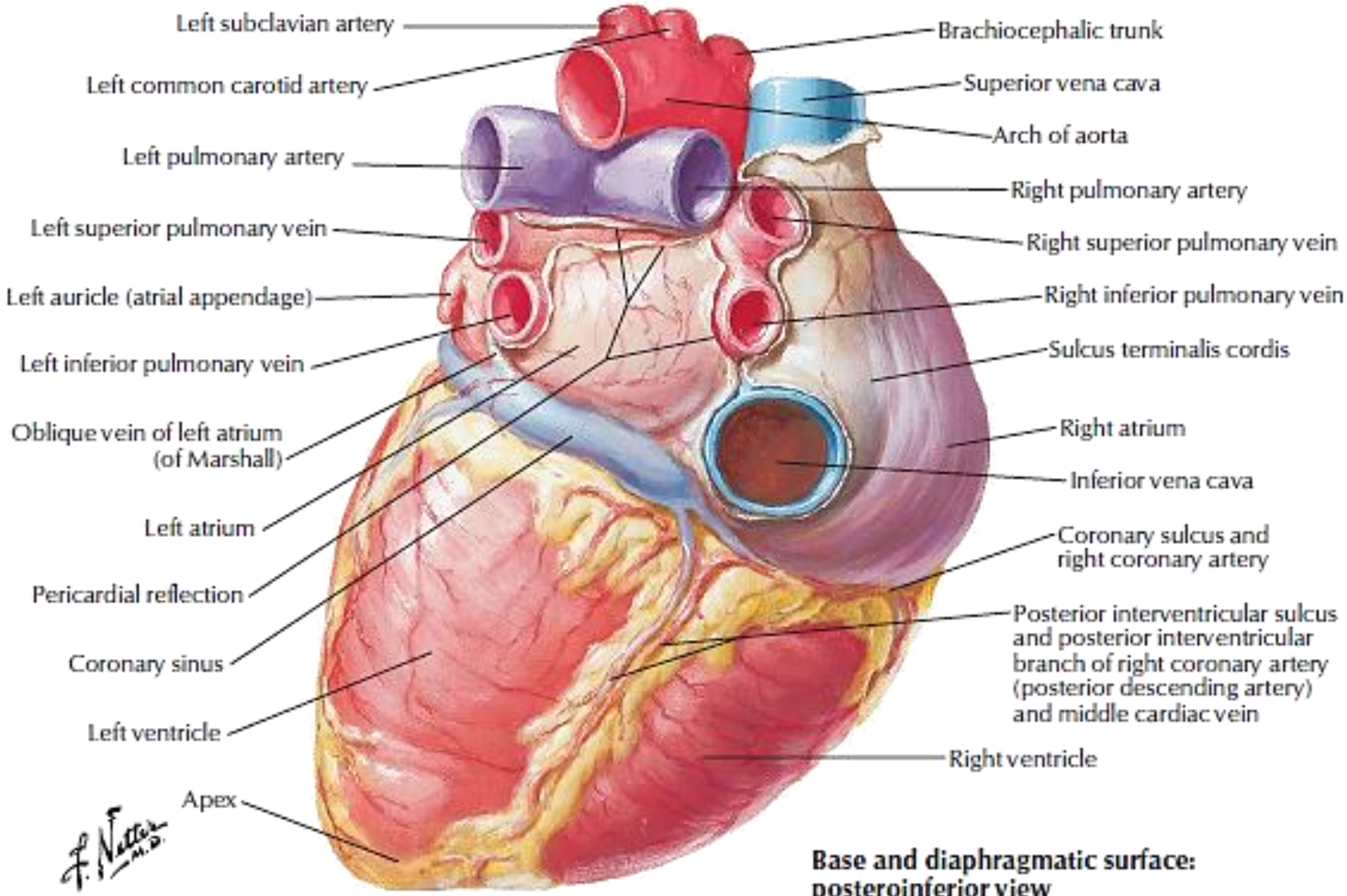
DIAPHRAGMATIC SURFACE

It is possible to identify:

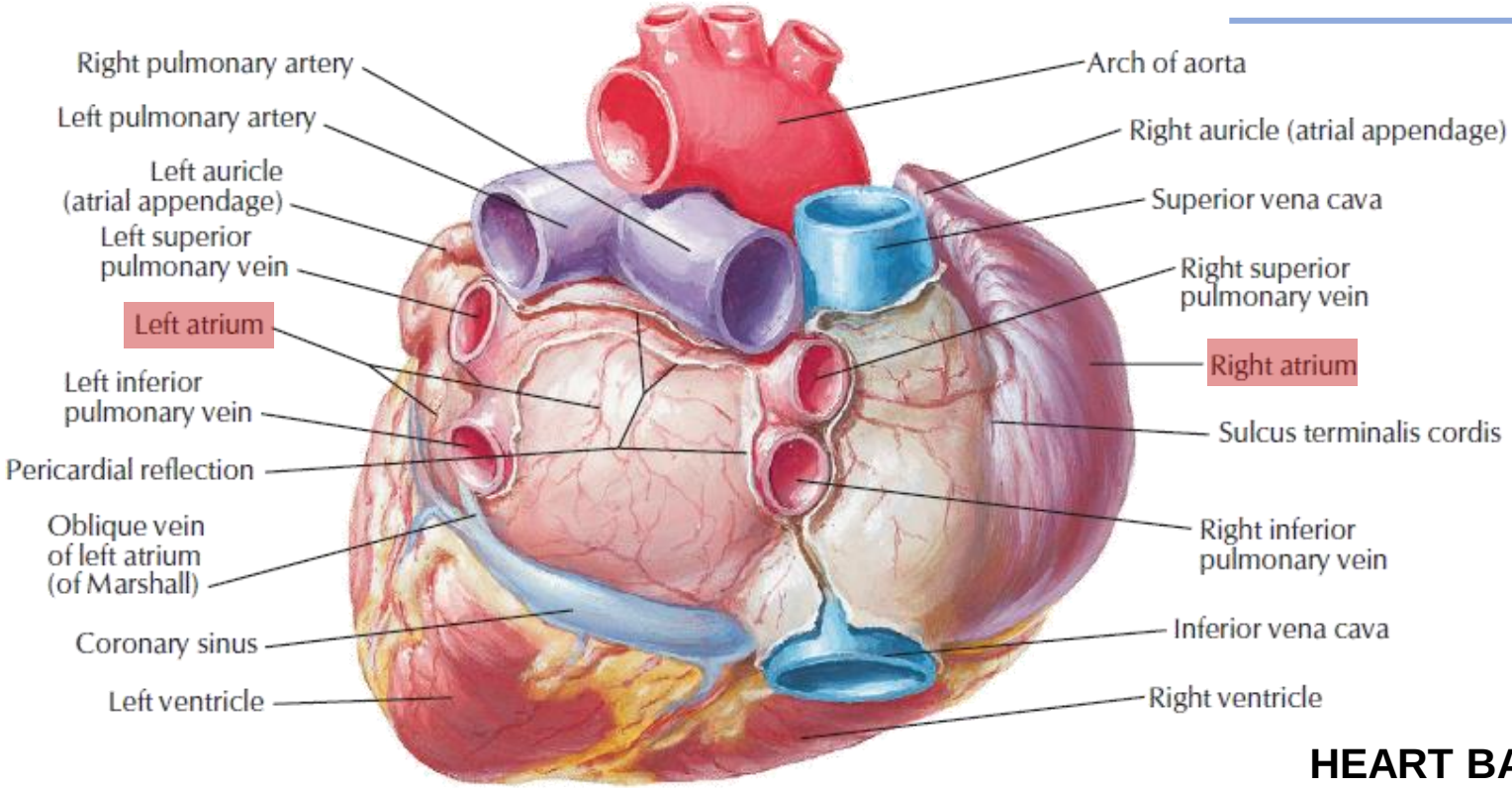
- the **right and left atria**
- the **right and left ventricles**
- the **atrioventricular** or **coronary sulcus**
- the **posterior interventricular sulcus**

► The **superior vena cava** (above) and the **inferior vena cava** (below) open into the **right atrium**, as well as the **coronary sinus**, the vein that vascolarizes the heart

► the **4 pulmonary veins**, 2 on the right and 2 on the left, open into the **left atrium**



Base and diaphragmatic surface: posteroinferior view



Base of heart: posterior view

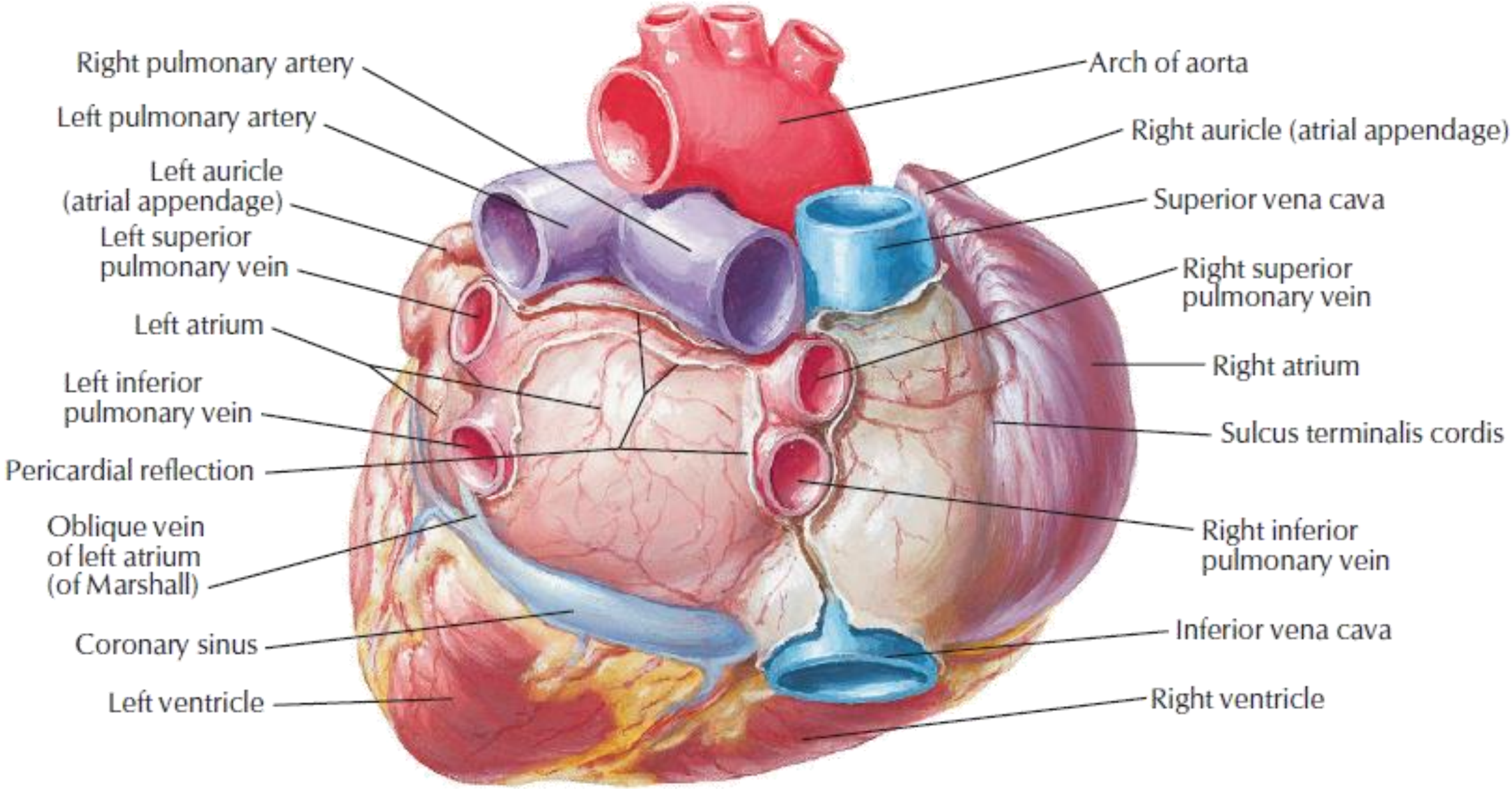
HEART BASE

From this point of view, it is possible to observe that:

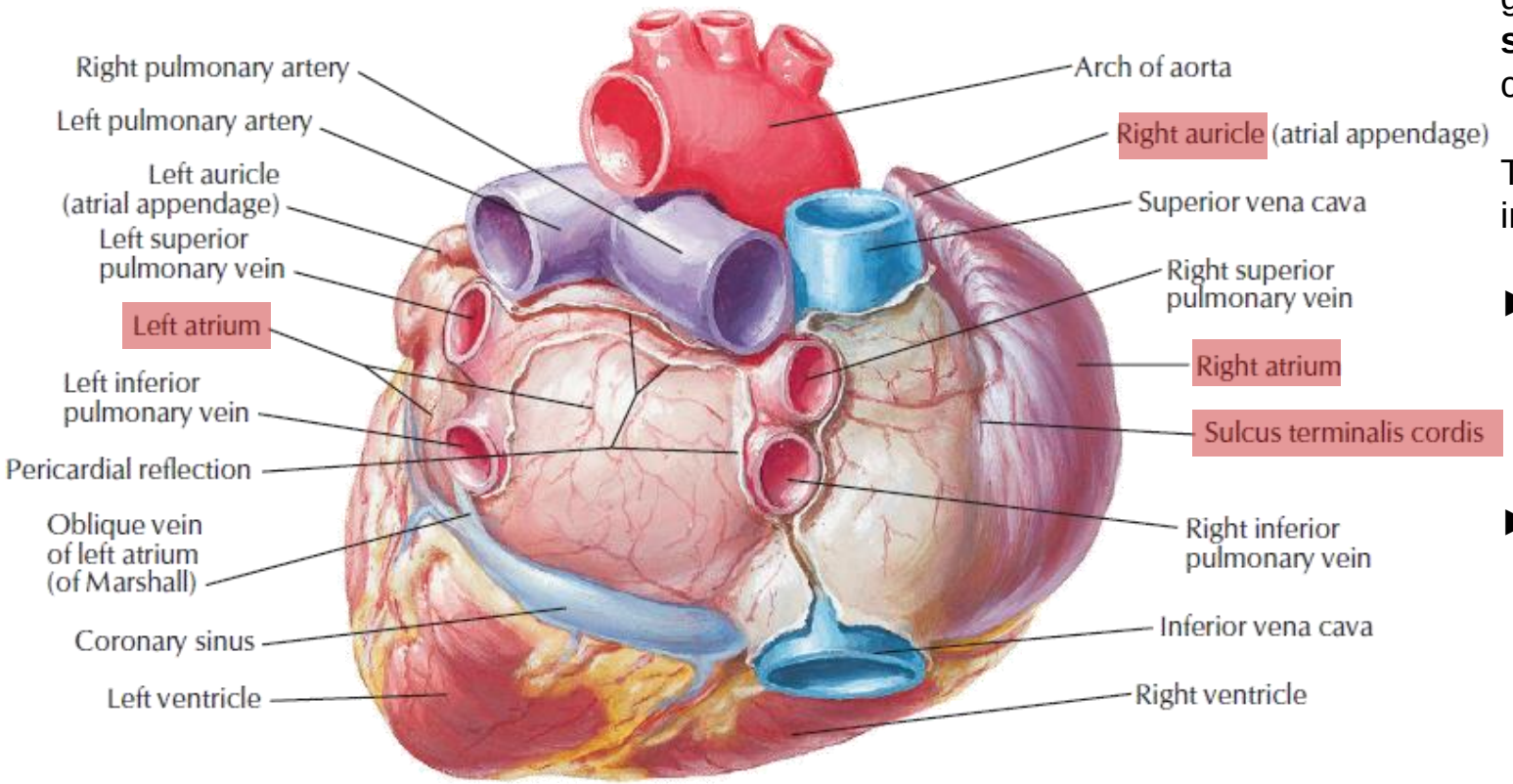
1. t<u>he right atrium has a different morphology with respect to the left atrium</u>

► the RIGHT ATRIUM is more developed along the cranial-caudal axis, in the longitudinal direction

► the LEFT ATRIUM is more developed along the transverse axis, in the horizontal direction



Base of heart: posterior view



Base of heart: posterior view

HEART BASE

From this point of view, it is possible to observe that:

2. The RIGHT ATRIUM is divided into 2 portions by a groove called **sulcus terminalis cordis** or **terminal sulcus**, which extends from the front of the superior vena cava to the front of the inferior vena cava.

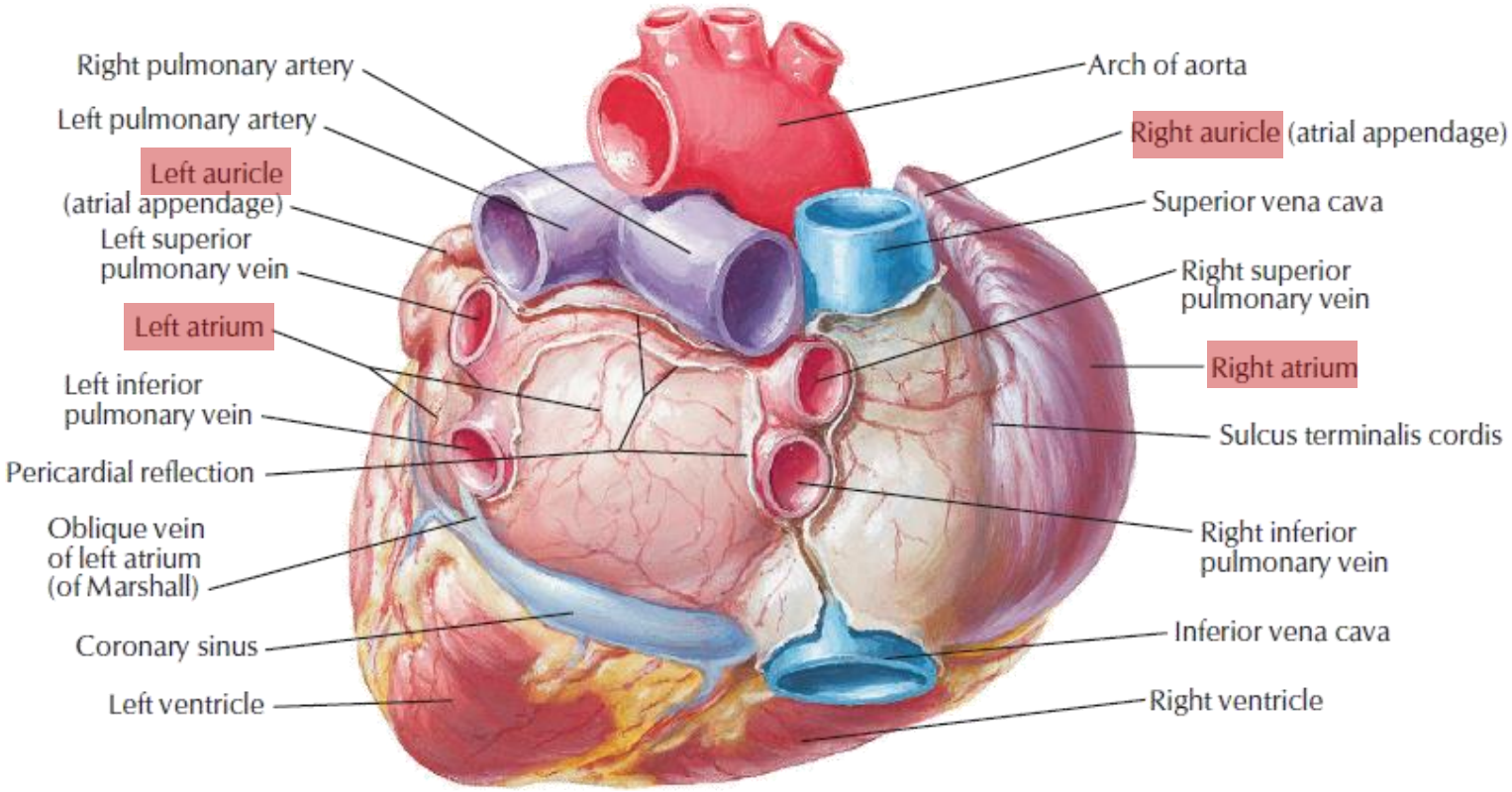
The terminal sulcus marks the separation of the right atrium into:

► The **SINUS OF VENAE CAVAE** (**sinus venarum**): which is the portion of the right atrium placed between the two venæ cavæ. Its walls are extremely thin and smooth.

► the **ATRIUM PROPER**, which has rough/irregular walls formed by PECTINATE MUSCLES → It is also called the region of the right atrial pectinate muscles

The **atrium proper** includes the **auricle of the right atrium**, which corresponds to the most anterior portion of the atrium.

The auricle is a relatively thin-walled structure that can fill with blood. This blood tends to stagnate and form clots which can detach and go into circulation, becoming emboli



Base of heart: posterior view

HEART BASE

From this point of view, it is possible to observe that:

3. the left atrium shows a more simple structure than the right atrium, with no internal subdivisions. It is possible to identify **the left auricle** with an S-shaped profile, which extends anteriorly

Observing the base of the heart, it is also possible to recognize the **reflection line** of the visceral pericardium to form the parietal pericardium

↓

The visceral pericardium covers the entire cardiac surface, even posteriorly at the level of the atria, and then turns on itself to form the parietal layer of the pericardium