

وسهلا

أهلا

يُمنع أخذ السلايدات بدون  
إذن المحرر واي اجراء  
يخالف ذلك يقع تحت طائلة  
المسؤولية القانونية  
جميع المعلومات للاستخدام  
التعليمي فقط

Welcome

## الأستاذ الدكتور يوسف حسين

أستاذ التشريح وعلم الأجنة - كلية الطب - جامعة الزقازيق - مصر

رئيس قسم التشريح والأنسجة والأجنة - كلية الطب - جامعة مؤتة - الأردن

دكتورة من جامعة كولونيا المانيا

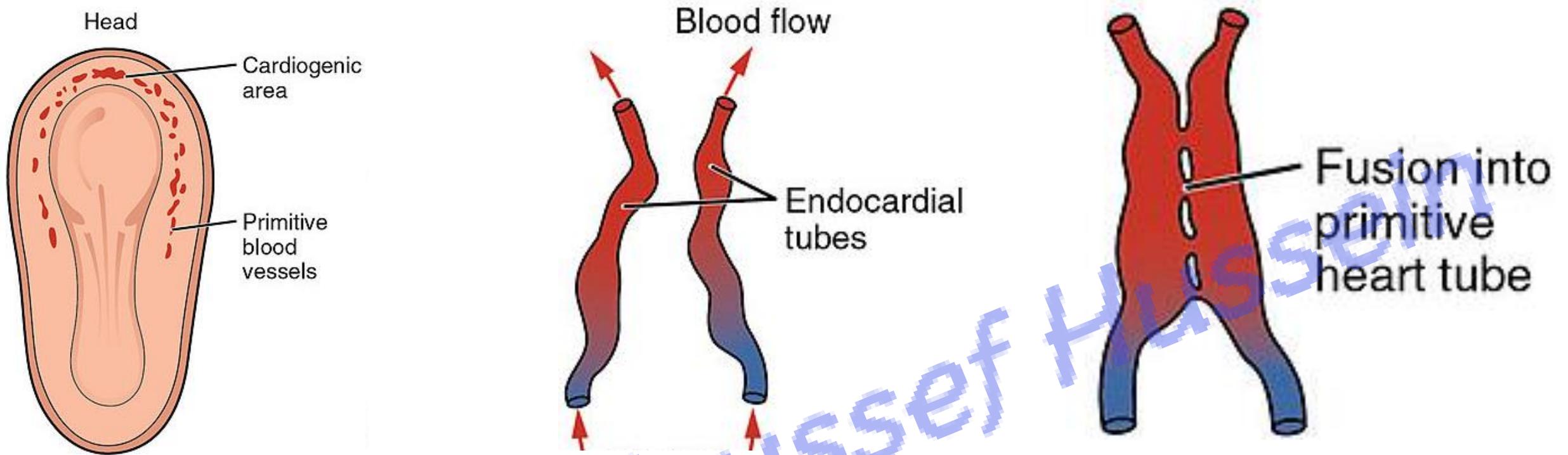
جميع المعلومات المنشورة هي فقط للاستخدام التعليمي

جروب الفيس د. يوسف حسين (استاذ التشريح)

اليوتيوب د. يوسف حسين

Prof. Dr. Youssef Hussein Anatomy - YouTube

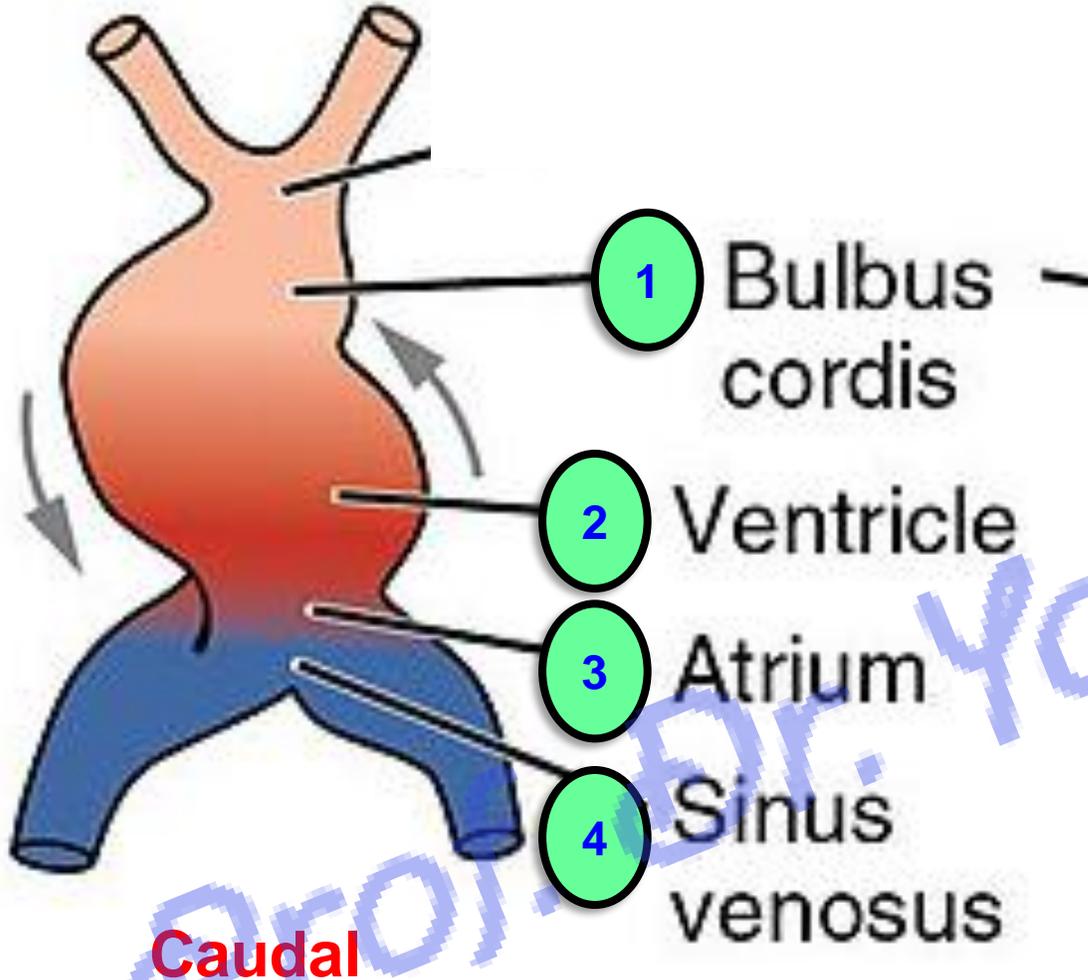
[https://www.youtube.com/channel/UCVSNqbibj9UWYaJdd\\_cn0PQ](https://www.youtube.com/channel/UCVSNqbibj9UWYaJdd_cn0PQ)



### • DEVELOPMENT OF THE HEART TUBE

- The **vascular system** (heart and blood vessels) as well as blood elements are **mesodermal in origin**.
- The **angioblasts** (vascular **mesodermal cells**) condensed and form clusters of cells called **blood island**.
- The blood island in the cardiogenic area of the **embryonic disc** forms **two endocardial heart tubes** while in the rest of the embryonic regions forms **primitive blood vessels**.

**\*\* After lateral folding of the embryonic disc, The 2 endocardial heart tubes fuse forming a single endocardial heart tube.**



## **\*\* Differentiation of the heart tube**

\* Unequal growth of the heart tube leads to the formation of **4 dilated sacs** separated from each other by narrow constrictions.

\* The sacs arranged as follows:

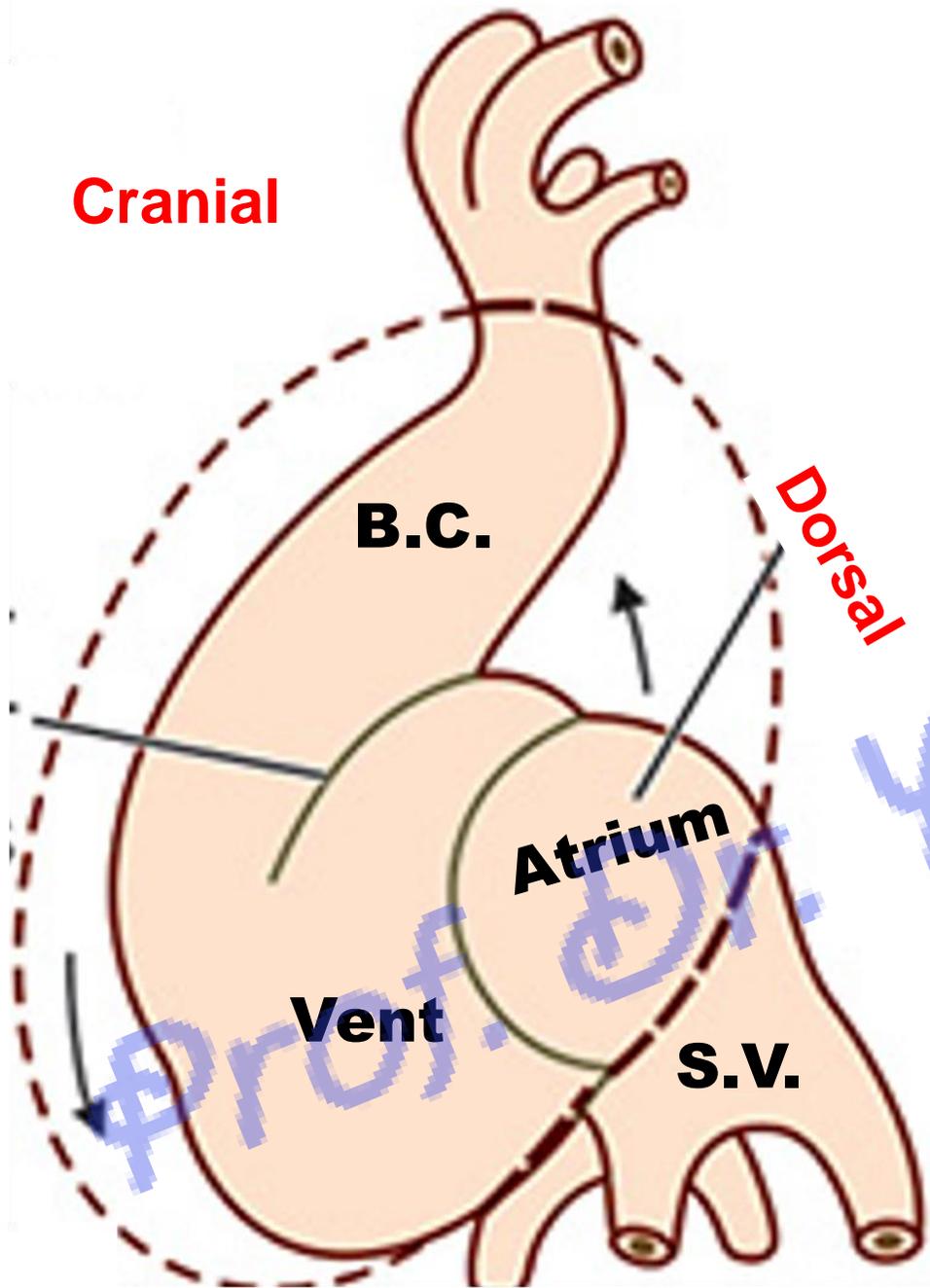
**1. Bulbus cordis (most cranially).**

**2. Primitive ventricle.**

**3. Primitive atrium.**

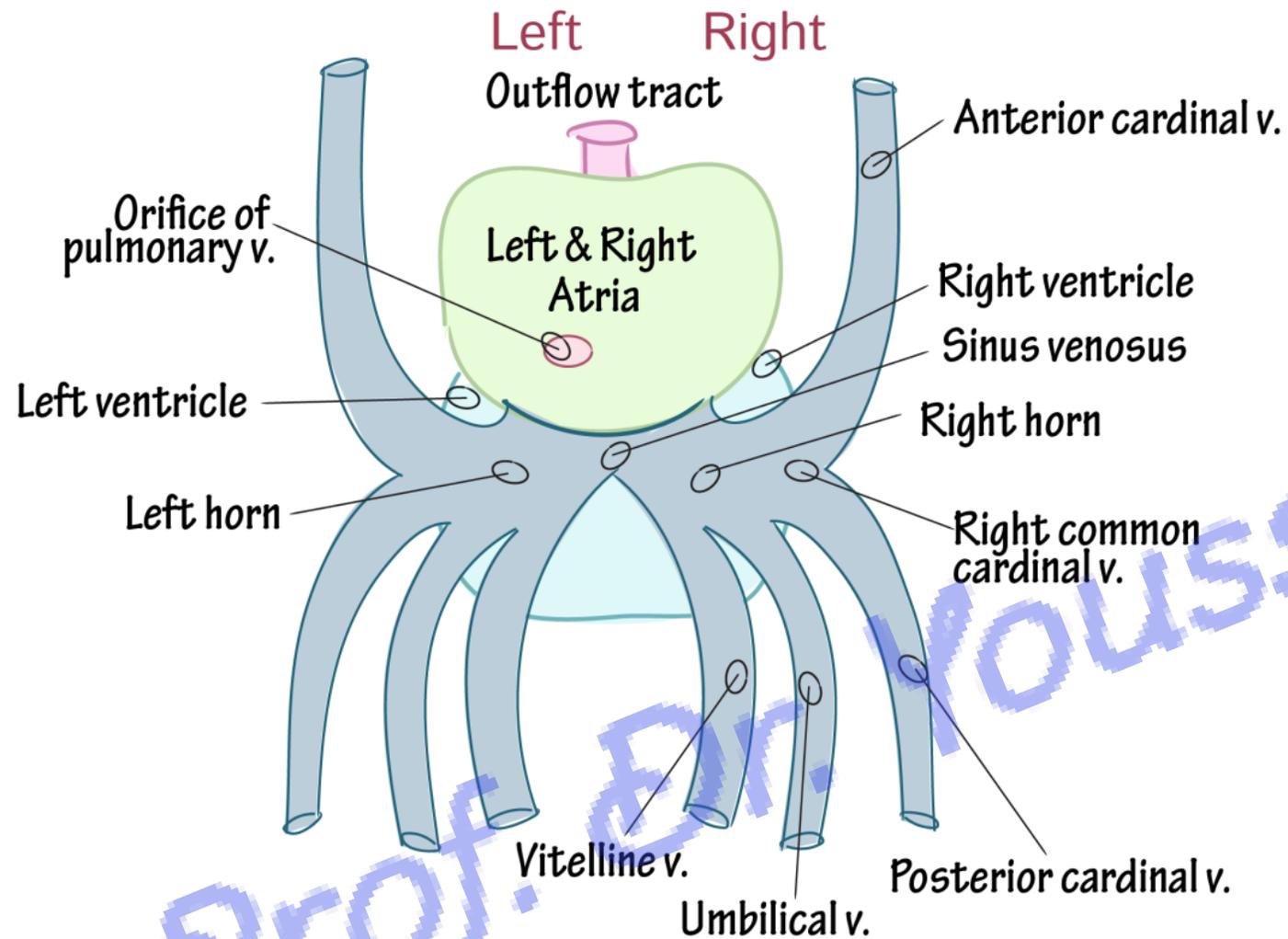
- The atrium and ventricle are connected by **atrioventricular canal**.

**4. Sinus venosus (most caudally).**



\* Rapid growth of the heart tube than the pericardium resulted in dorsal folding of the heart tube on itself forming **S-shaped loop**. This will result in the following:

- 1- **The primitive atrium** lies cranial to the primitive ventricle and dorsal to the primitive ventricle
- 2- **The bulbus cordis** lies cranial to the primitive ventricle and ventral to the primitive atrium.
- 3- **The sinus venosus** lies caudal to the primitive atrium and dorsal to the primitive ventricle.



## Derivatives (fate) of the Sinus Venosus

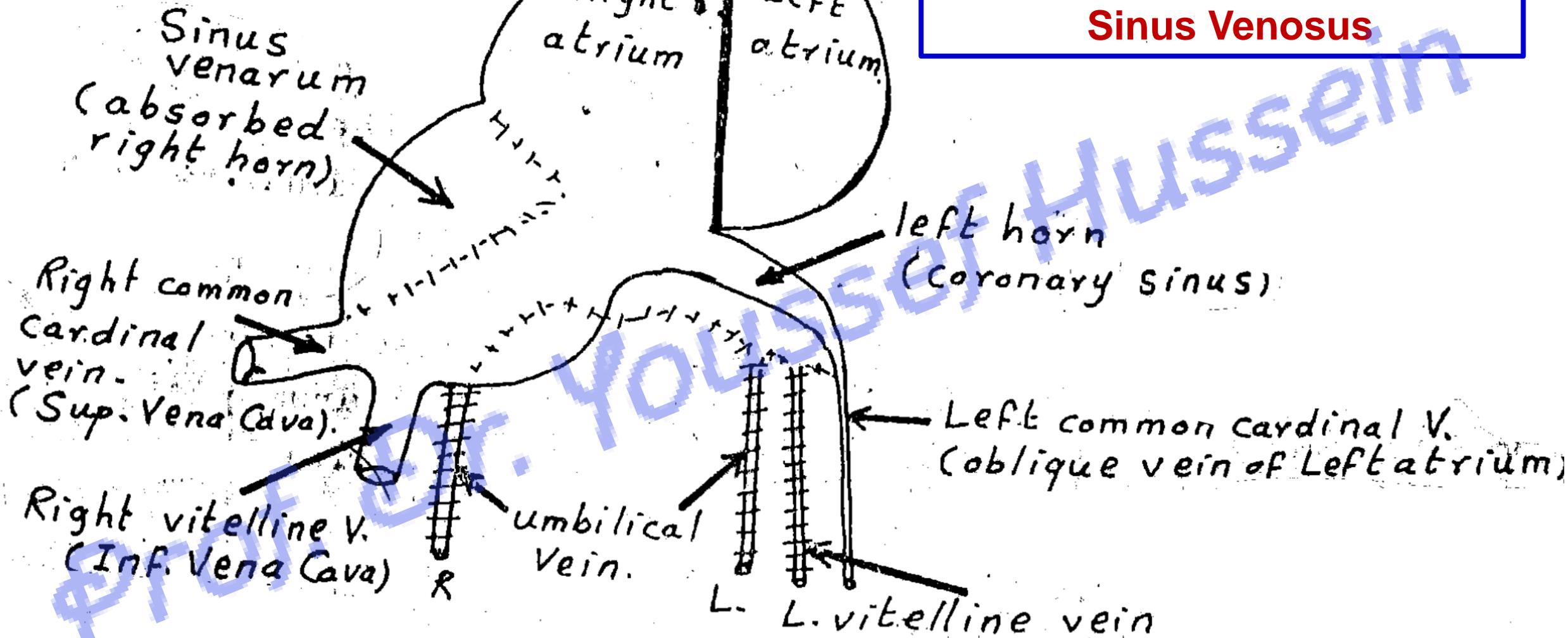
- The sinus venosus is formed of a body and **2 horns** (right and left).
- Each horn receives 3 veins:

**I. Umbilical vein** carried oxygenated blood from the **placenta**.

**II. Vitelline vein** drains blood from the **yolk sac**.

**III. Common cardinal vein** drains blood from the **body** of the embryo.

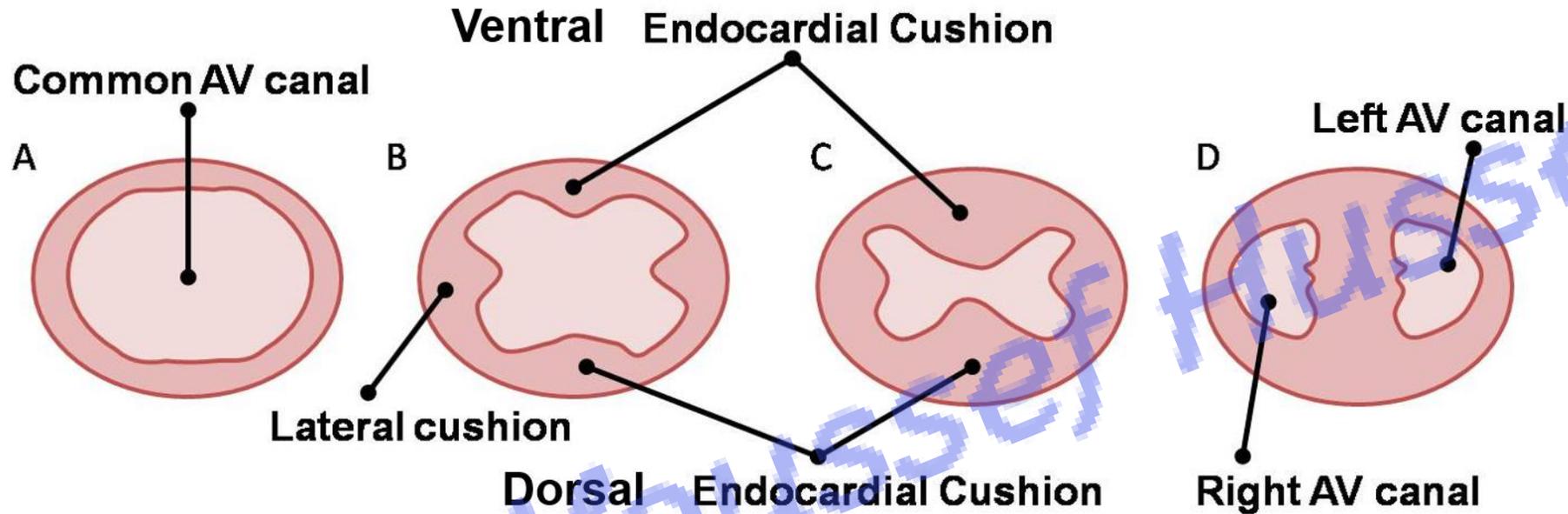
## Derivatives (fate) of the Sinus Venosus



## Derivatives (fate) of the Sinus Venosus

	<b>right side</b>	<b>left side</b>
<b>Horn</b>	Smooth posterior part of the right atrium	coronary sinus
<b>Common cardinal vein</b>	lower part of the superior vena cava	oblique vein of the left atrium
<b>Vitelline vein</b>	suprahepatic part of the inferior vena cava	degenerated
<b>Umbilical vein</b>	Degenerated	After labor forms ligamentum teres of the liver

# Changes of the atrioventricular canal



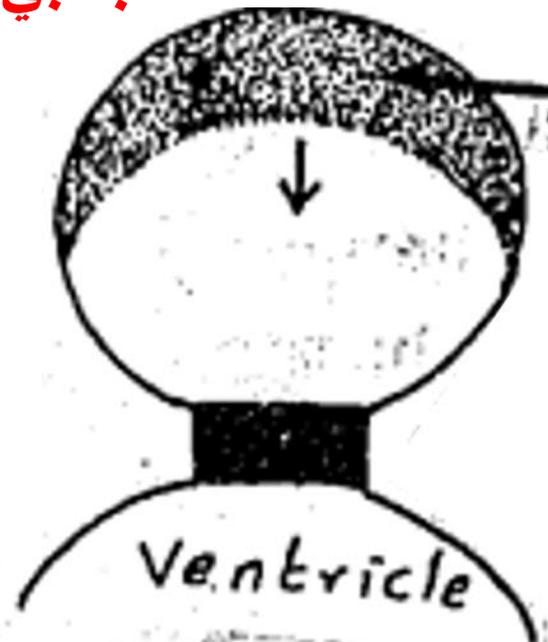
- **Atrioventricular septum;**

- Ventral and dorsal endocardial swellings develop in the atrioventricular canal.
- They enlarged and fused with each other forming the atrioventricular septum dividing the canal into right and left atrioventricular canals.

- **The upper part** is added into the developing **atria** while the **lower part** is added into the developing **ventricles**

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septum primum.



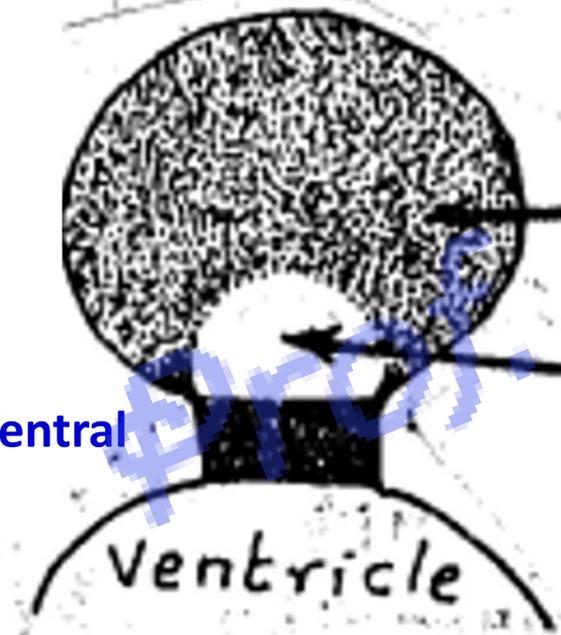
Right A-V. canal

A.V. septum.

Left A-V. canal

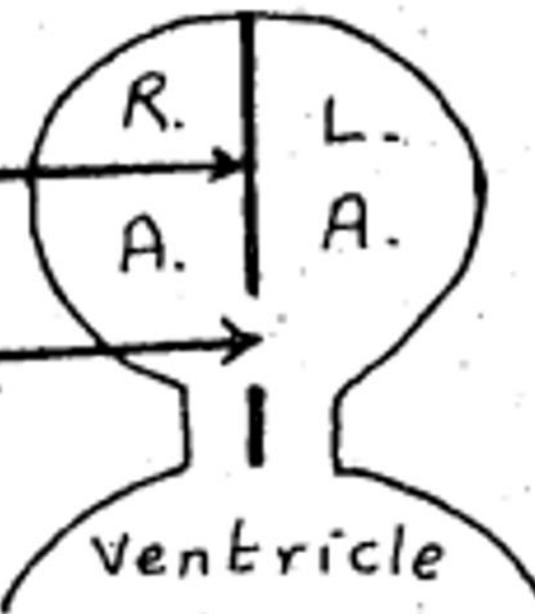
Ventricle

(a)



Sep-um primum.

Ostium primum.



Ventricle

(b)



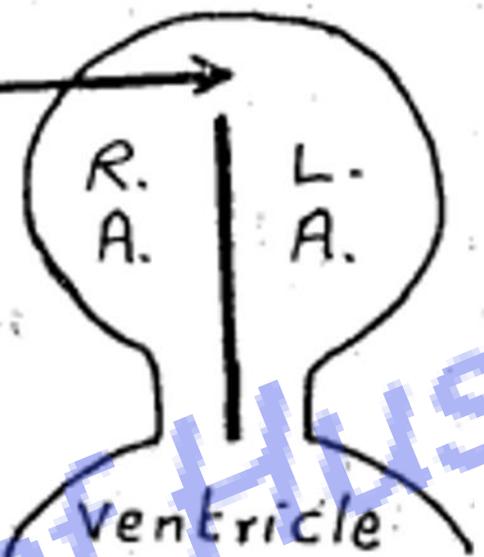
**Development of interatrial septum**

Ventral



Ostium secundum.

**Development of interatrial septum**



(c)

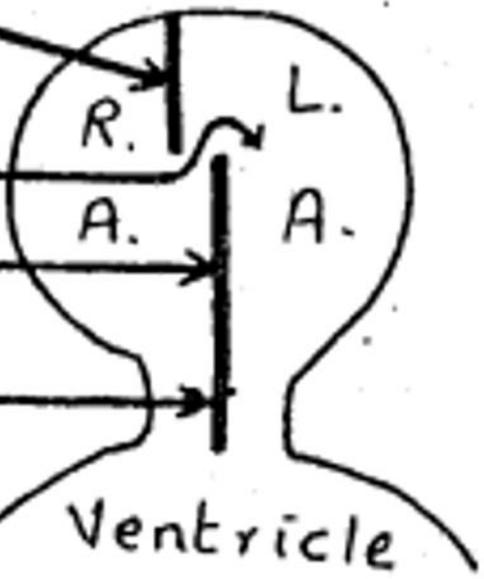


Septum secundum.

Foramen ovale.

Septum primum.

A-v. septum.



(d)

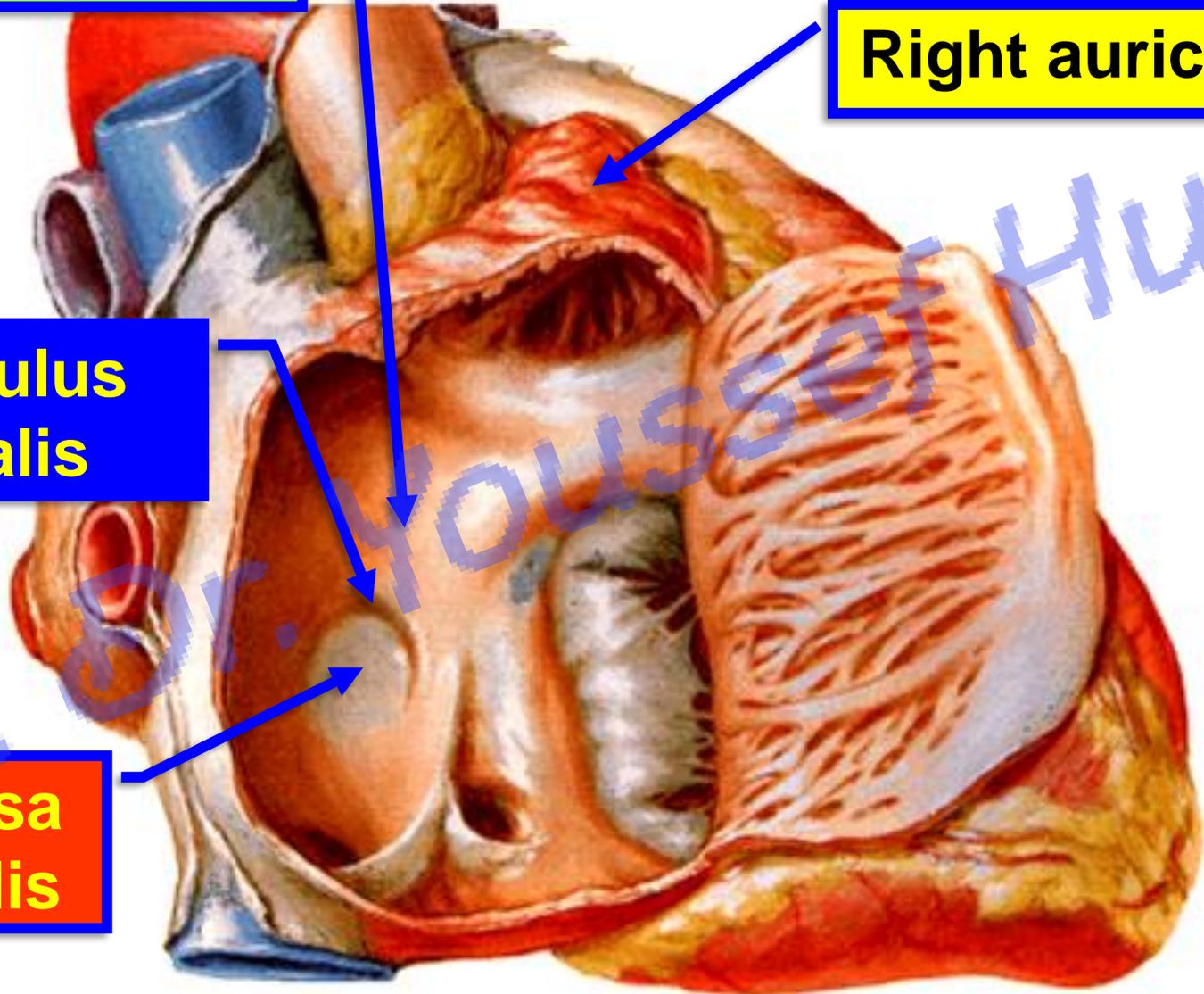
**Opened Right Atrium**

**interatrial septum**

**Right auricle**

**Annulus ovalis**

**Fossa ovalis**



Prof. Dr. Yousef Hussein

Dr. Yousef Hussein  
YouTube

- **Development of the inter-atrial septa**

- It divides the common atrium into right and left atria as follows.

**1- Septum primum;**

- A sickle shaped septum descends from the roof of the common atrium and grows towards the atrioventricular canal.
- The anterior and posterior ends of the septum reach the atrioventricular septum before the central part. As a result, a temporary opening called **ostium primum** between the lower end of the septum primum and atrioventricular septum.
- **Before closure** of the ostium primum, another foramen appears by breaking of the upper part of the septum primum called **ostium secundum**.
- Both ostium primum and ostium secundum are necessary to passage of blood from the right atrium to left atrium during foetal life.

**2- Septum secundum;**

- Another sickle-shaped septum descends from the roof of the atrium to the **right side of the septum primum** till covers the ostium secundum.
- The gap between the lower edge of the septum secundum and upper edge of the septum primum is called **foramen ovale**. This foramen allows the passage of blood from the right atrium to the left atrium.
- **After birth**, the foramen ovale is closed **by the apposition of** the 2 septa; the septum primum forms the floor of the fossa ovalis and the lower edge of the septum secundum forms the annulus ovalis.

## Development of the atrium

- Two expansions from the primitive atrium around the bulbus cordis forming the right and left auricles.

\* **The definitive right and left atria are developed from**

<b>Right atrium</b>	<b>Left atrium</b>
<p>I. Right 1/2 of primitive atrium</p> <p>II. Right 1/2 of A-V canal</p> <p>III. Absorbed right horn of sinus venosus forming smooth posterior part which receives openings of the SVC, IVC and coronary sinus</p>	<p>I. Left 1/2 of primitive atrium</p> <p>II. Left 1/2 of A-V canal</p> <p>III. Absorbed common pulmonary vein forms smooth part, as a result; the 4 pulmonary veins open separately into the left atrium.</p>

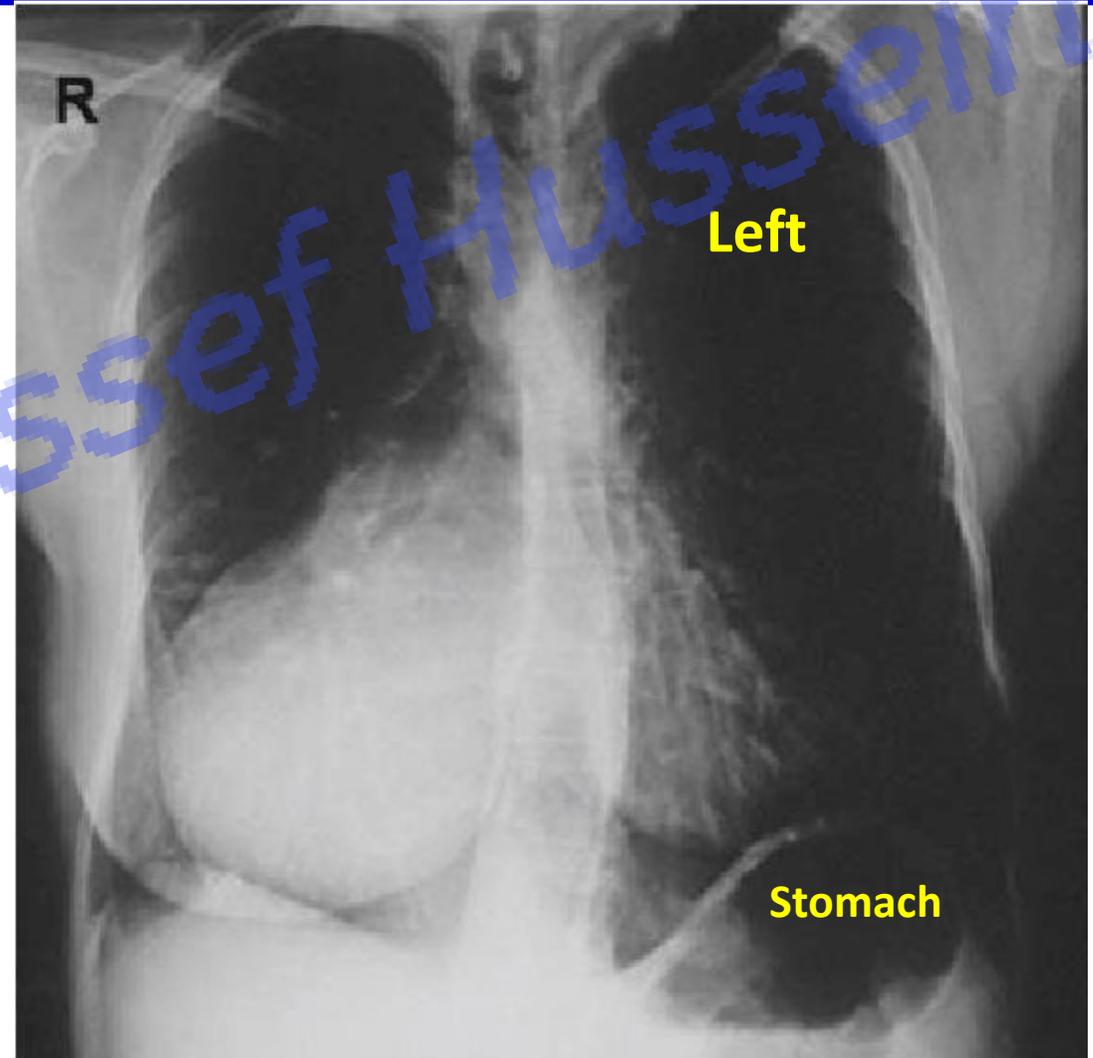
**Ectopia cordis:** The costal surface of the heart is exposed to the surface due to defect in the sternum.



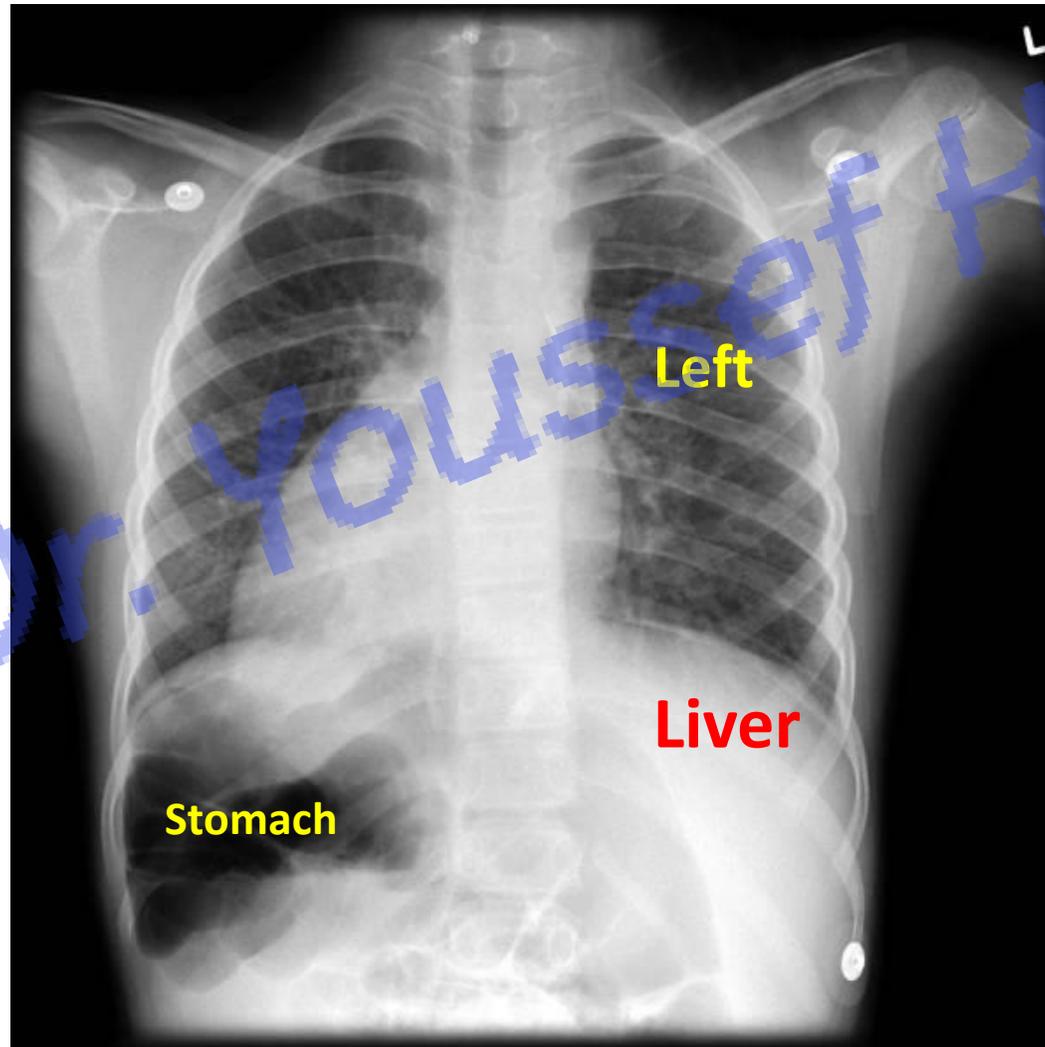
**Dextrocardia:** the apex of the heart is directed to the **right** side with partial **situs inversus**

➤ **Situs inversus** is a congenital condition in which the organs in the chest and abdomen are reversed or mirrored from their normal positions.

- Partial or complete



**Dextrocardia:** the apex of the heart is directed to the **right** side with complete **situs inversus**



- **Congenital anomalies of the interatrial septa**

**1- Common atrium:** due to failure of development of the interatrial septum.

**2- Patent ostium primum:** incomplete descend of the septum primum to close the ostium primum.

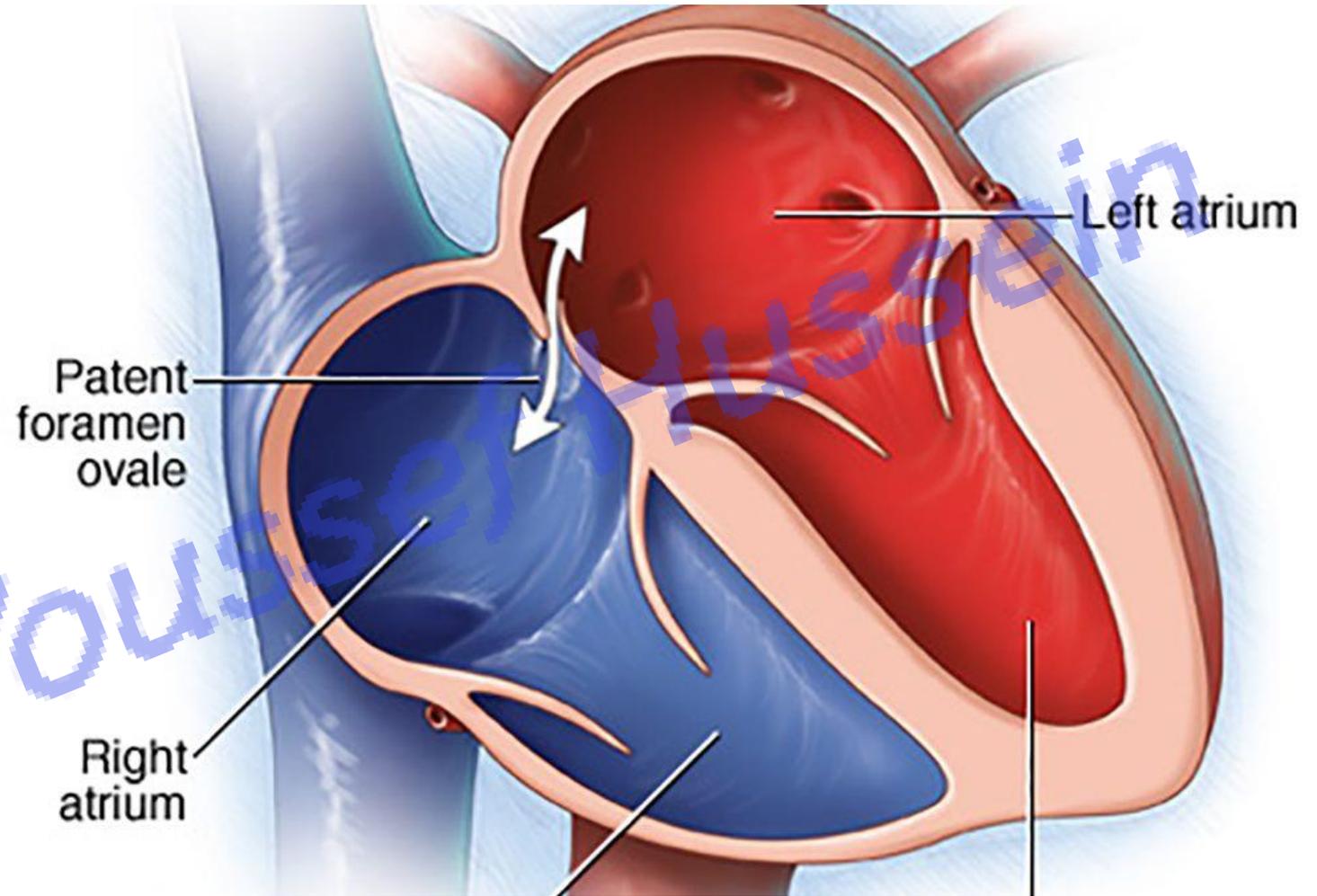
**3- Patent ostium secundum:** failure of development of the septum secundum or excessive breaking down of the septum primum.

#### 4- Patent foramen ovale:

failure of closure of the foramen ovale after birth.

- This leads to shunt of the blood from the left to the right atrium with the result of right atrium enlargement.

5- Premature closure of the foramen ovale: leading to hypertrophy of the right atrium and ventricle

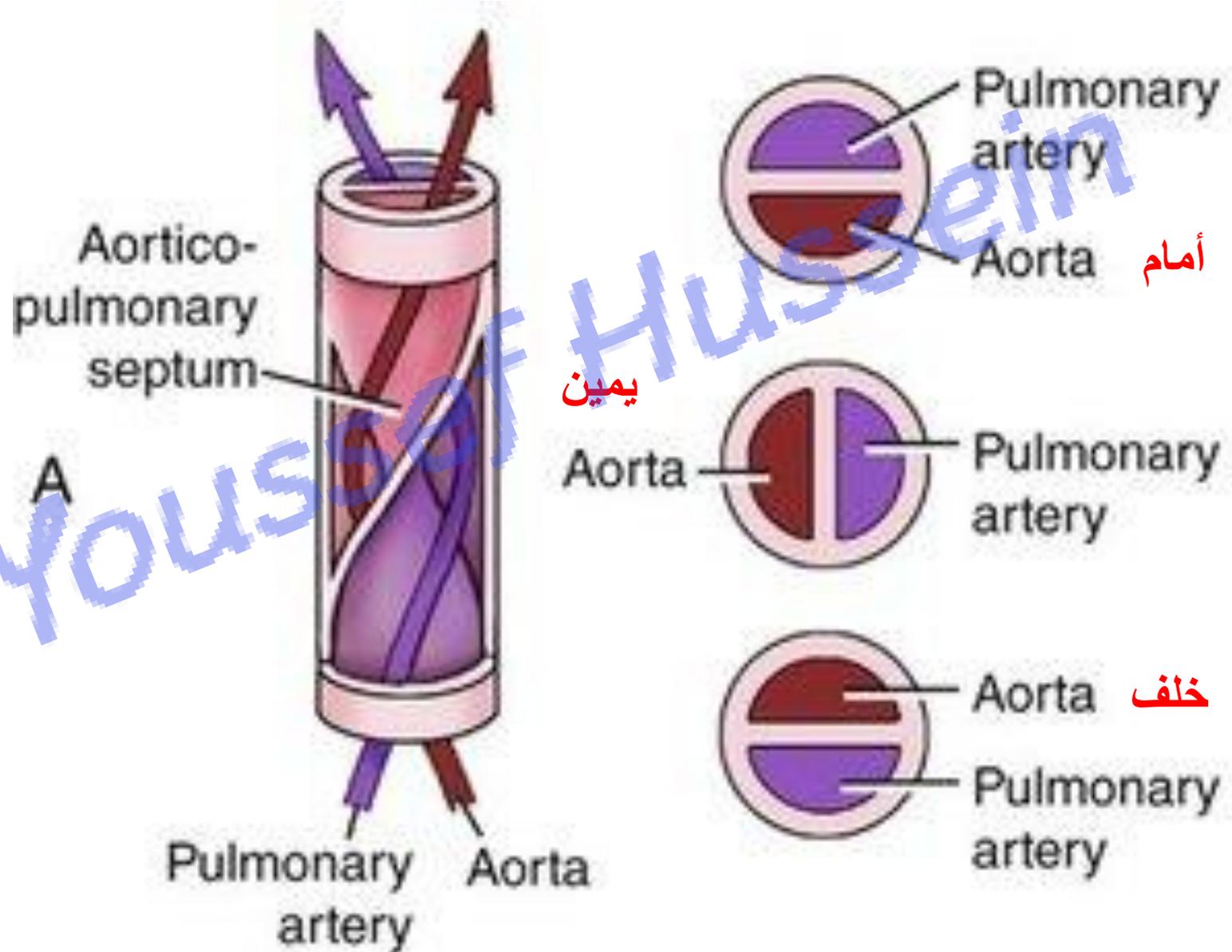


**The proximal part:** is absorbed and added to the ventricle.

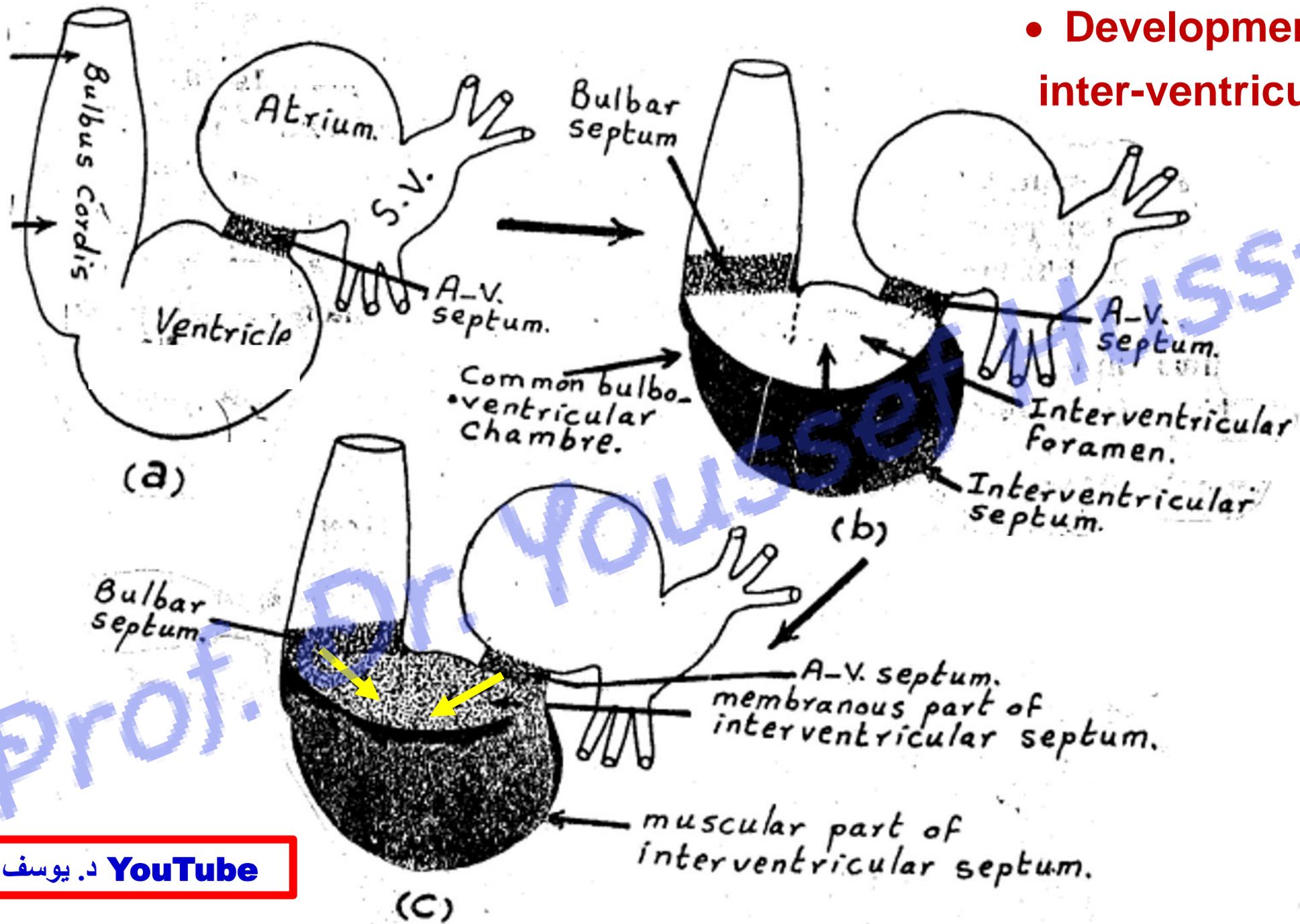
\* **The distal part [truncus arteriosus]:** is divided into aorta and pulmonary trunk by a **bulbar (spiral) septum**. The lower end of the septum descends towards the inter-ventricular septum. **It rotates in a clockwise direction.**

- I. In the **upper part:** The septum is **transverse**. The **aorta** lies in **front** of the pulmonary trunk.
- II. In the **middle part:** the septum is **antero-posterior**. The **aorta** lies to the **right side** of the pulmonary trunk.
- III. In the **lower part:** The septum is **transverse**. The **aorta** lies **behind** the pulmonary trunk. **SO**, the aorta opens into the left ventricle and pulmonary trunk opens into the right ventricle

## Development of the bulbus cordis



• Development of the inter-ventricular septa



## **Development of the definitive ventricles**

- The **proximal part of the bulbus cordis** and the **lower part of the atrioventricular canal** are absorbed into the primitive ventricle forming a **common bulboventricular chamber**.

1) The **absorbed bulbus cordis** gives also rise to the **smooth outflow parts of the definitive ventricles** (**infundibulum** of the right ventricle and **vestibule** of the left ventricle).

2) The **absorbed atrioventricular canal** forms the part of the ventricles at the atrioventricular opening.

3) The **primitive ventricle** forms the **rough part** of the ventricular cavities.

\* It is divided into 2 parts, right and left ventricles by the inter-ventricular septum.

- **Development of the interventricular septa**

### **1- Muscular part of the septum:**

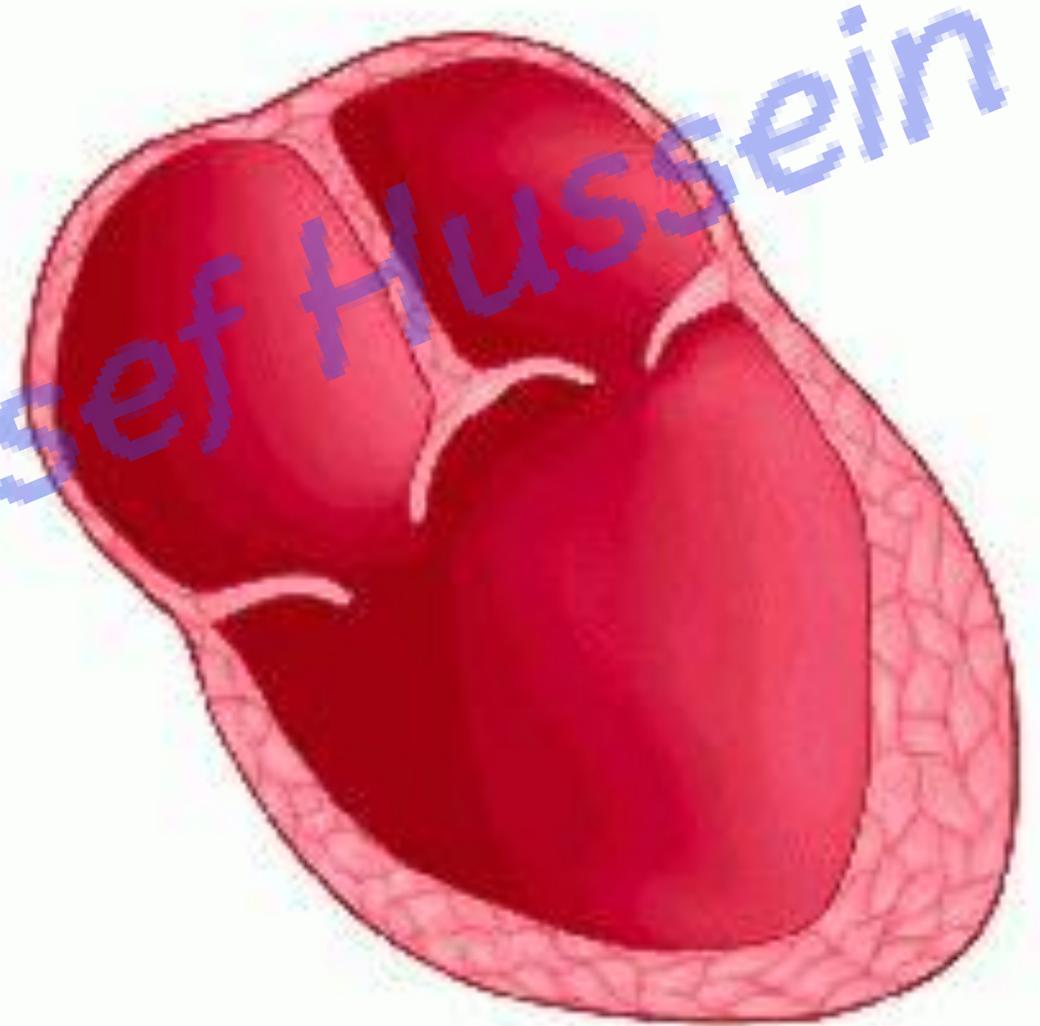
- A sickle-shaped septum developed from the floor of the common ventricular chamber
- It ascends upward towards the bulbar septum and atrioventricular septum leaving an opening called **interventricular foramen** connecting the two ventricles and forms **muscular** part of interventricular septum.

**2- Bulbar septum** and **atrioventricular septum** descends **downward** to meet the upper margin of muscular part forming **membranous part of the interventricular septum**

# Cor trilocular

- **Congenital anomalies of the ventricle**

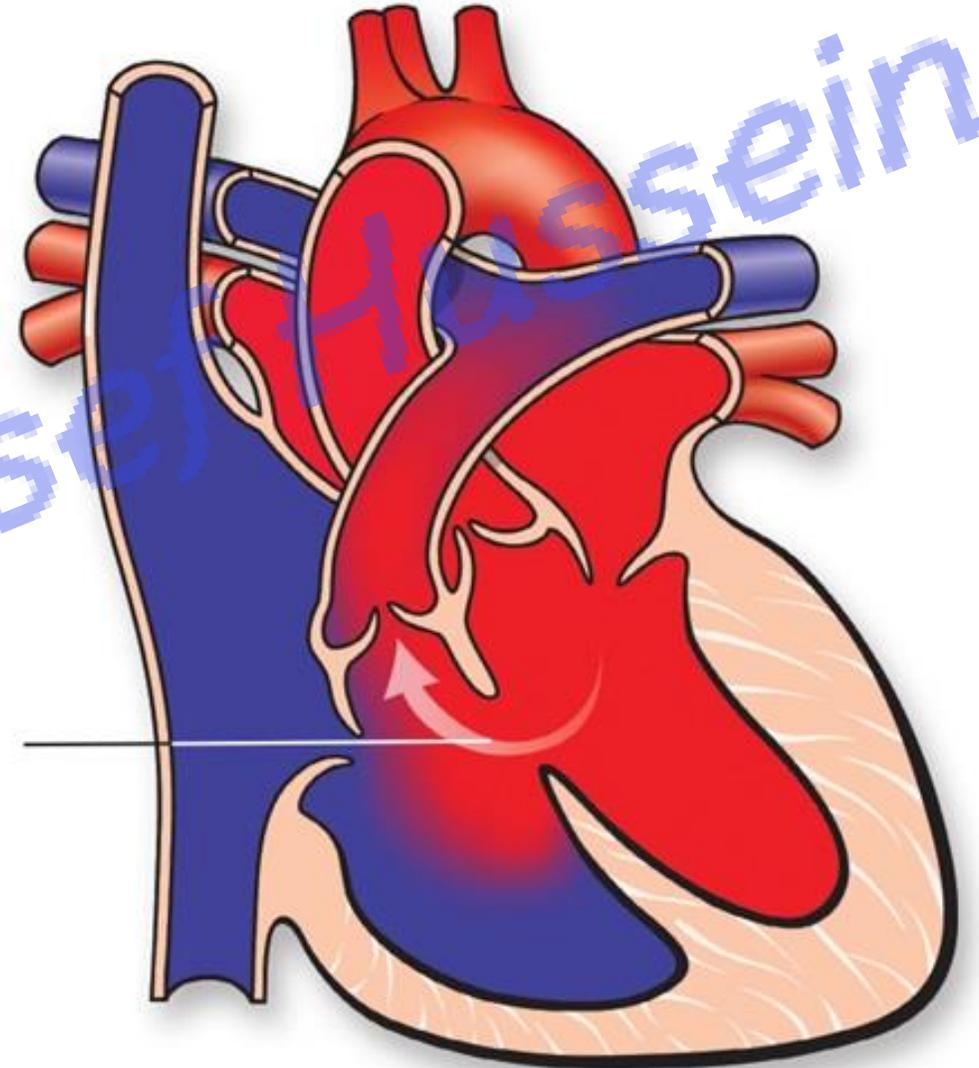
- **Cor bilocular:** the heart consists of one atrium and one ventricle due to failure of development of the septa.
- **Cor trilocular,** the heart consists of 2 atria and one ventricle due to absent of the interventricular septum.



## • Congenital anomalies of the ventricle

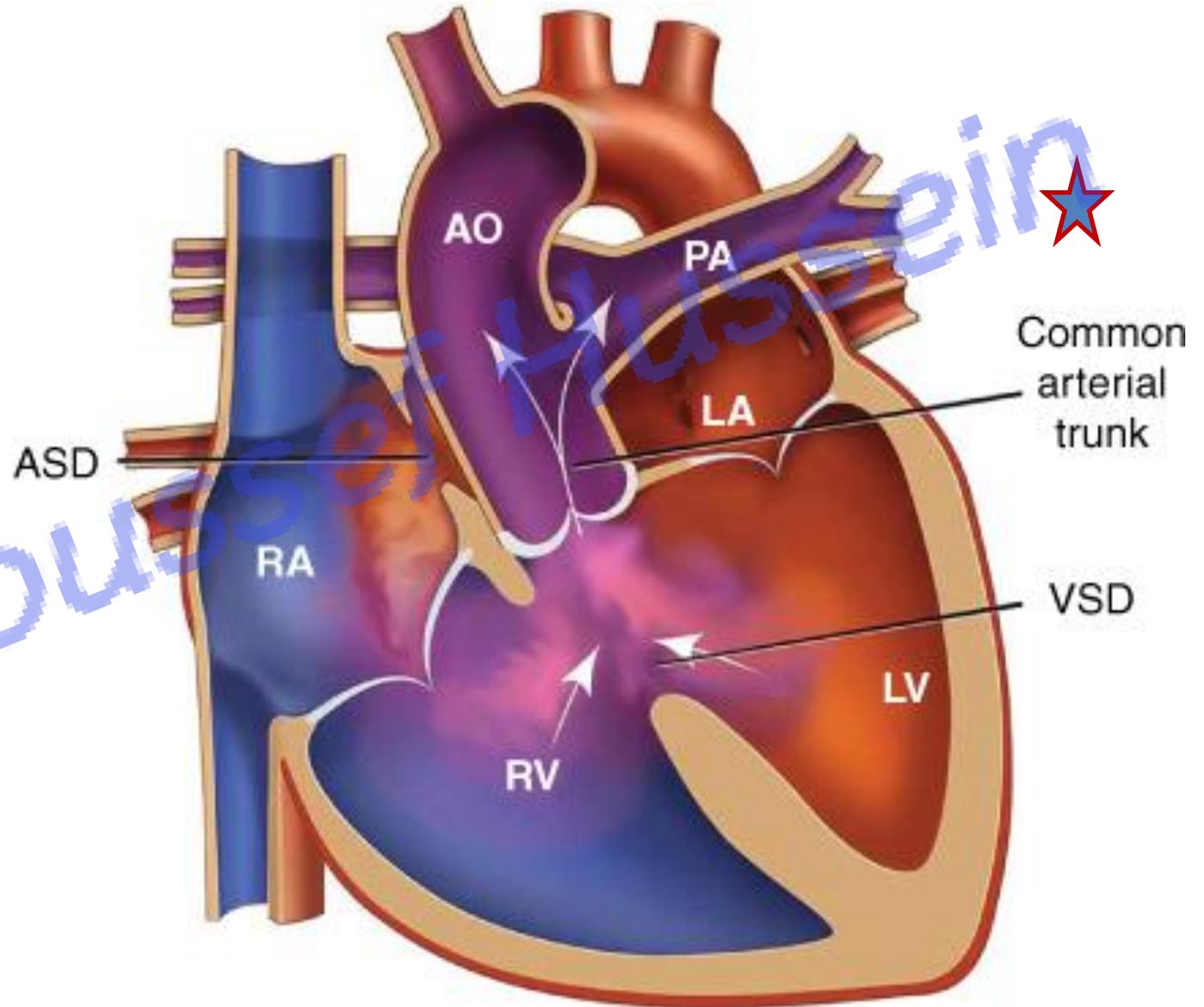
- **Ventricular septal defect (VSD= Rogers' syndrome)**: due to failure of development of the membranous part of the interventricular septum.
- It allows the passage of the blood from the left ventricle to the right ventricle leading to **cyanosis**.

Ventricular Septal Defect



## Anomalies of the bulbar septum

- **Persistent bulbus cordis (common arterial trunk):** due to failure of development of the bulbar septum and so the great vessels arise as a common trunk and receives blood from both ventricles (**Ventricular Septal Defect**).



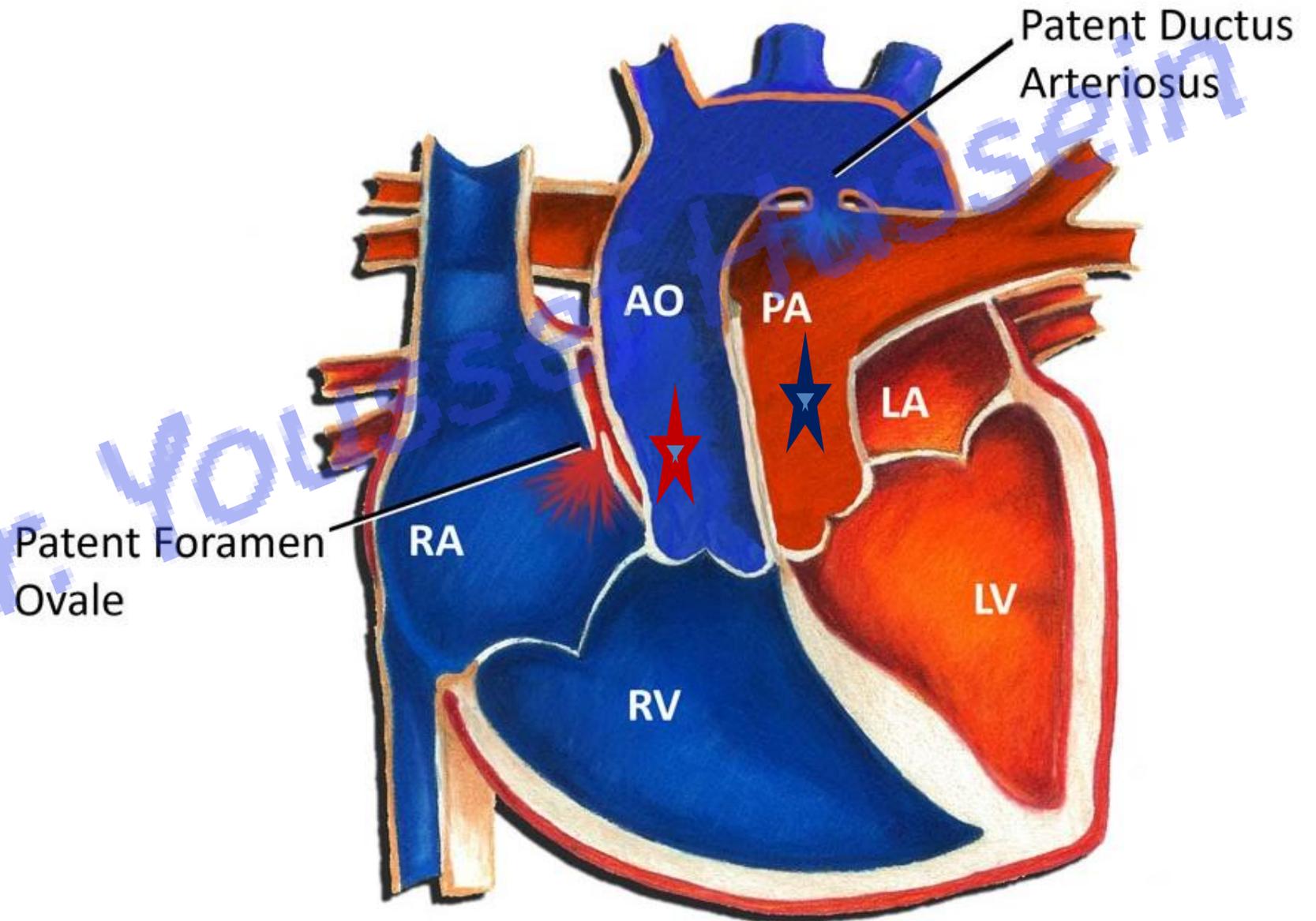
- **Transposition of the great vessels**

- Aorta arises from the right ventricle while the pulmonary trunk arises from the left ventricle due to

**reversed rotation of the bulbar septum**

**(Anticlockwise)**

## Transposition of the Great Arteries



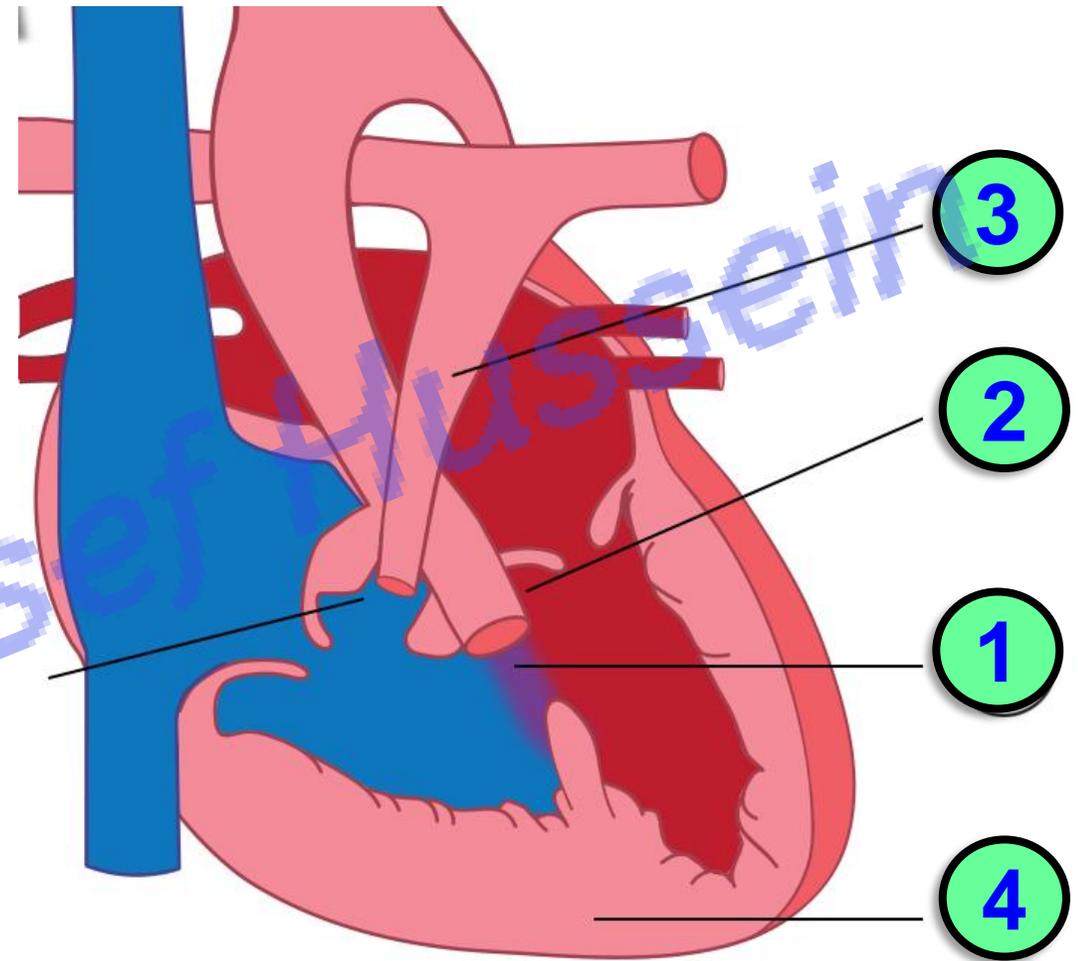
# • Fallot's tetralogy

## - It is caused by

- 1) Anterior displacement of the bulbar septum.
- 2) Failure of development of the membranous septum.

## - It consists of:

- 1- **Ventricular septal defect** [VSD] due to failure of development of the membranous part of the interventricular septum
- 2- **Overriding of the aorta** (the aorta arises from the 2 ventricles due to anterior displacement of the bulbar septum).
- 3- **Pulmonary stenosis.**
- 4- **Right ventricular hypertrophy.**

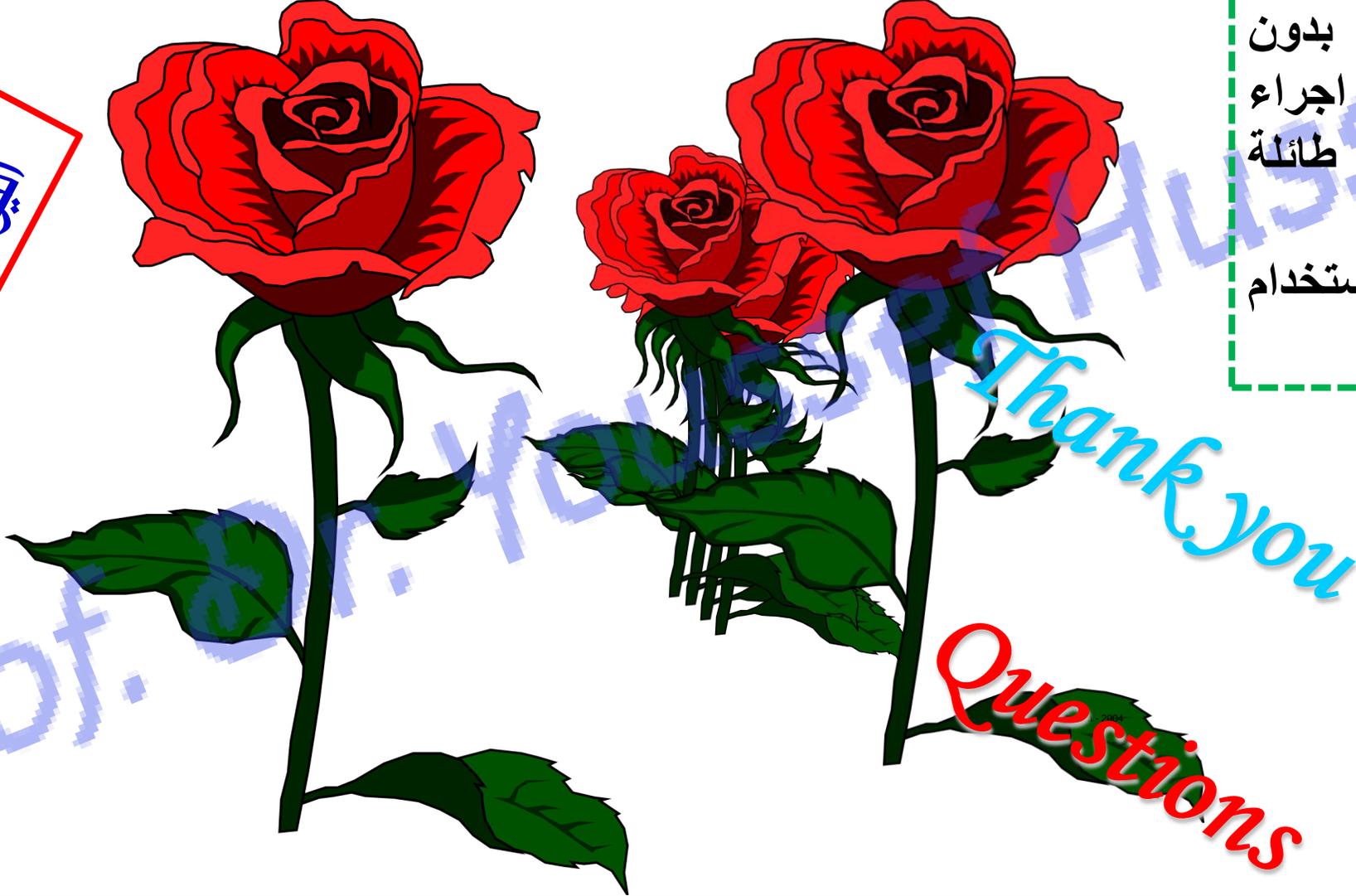


**Eisenmenger's syndrome:** as Fallot's tetralogy **without** pulmonary stenosis.

[https://www.youtube.com/channel/UCVSNqbibj9UWYaJdd\\_cn0PQ](https://www.youtube.com/channel/UCVSNqbibj9UWYaJdd_cn0PQ)

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