

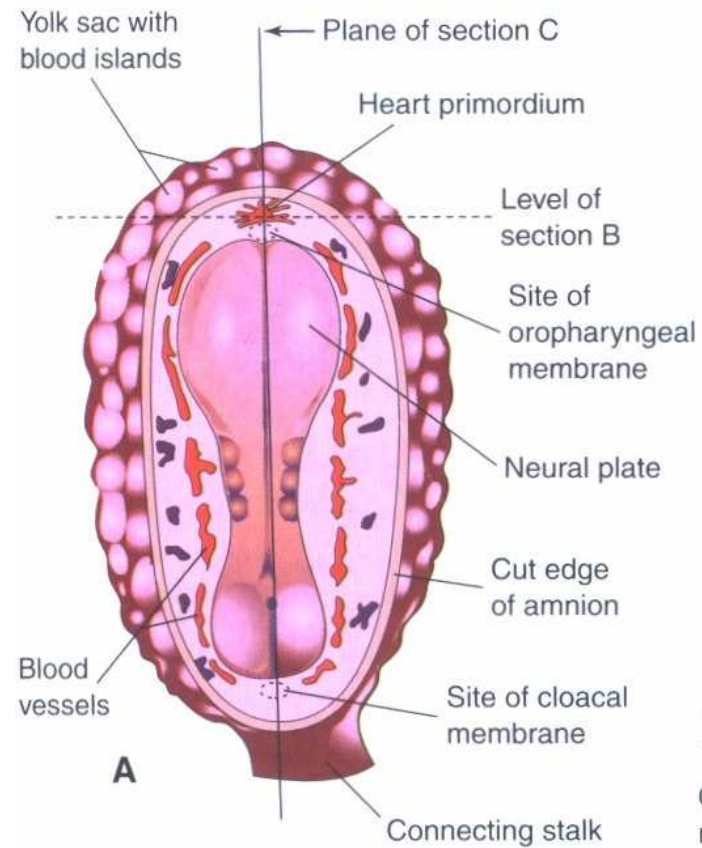
CARDIOVASCULAR DEVELOPMENT

- **Cardiovascular system is composed of:**
 - **Cells (red and white).**
 - **Vessels (arteries, veins and lymphatic's).**
 - **Pump (heart).**

CARDIOVASCULAR DEVELOPMENT

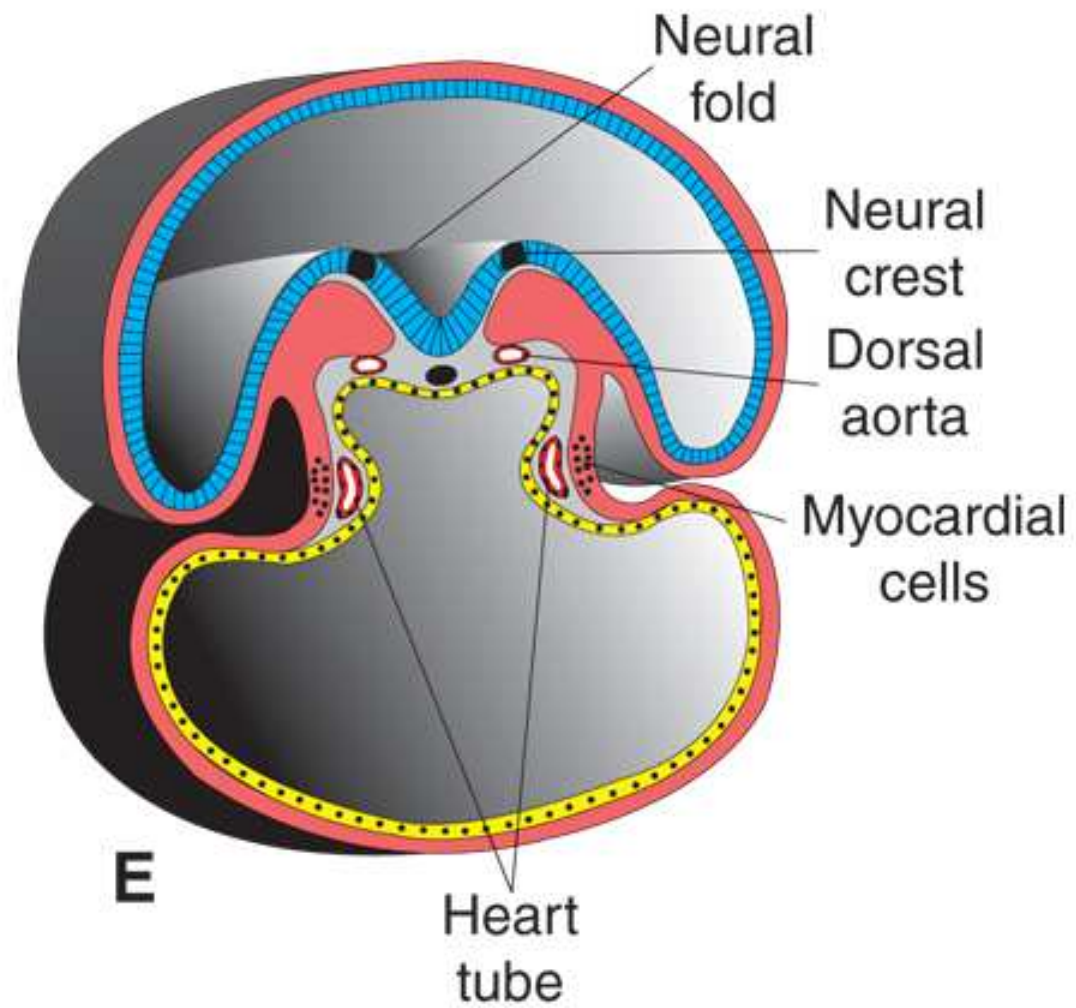
- **Heart begins to develop in middle of 3rd week because diffusion won't supply adequate nutrition.**
- **Mesenchymal cells from visceral mesoderm form angiogenic cells which give rise to blood vessels.**

ANGIOGENESIS



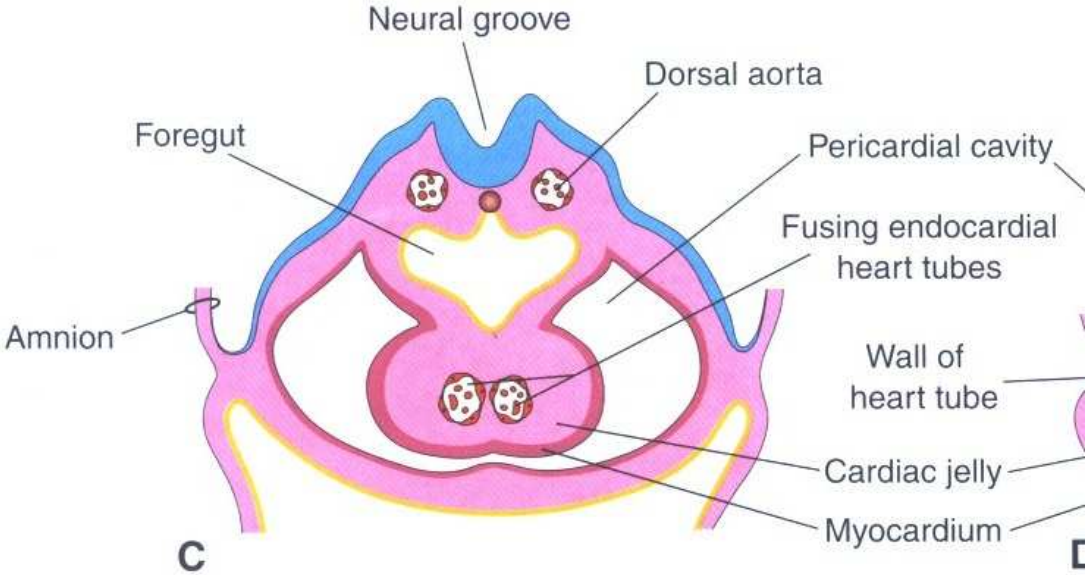
CARDIOVASCULAR DEVELOPMENT

- At the dorsal region of the embryo, 2 vascular tubes form: the dorsal aortae.
- At the ventral region of the embryo, 2 vascular tubes form: the heart tubes.
- The 2 heart tubes fuse together into a single heart tube and it occupies a pericardial cavity.

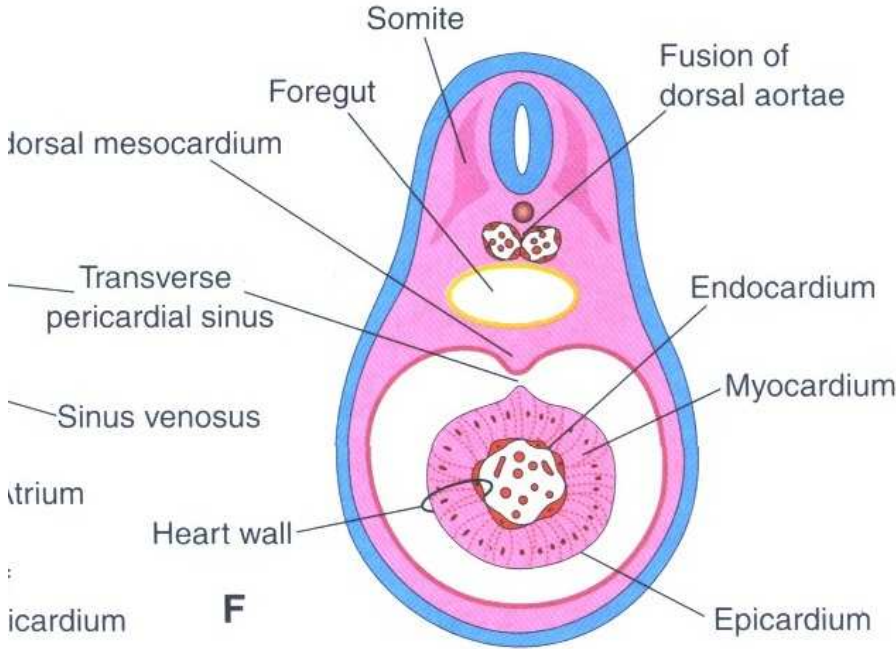


5-1E Heart development: Heart tube

FUSION OF HEART TUBES

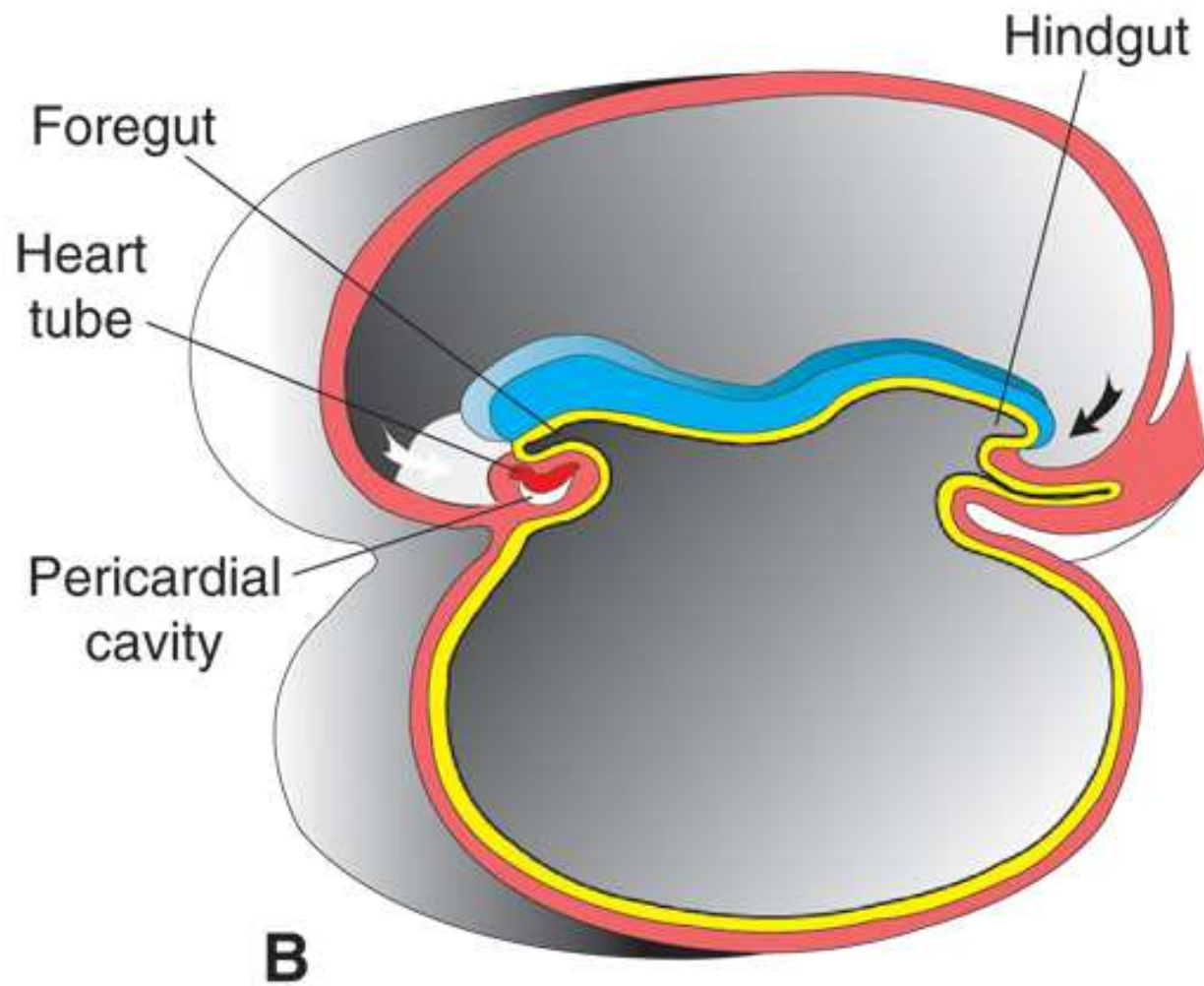


FORMATION OF HEART WALL

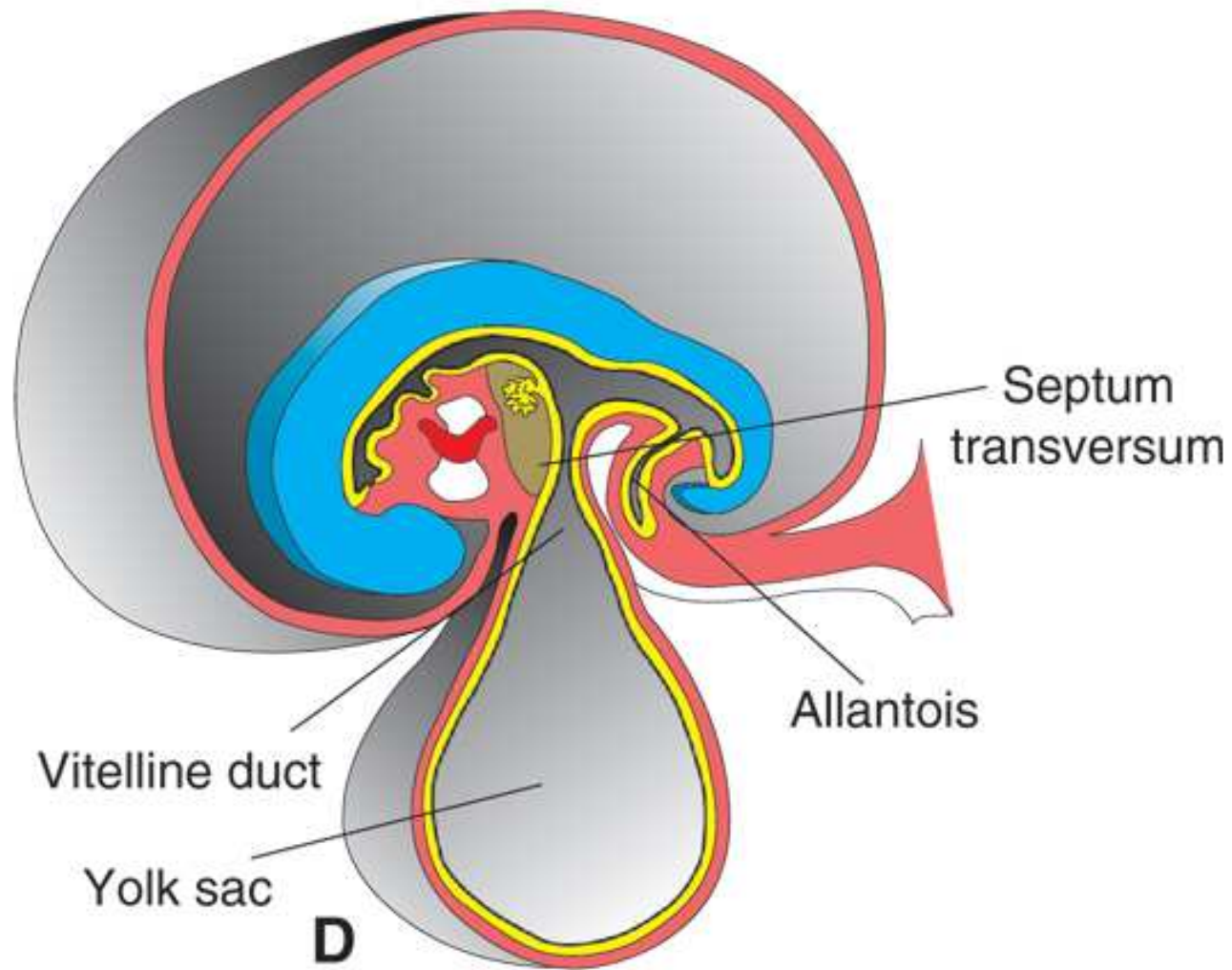


CARDIOVASCULAR DEVELOPMENT

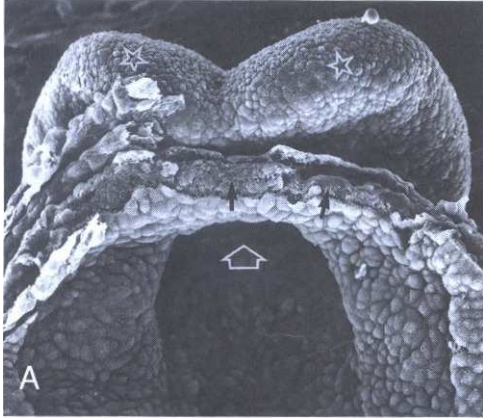
- Rapid brain growth moves the heart to a ventral and caudad position.
- Because of space restriction, and rapid rate of heart tube growth, the tube folds on itself.
- Folding results in base of heart being cephalad and apex being caudad.
- The septum transversum forms between the heart cavity and the abdominal cavity and will become the respiratory diaphragm.
- Heart is usually located on left side unless dextrocardia occurs.

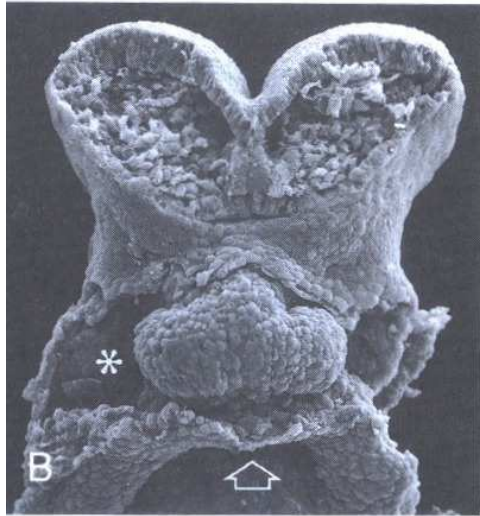


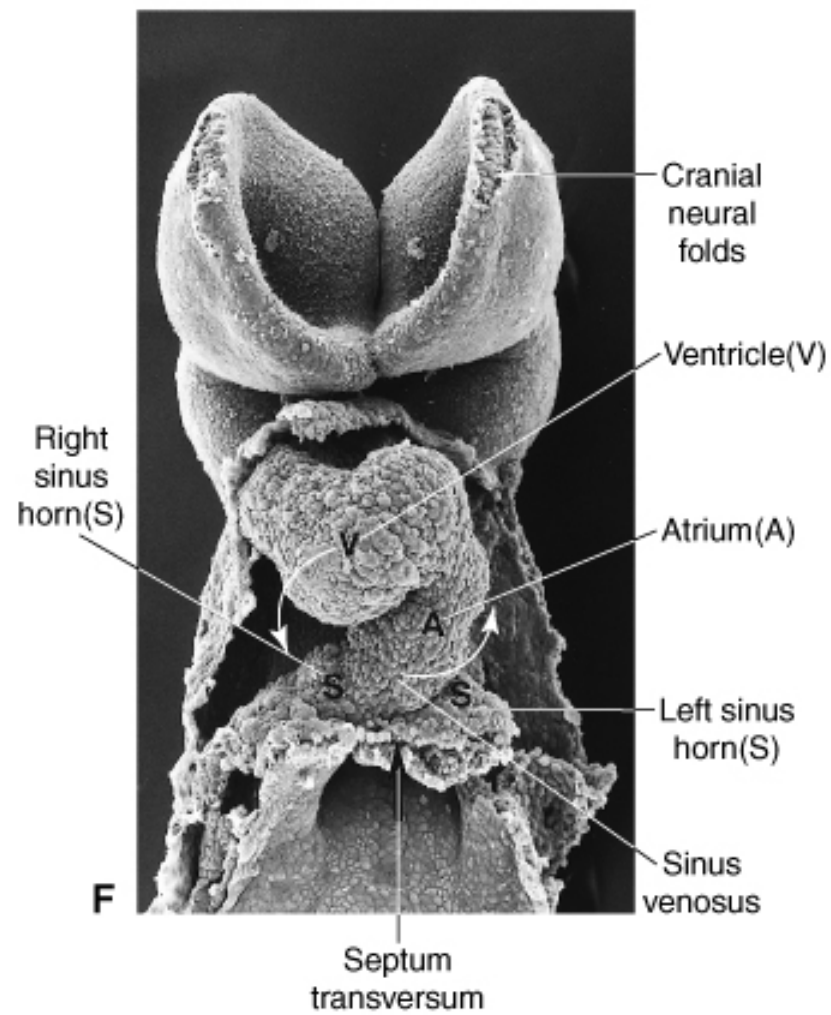
B
5-2B Heart development: Positioning to the thorax



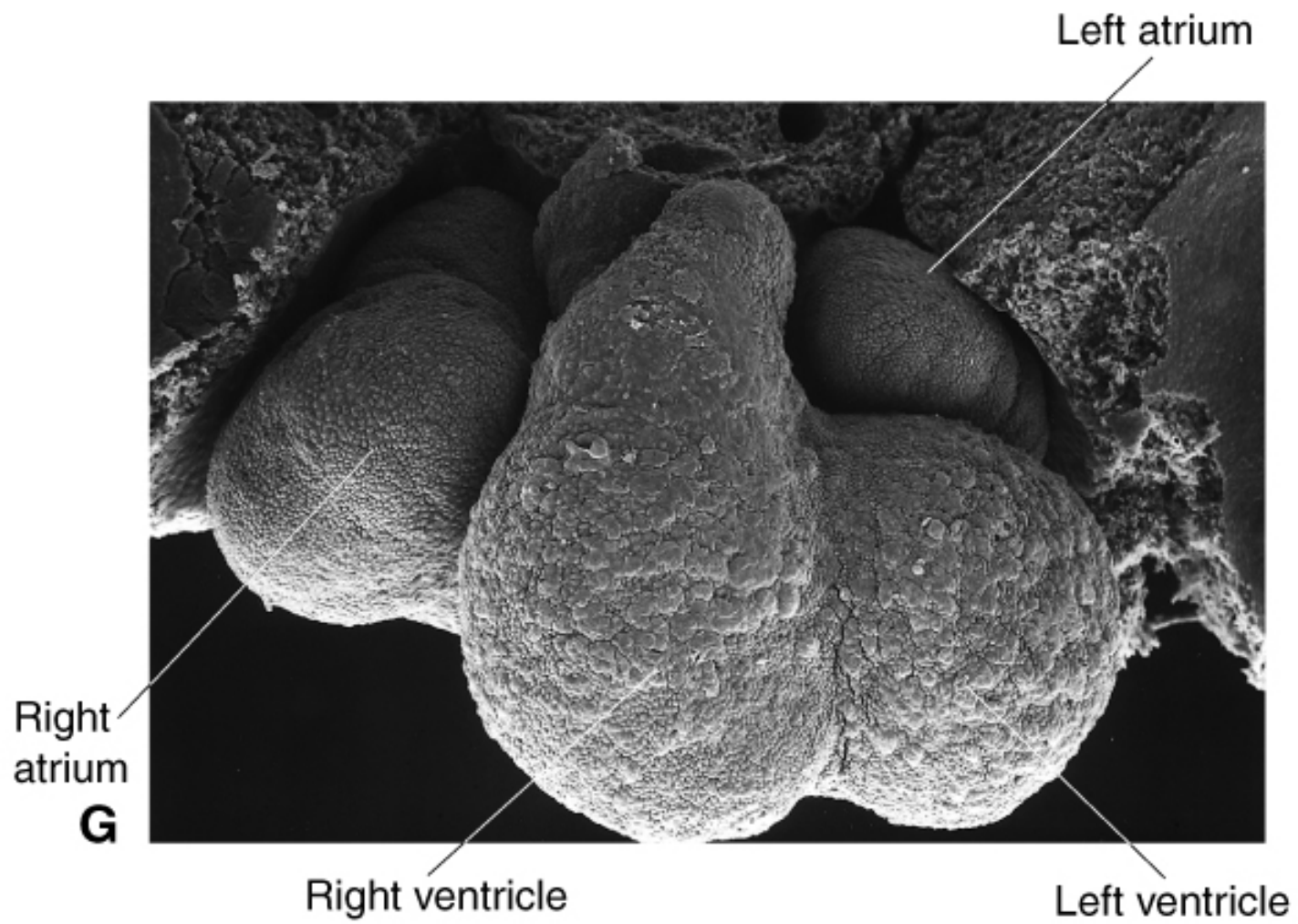
5-2D Heart development: Positioning to the thorax







5-3F Heart looping

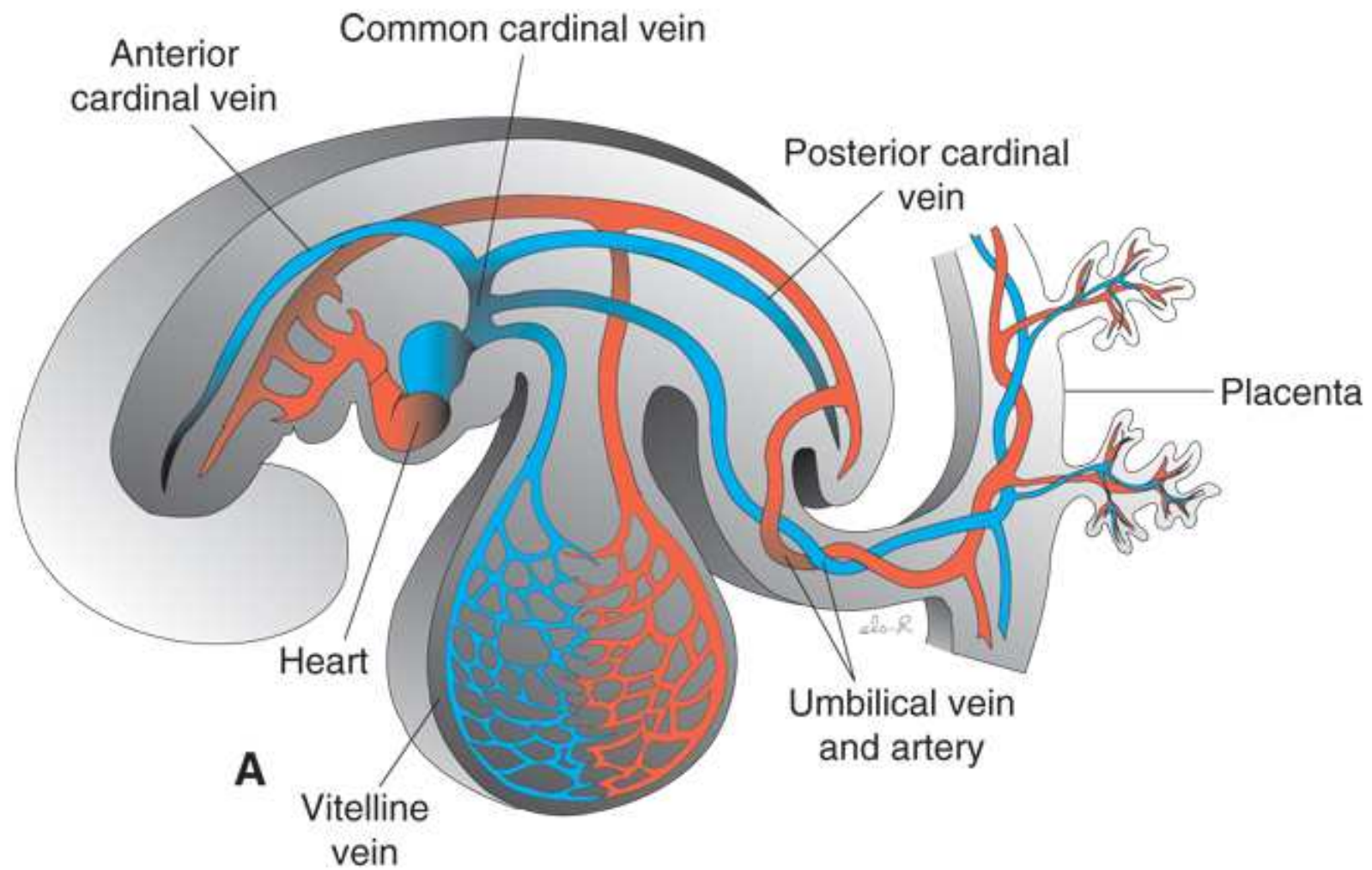


5-3G Heart looping

Copyright © 2005 Lippincott Williams & Wilkins.

CARDIOVASCULAR DEVELOPMENT

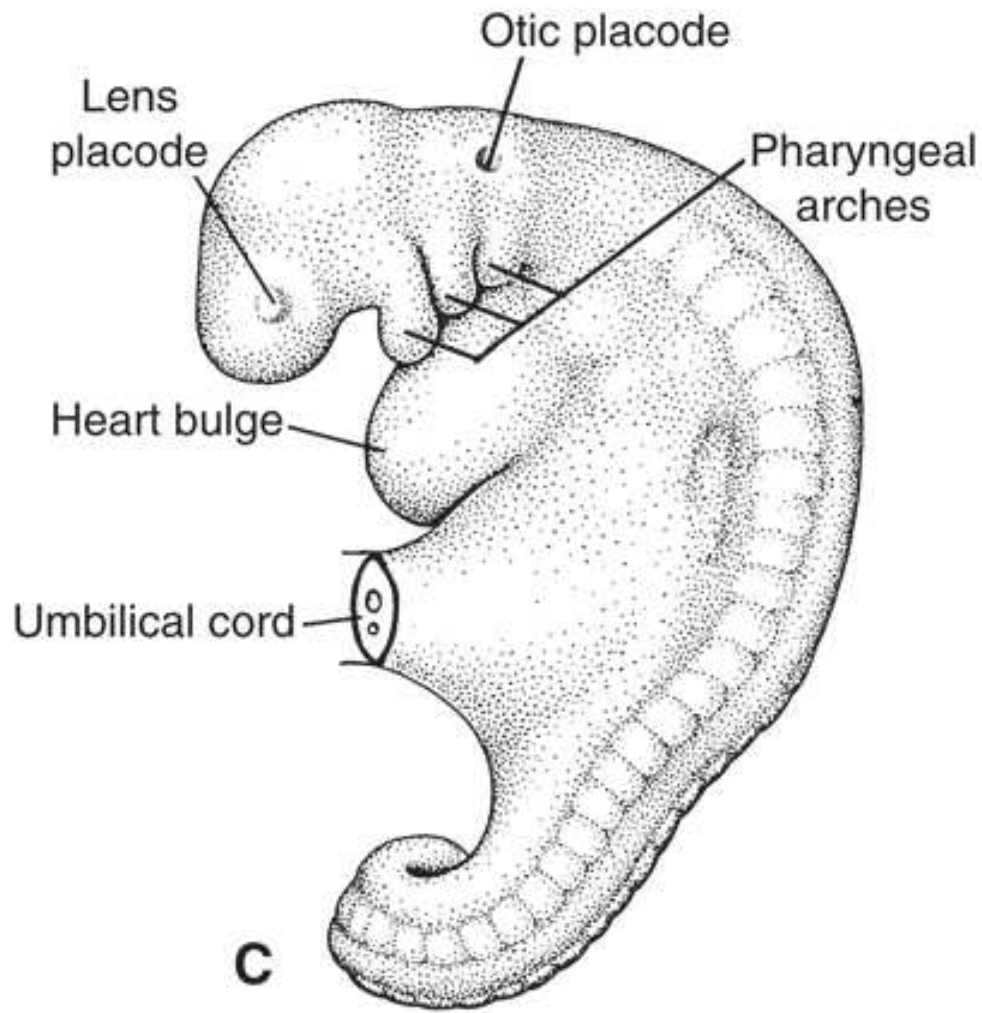
- **At 4 weeks primitive circulation is present.**
- **Aortic arches are forming arteries in the head (pharyngeal pouches).**
- **Dorsal aorta is present.**
- **Major veins are present:**
 - **1. Vitelline veins draining yolk sac.**
 - **2. Common cardinal veins drain body.**
 - **3. Umbilical veins bring blood from primitive placenta to embryo.**



5-13A Venous development

CARDIOVASCULAR DEVELOPMENT

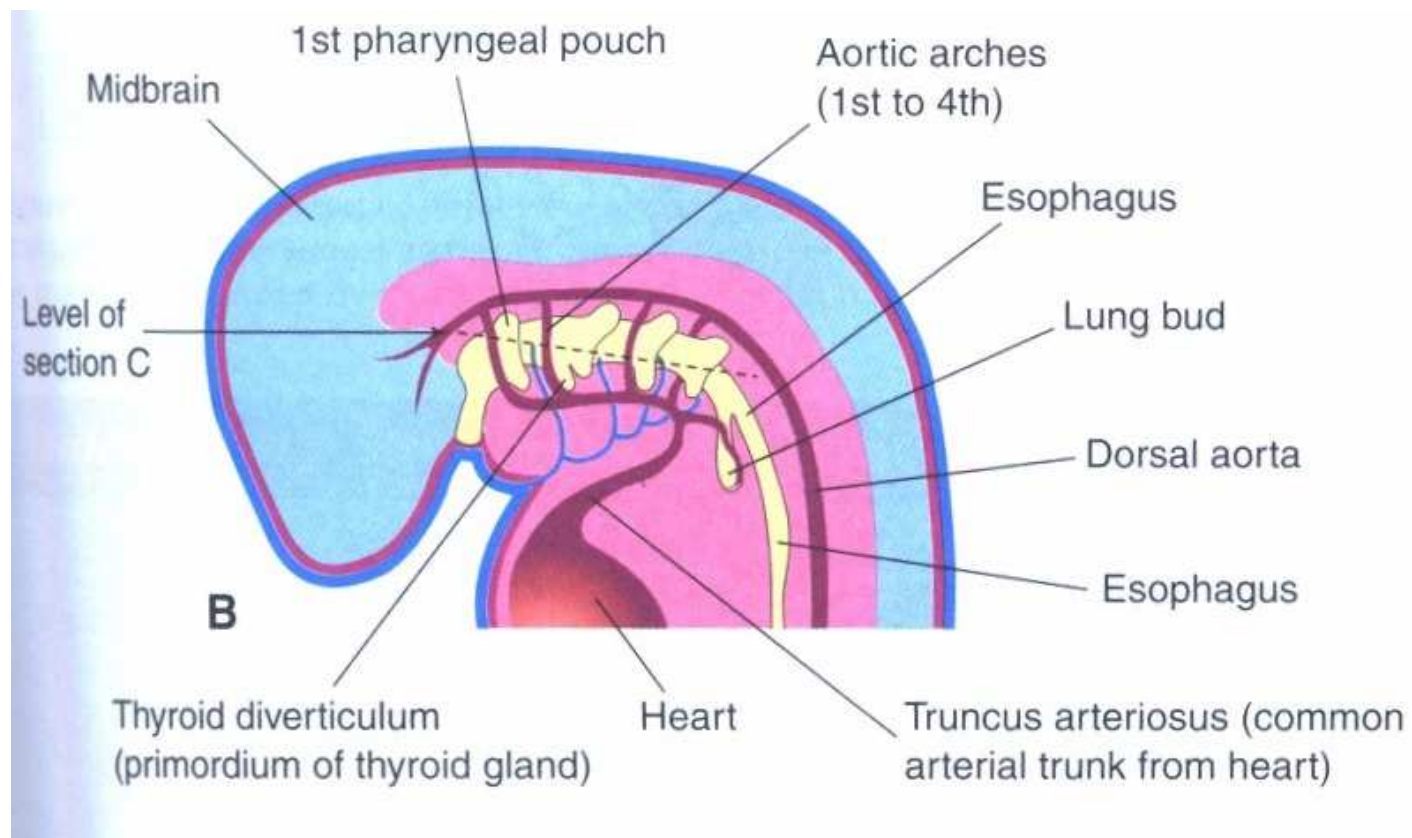
- **The pharyngeal apparatus consists of:**
 - **1. Arches**
 - **2. Clefts**
 - **3. Pouches**
 - **The pharyngeal apparatus forms structures in head and neck and each arch has a nerve artery and vein.**
 - **Six aortic arches are present in the human embryo.**
 - **The arches arise ventrally from the truncus arteriosus (aortic sac) and join the dorsal aorta.**
 - **Arches 3, 4 and 6 persist in humans to become major arteries in the head and neck.**
 -



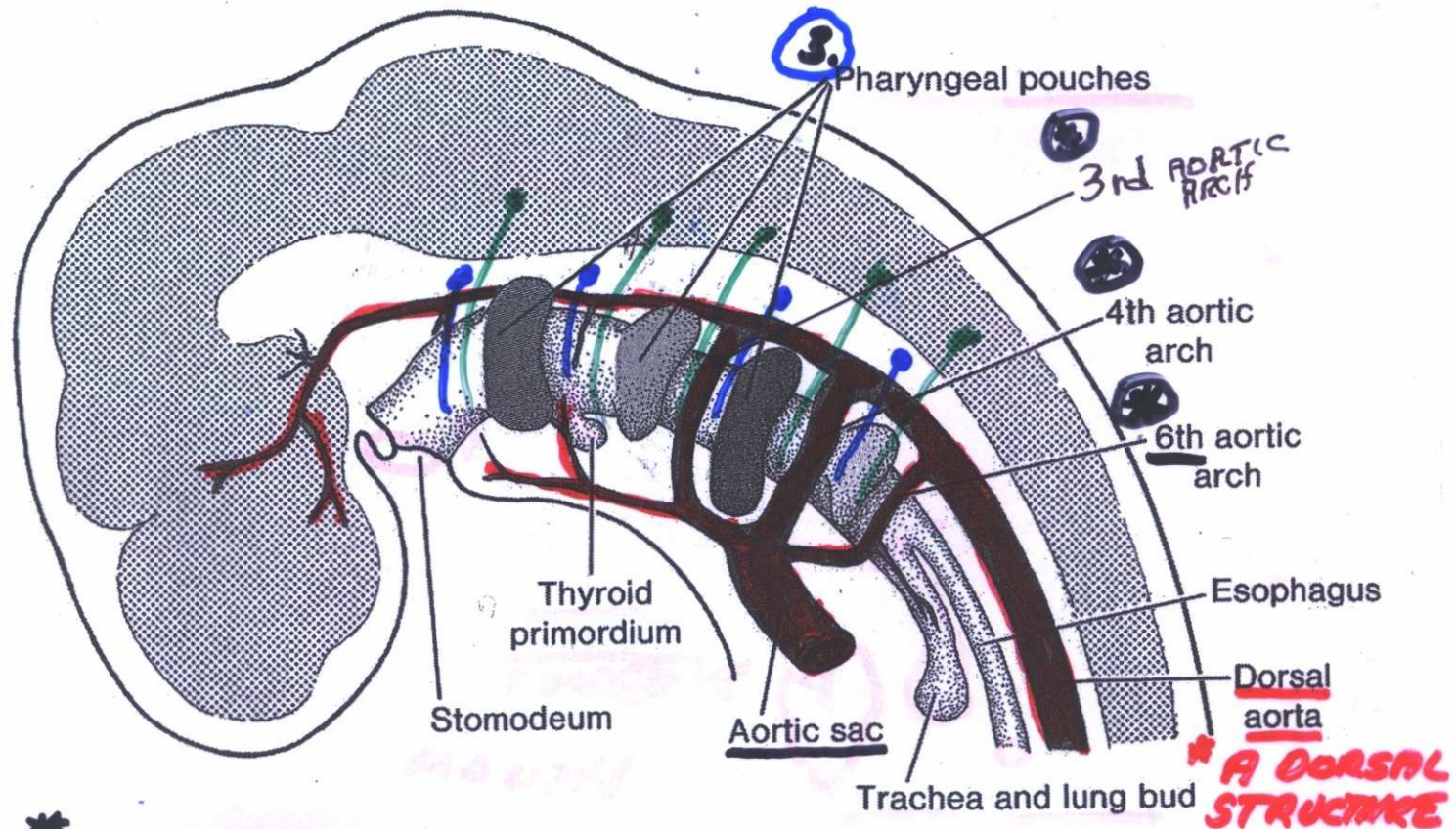
5-10C Aortic arch development

Copyright © 2005 Lippincott Williams & Wilkins.

PHARYNGEAL ARCHES CLEFTS AND POUCHES

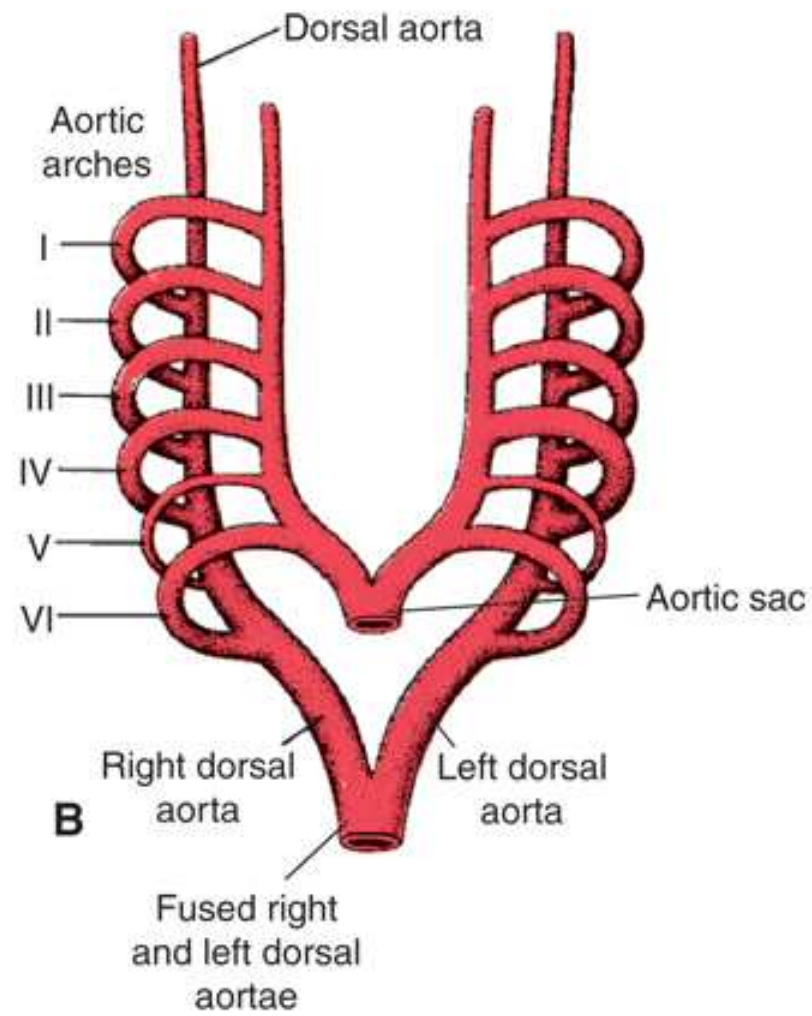


PERSISTING ARCHES 3,4 AND 6.

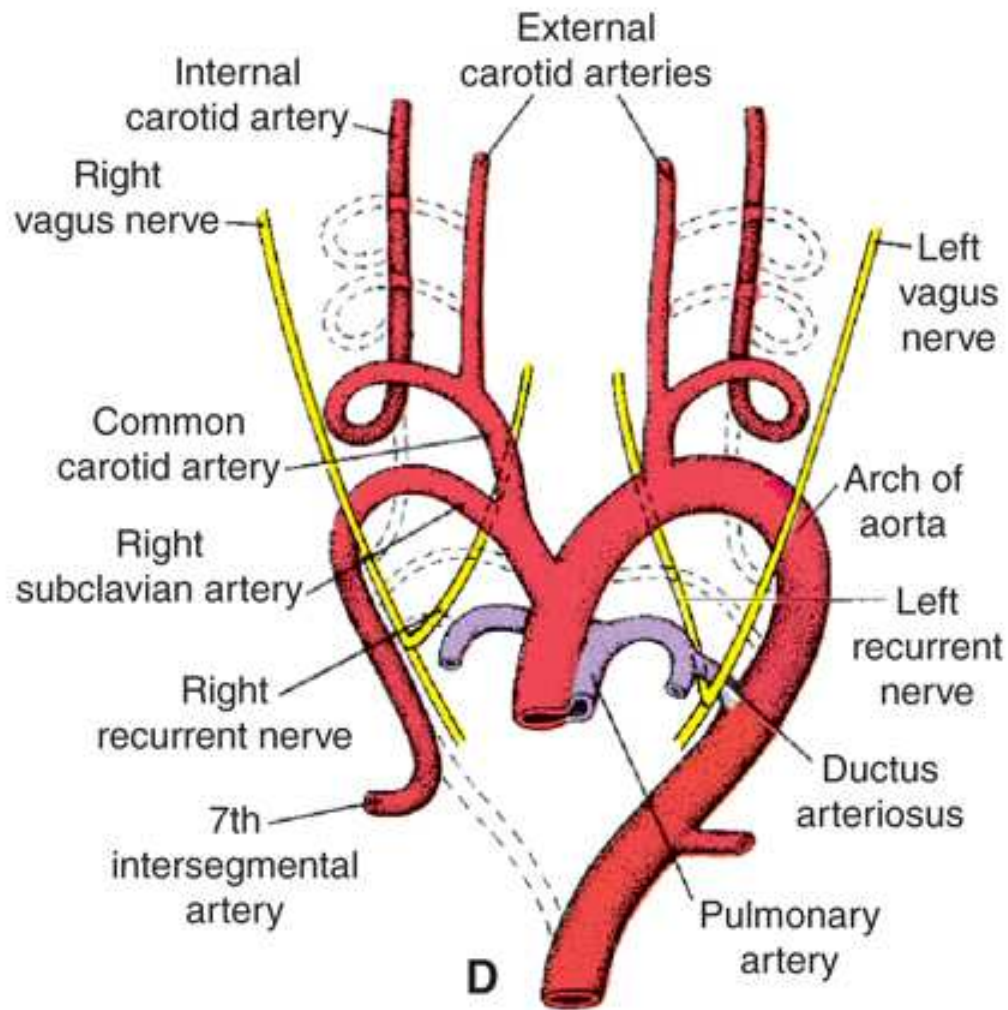


CARDIOVASCULAR DEVELOPMENT

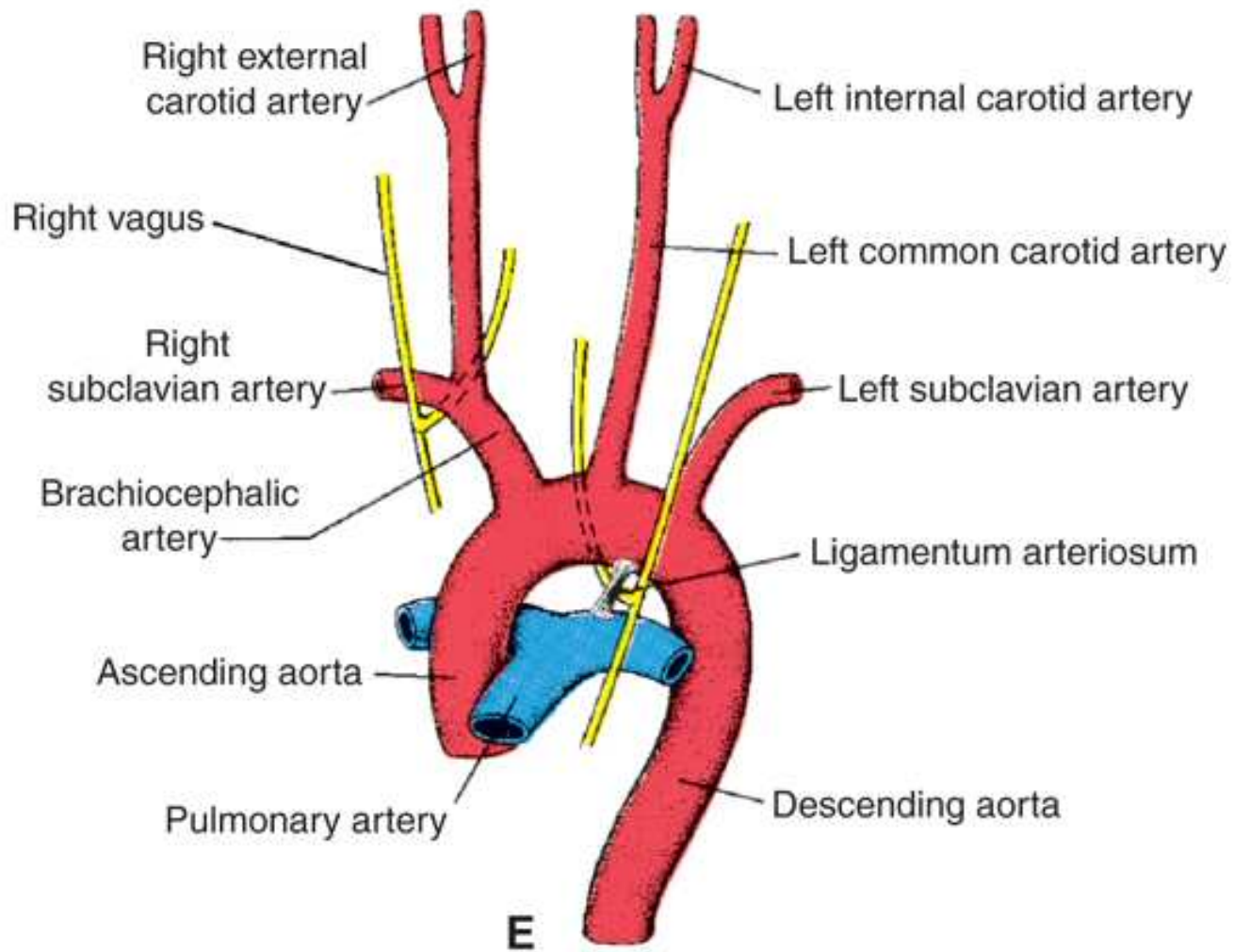
- **Fate of the pharyngeal arches:**
 - **#3 arch gives rise to common carotid aa.**
 - **#4 arch gives rise to aortic arch and right subclavian artery.**
 - **#6 arch gives rise to pulmonary artery and ductus arteriosus.**
 - **#'s 1,2 and 5 arches are obliterated and disappear.**



5-10B Aortic arch development



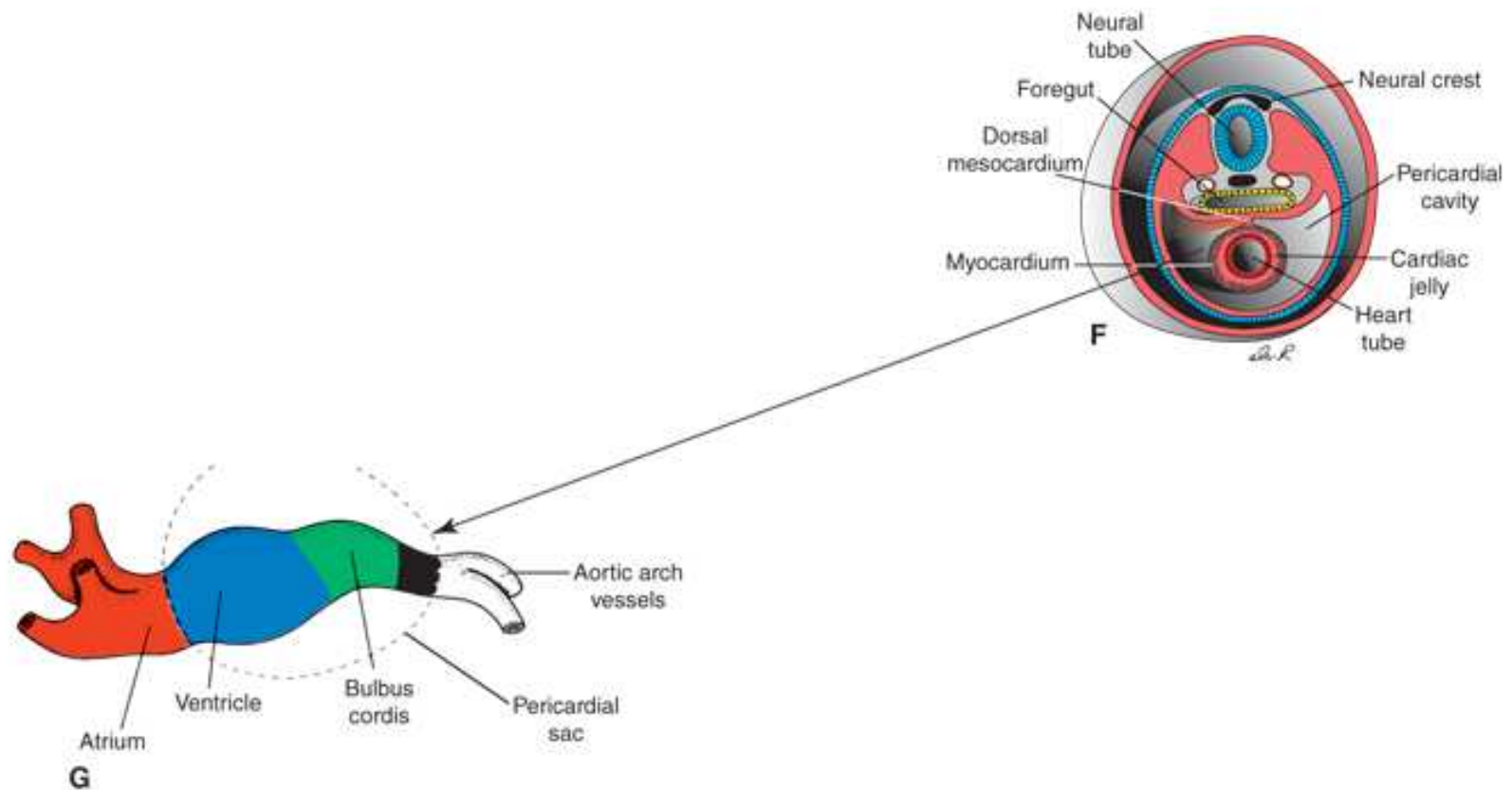
5-10D Aortic arch development



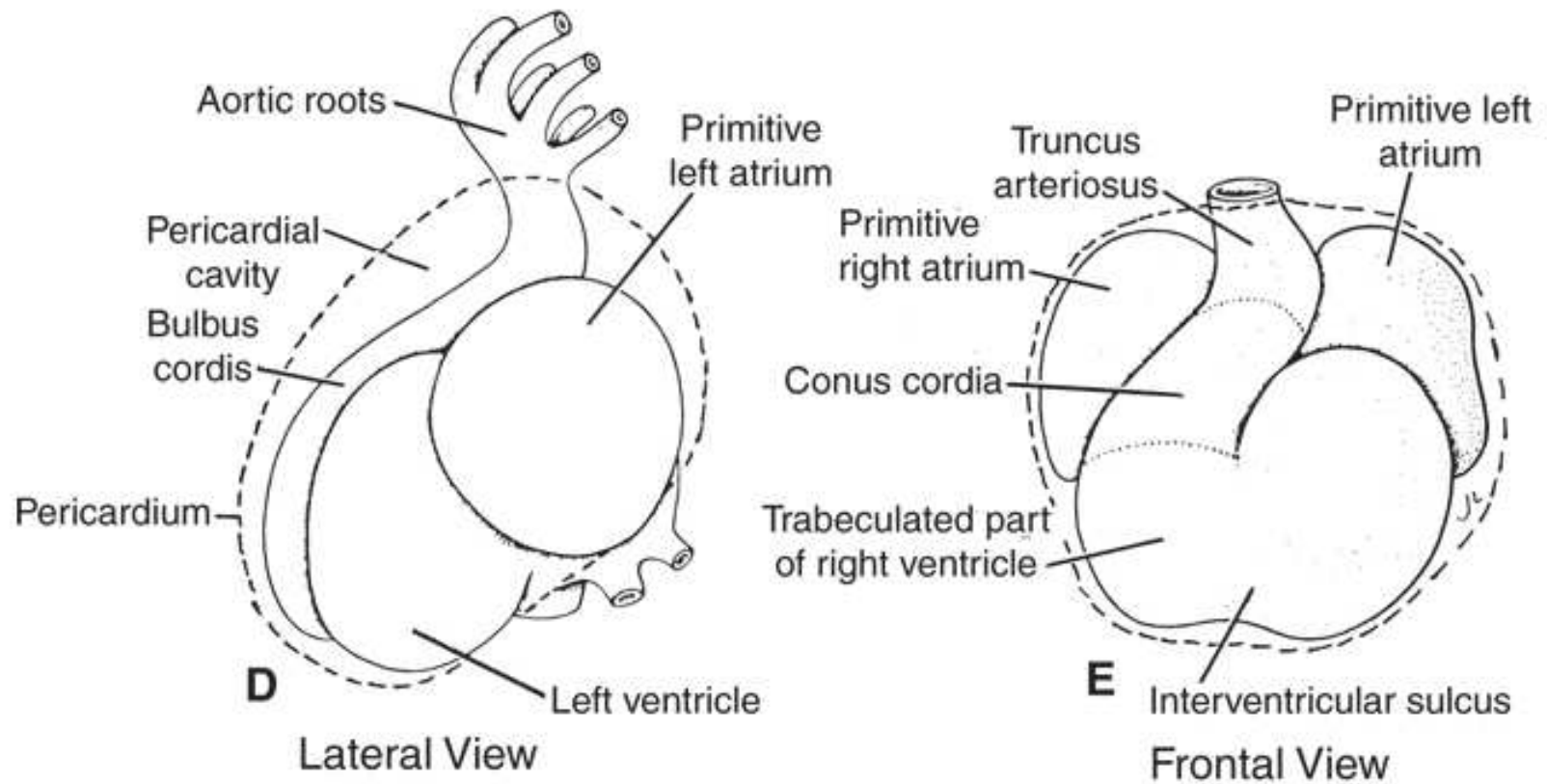
5-10E Aortic arch development

DIVIDING HEART INTO RIGHT AND LEFT ATRIA (SEPTATION).

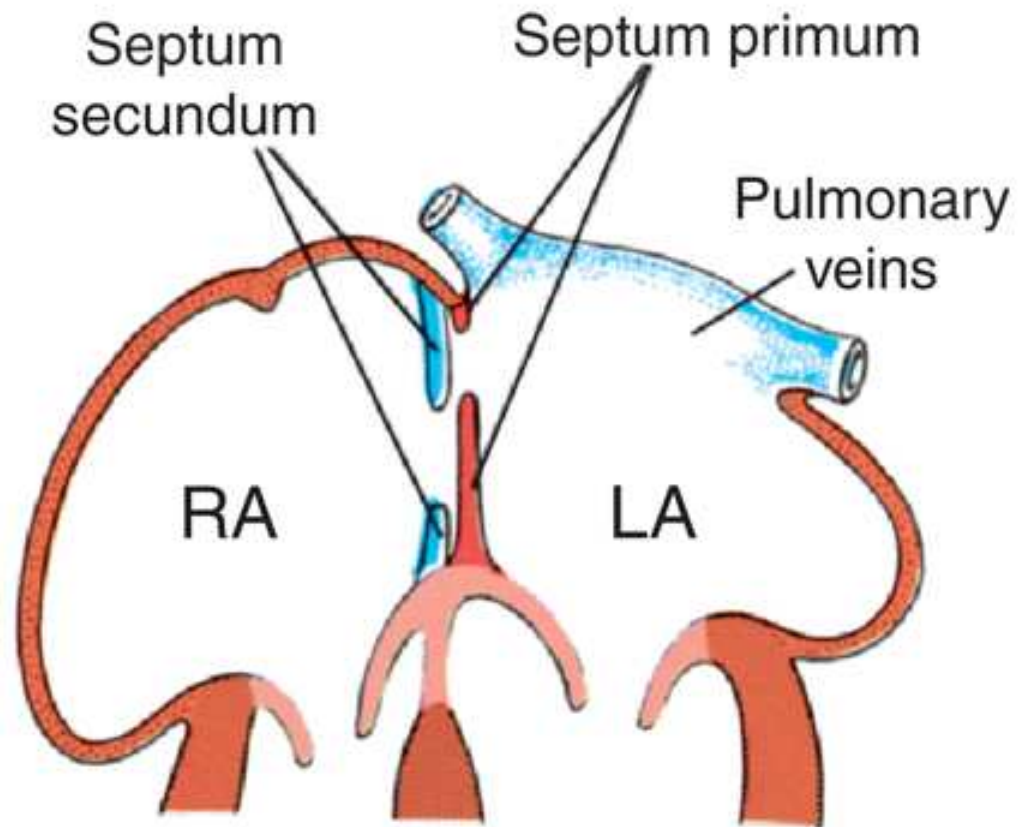
- **Right and Left atria are separated by primary and secondary embryonic walls (septa).**
- **A prenatal “valve” is composed of the lower portion of primary septa and upper portion of the secondary septa.**
- **Valve is named “foramen ovale” which closes at birth and becomes the “fossa ovale”.**
- **Foramen ovale allows blood to “by-pass” fetal lungs.**



5-1F and G Heart development: Heart tube and aortic arch vessels



5-3D and E Heart looping



A

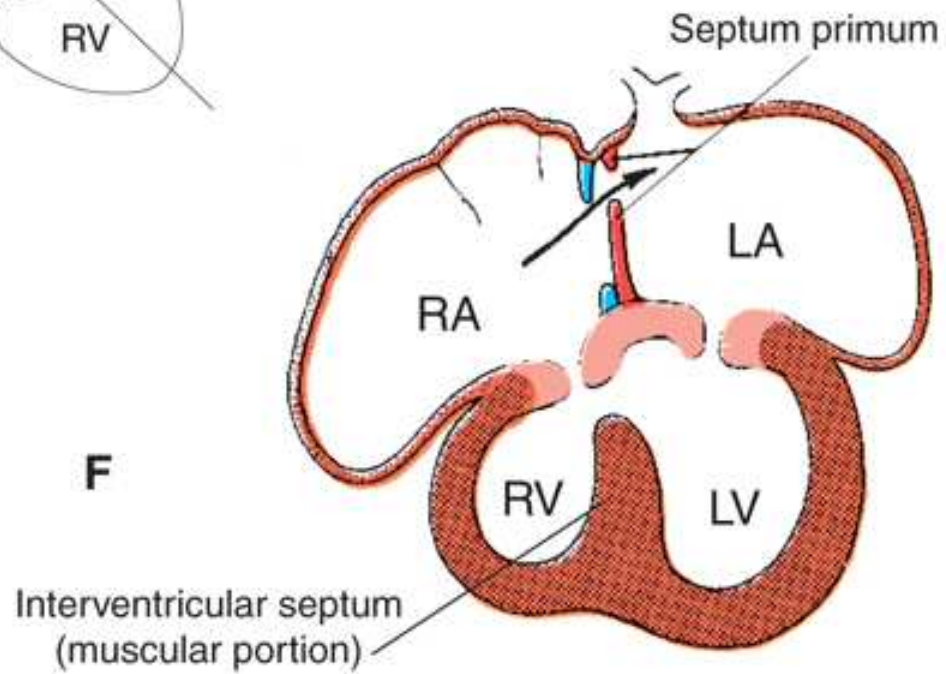
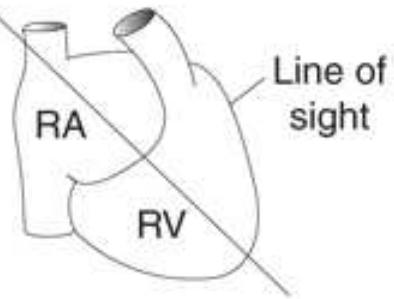
Normal septum formation

5-8A Atrial and ventricular septal defects

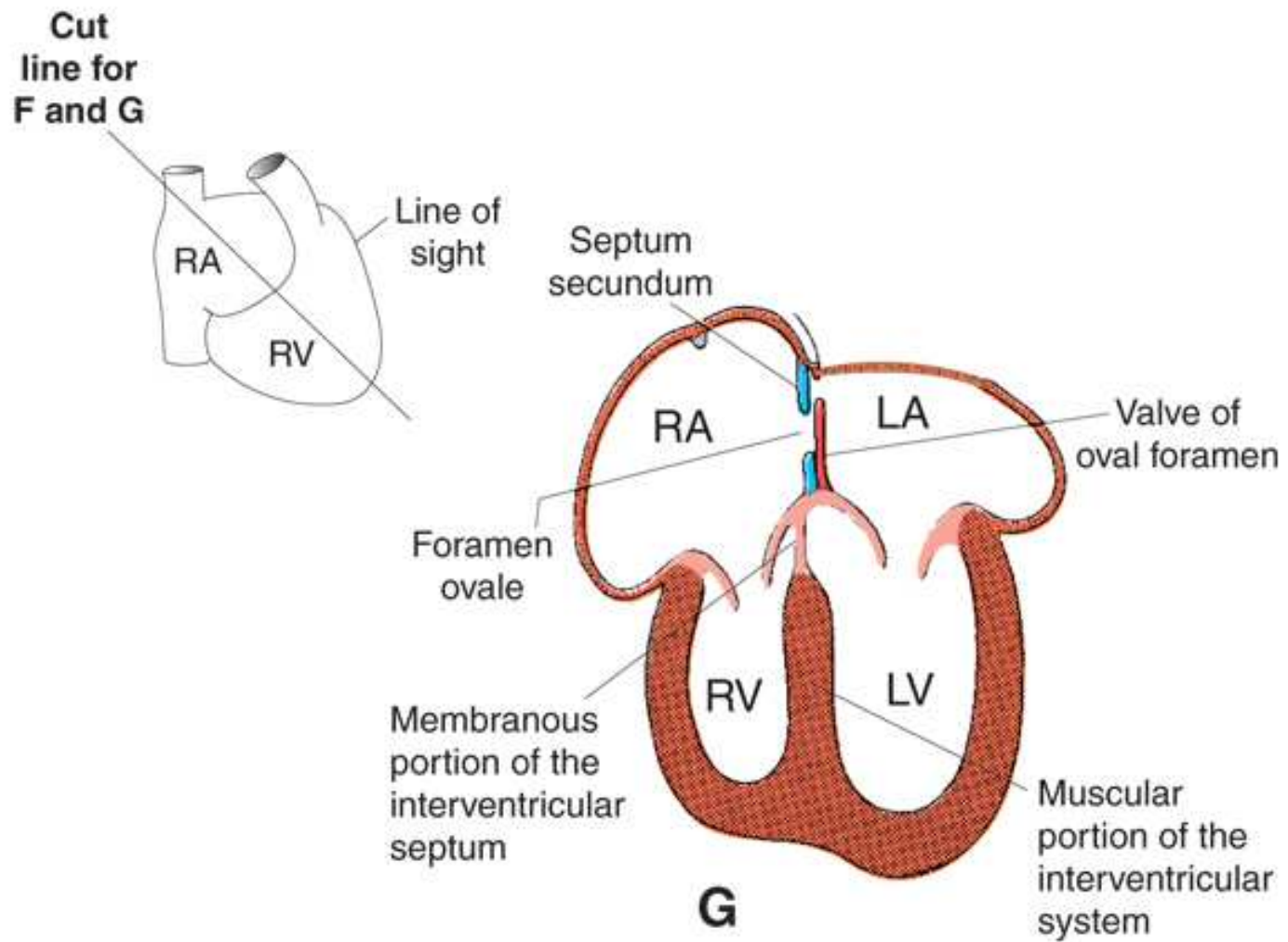
DIVIDING HEART INTO LEFT AND RIGHT VENTRICLES.

- **The ventricles are divided by septa of 2 different tissue types:**
 - **The upper intramembranous septa.**
 - **The lower intramuscular septa.**
 - **The endocardial cushion tissue plays a major role in development of septa and valves of heart.**

Cut
line for
F and G



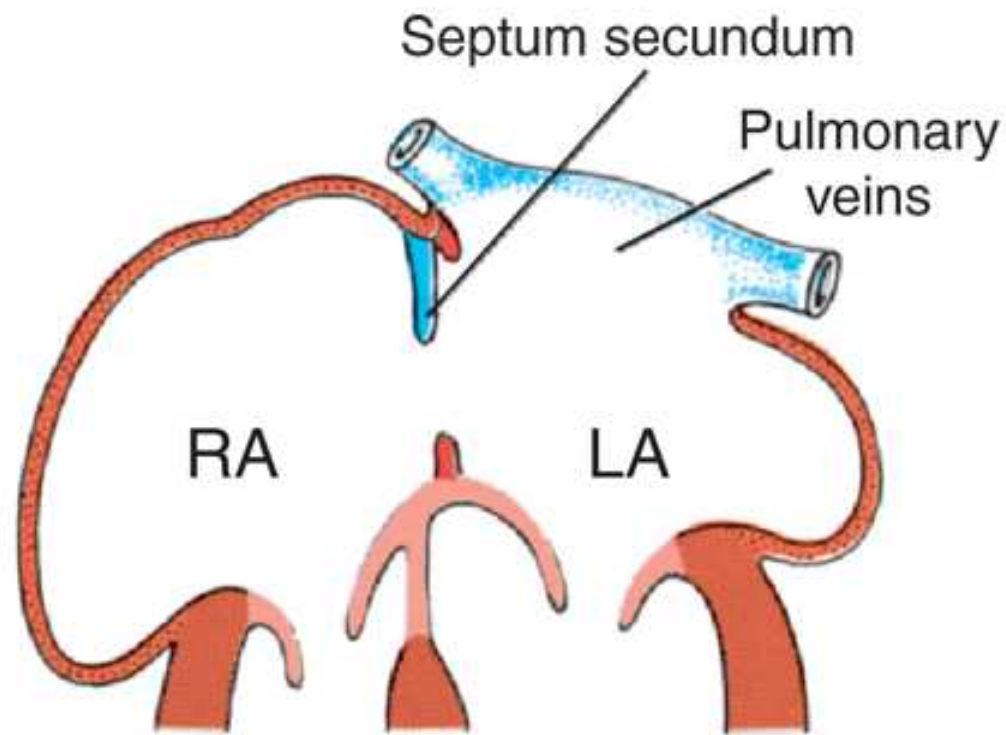
5-6F Heart septation: Atria and ventricles



5-6G Heart septation: Atria and ventricles

CARDIAC SEPTAL DEFECTS

- **Intra-atrial septal defects occur when primary and secondary atrial septa fail to form correctly.**
- **Approximately 20% of adults have “probe patent foramen ovale”.**
- **The most common congenital cardiac malformation is ventricular intramembranous septal defect.**

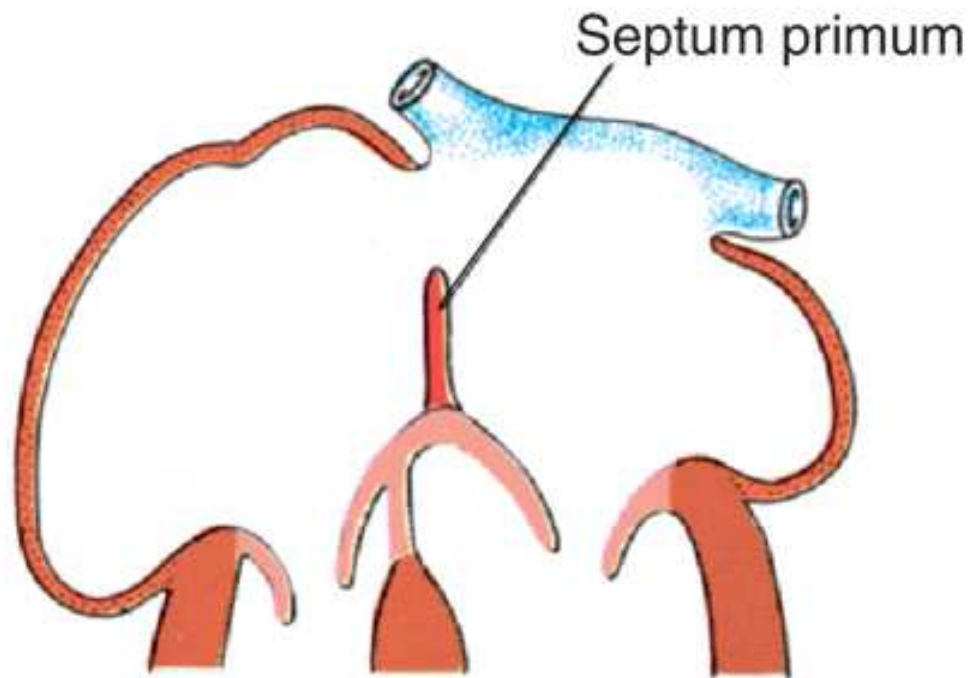


B

Excessive resorption of
septum primum

5-8B Atrial and ventricular septal defects

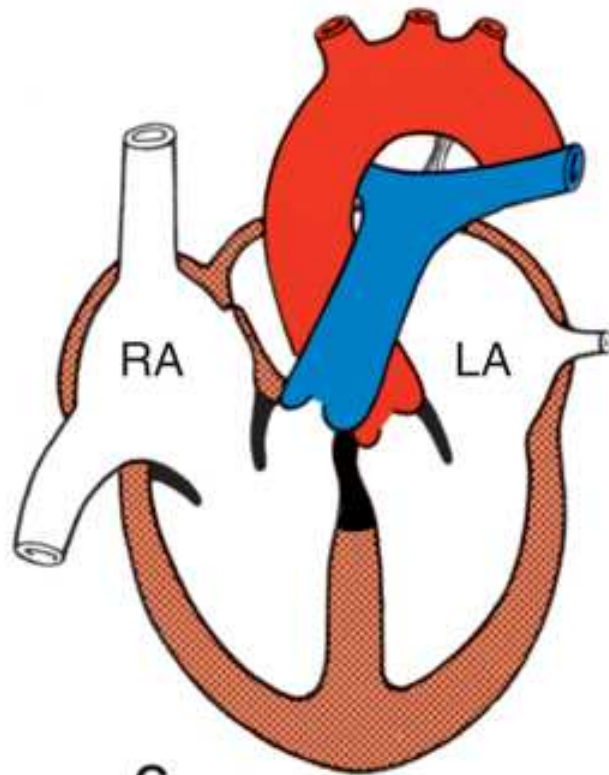
Copyright © 2005 Lippincott Williams & Wilkins.



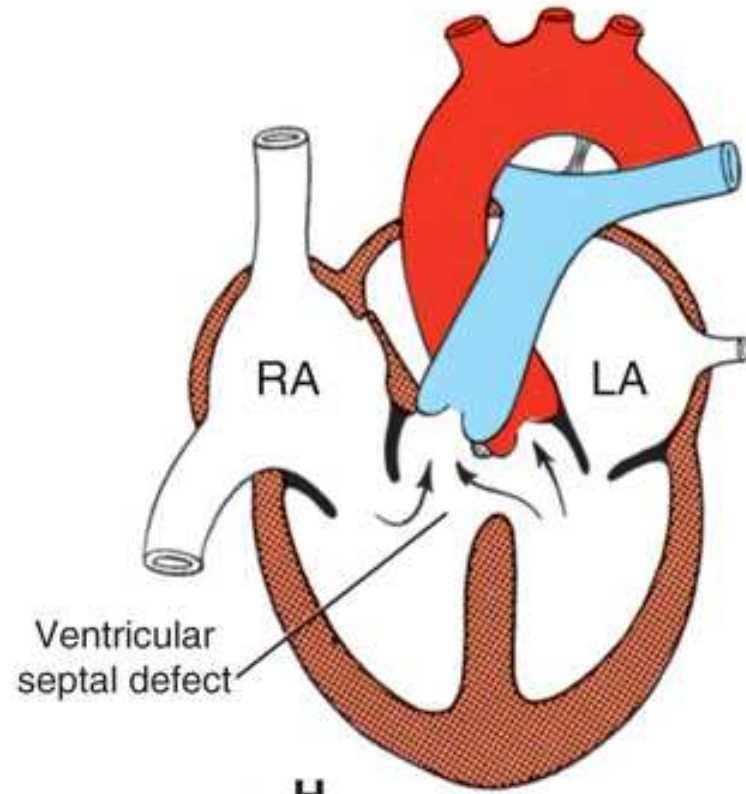
D

Absence of septum secundum

5-8D Atrial and ventricular septal defects



G Normal ventricular septum development



H Ventricular septal defect (VSD)

5-8G and H. Atrial and ventricular septal defects