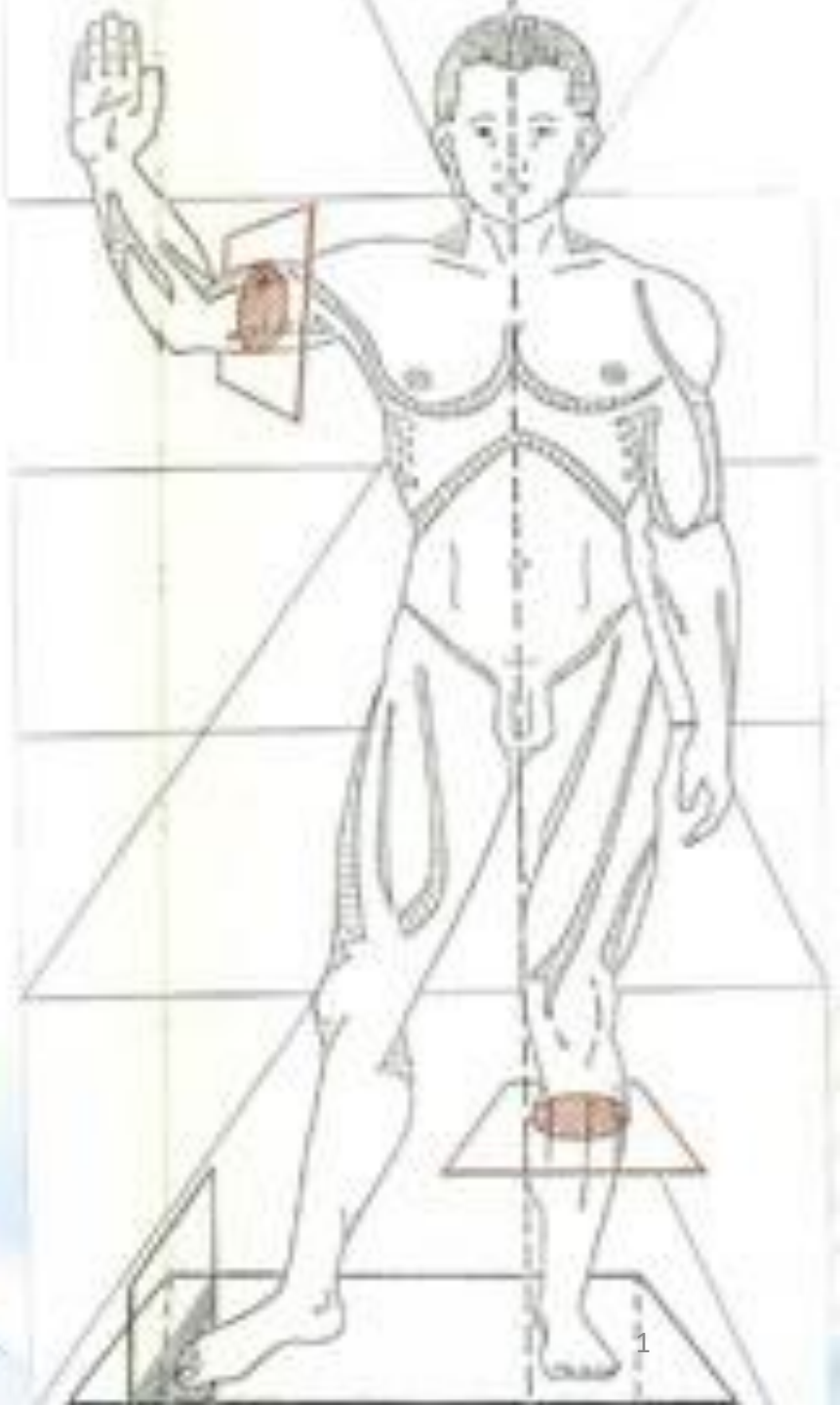
EXTRINSIC AND INTRINSIC INNERVATION OF THE HEART



Pr. M.D.EL AMRANI

Dr. Chaima KASSI

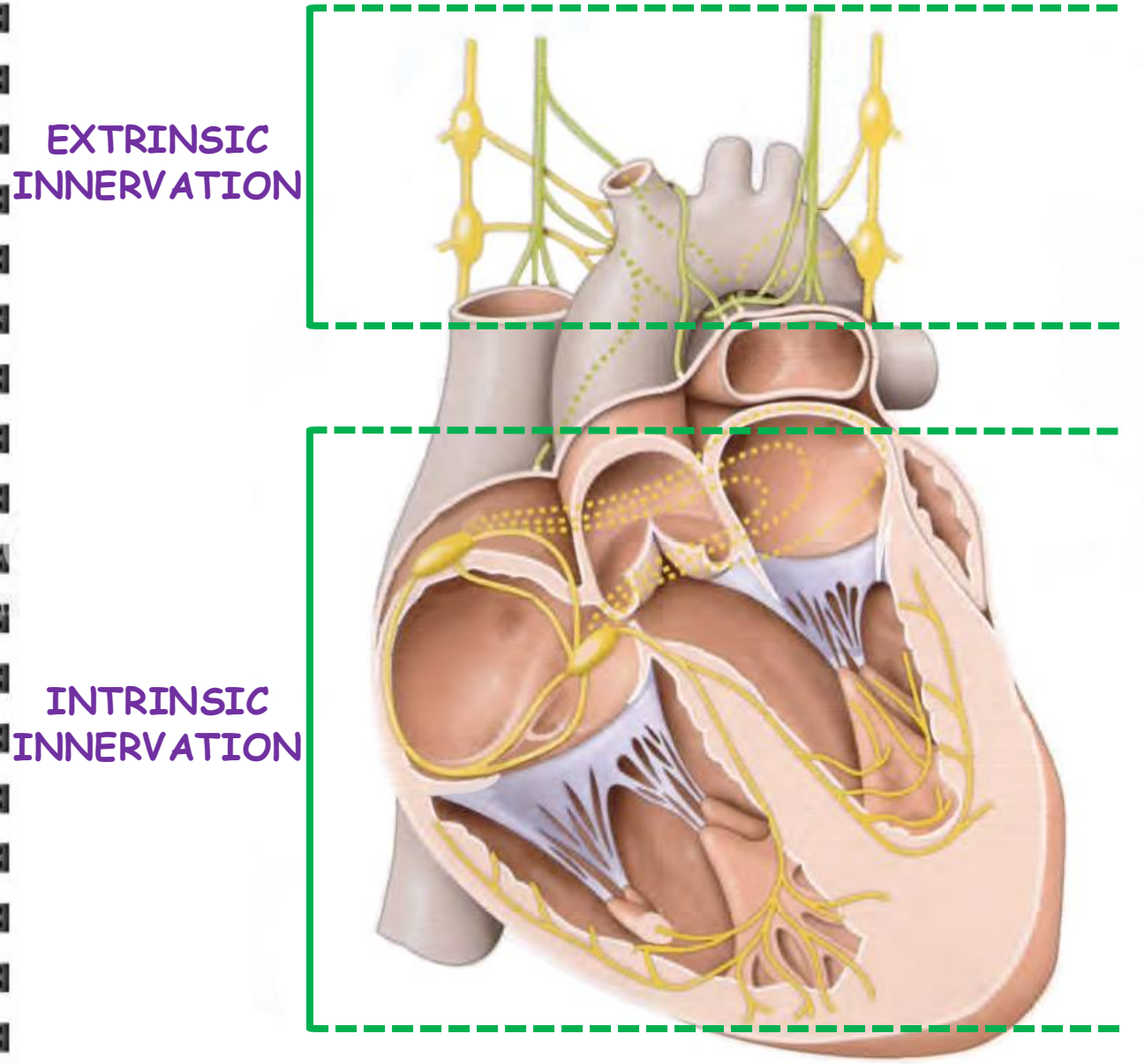
PLAN

I. EXTRINSIC INNERVATION OF THE HEART

II. INTRINSIC INNERVATION OF THE HEART

III. CLINICAL APPLICATIONS

IV. CONCLUSION



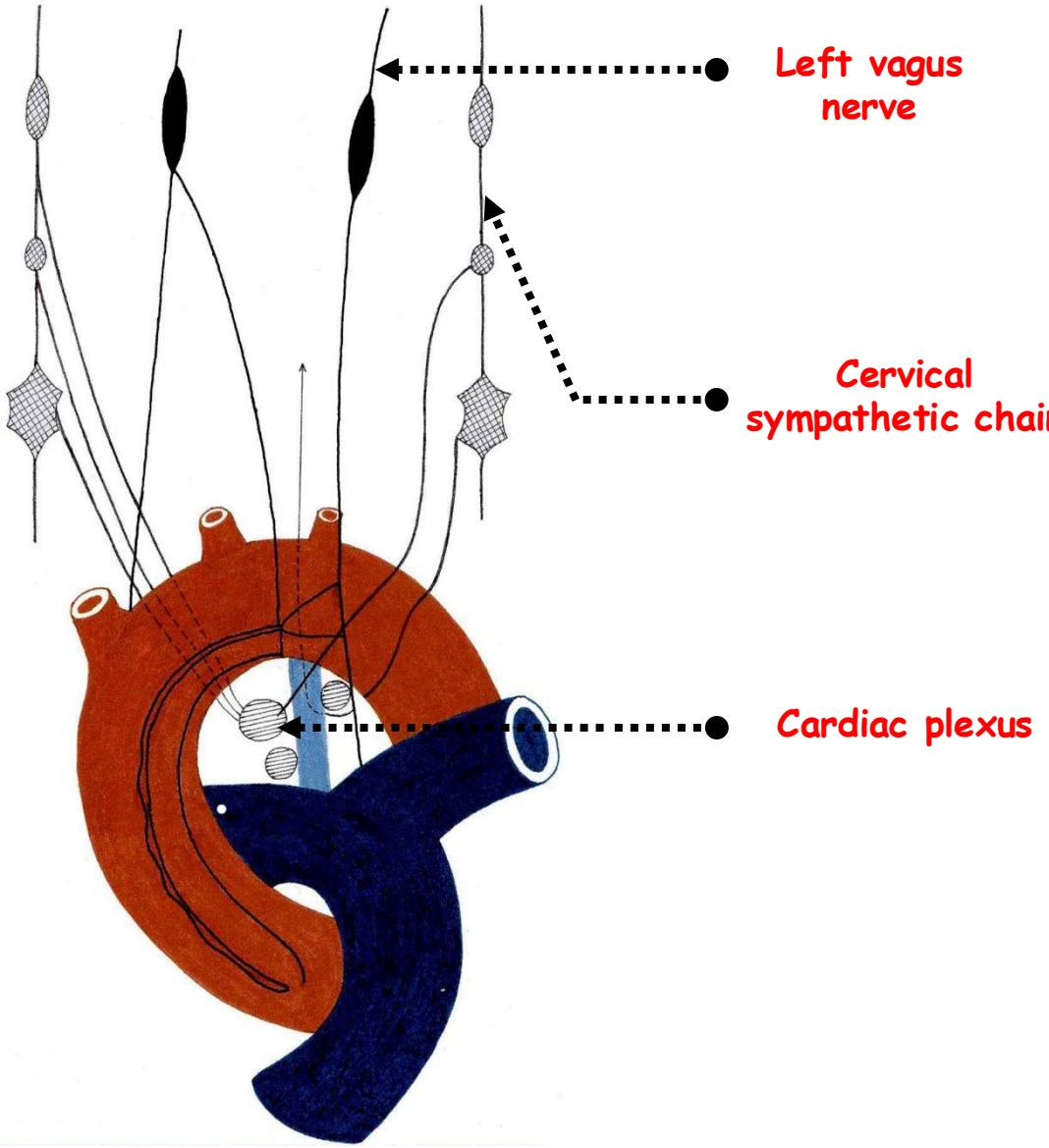
Intrinsic Conduction System of the Heart (Frontal Section, Anterior View)

I-EXTRINSIC INNERVATION OF THE HEART

A. SYMPATHETIC TRUNKS

B. VAGUS NERVES

C. CARDIAC PLEXUS



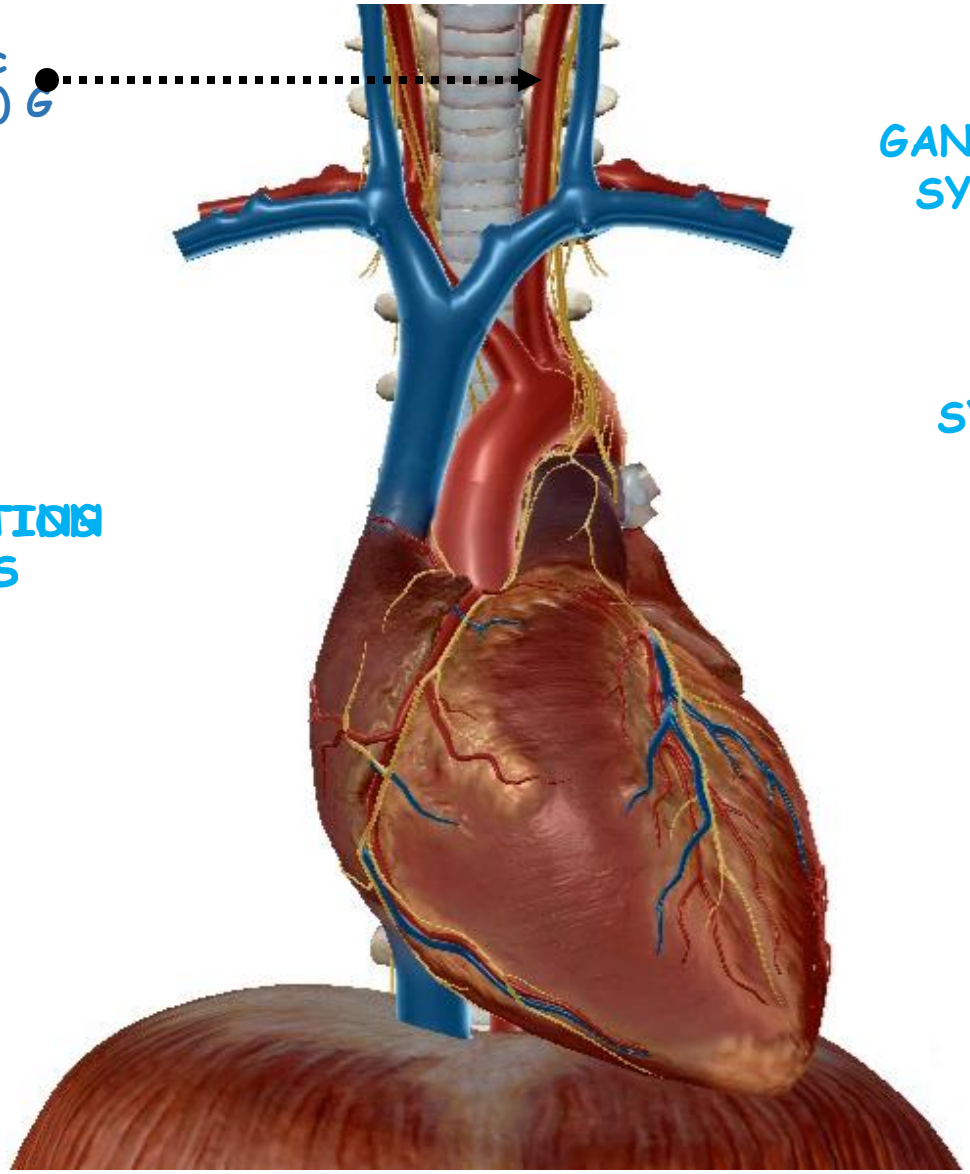
Anterior View of the Great Vessels at the Base of the Heart Showing the Distribution of Cardiac Nerves

A-SYMPATHETIC TRUNKS

- In the thorax, the ganglionic chain is represented on each side of the vertebral column by twelve ganglia, with the first one being often fused with the inferior cervical ganglion.

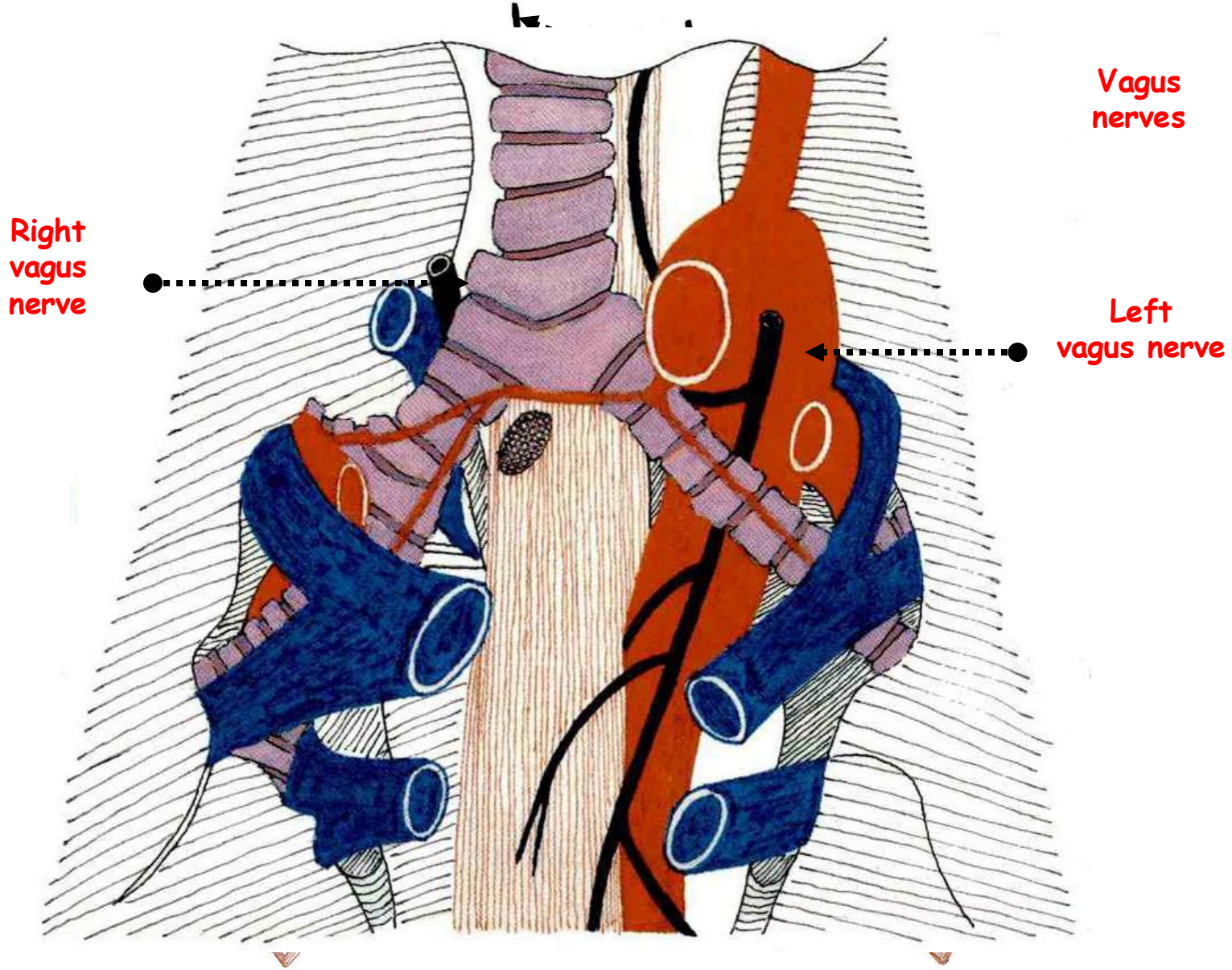
- Each of this ganglia is located anterior to the corresponding costovertebral joint and posterior to the pleura ; the sympathetic trunks connecting them is crossed posteriorly by the intercostal vessels.

RIGHT SYMPATHETIC CHAIN – THORACIC REGION



B-VAGUS NERVES

1. RIGHT VAGUS NERVE
2. LEFT VAGUS NERVE



Anterior View After Removal of the Sternocostal Plastron

1-RIGHT VAGUS NERVE

- In the anterior region of the neck, the vagus nerve is positioned posterior to the great vessels.

- It descends along the right side to the trachea to its bifurcation.

- It lies posterior to the right main bronchus, medial to the azygos vein, then moves to the right edge and the posterior surface of the esophagus with which it enters the abdominal cavity.

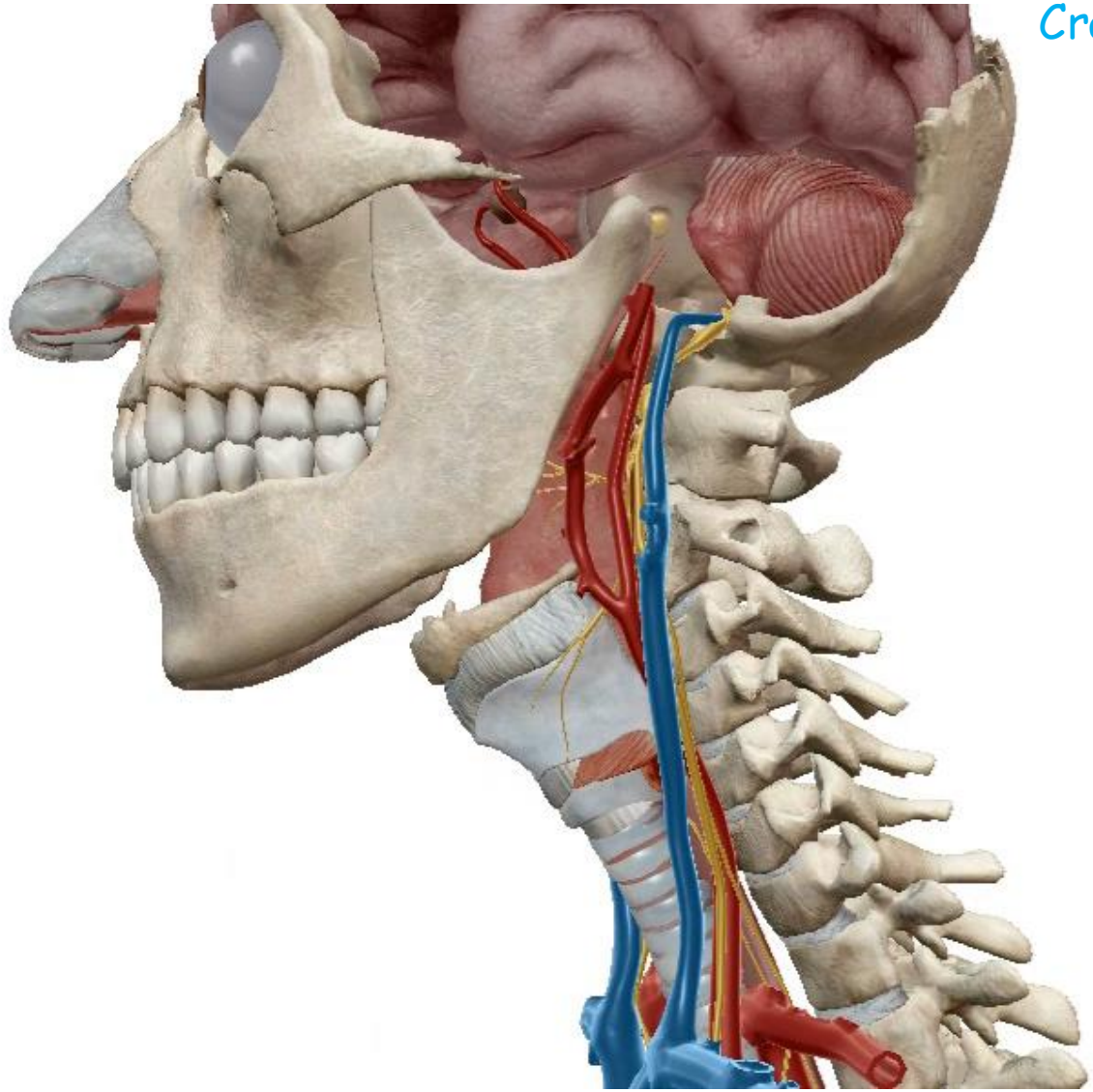
Right vagus nerve
Cranial nerve X (vagus)

2-LEFT VAGUS NERVE

- It crosses the lateral surface of the left common carotid artery to pass over the anterior surface of the aortic arch .

- It then travels posterior to the left main bronchus, moves to the left edge, then to the anterior surface of the esophagus, and then enters the abdominal cavity with it.

Vagus nerve
Anterior terminal branch



Left vagus nerve
Cranial nerve X (vagus)

C-CARDIAC PLEXUS-CARDIAC NERVES

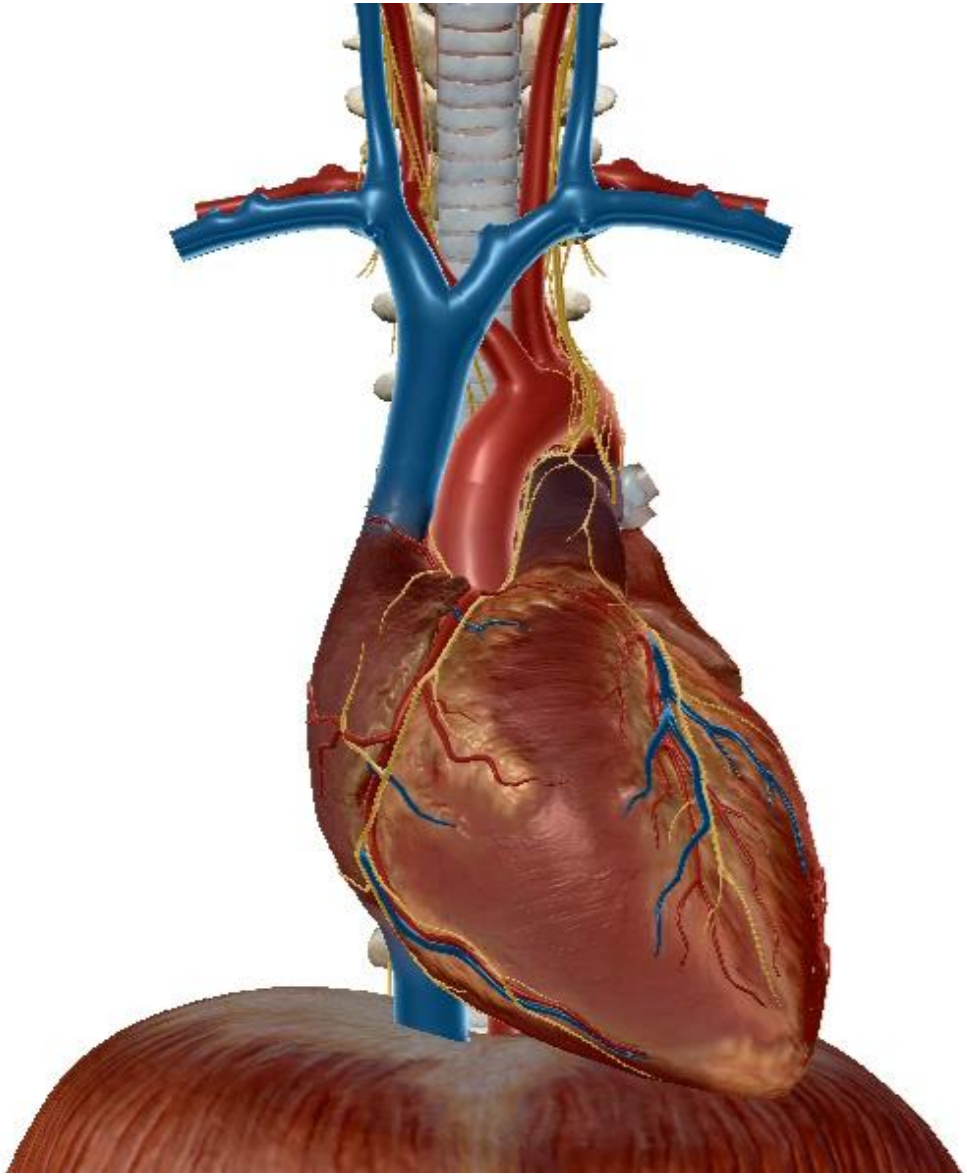
- The vagus nerve gives six branches, three on each sides :

- Two superior cardiac branches that arise from the cervical portion of the nerve.

- Two middle cardiac branches that come from the reccurent nerve.

- Two inferior cardiac branches that originate below the origin of the reccurent nerve.

Branches of the vagus nerve

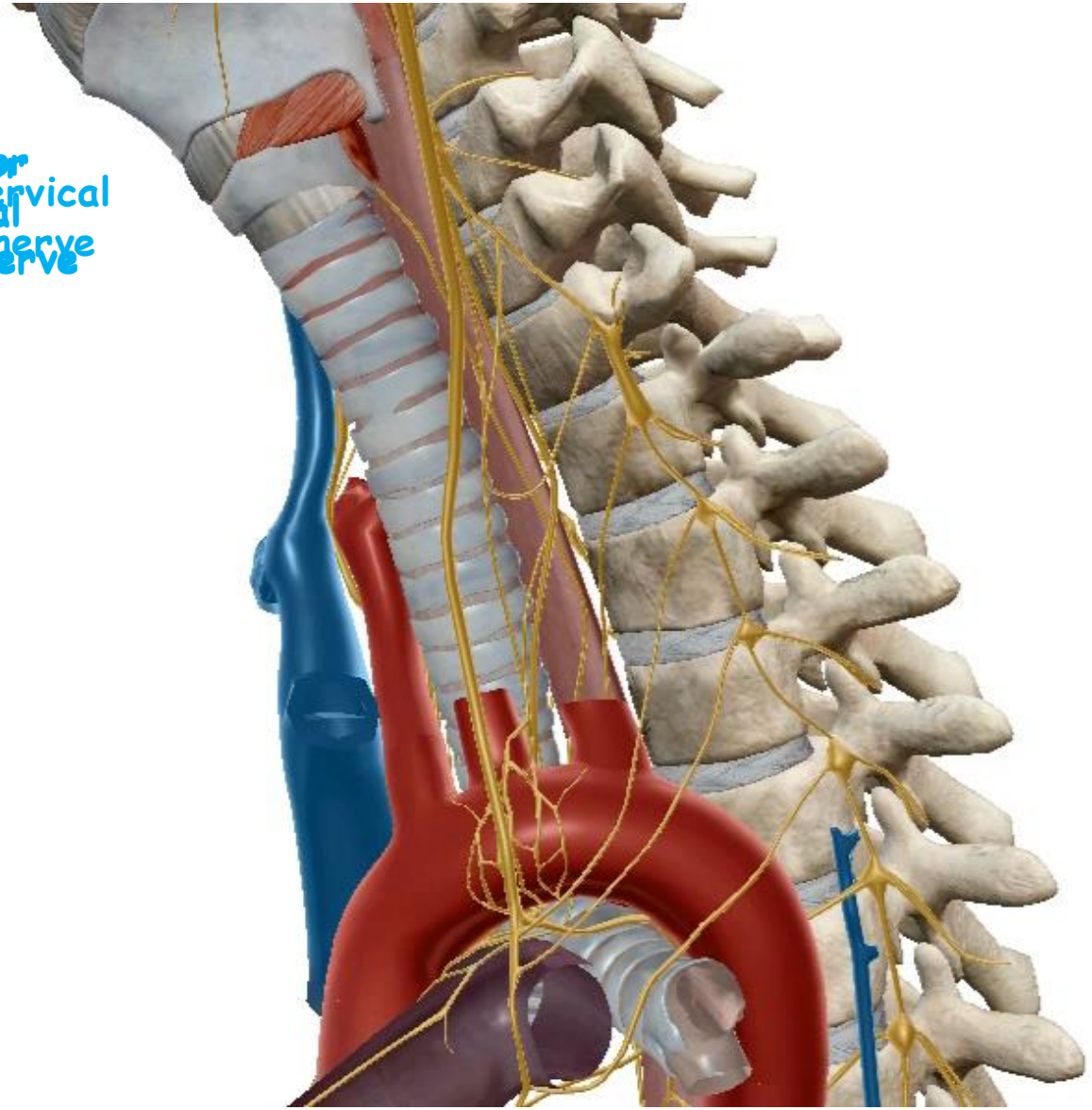


C-CARDIAC PLEXUS-CARDIAC NERVES

– The sympathetic nervous system also provides, on each side, cardiac branches that originate from three cervical ganglia of the sympathetic system on each side :

- Superior.
- Middle.
- And inferior.

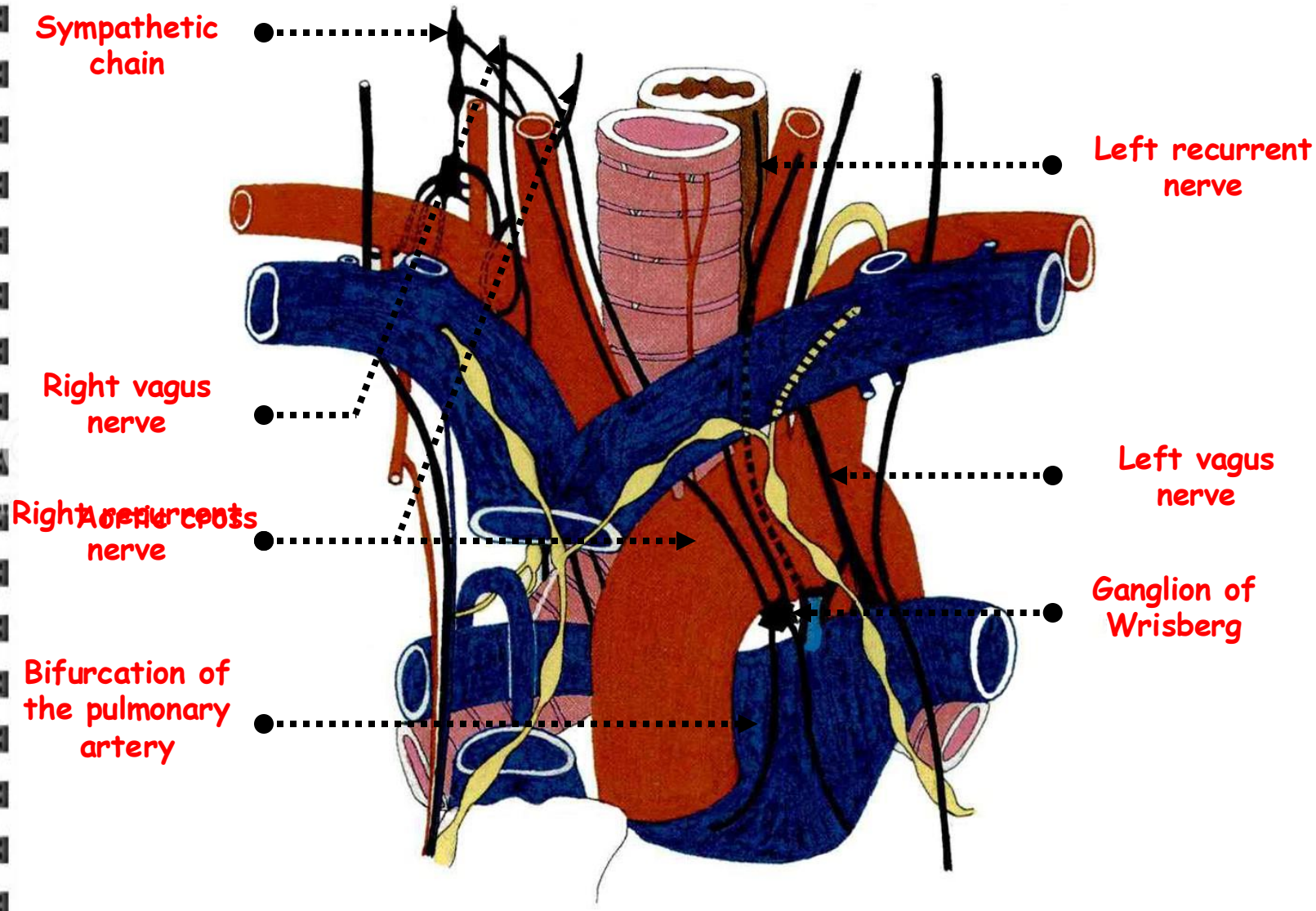
BRANCHES OF THE SYMPATHETIC THORACIC PLEXUS



C-CARDIAC PLEXUS

- All these branches converge toward the aortic cross, where they interconnect to form the cardiac plexus.

- The nerve structures that reach the heart form a nervous plexus around the great vessels emerging from the base of the heart. This plexus, called the ganglion of Wrisberg, is located between the aortic cross and the bifurcation of the pulmonary artery.



Anterior view of the mediastinum showing the main components

C-CARDIAC PLEXUS

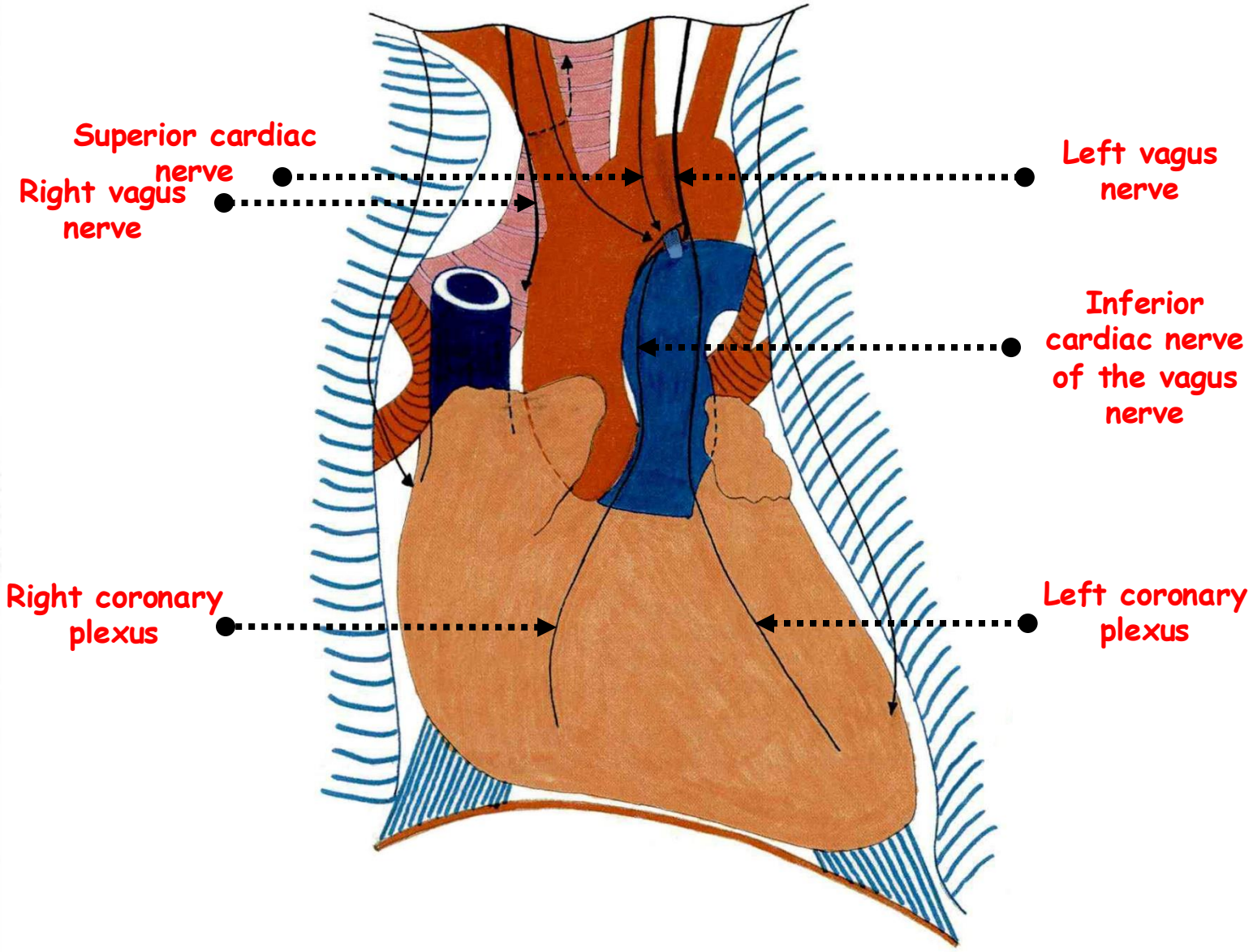
1. LEFT OR ANTERIOR PLEXUS

- It accompanies the left coronary artery and its terminal branches.

- It is formed by the superior cardiac branches of the vagus nerve and the left superior cardiac nerve of the sympathetic system.

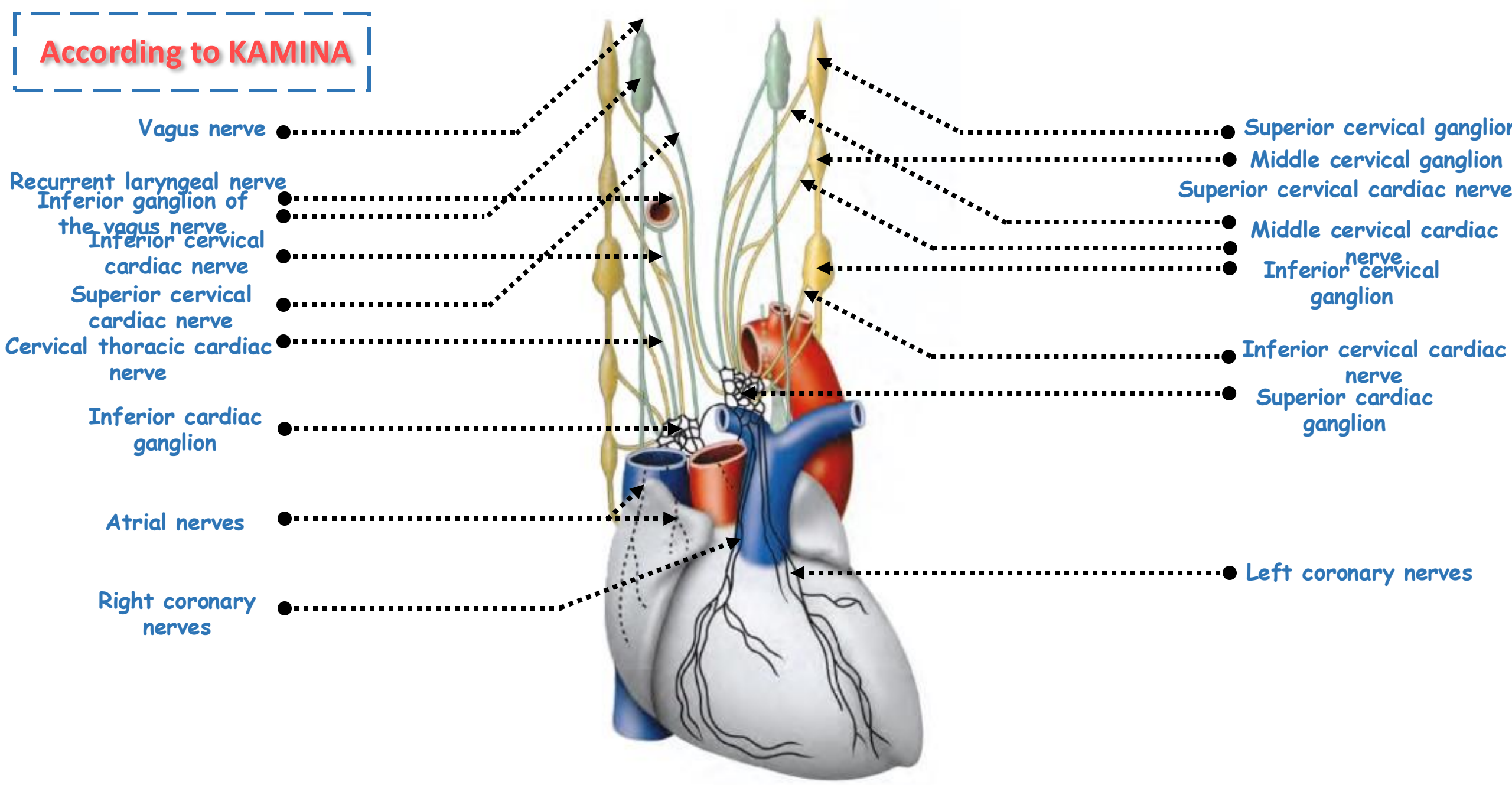
2. RIGHT OR POSTERIOR PLEXUS

- It accompanies the right coronary artery.
- It is made up of the middle and inferior cardiac branches of the vagus nerve as well as the other sympathetic branches, except the left superior branch.



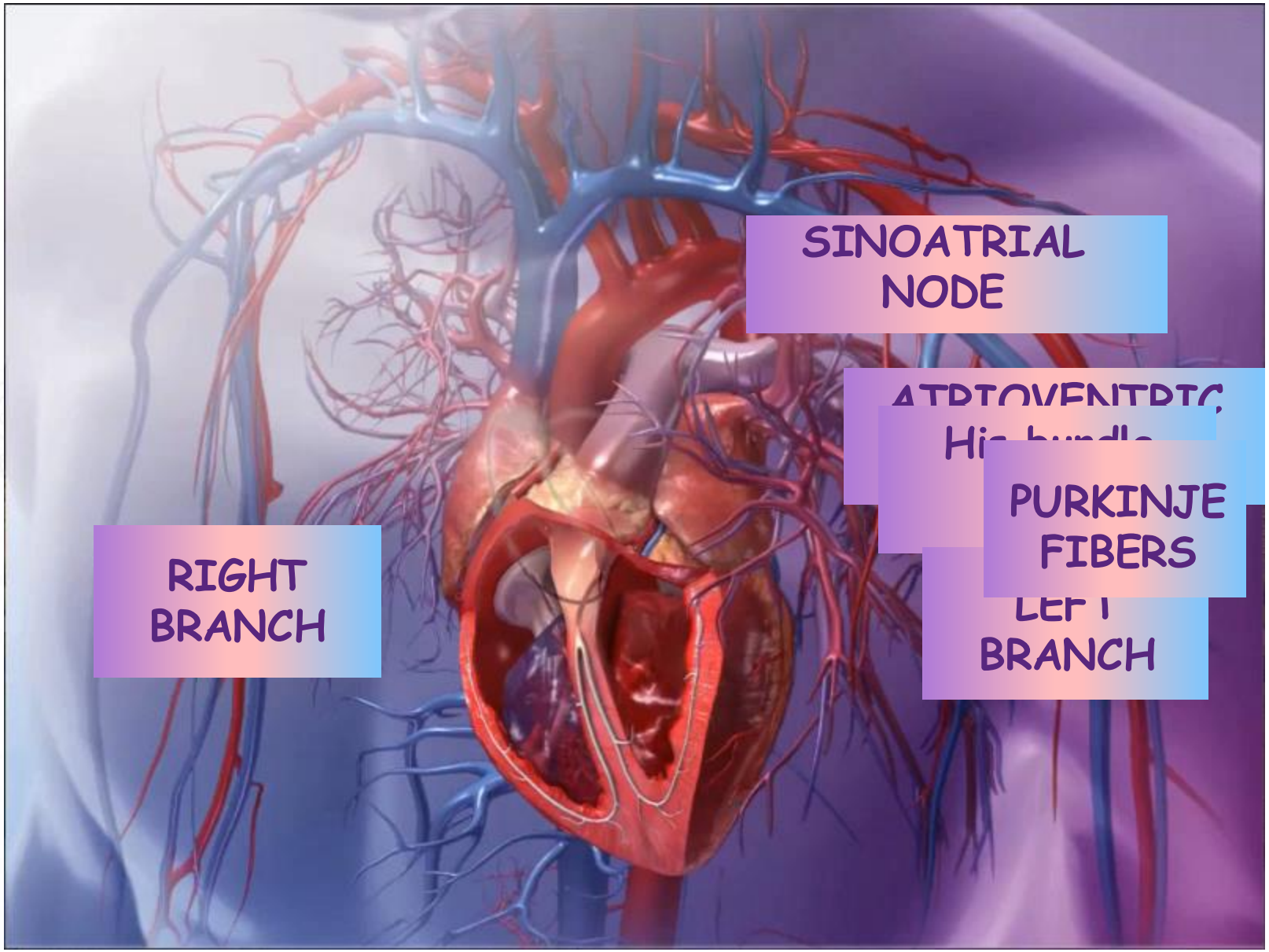
Schematic anterior view of the heart showing the relations of the great vessels at the base with the elements of the pulmonary hilum

According to KAMINA



Cardiac nerves and plexus

II-INTRINSIC INNERVATION OF THE HEART



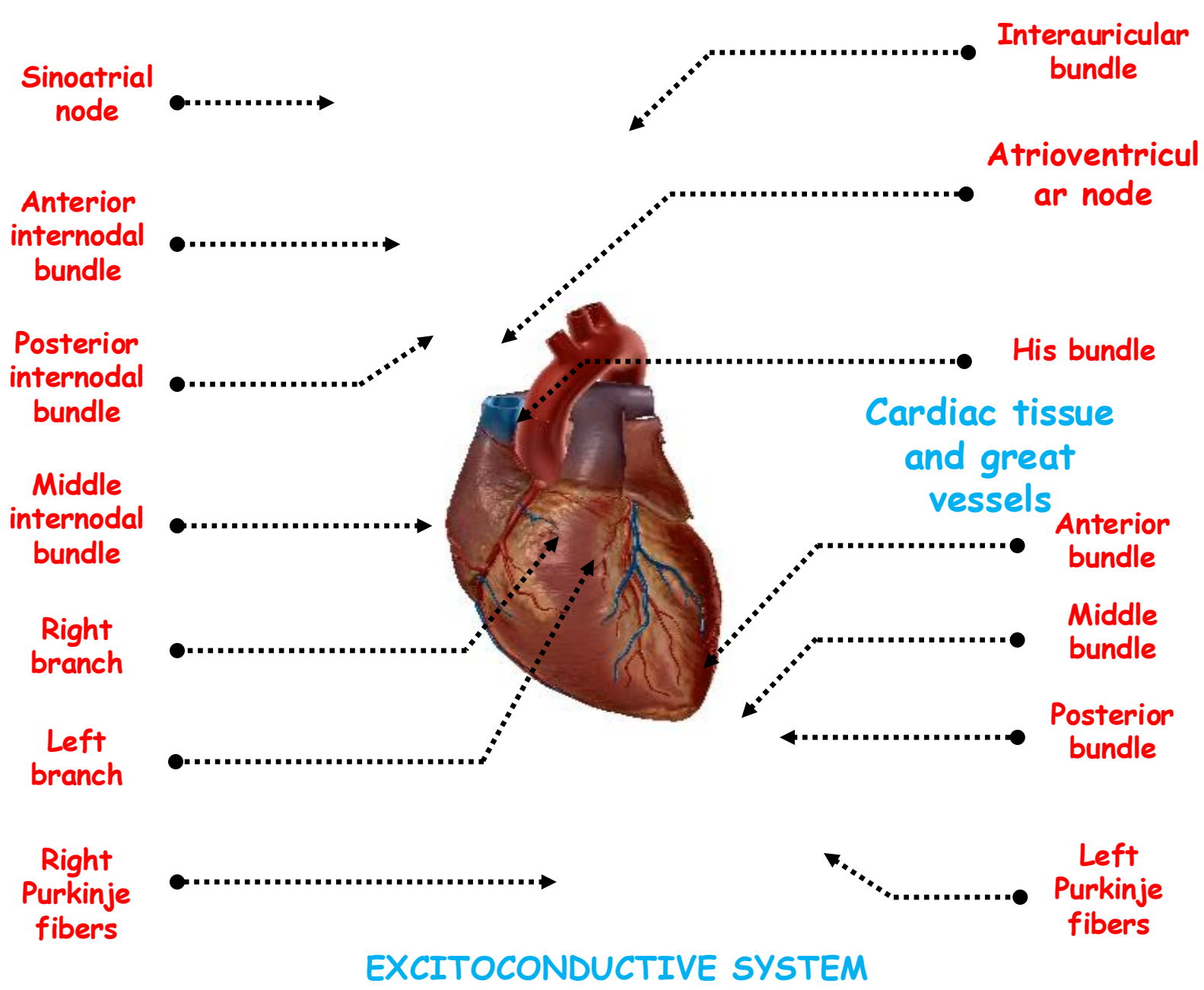
II-INTRINSIC INNERATION OF THE HEART

It is the command or excito-conductive system :

A. SINOATRIAL NODE OR KEITH AND FLACK NODE

B. ATRIOVENTRICULAR BUNDLE OR HIS BUNDLE

C. VASCULARIZATION OF THE EXCITO-CONDUCTIVE SYSTEM

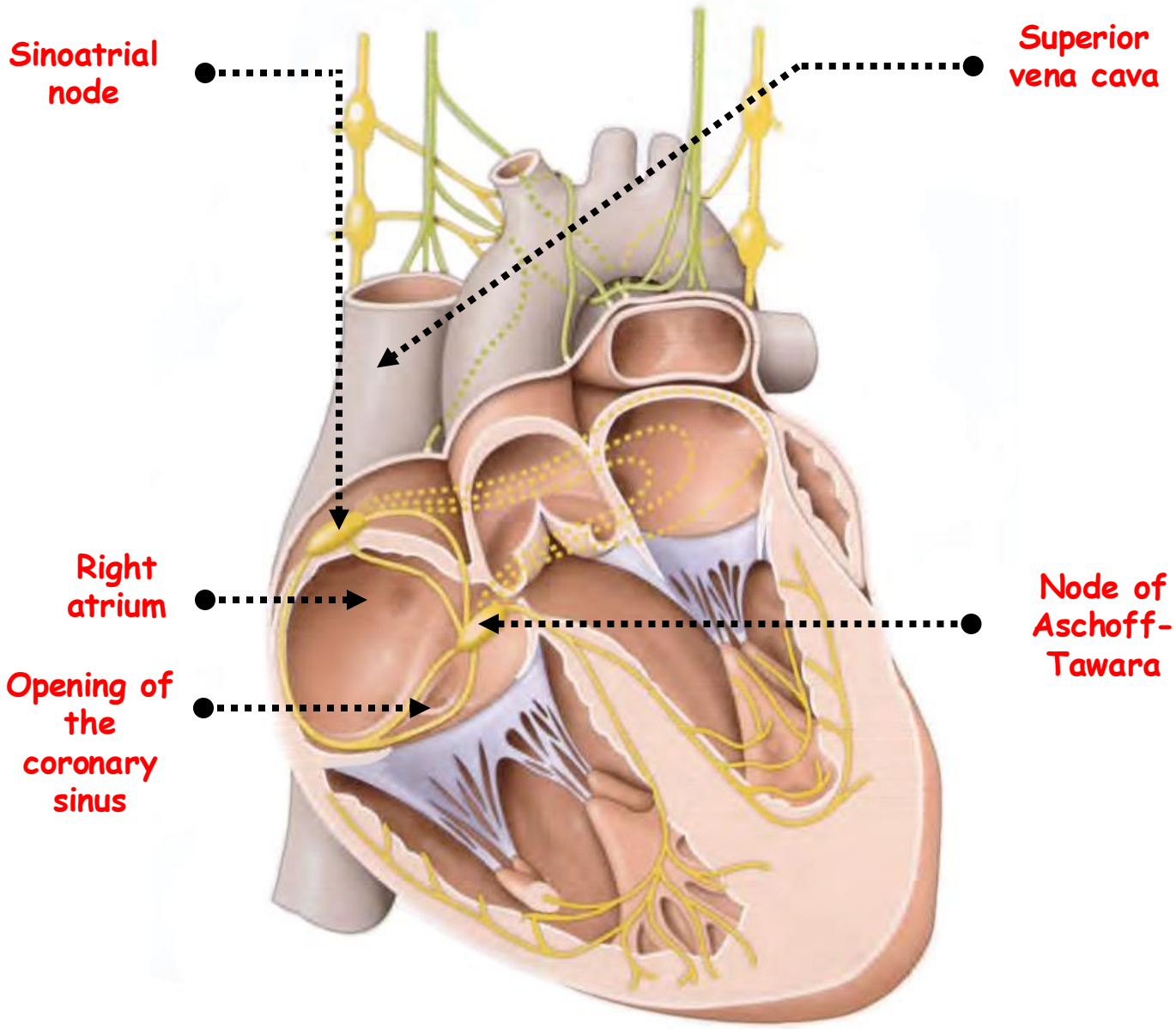


A-SINOATRIAL NODE OR KEITH AND FLACK NODE

- It's a cluster of muscle cells.

- It runs along the posteror wall of the right atrium, following the sulcus terminalis of His.

- It begins at the top, beneath the pericardium, on the lateral side of the opening of the superior vena cava and descends along the His sulcus. After a course of 2 to 3 cm, it positions itself in the deep layer of the atrial wall, near the opening of the coronary sinus.

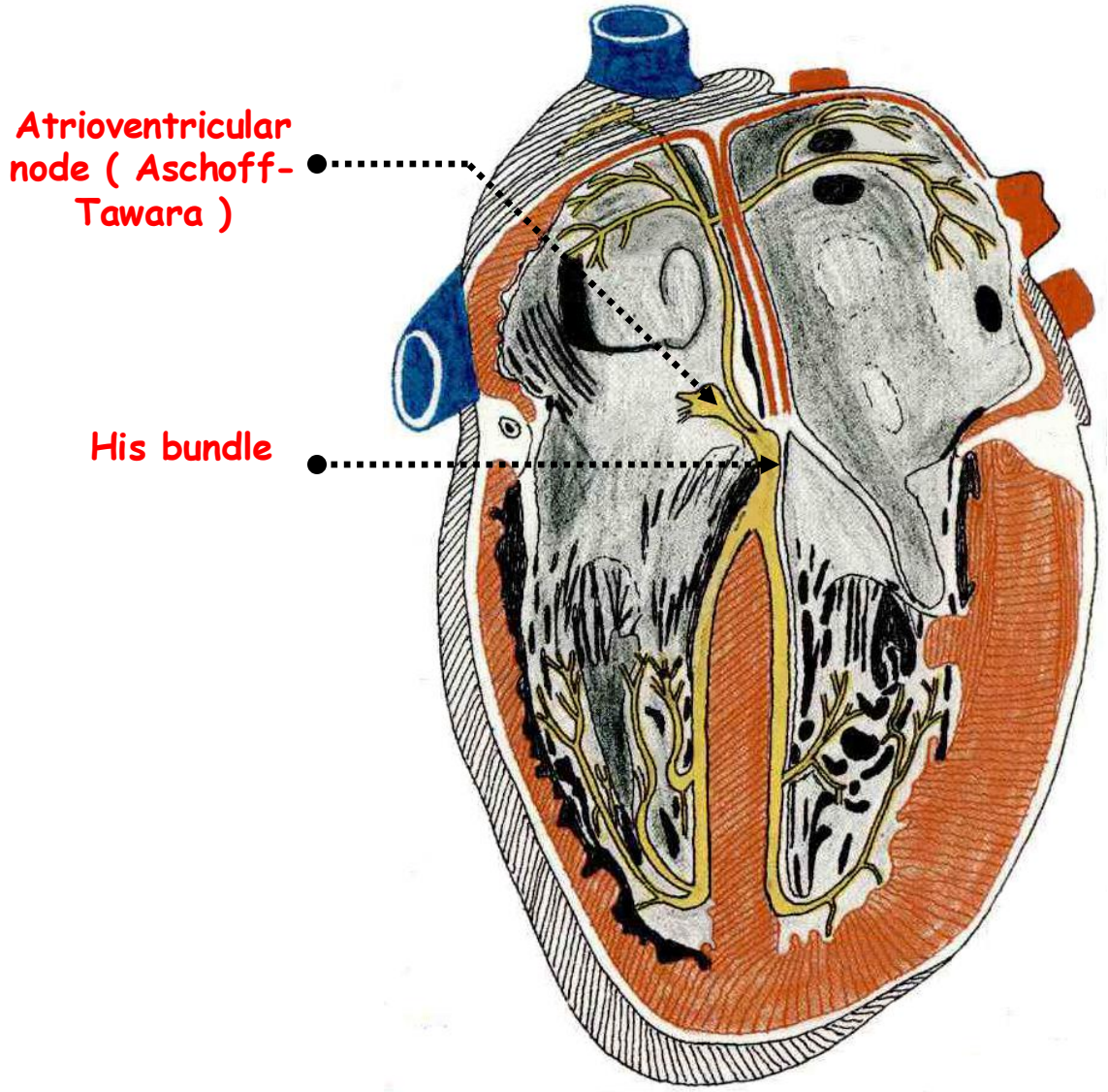


Internal Conduction System of the Heart (Frontal Section, Anterior View)

B-ATRIOVENTRICULAR BUNDLE OR HIS BUNDLE

- It originates in the atrial wall, near the coronary sinus.

- Its fibers gather to form the Aschoff-Tawara node, which then leads to the trunk of the His bundle.



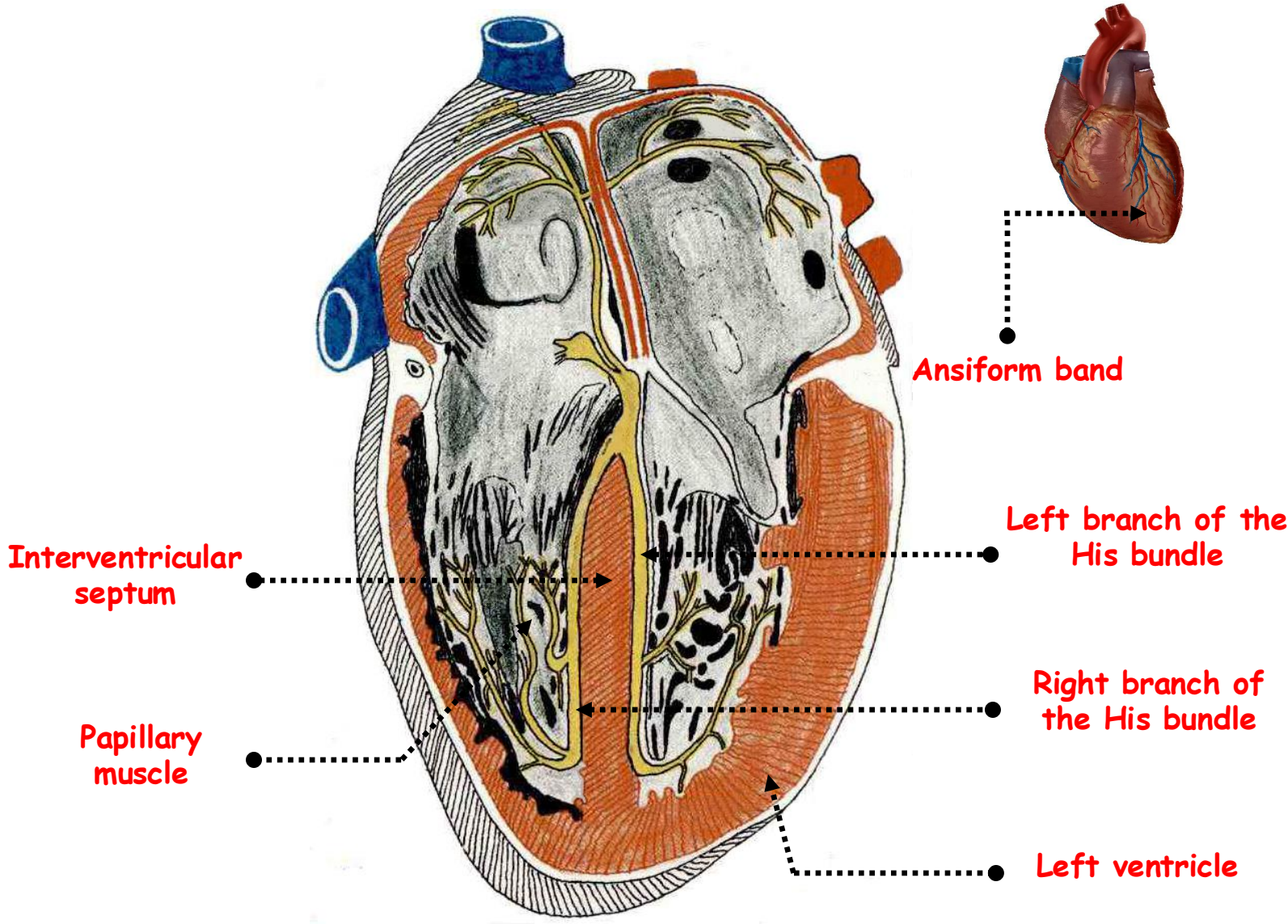
Oblique Frontal Section of the Heart Showing the Arrangement of the Chambers and the Conduction System

B-ATRIOVENTRICULAR BUNDLE OR HIS BUNDLE

– Upon reaching the anterosuperior limit of the membranous segment of the interventricular septum, it divides into :

- A right bundle that moves forward, penetrates the ansiform band, and then enters the base of the anterior and posterior papillary muscles where it eventually disappears.

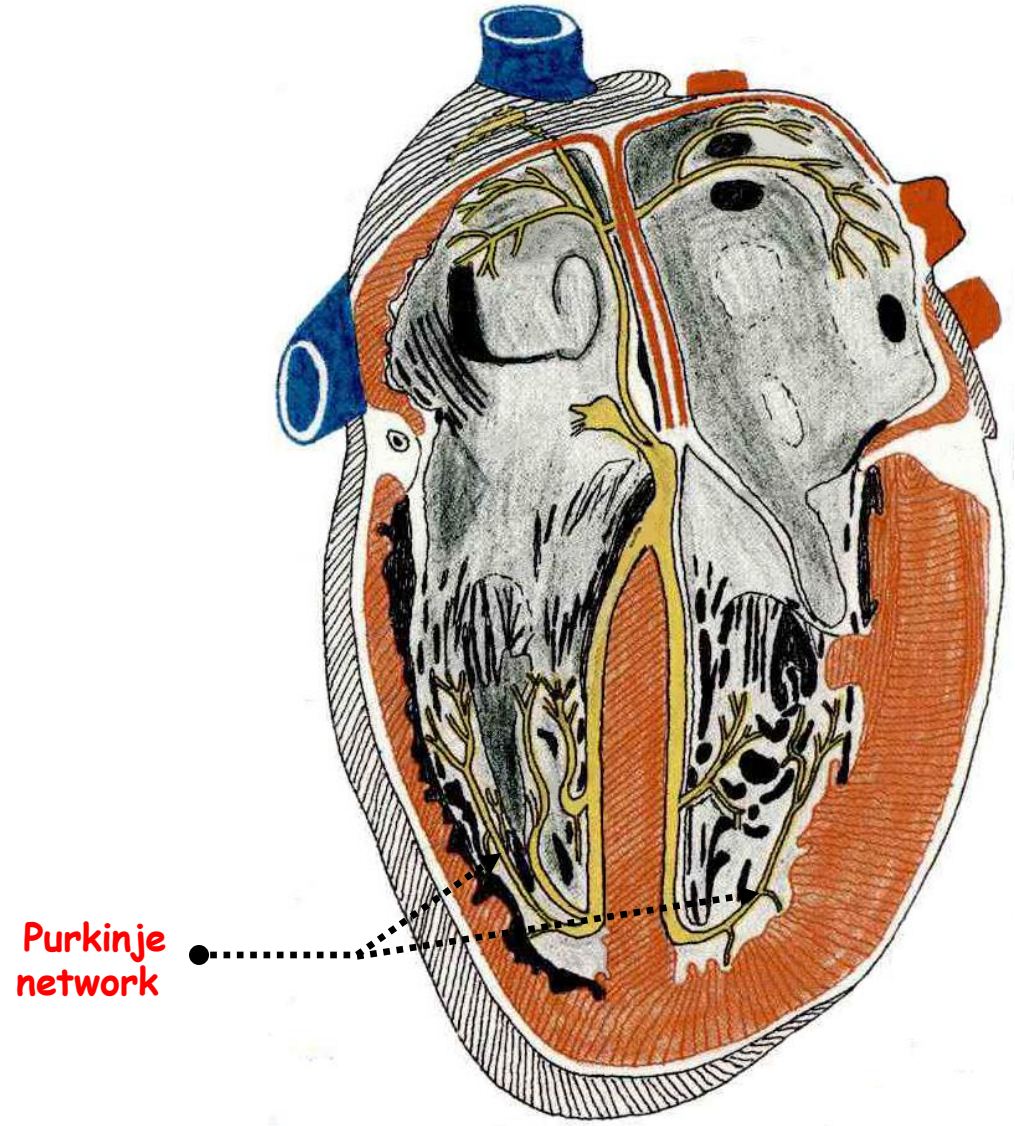
- And a left bundle that descends along the interventricular septum, then divides into two groups of fibers that spread out and extend to the base of the papillary muscles of the left ventricle.



Oblique Frontal Section of the Heart Showing the Arrangement of the Chambers and the Conduction System

B-ATRIOVENTRICULAR BUNDLE OR HIS BUNDLE

- The right and left bundles divide toward the base of the papillary muscles into numerous branches, forming a subendocardial network known as the Purkinje network.



Oblique Frontal Section of the Heart Showing the Arrangement of the Chambers and the Conduction System

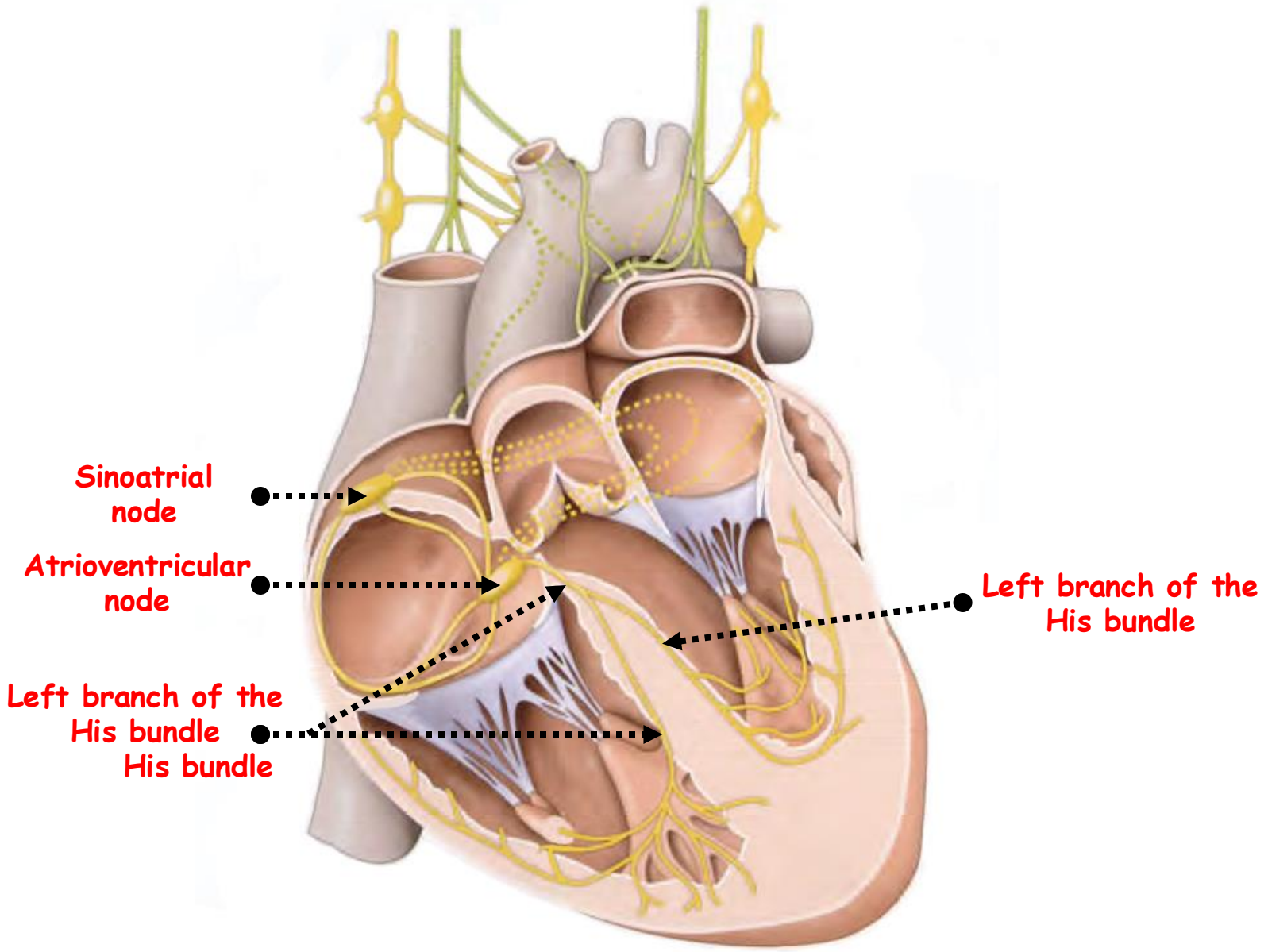
C-VASCULARIZATION OF THE EXCITOCONDUCTIVE SYSTEM

- The Keith et Flack bundle is supplied by a branch of the anterior auricular artery arising from the right coronary artery, and sometimes from the left coronary artery.

- The Tawara node and the trunk of the His bundle are supplied by the first posterior septal arteries, which arise from the atrioventricular portion of the right coronary artery.

- The right branch of the His bundle receives a branch from the second anterior perforating artery (artery of the anterior papillary muscle of the right ventricle).

- The left branch of the His bundle is vascularized by the anterior and posterior septal arteries.



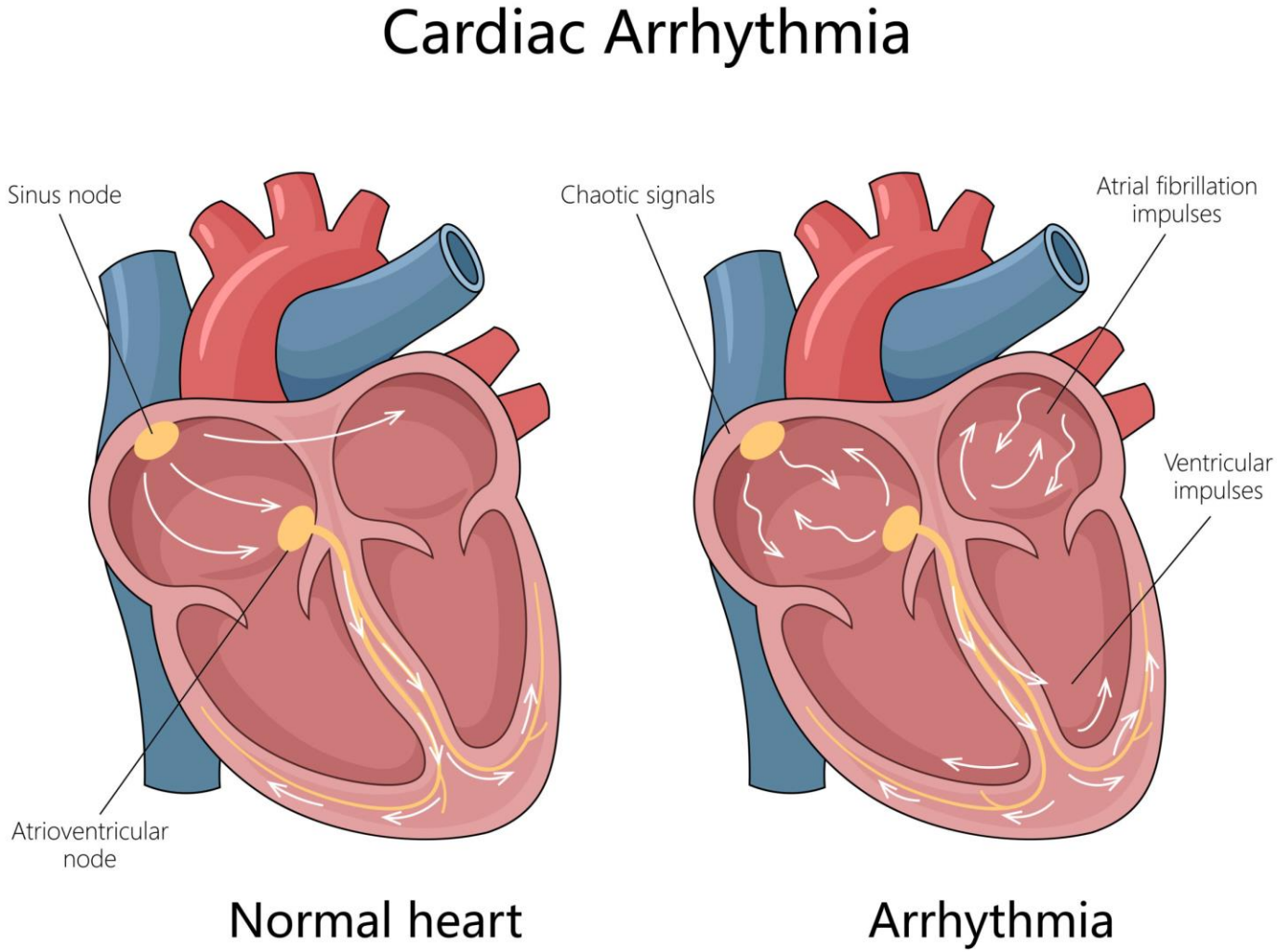
Internal Conduction System of the Heart (Frontal Section, Anterior View)

II-CLINICAL APPLICATIONS

❖ Arrhythmias or cardiac dysrhythmias

These result from abnormal impulse generation or conduction within the excitoconductive system. Examples include:

- Sinus bradycardia or tachycardia (linked to dysfunction of the sinoatrial node).
- Atrial fibrillation (due to disorganised atrial activity, often involving altered autonomic tone).
- Heart blocks, such as:
  - First-degree AV block (delayed conduction through the AV node)
  - Second- or third-degree AV block (complete block of conduction via the His bundle or branches)



❖ Neurocardiogenic syncope or vasovagal syncope

- Vasovagal syncope is the most common type of reflex syncope, characterised by a transient loss of consciousness resulting from a sudden drop in heart rate and blood pressure, leading to cerebral hypoperfusion.

- It involves an abnormal reflex between the autonomic nervous system and the cardiovascular system:

  - A trigger (such as emotional distress, prolonged standing, pain, or fear) causes a paradoxical autonomic response.
  - The parasympathetic system (via the vagus nerve) becomes overactivated, while the sympathetic tone is withdrawn.

❖ Neurocardiogenic syncope or vasovagal syncope

- This leads to:
  - Bradycardia (via increased vagal tone on the sinoatrial and atrioventricular nodes)
  - Vasodilation and hypotension (due to reduced sympathetic vasoconstriction)
- The combination results in decreased cerebral perfusion and fainting.

II-CONCLUSION

- In conclusion, the heart's activity is regulated by a finely balanced interaction between extrinsic and intrinsic innervation.
- The extrinsic system, composed of sympathetic and parasympathetic fibres, modulates heart rate and contractility in response to physiological demands through the cardiac plexuses.
- Meanwhile, the intrinsic system, consisting of the sinoatrial node, atrioventricular node, His bundle, and Purkinje fibres, ensures the automatic generation and coordinated propagation of electrical impulses.
- Together, these systems maintain the heart's rhythm and adaptability, and their disruption underlies many important cardiac pathologies.