Heart and Circulatory System II

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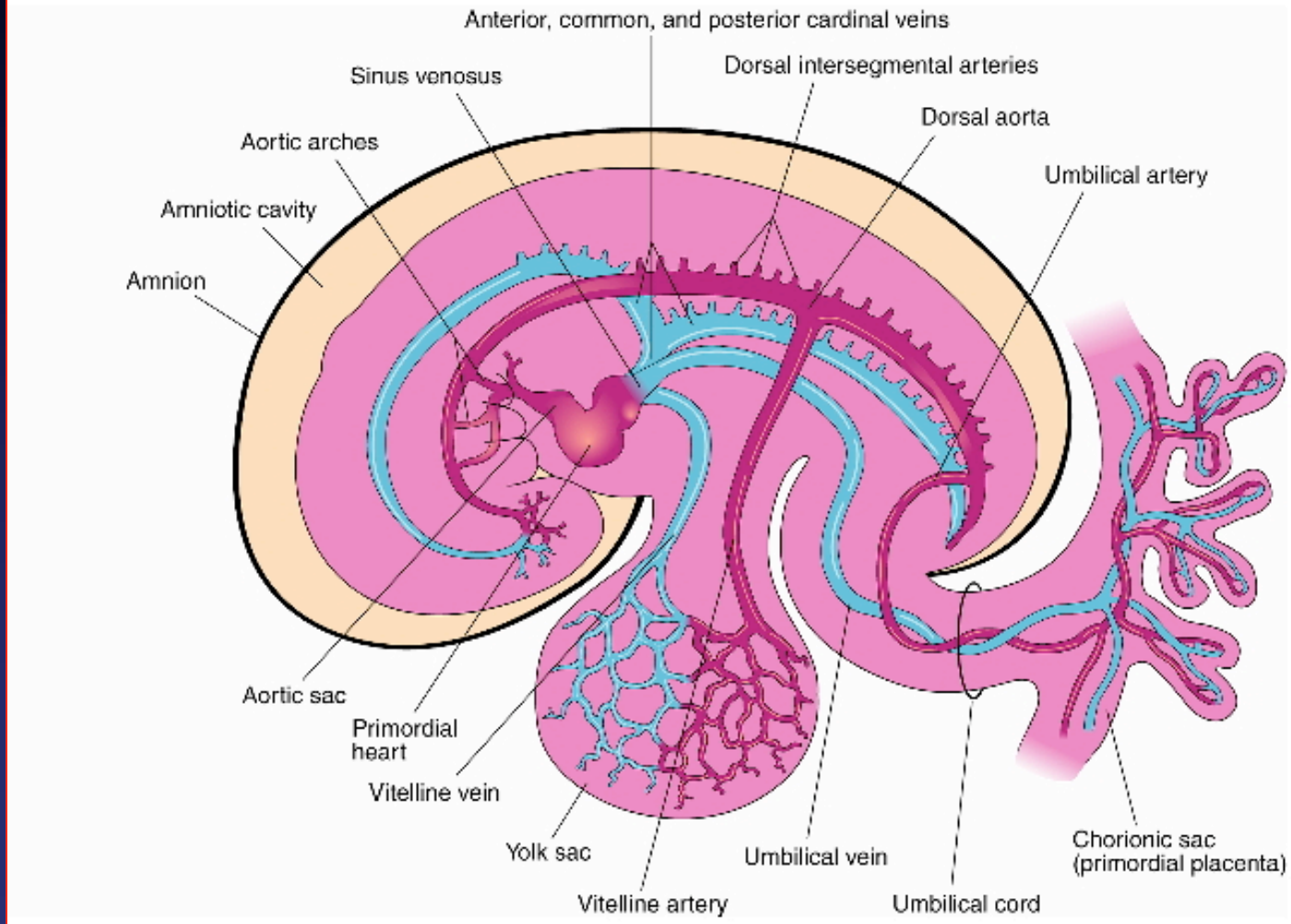
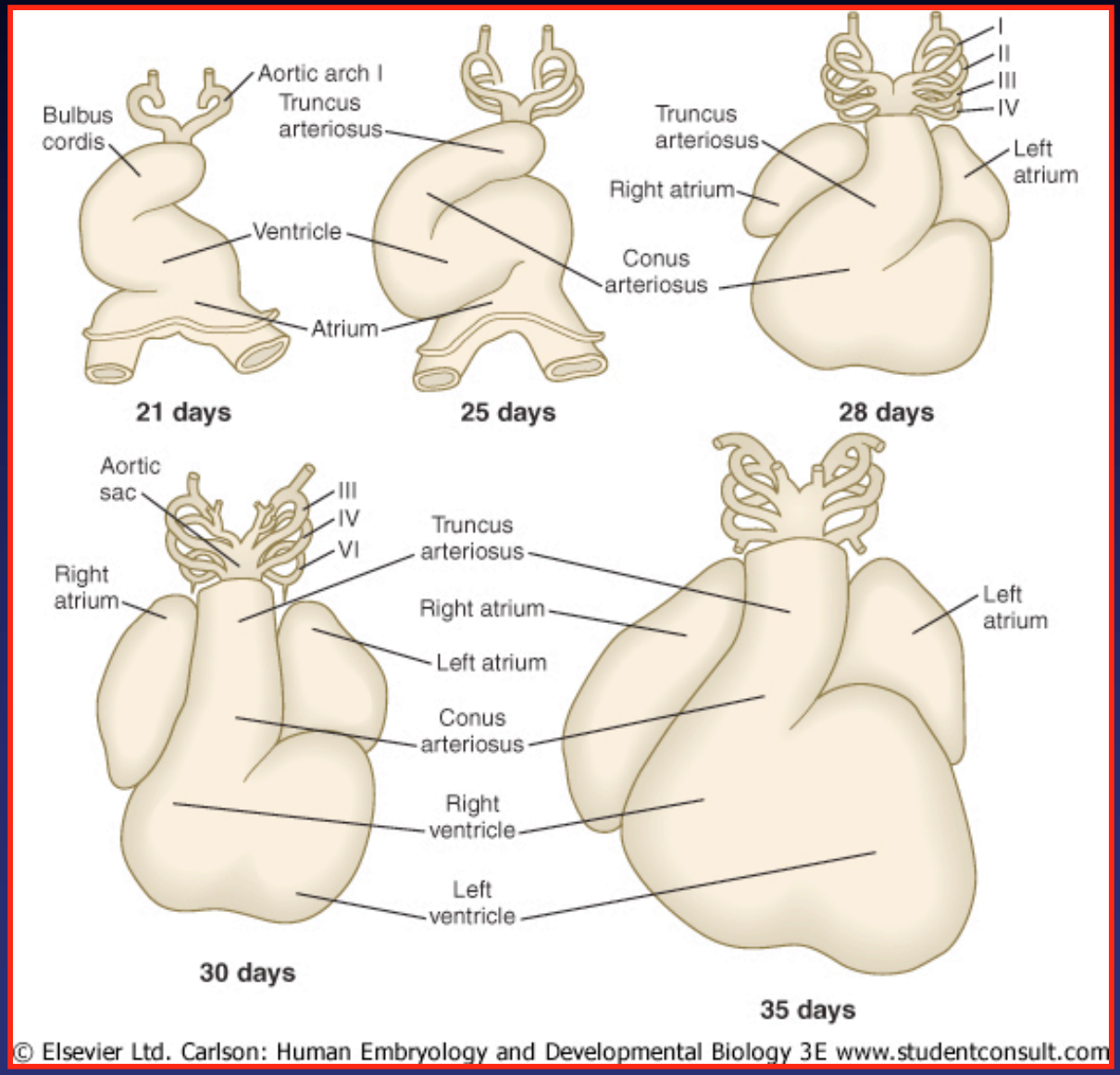
Outline

- Primitive Ventricular Septum
- Atrioventricular Canal/Endocardial Cushions
- Conotruncal Septation
  - Great Arteries
  - Semi-lunar valves
- Ventricular septation
  - Primitive Ventricular Septum
  - Endocardial Cushion
  - Conotruncal Septum
- Congenital Heart Defects

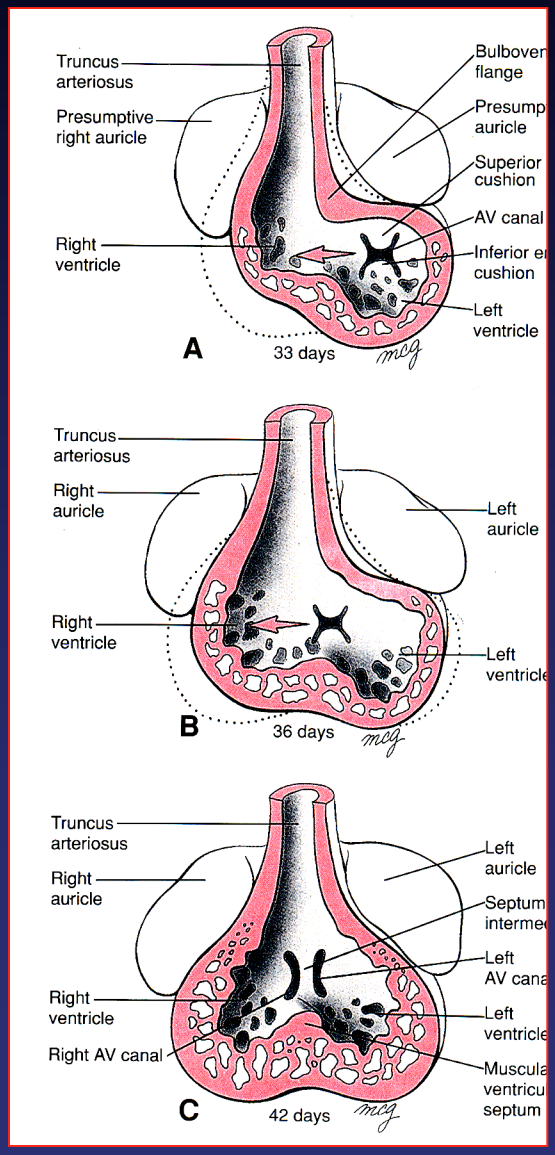
Heart Development: 26 days

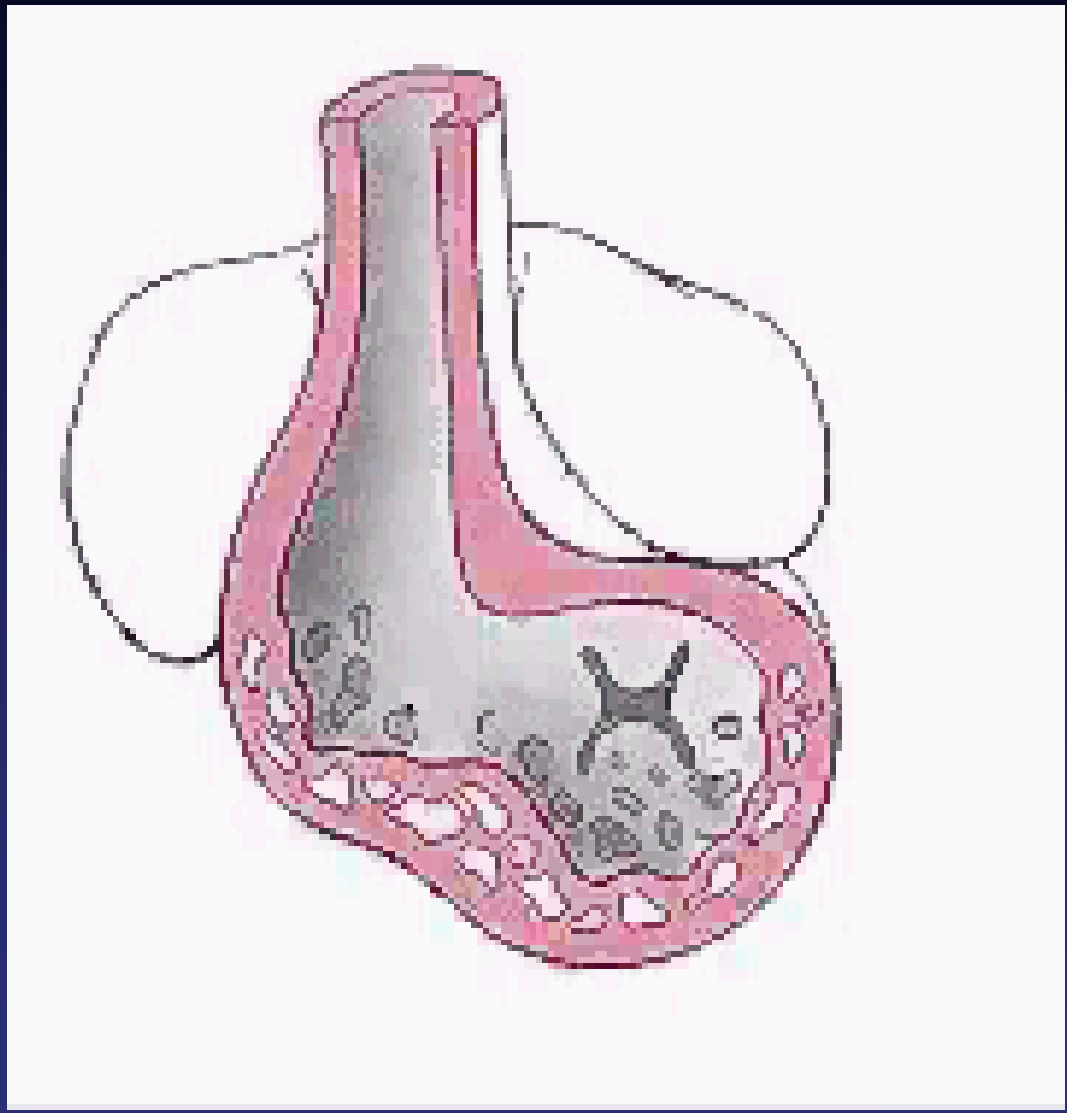


From Primitive Heart Tube to Four Chambers: External View



Formation of Primitive Ventricles





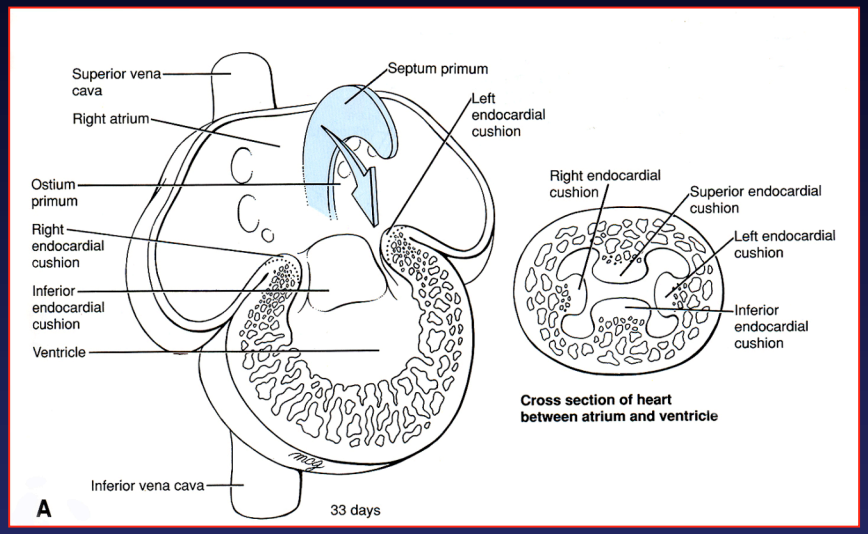
Endocardial Cushions

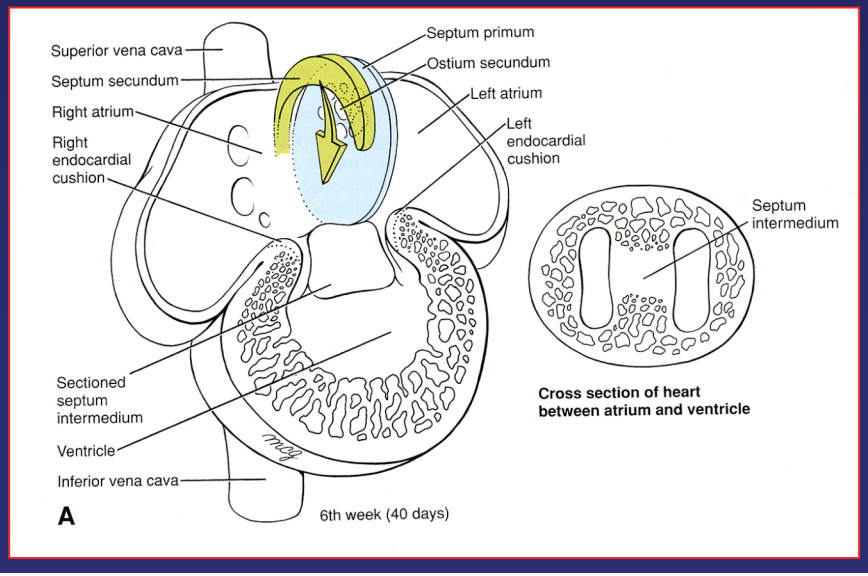
- Atrioventricular Canal: Divide between the atria and ventricles
- Endocardial Cushions: Four tissue expansions found in periphery of AV canal
  - Atrial septation
  - Atrioventricular valve formation: Mitral and Tricuspid Valves
  - Ventricular septation

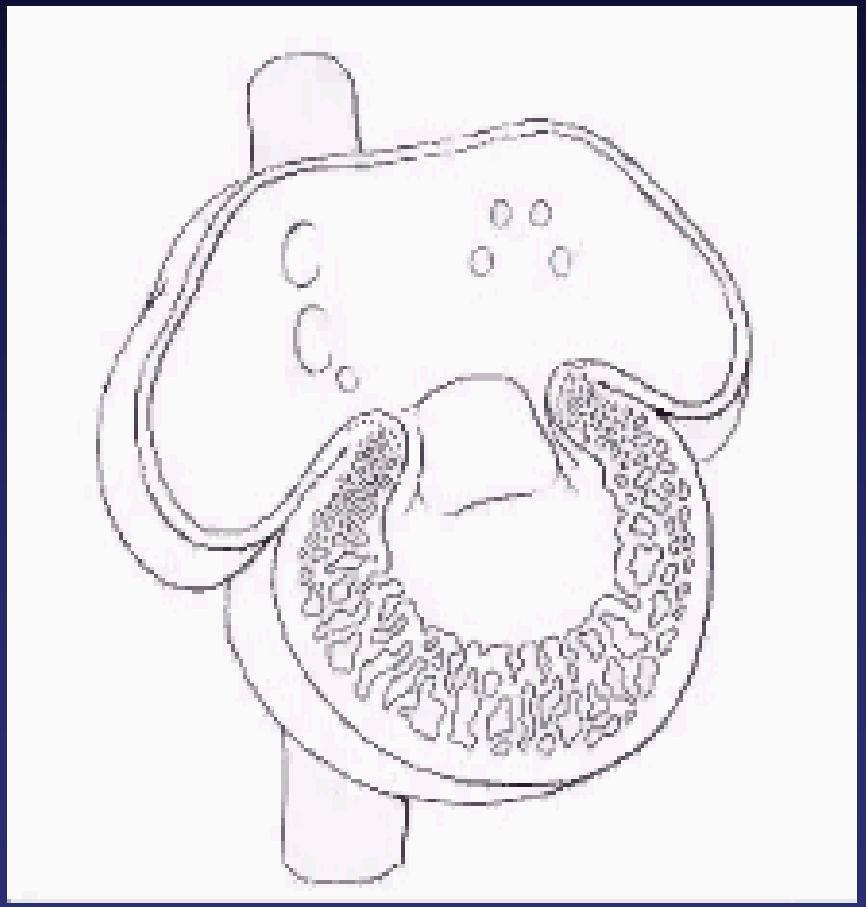
Endocardial Cushions

- **Superior-Inferior cushions**
  - Septum Intermedium
  - Inferior atrial septum
  - Posterior/superior ventricular septum
- **Right and Left Cushions**
  - Ventricular myocardium
  - Mitral valve
  - Tricuspid valve

Atrial Septation: 3 Septums
Primum, Secundum, Intermedium

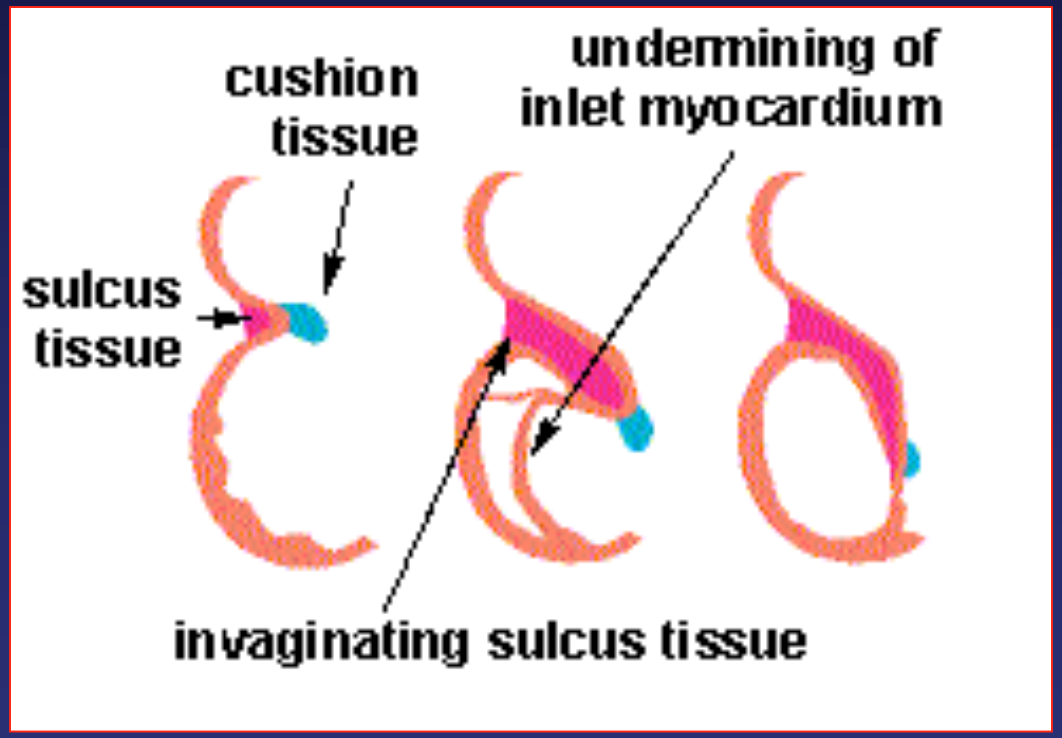


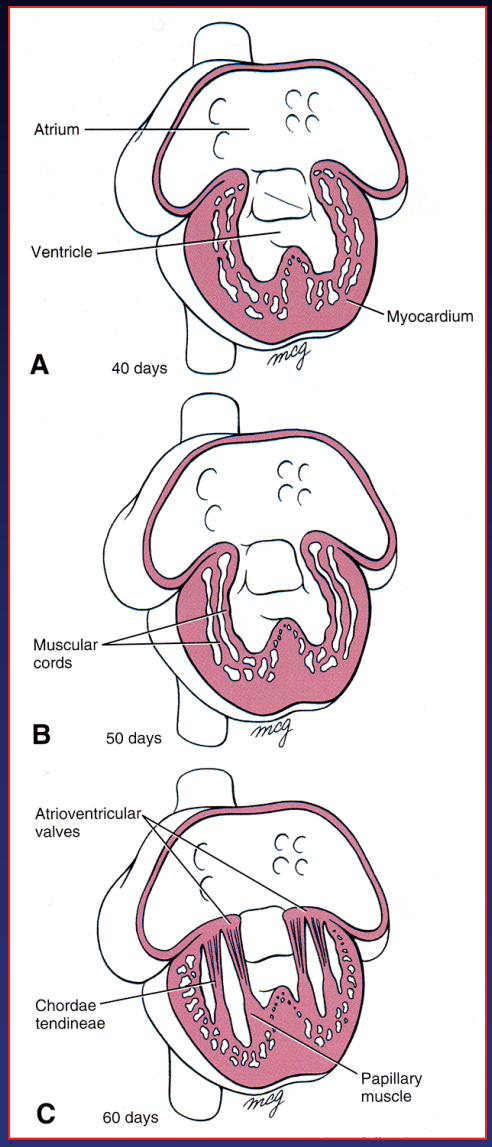




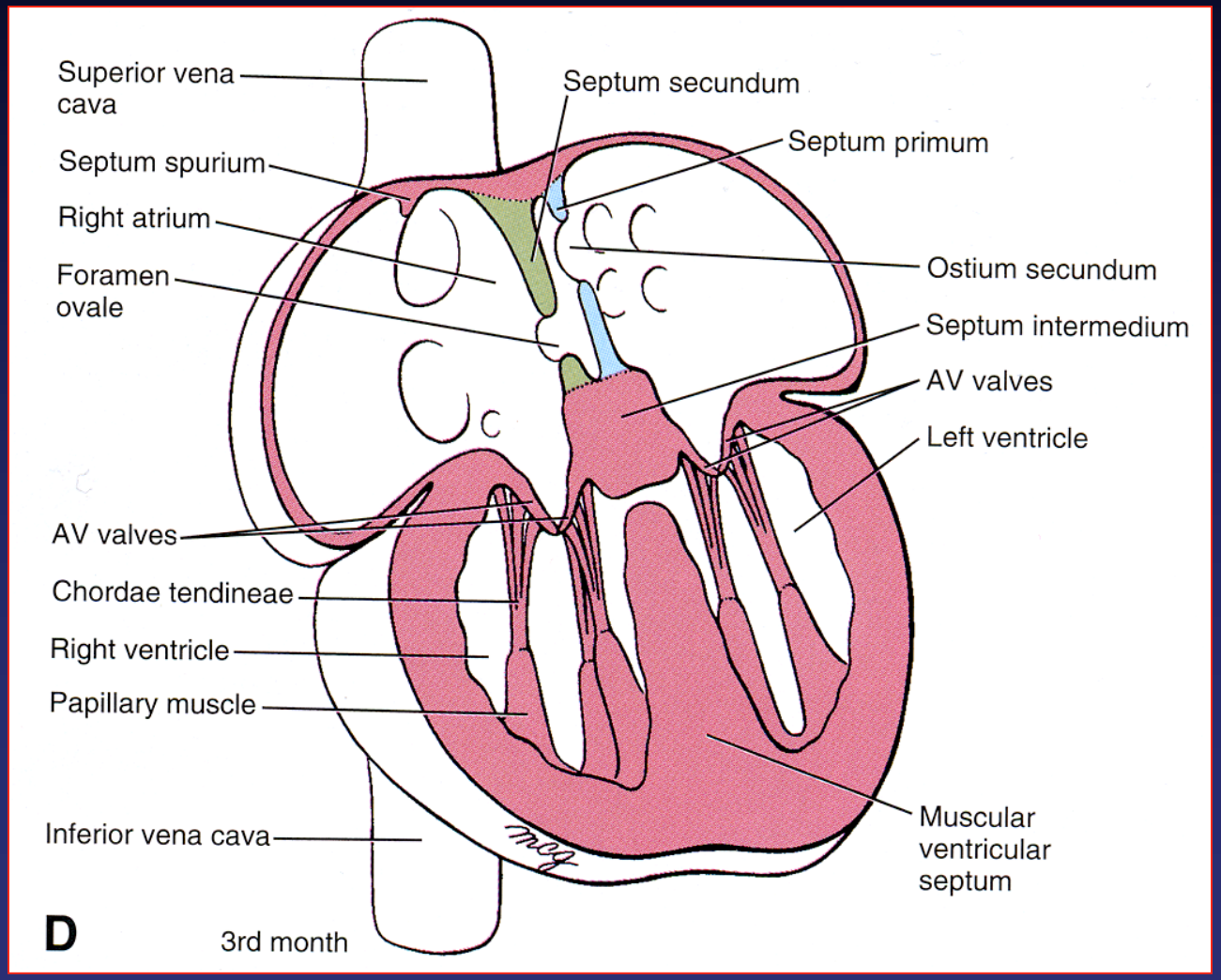
Atrioventricular Valve Formation

- **Left and Right Endocardial Cushions**

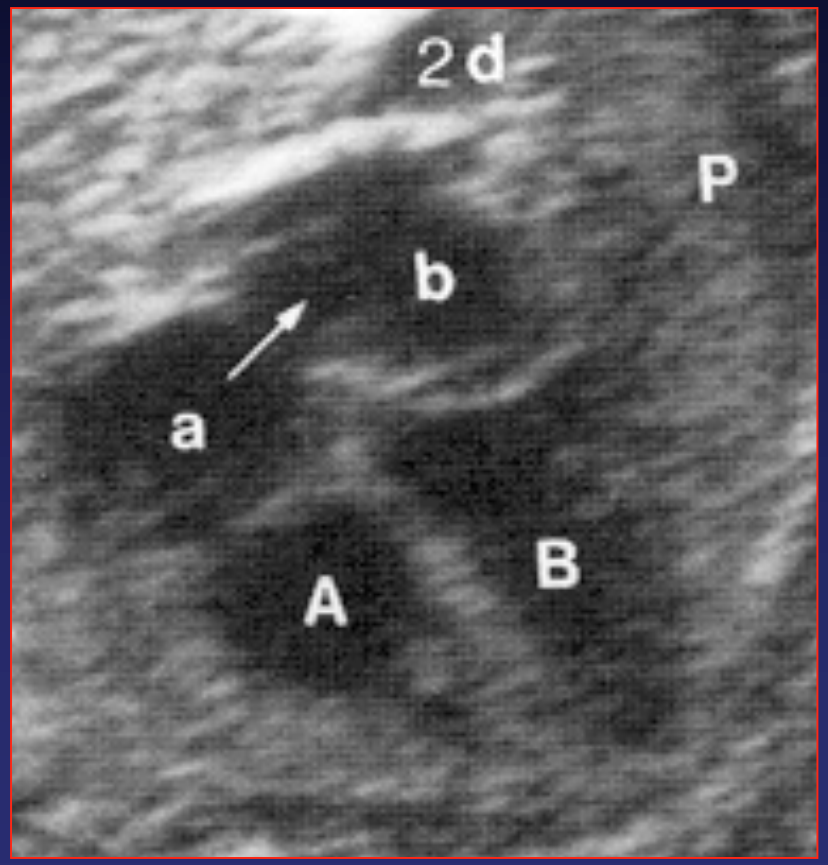




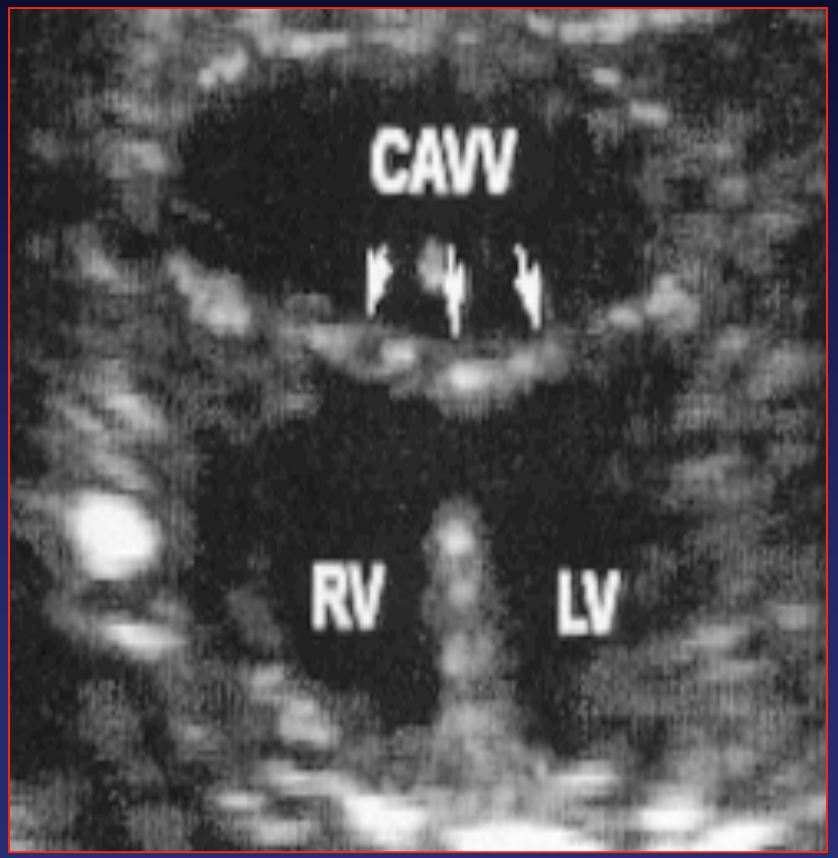
Endocardial Cushion: 80 days



Congenital Heart Defect: Endocardial Cushion Defect

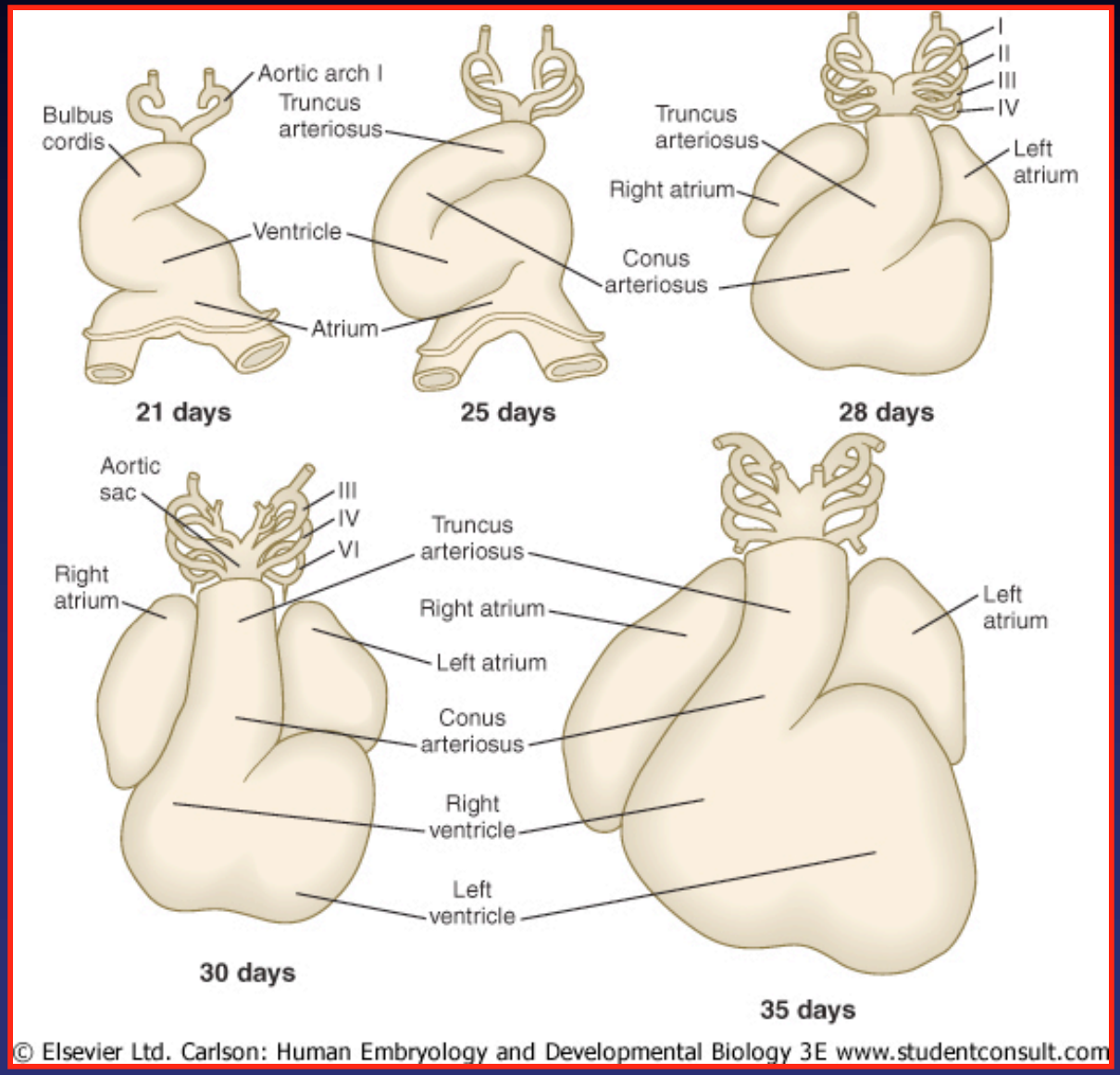


Normal



Endocardial Cushion Defect

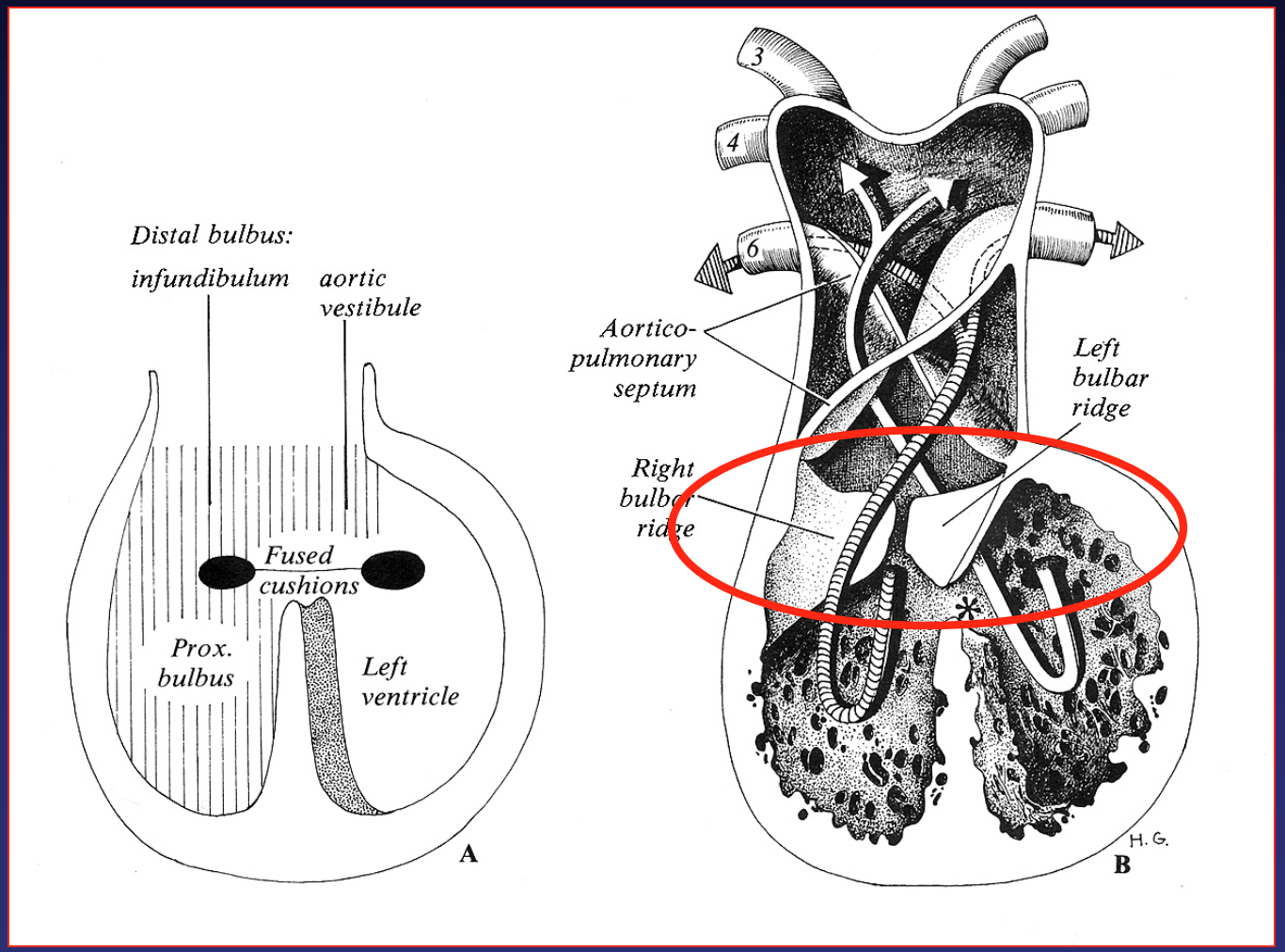
From Primitive Heart Tube to Four Chambers: External View



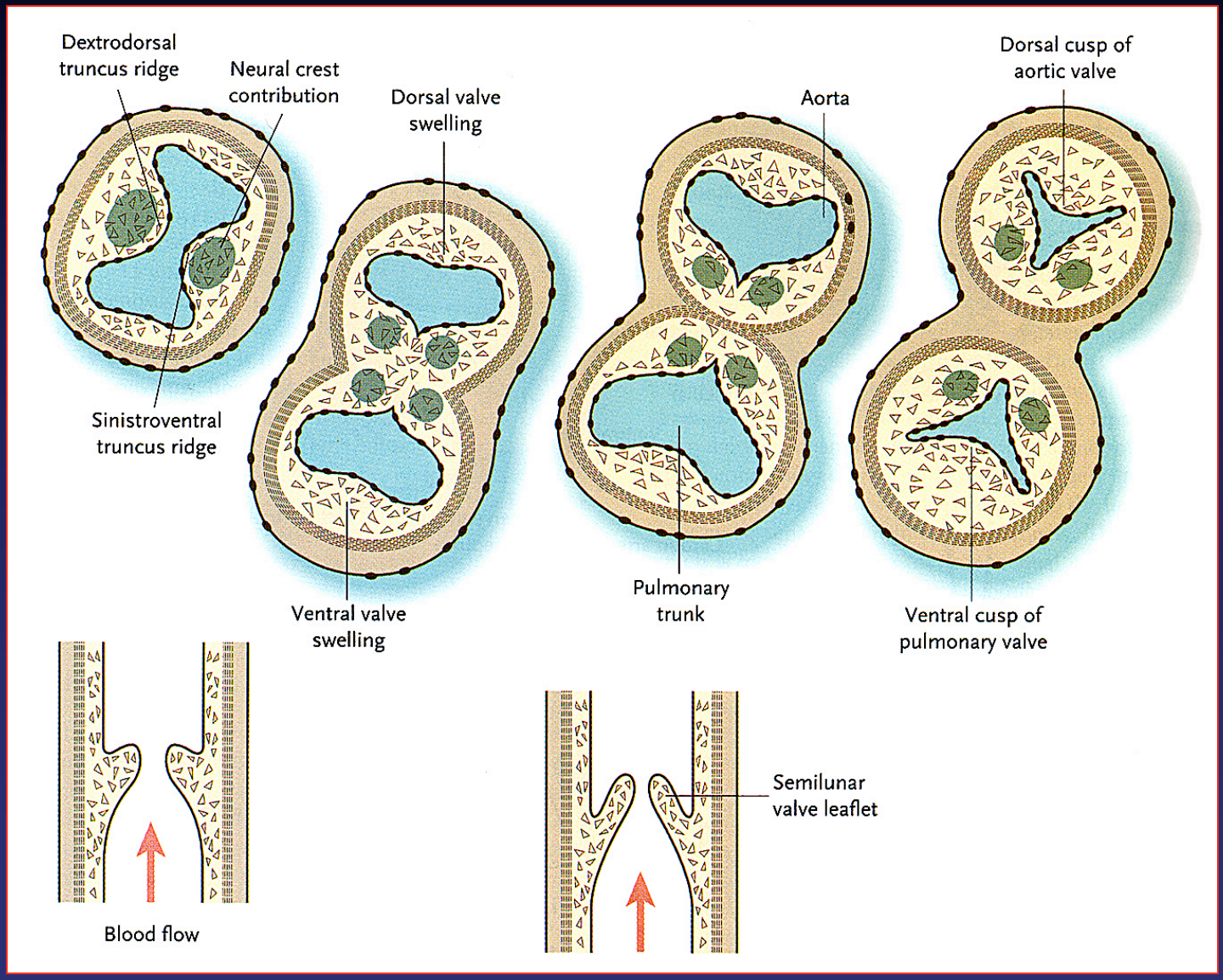
Ventricular Outflow Tracts and Great Arteries

- Truncus Arteriosus: common arterial trunk from the primitive ventricle
- Conus (Bulbus) Cordis: outflow portion of the primitive ventricle
- Bulbar Ridges: Tissue ridges at junction of the conus and truncus
  - Conotruncal septum
  - Semi-lunar valves (aortic and pulmonic)
- Truncal Ridges: Within Truncus
  - Septation of the Aorta and Pulmonary arteries

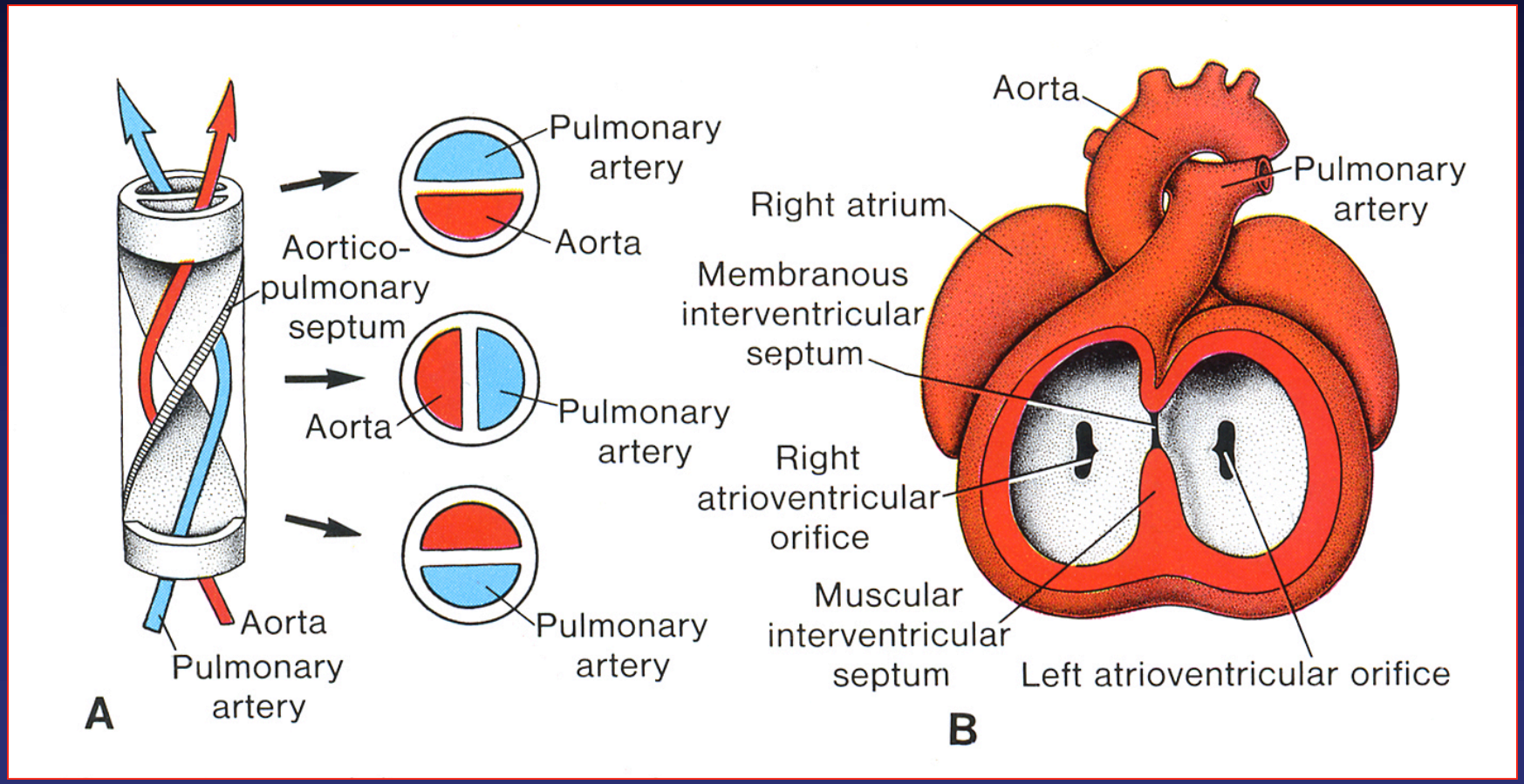
Formation of the Conotruncal Septum



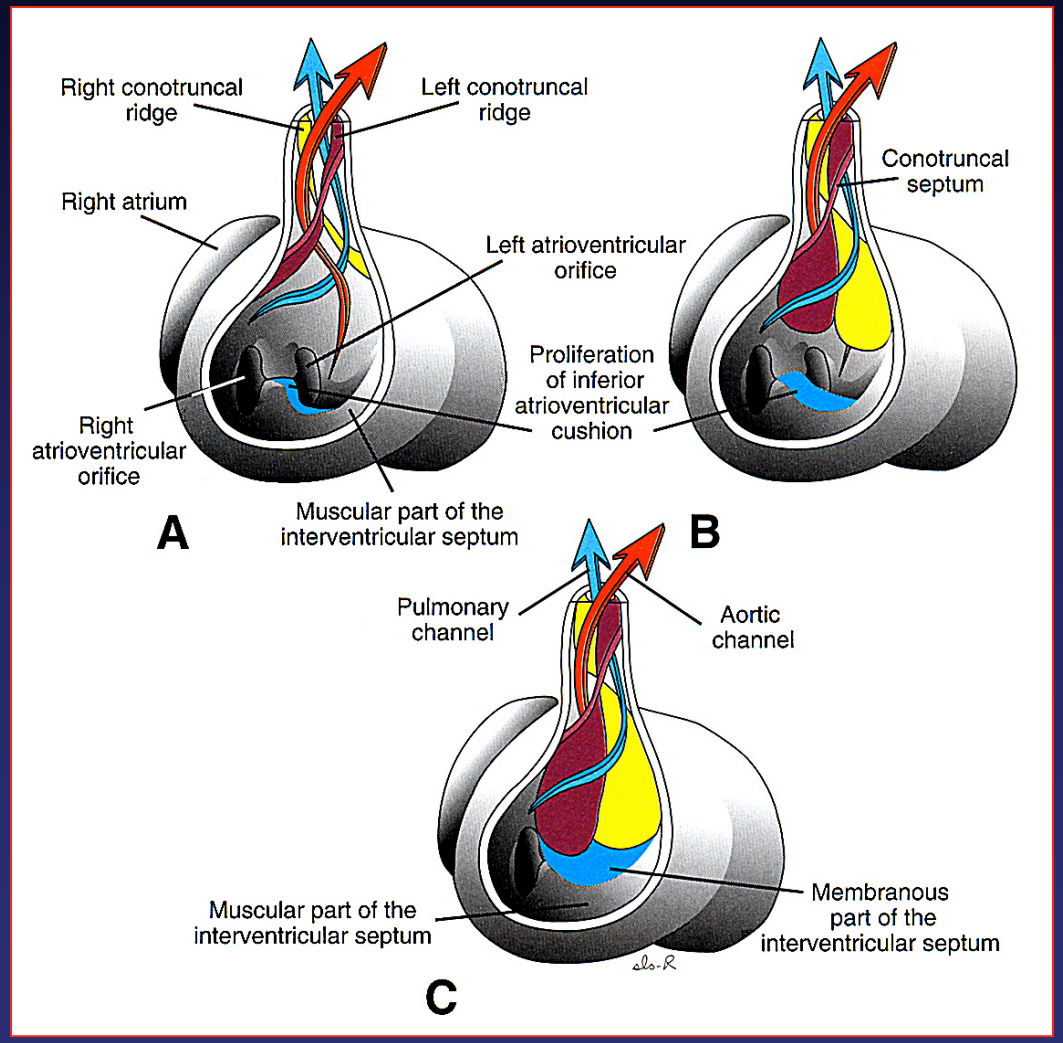
Semilunar Valve Formation

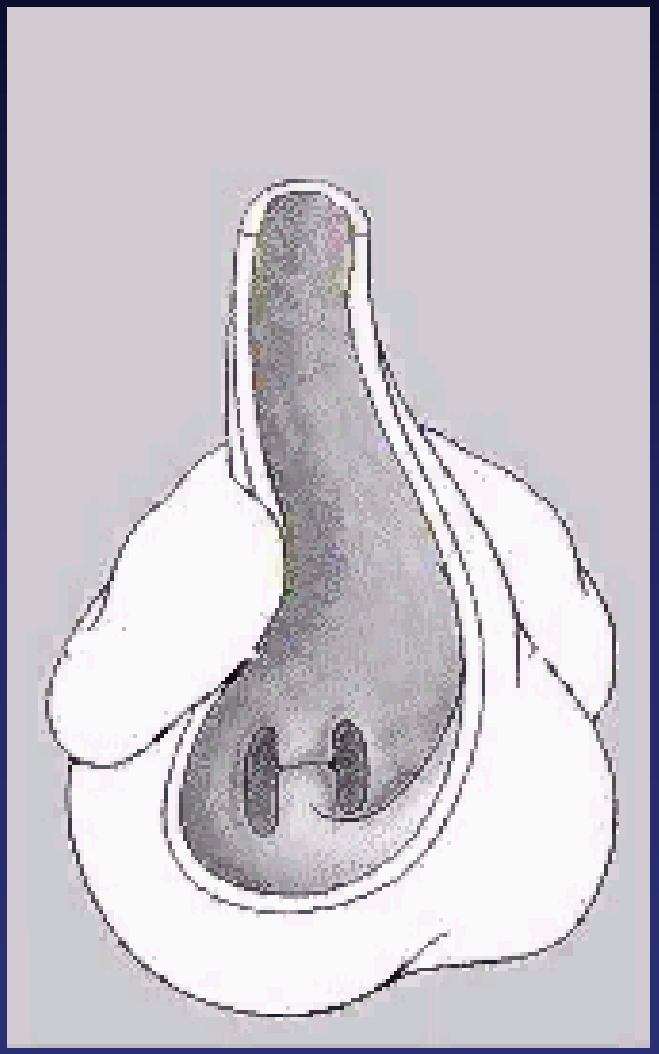


Formation of the Aorta and Pulmonary Artery



Conotruncal Septation

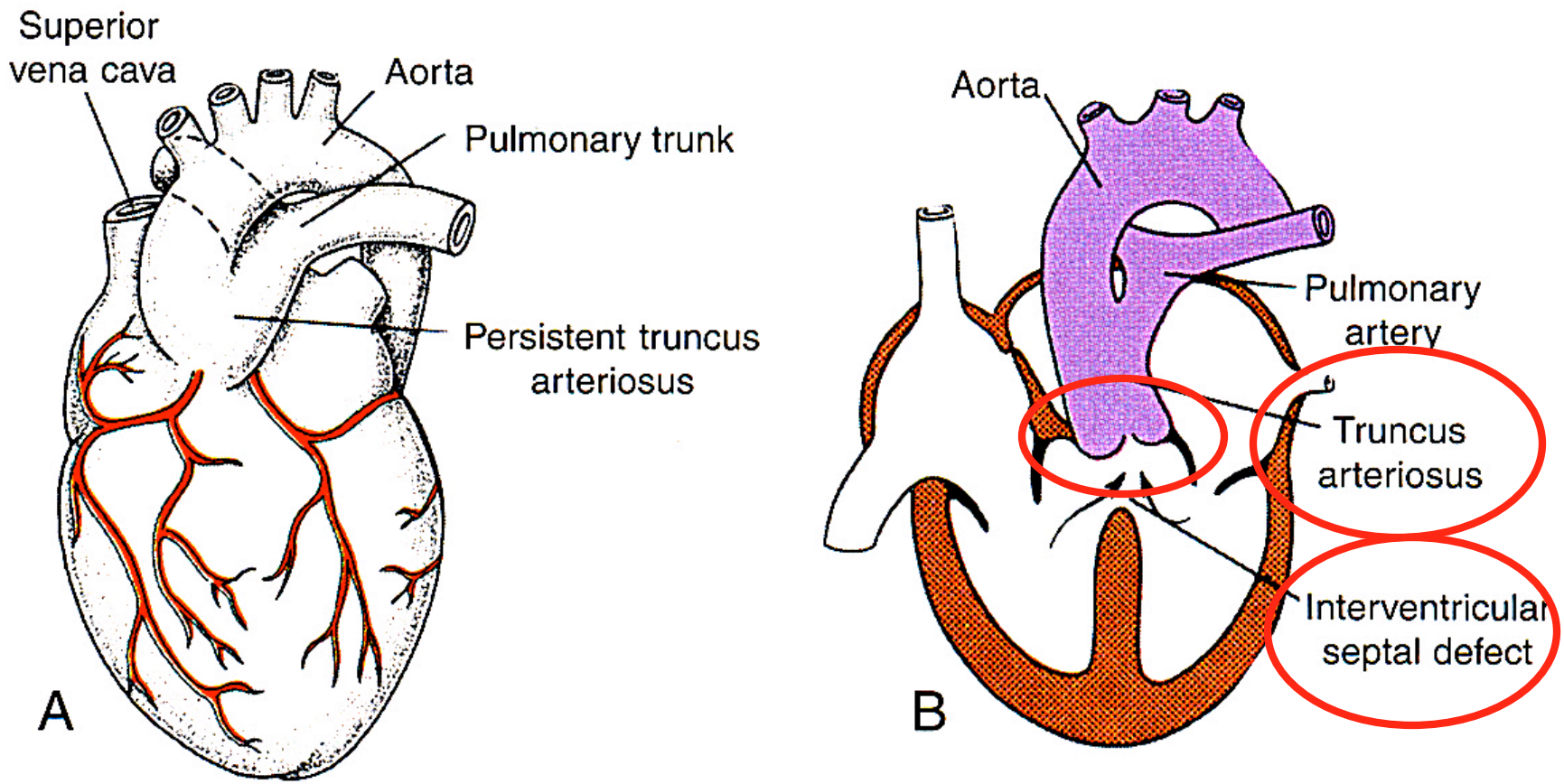




Defects of Conotruncal Septation

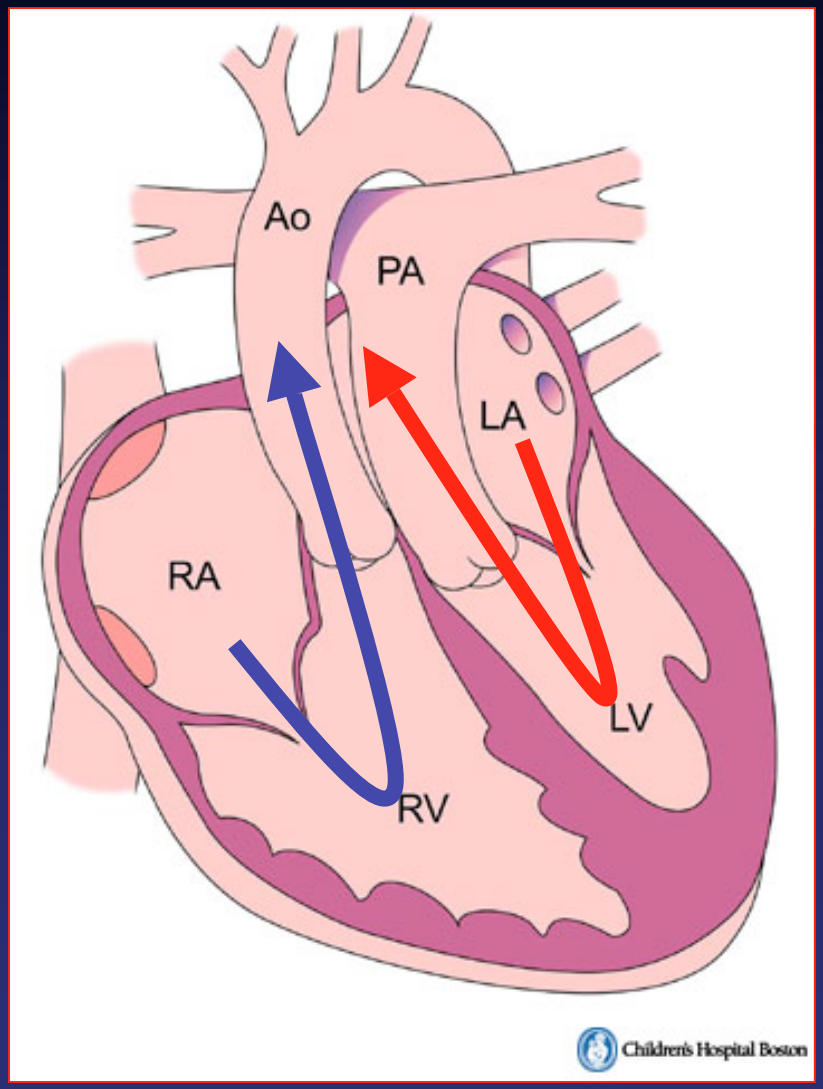
- **Persistent Truncus Arteriosus**
  - Failure of conotruncal septation
- **Transposition of the Great Arteries**
  - Failure of helical twisting during truncal septation
- **Tetralogy of Fallot**
  - Malalignment of conoventricular septum

Persistent Truncus Arteriosus

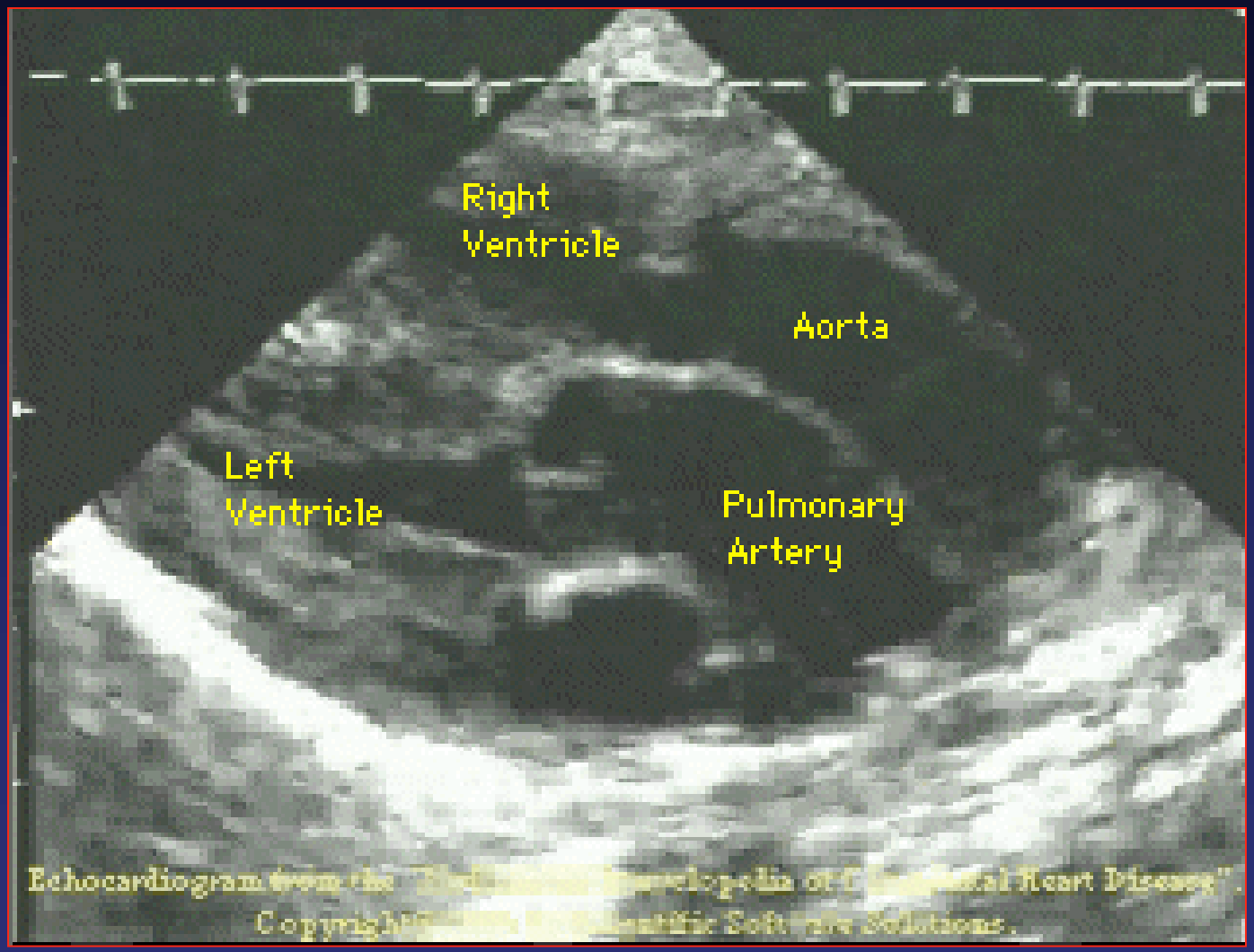


Transposition of the Great Arteries

- Failure of helical twisting during truncal septation
- Aorta arises from RV
- Pulmonary artery arises from LV
- VSD in 20% of cases



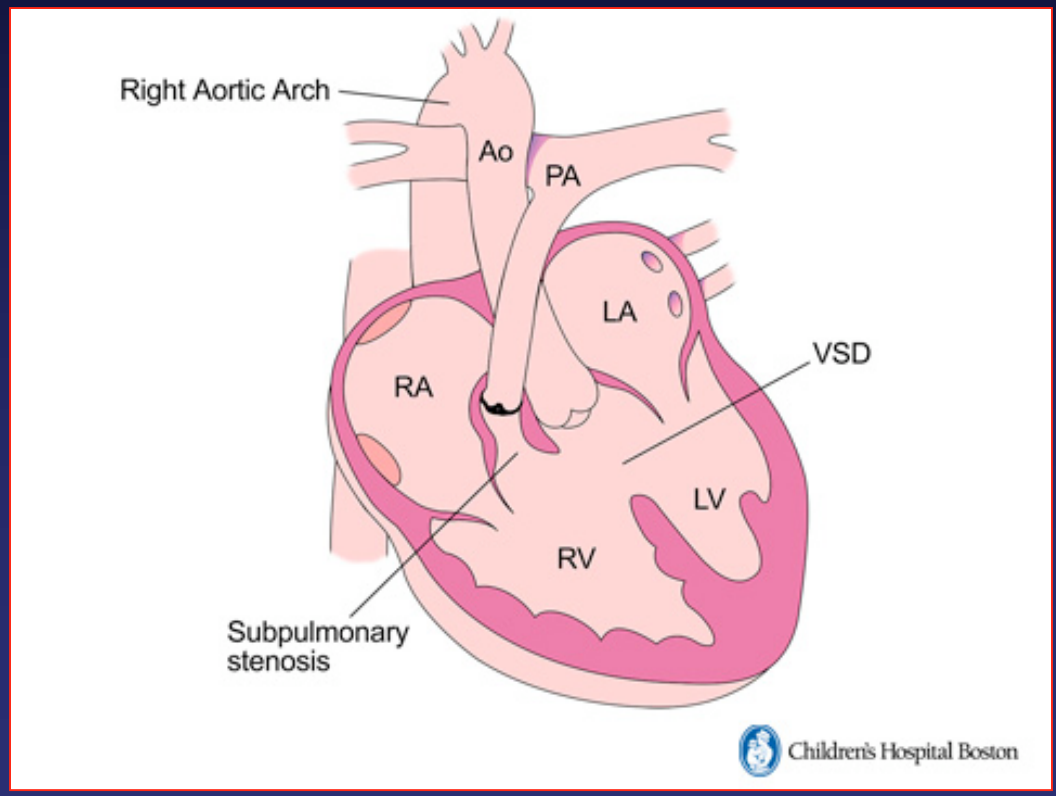
Transposition of the Great Arteries



Tetralogy of Fallot

- **Malalignment of conoventricular septum**

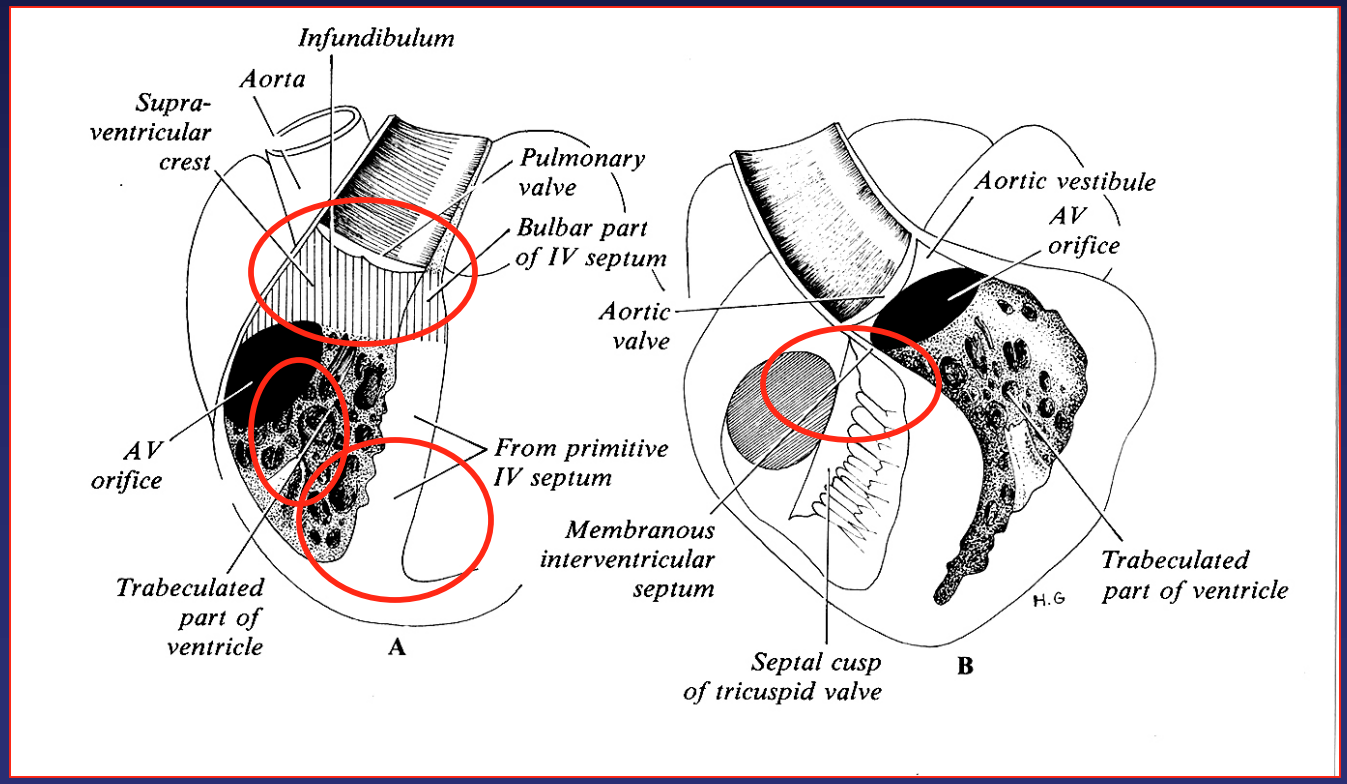
1. **Ventricular septal defect**
2. **Aortic valve override**
3. **Pulmonary stenosis**
4. **Right ventricular hypertrophy**



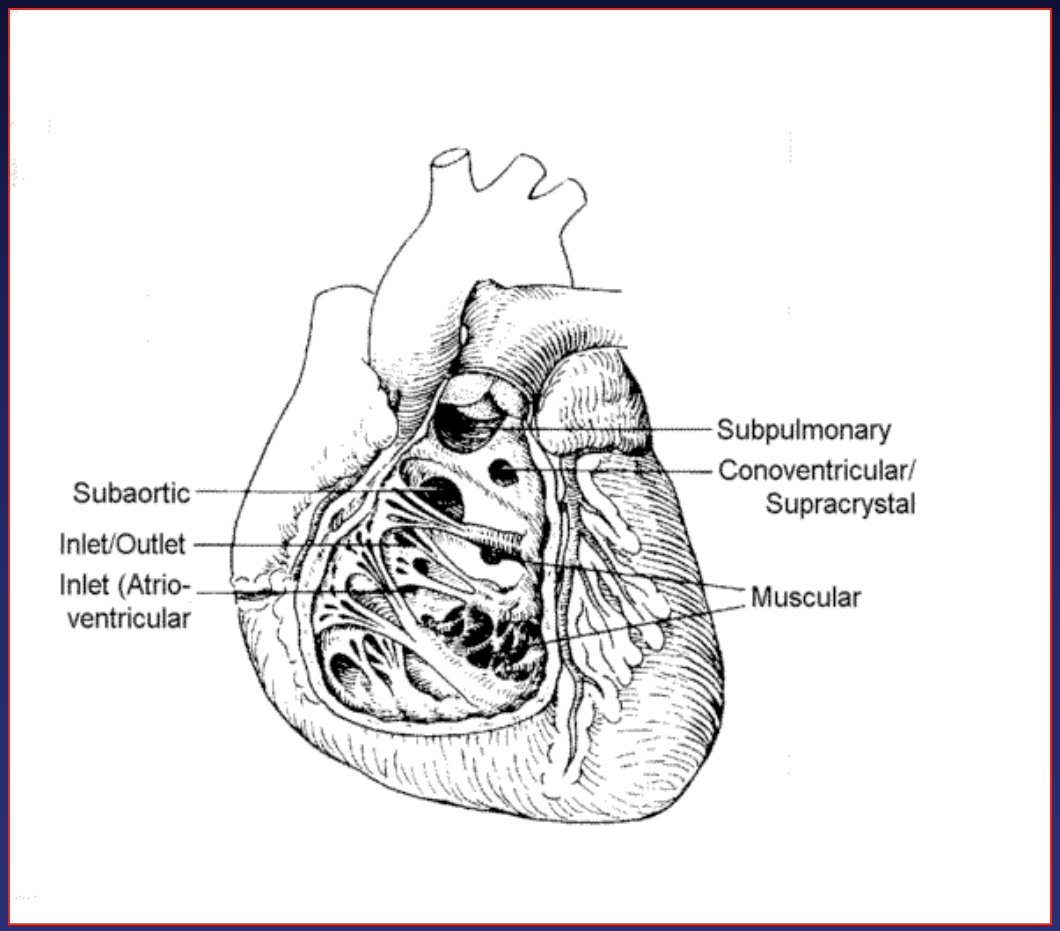
Ventricular Septum

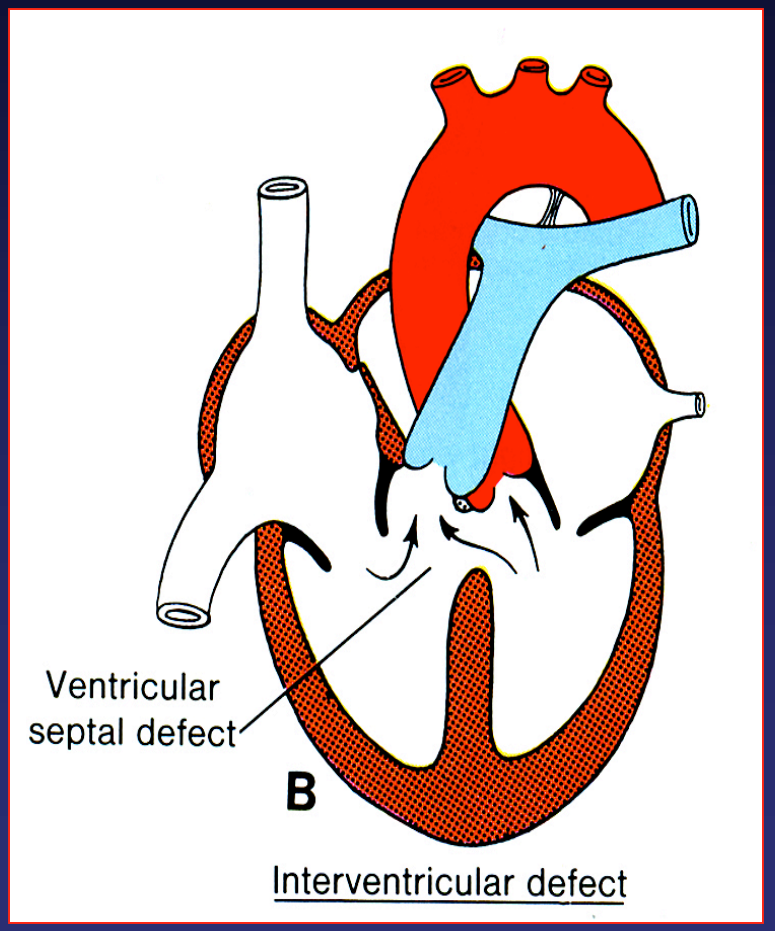
Primitive Septum **Conotruncus**

Endocardial Cushion **Membranous**



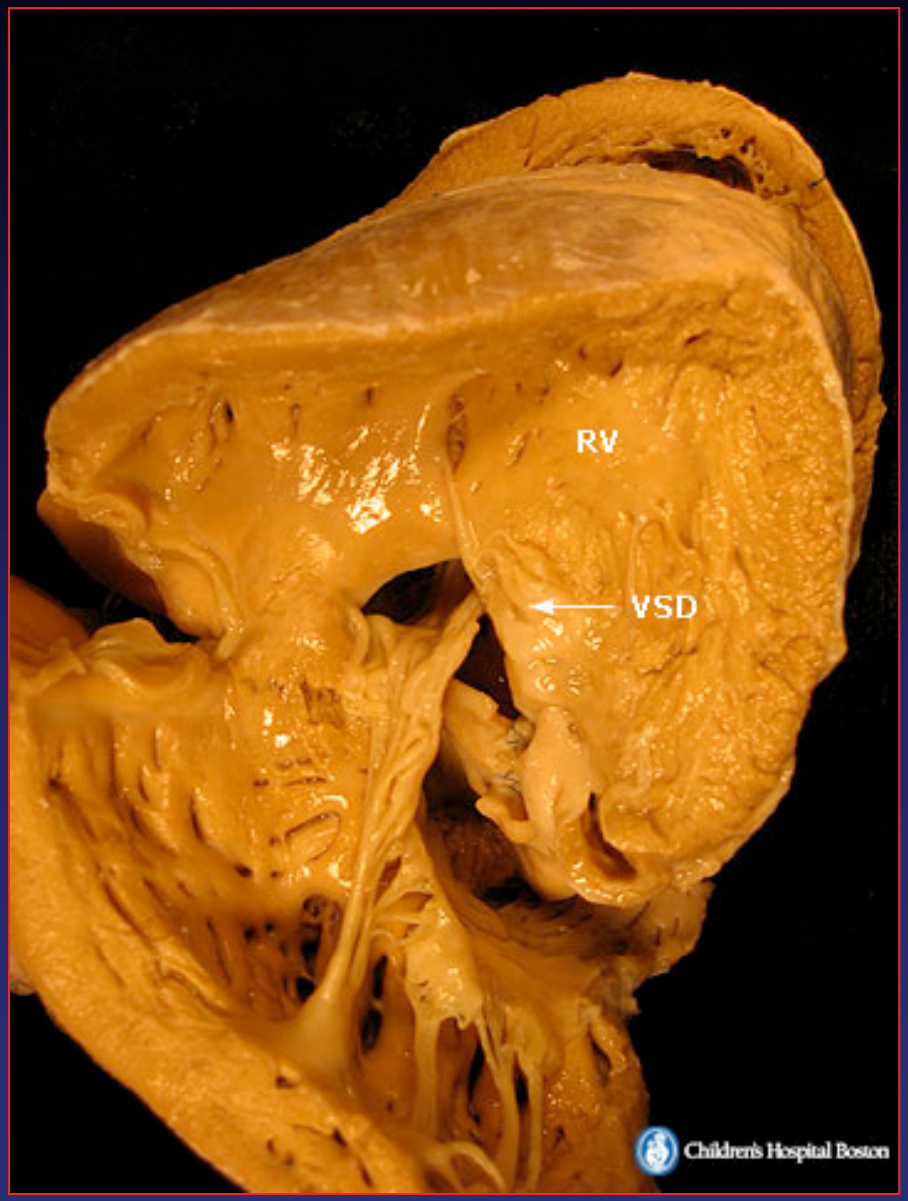
Ventricular Septal Defect (VSD)

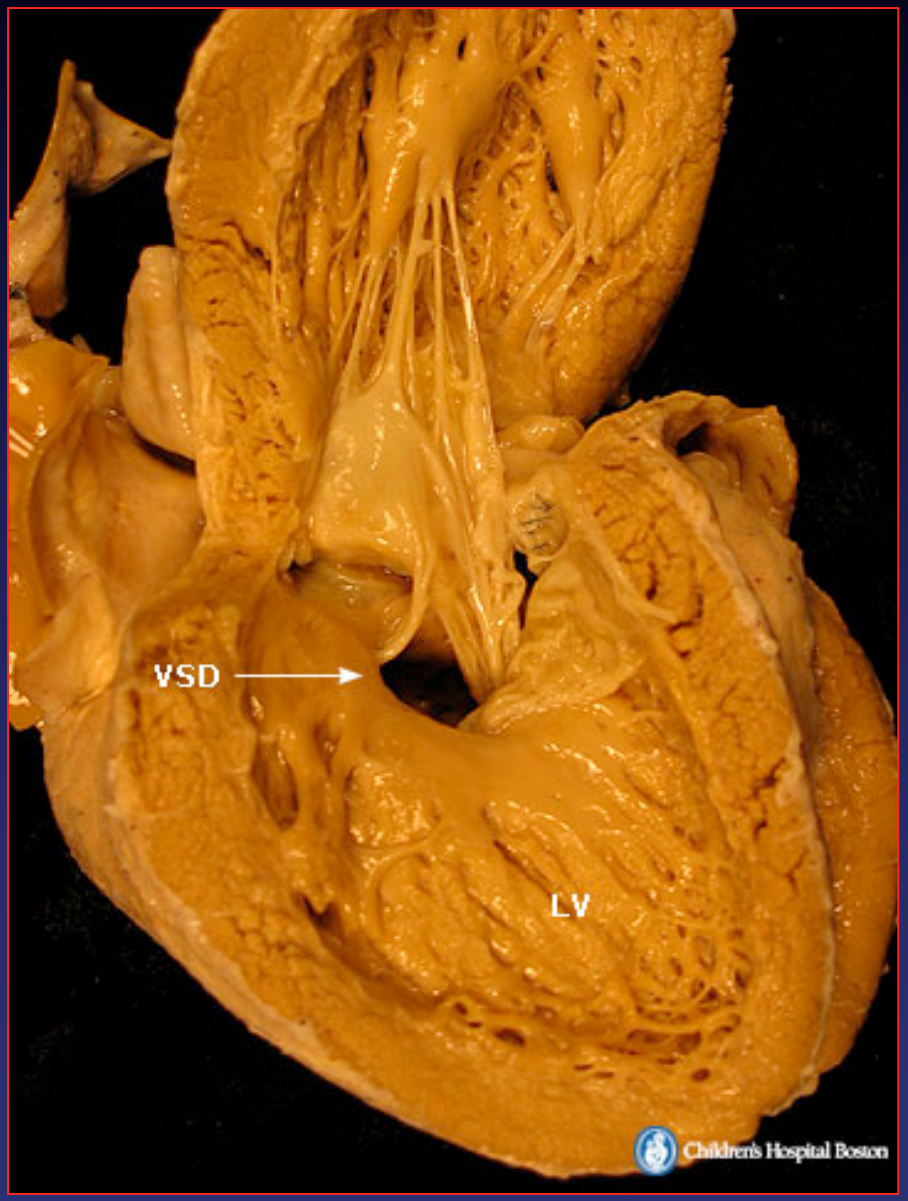




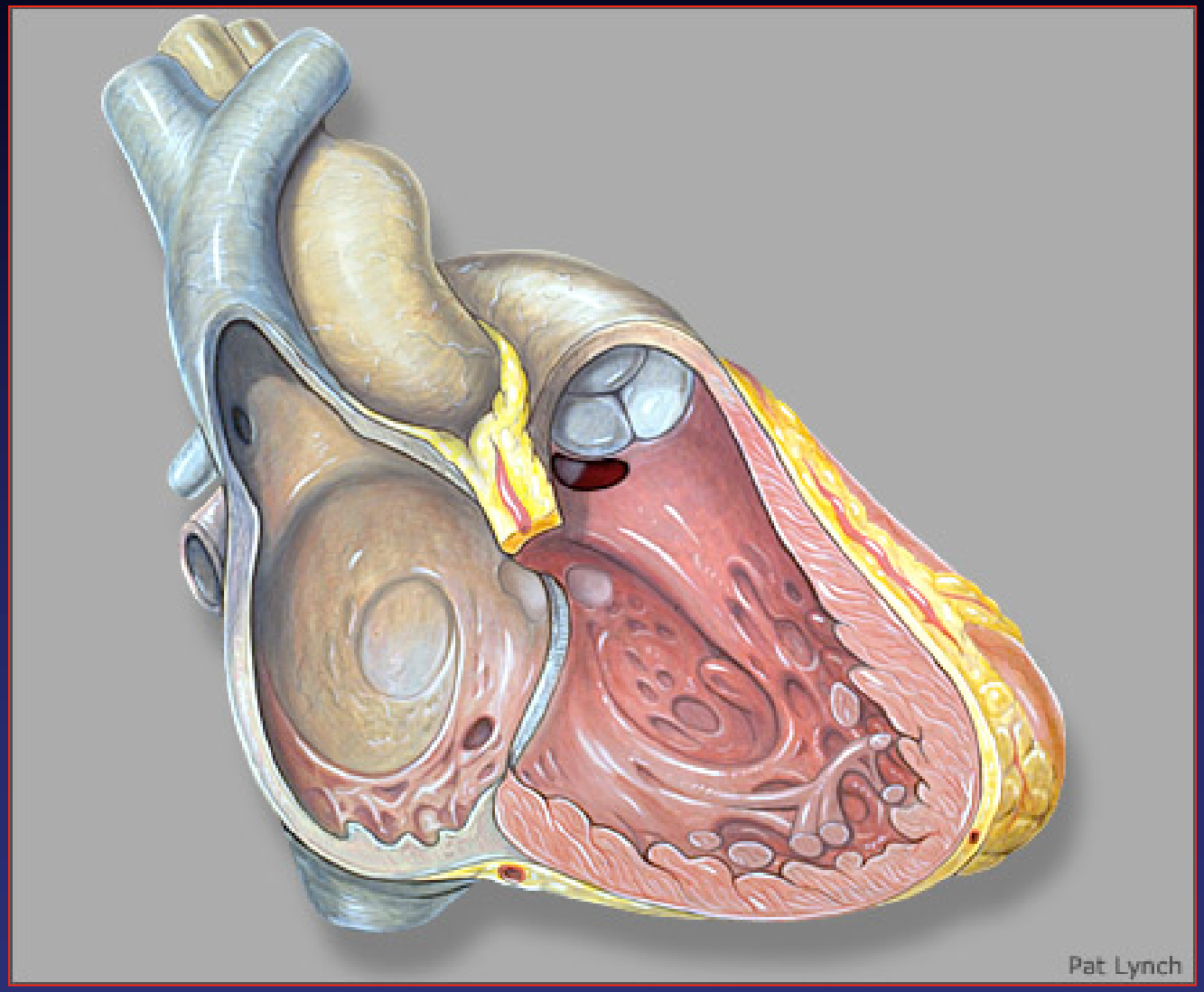
Muscular VSD

Endocardial Cushion (Inlet VSD)

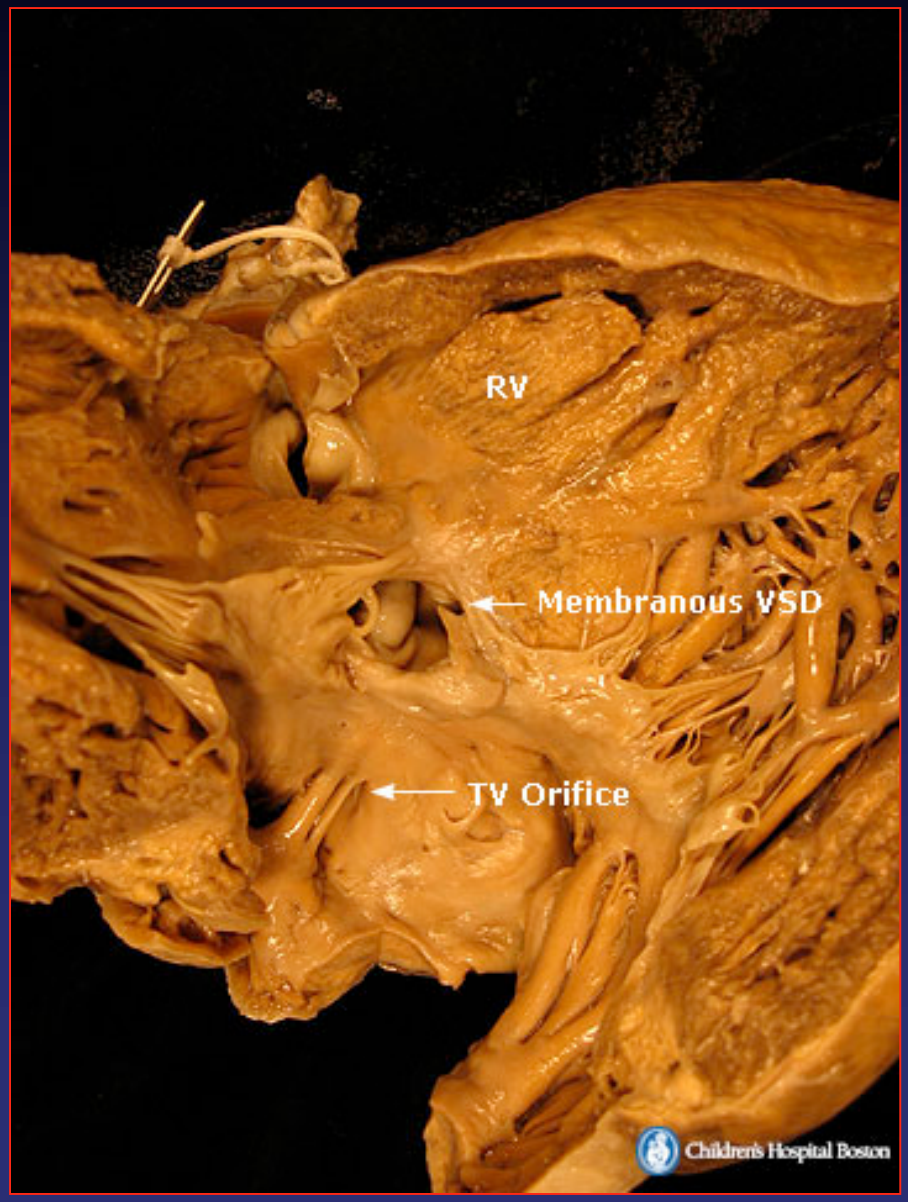




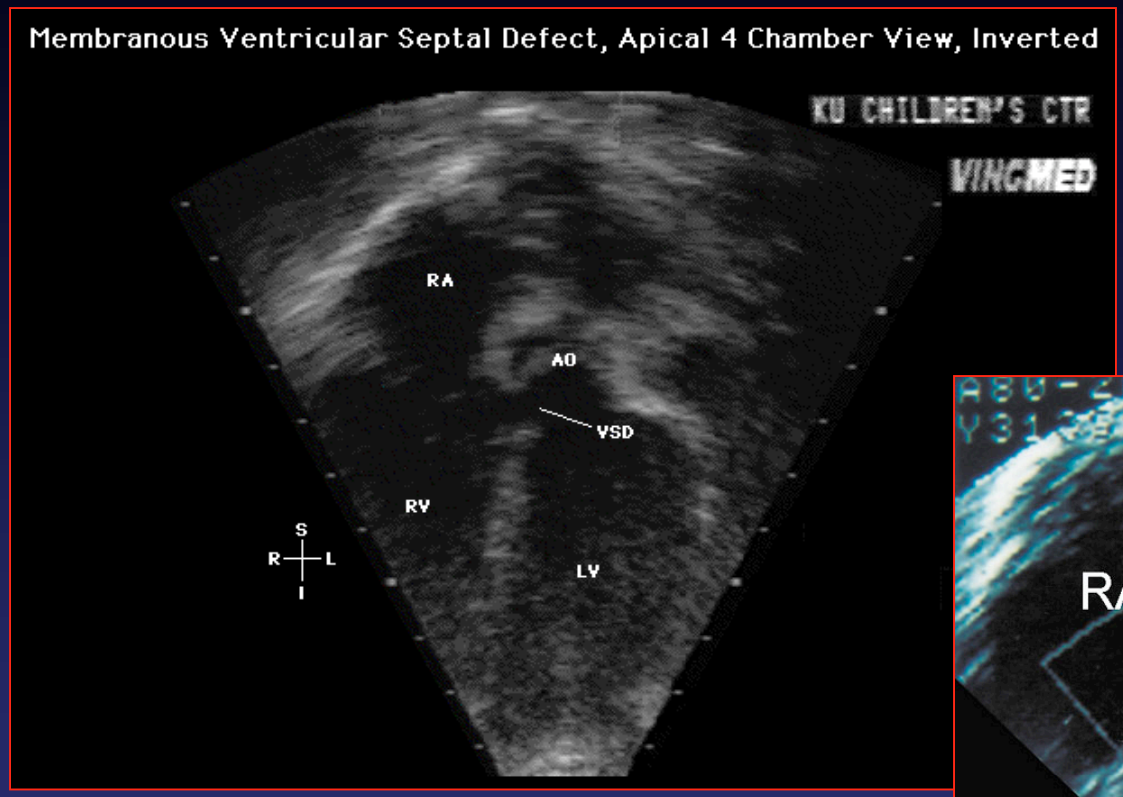
Supracristal VSD

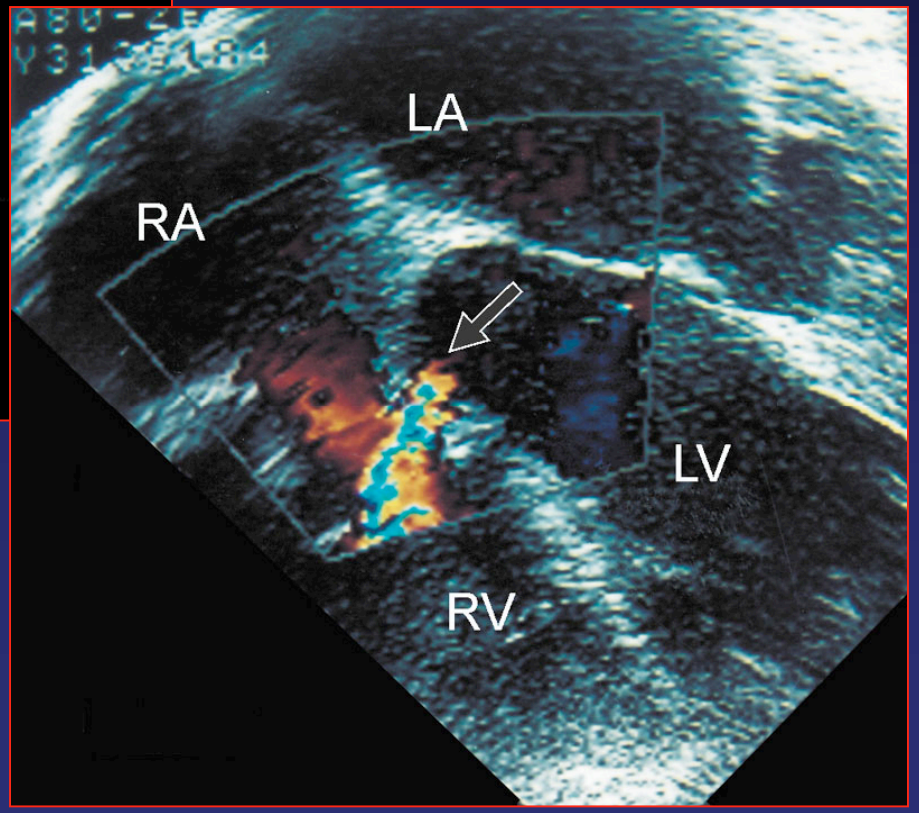


Membranous VSD

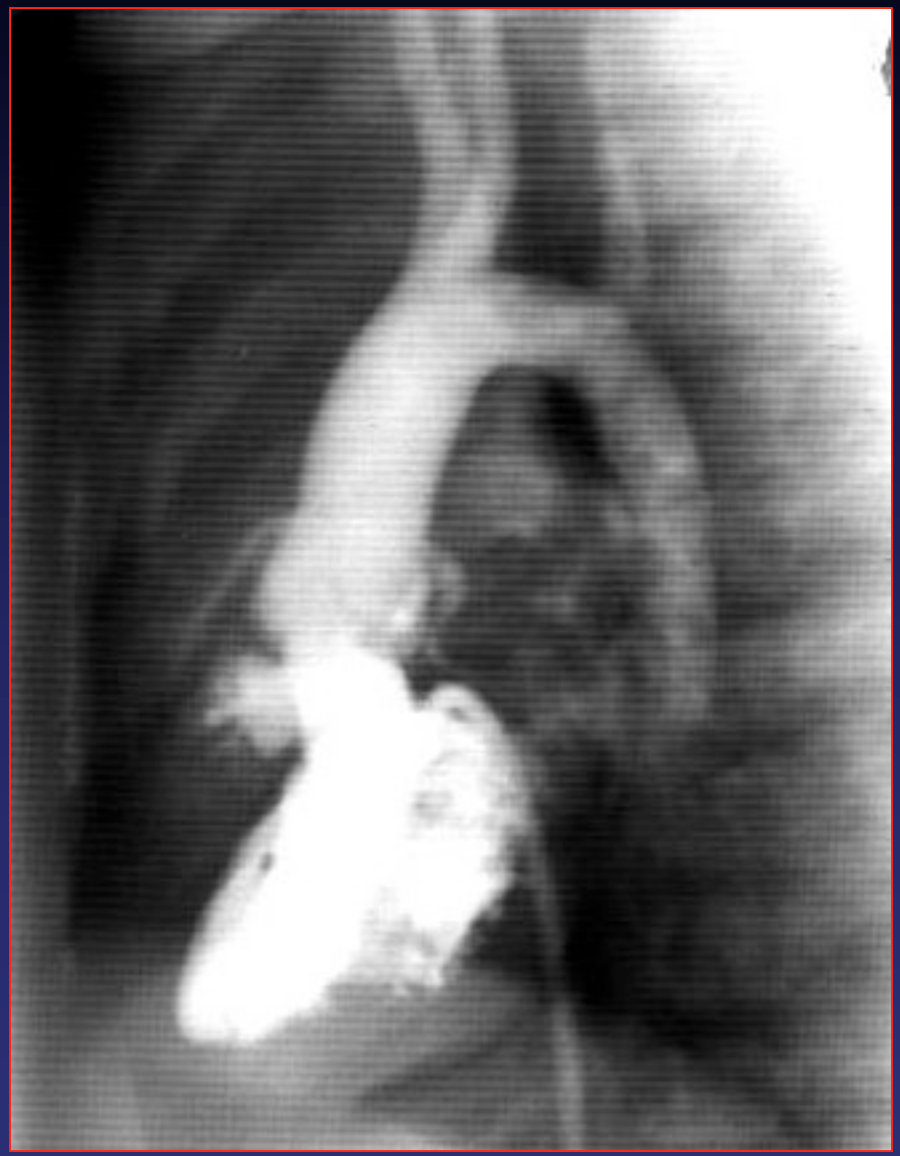


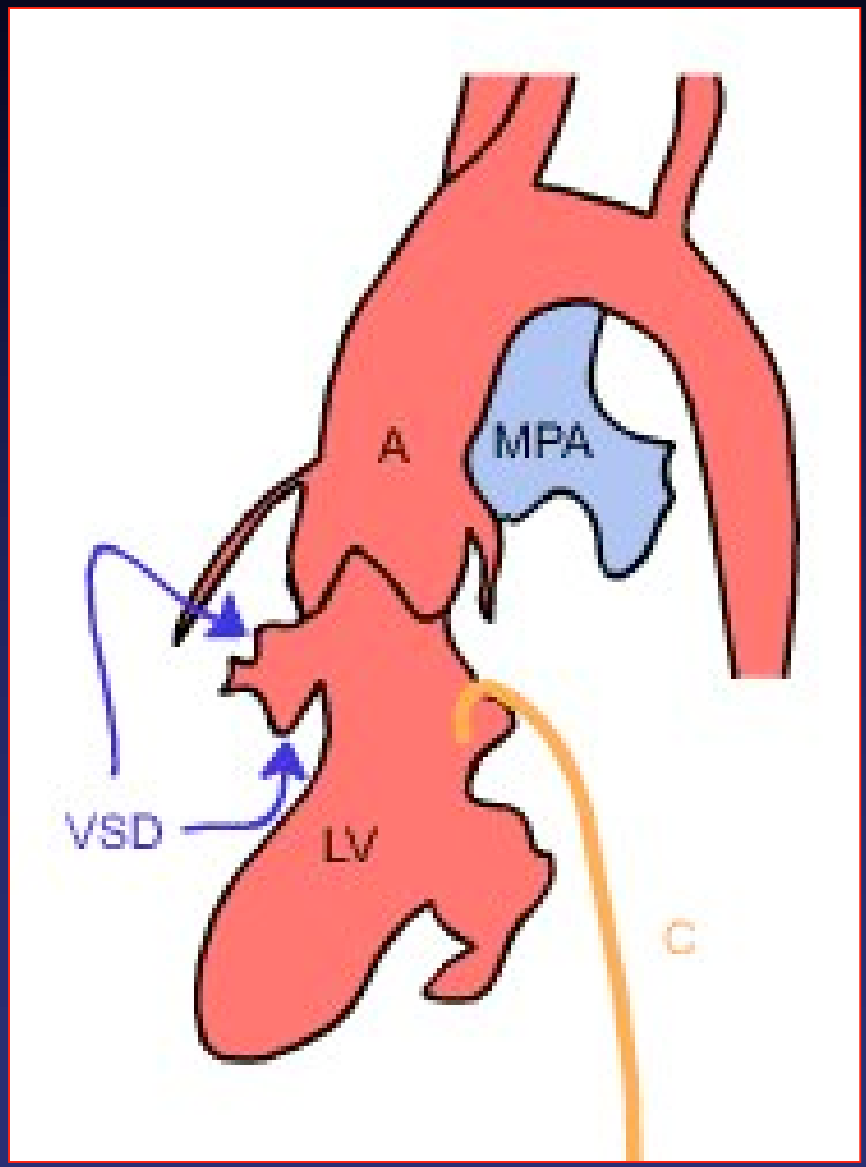
Echocardiogram: Membranous VSD





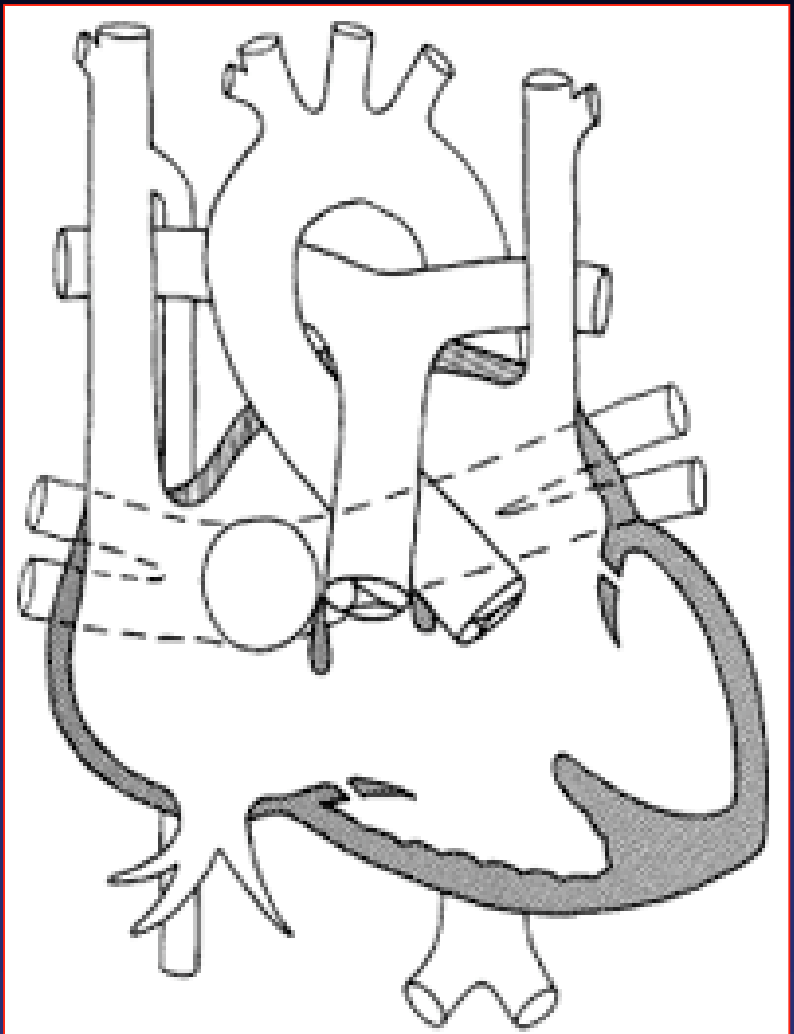
Angiogram: VSD





Multiple Defects: Bilateral Left-Sidedness

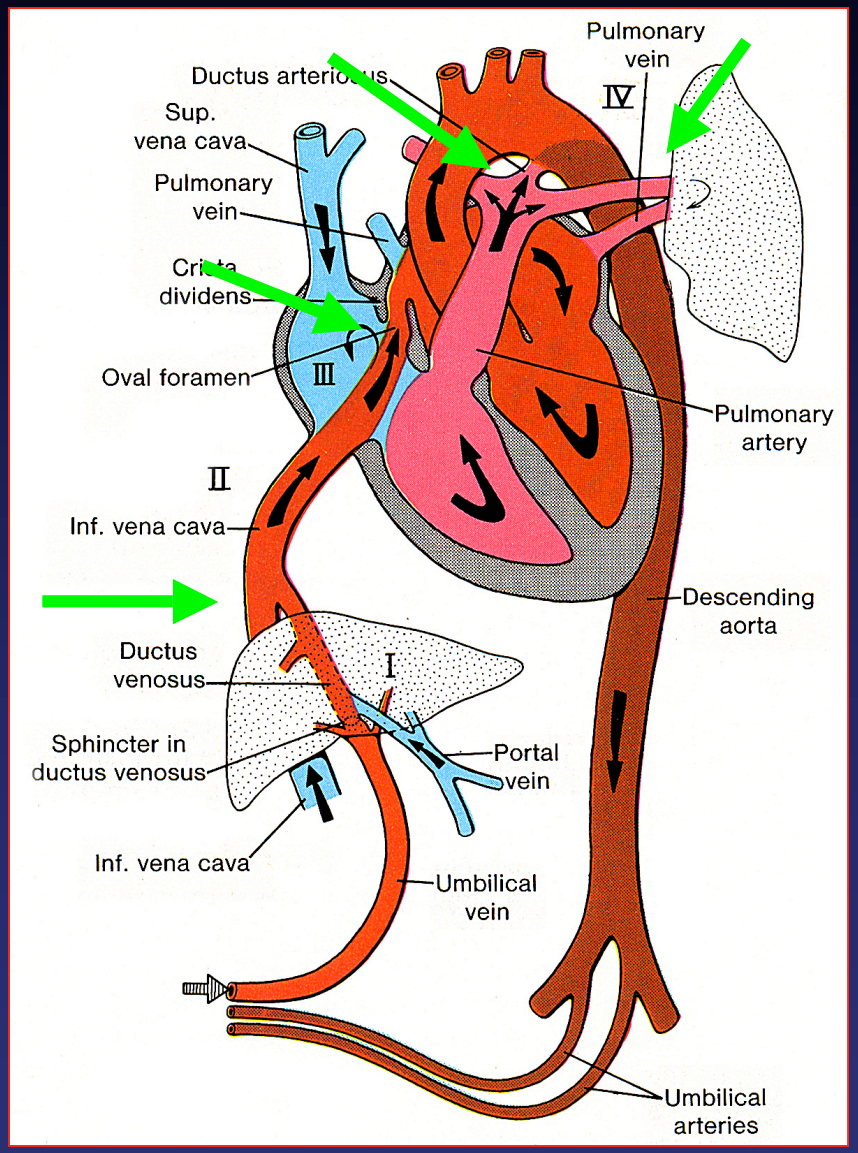
- **Systemic Veins**
  - Interrupted IVC
  - Bilateral SVC
- **Common Atrium**
- **Common Ventricle**
  - VSD: endocardial cushion, supracristal
- **Pulmonary veins:**
  - Ipsilateral
- **Pulmonary Stenosis**



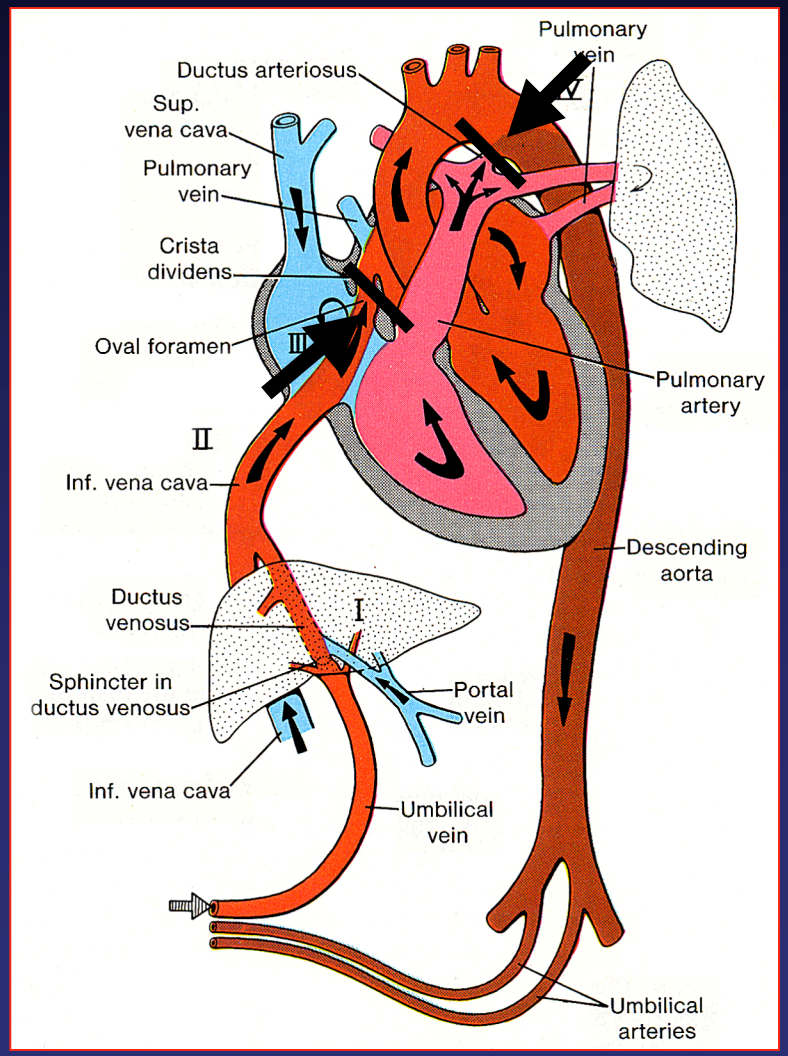
Heterotaxy Syndrome
with Bilateral "Left-Sidedness"

Fetal Circulation

- Placenta supplies oxygenated blood via ductus venosus
- Pulmonary blood flow minimal
- **Foramen ovale** directs blood to left atrium
- **Ductus arteriosus** allows flow from PA to descending aorta



Transition from Fetal to Neonatal Circulation



↑ Pulmonary blood flow

↓

↑ Pulmonary venous return

↓

↑ Left atrial pressure

↓

Closure Foramen Ovale

↑ Arterial pO_2

↓

Closure Ductus Arteriosus

Neonatal Circulation

- Separation of maternal and fetal circulations
- Increase pulmonary blood flow
- Closure of foramen ovale
- Closure of ductus arteriosus