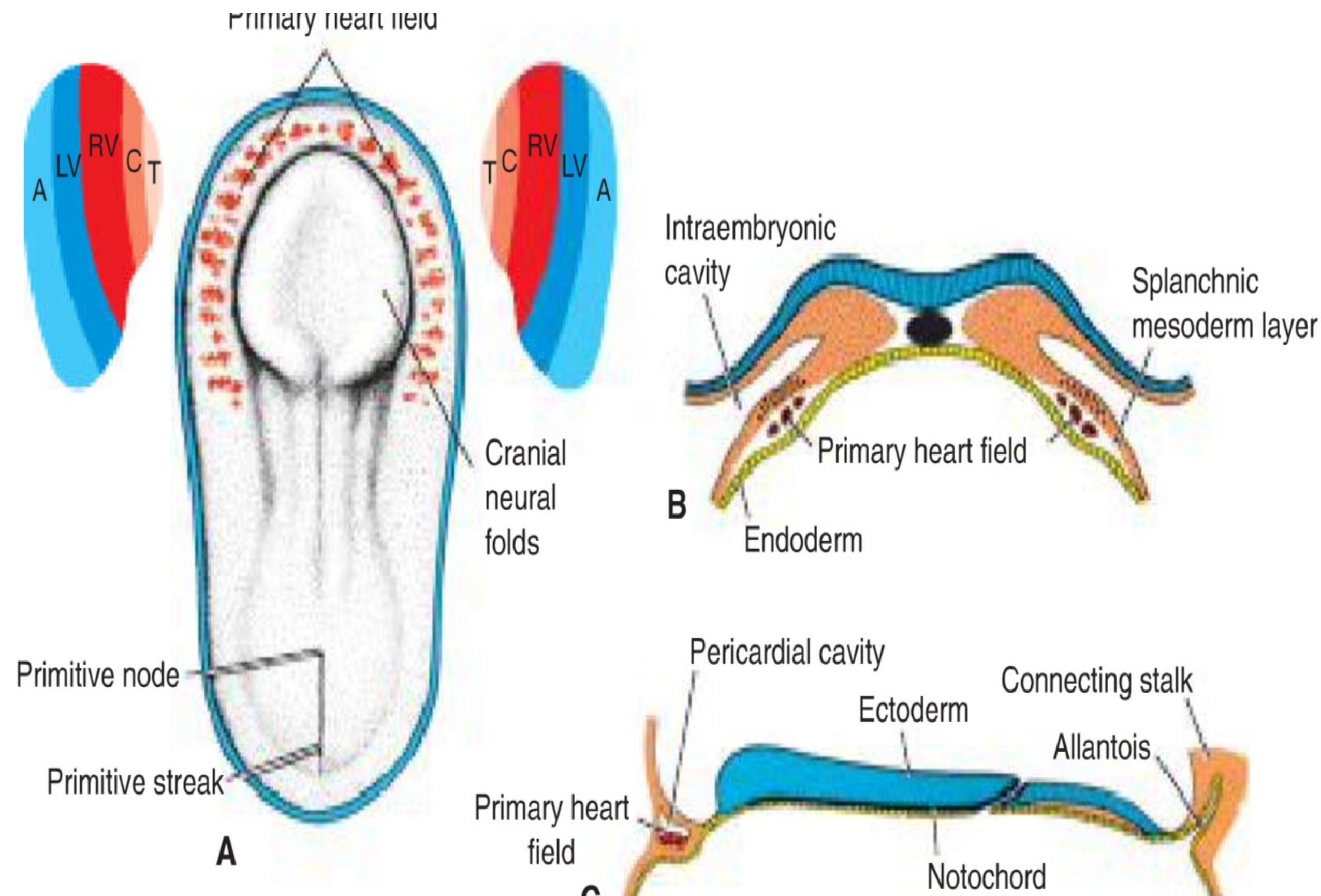


Development and teratology of cardiovascular systems

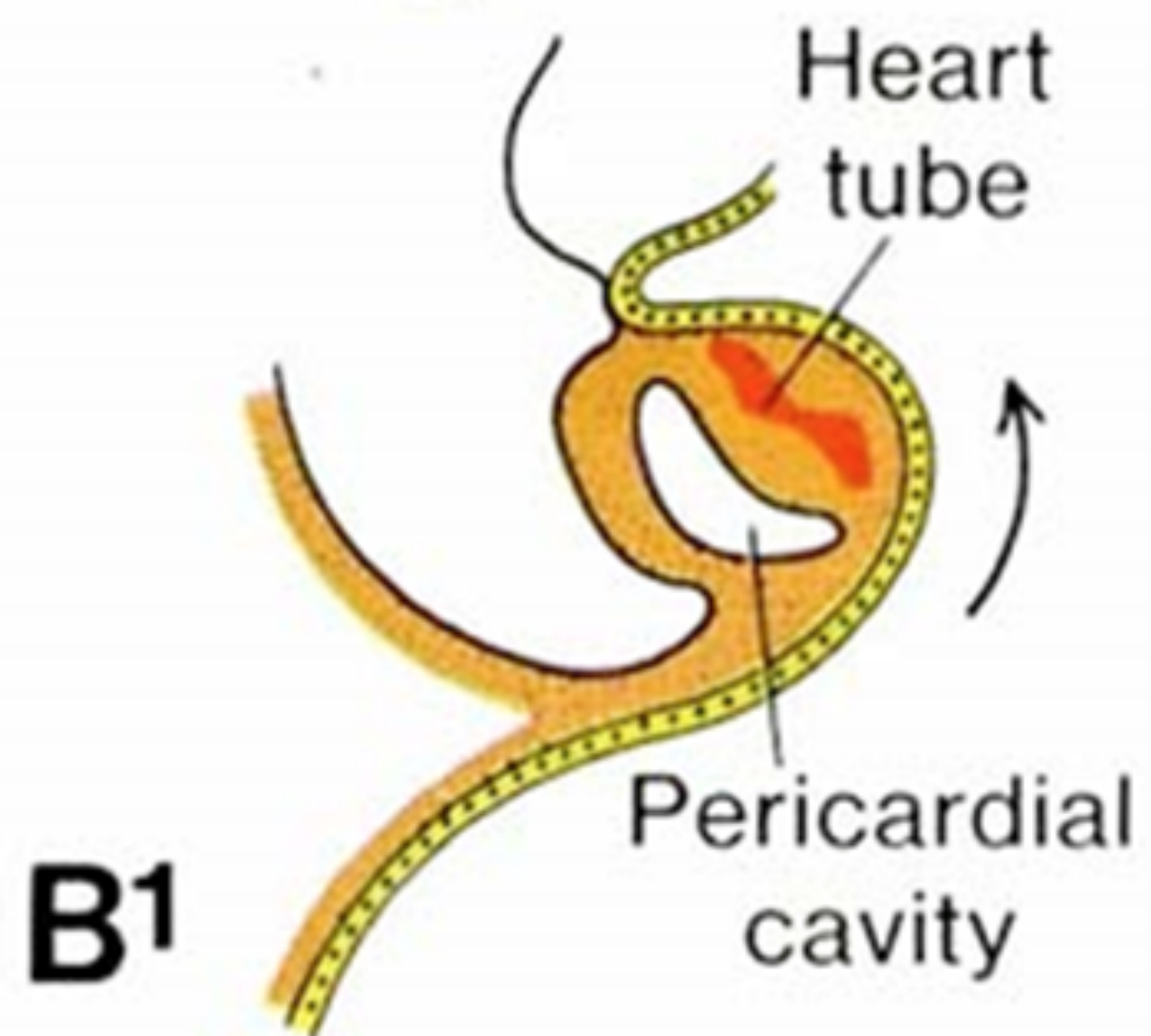
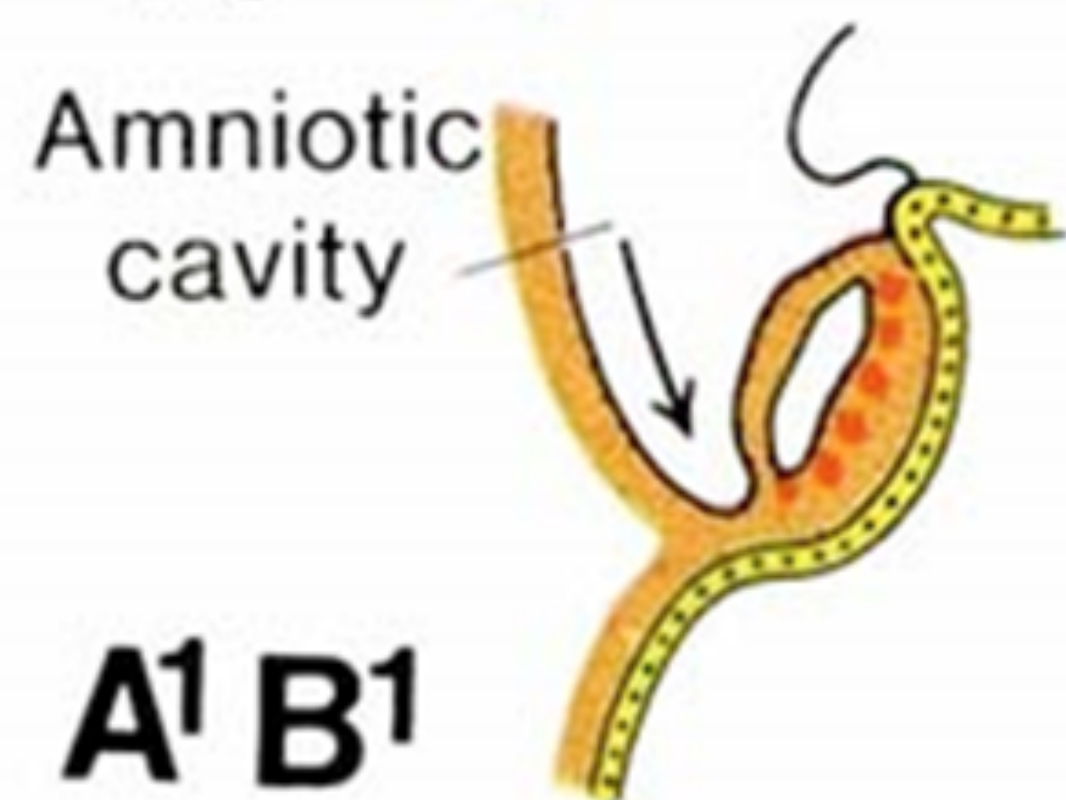
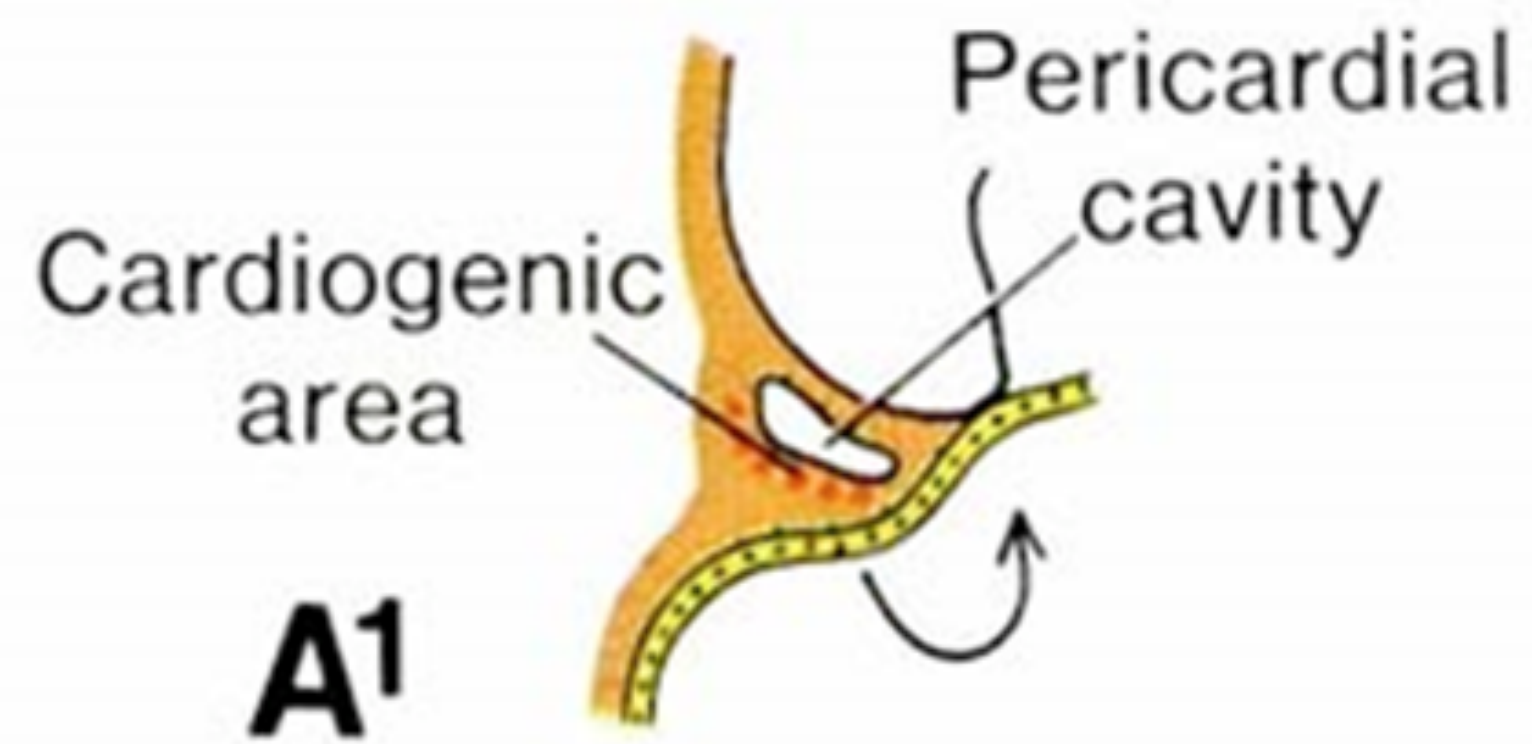
27.2.2023

Anna Mac Gillavry Danylevska

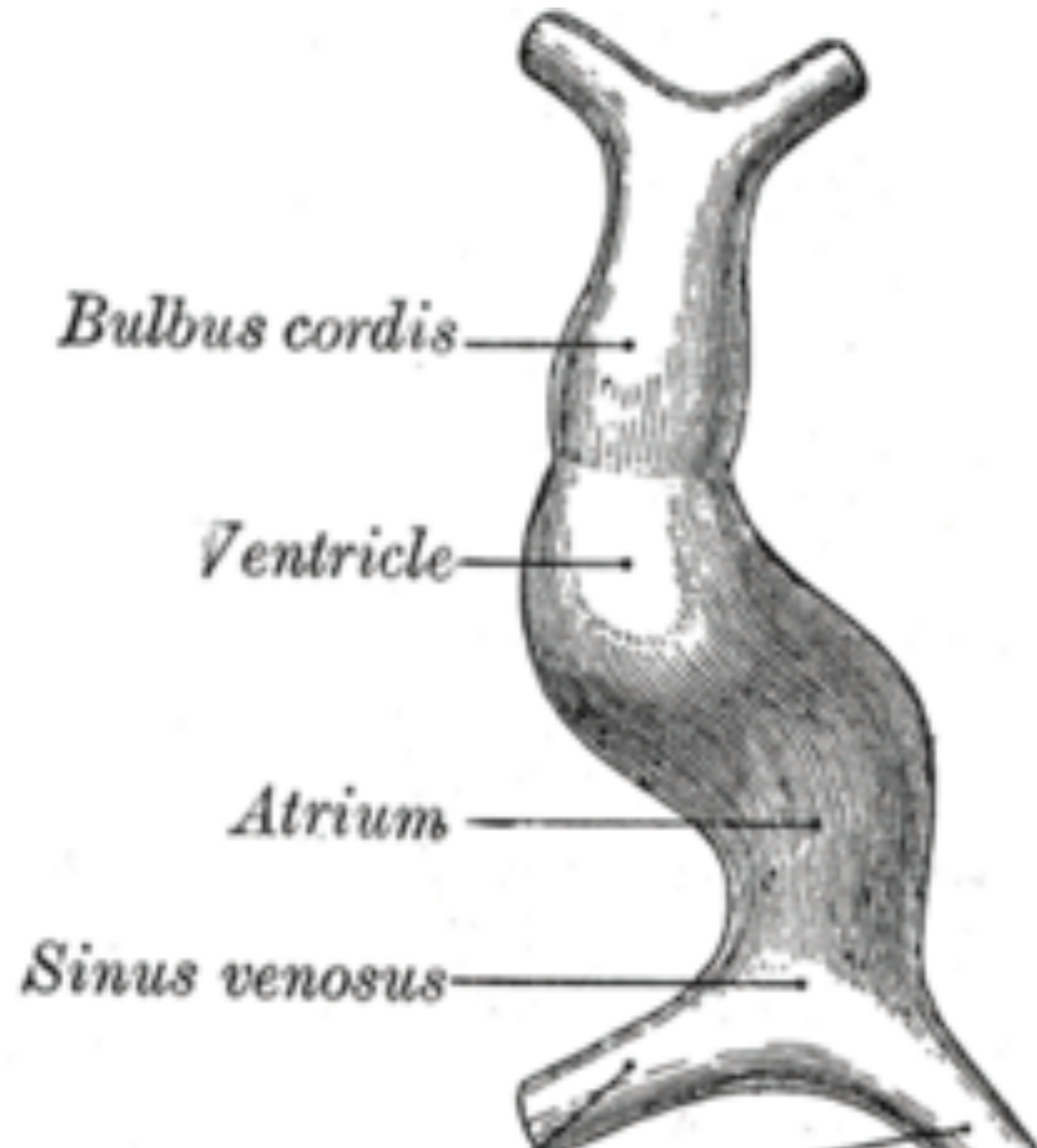
Formation of primary heart field



- WHEN? - middle of the 3rd week (day 16)
- WHAT? - progenitor heart cells
- WHERE? - from epiblast through the primitive streak to the visceral layer of lateral plate mesoderm
- DO WHAT? - form PHF

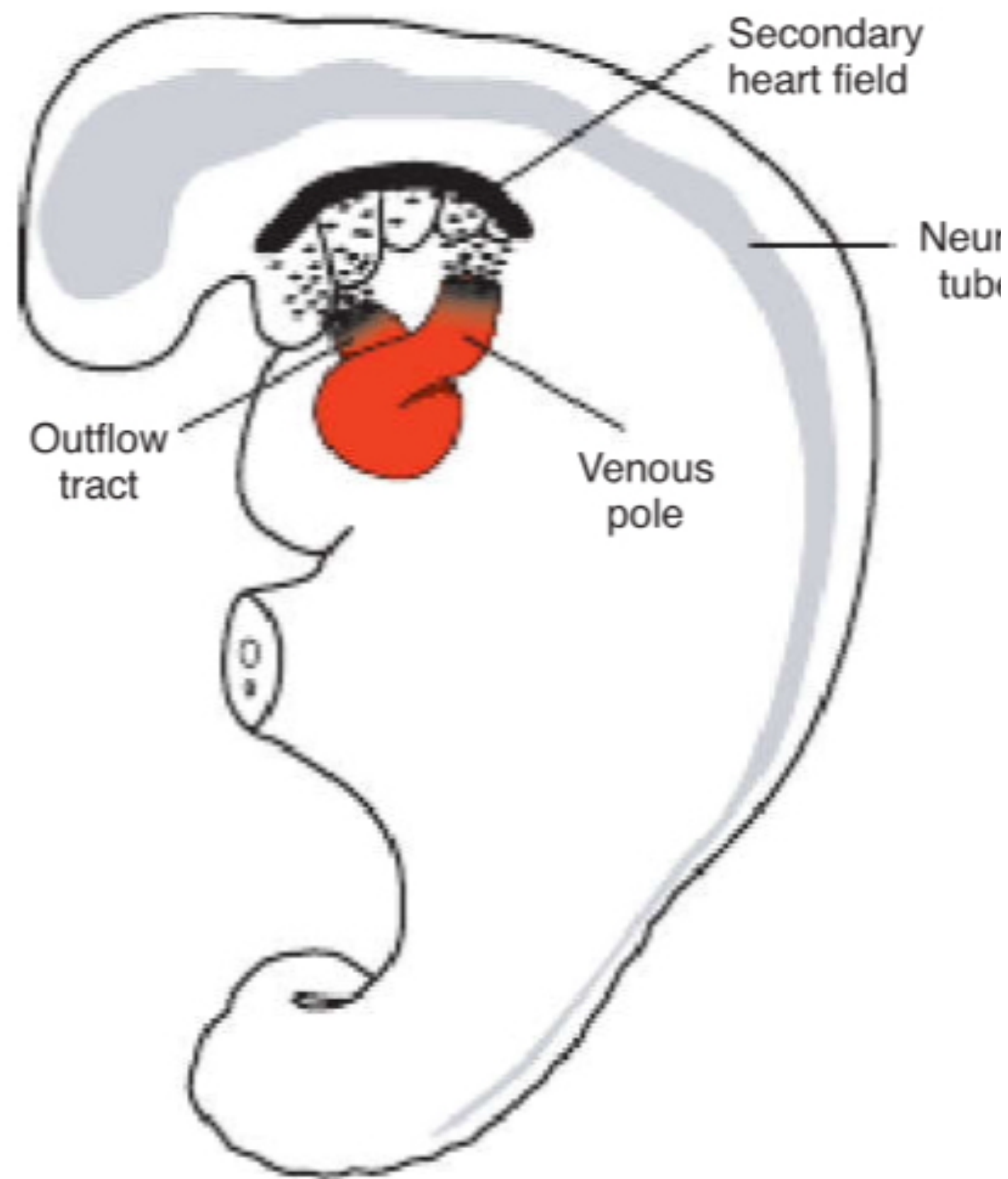


Formation of the heart tube

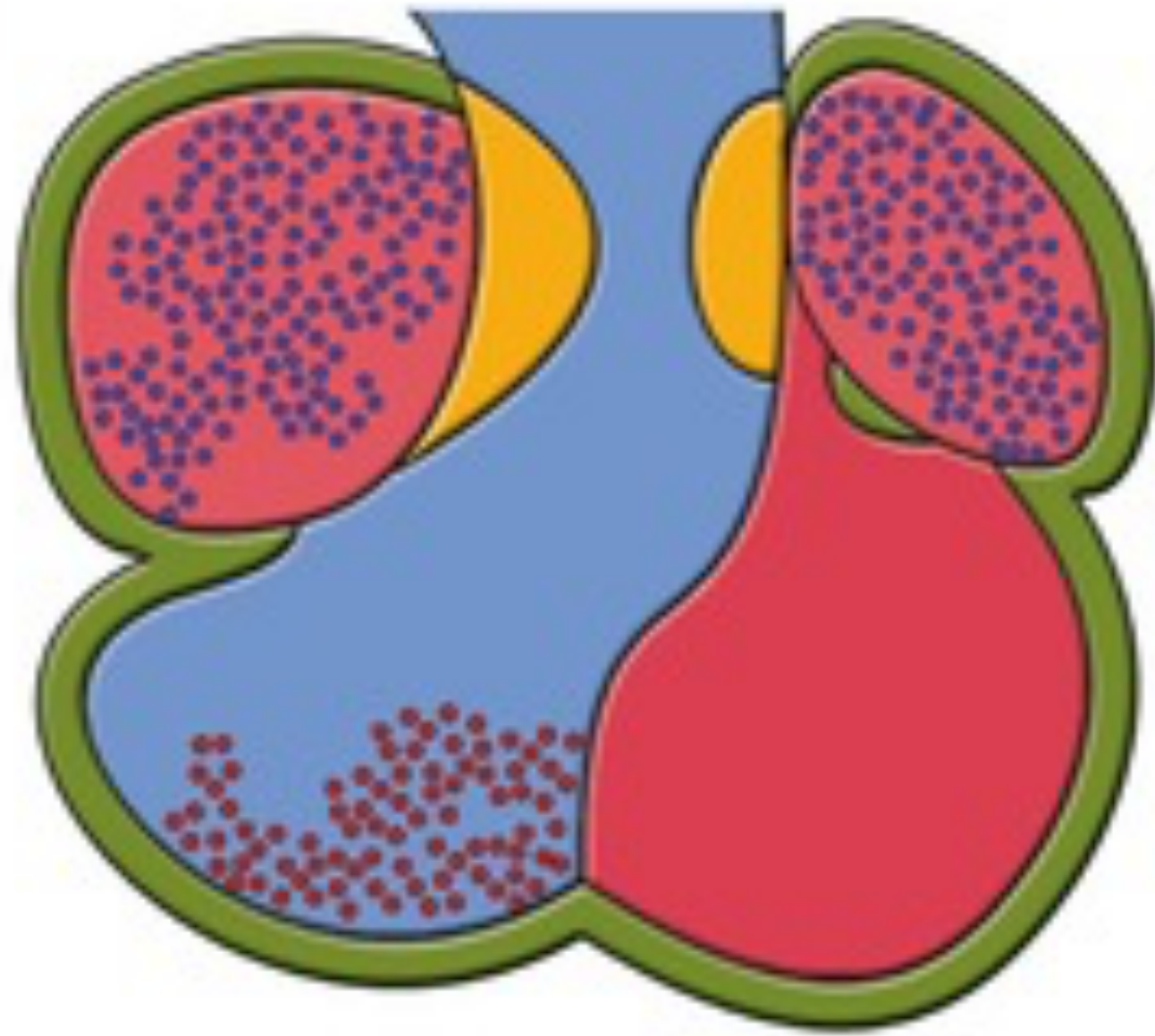


- WHEN? - day 22-28
- WHAT? – cells of the PHF
- DO WHAT? – form cardiac myoblasts and the blood islands ---> the horseshoe-shaped endothelial-lined tube surrounded by myoblast (=cardiogenic region/field), further the caudal portion fuse except for the caudalmost part

The heart tube lengthening



- **WHEN?** - day 22-28
- **WHAT?** – SHF in splanchnic mesoderm ventrally to the posterior pharynx
- **WHERE?** - thoracic region
- **DO WHAT?** – provides cells to lengthen both poles of the heart tube: atria and sinus venosus, right ventricle, conus cordis and truncus arteriosus



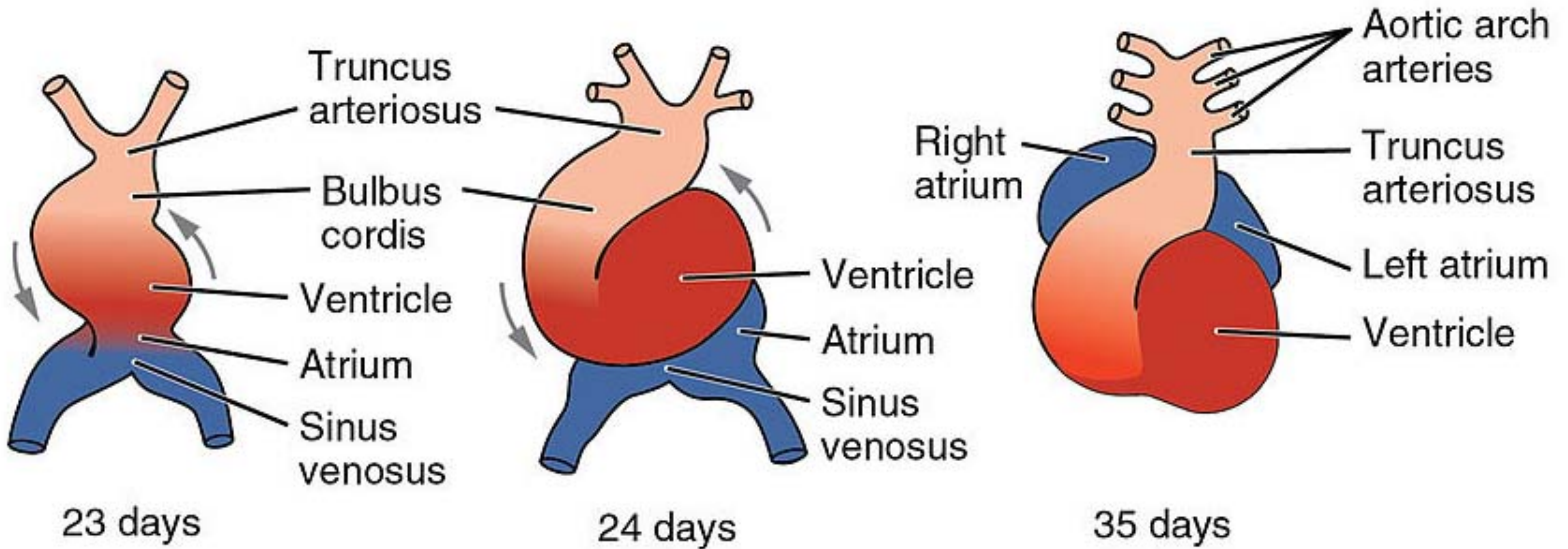
- First heart field
- Second heart field
- Neural crest
- Proepicardial organ

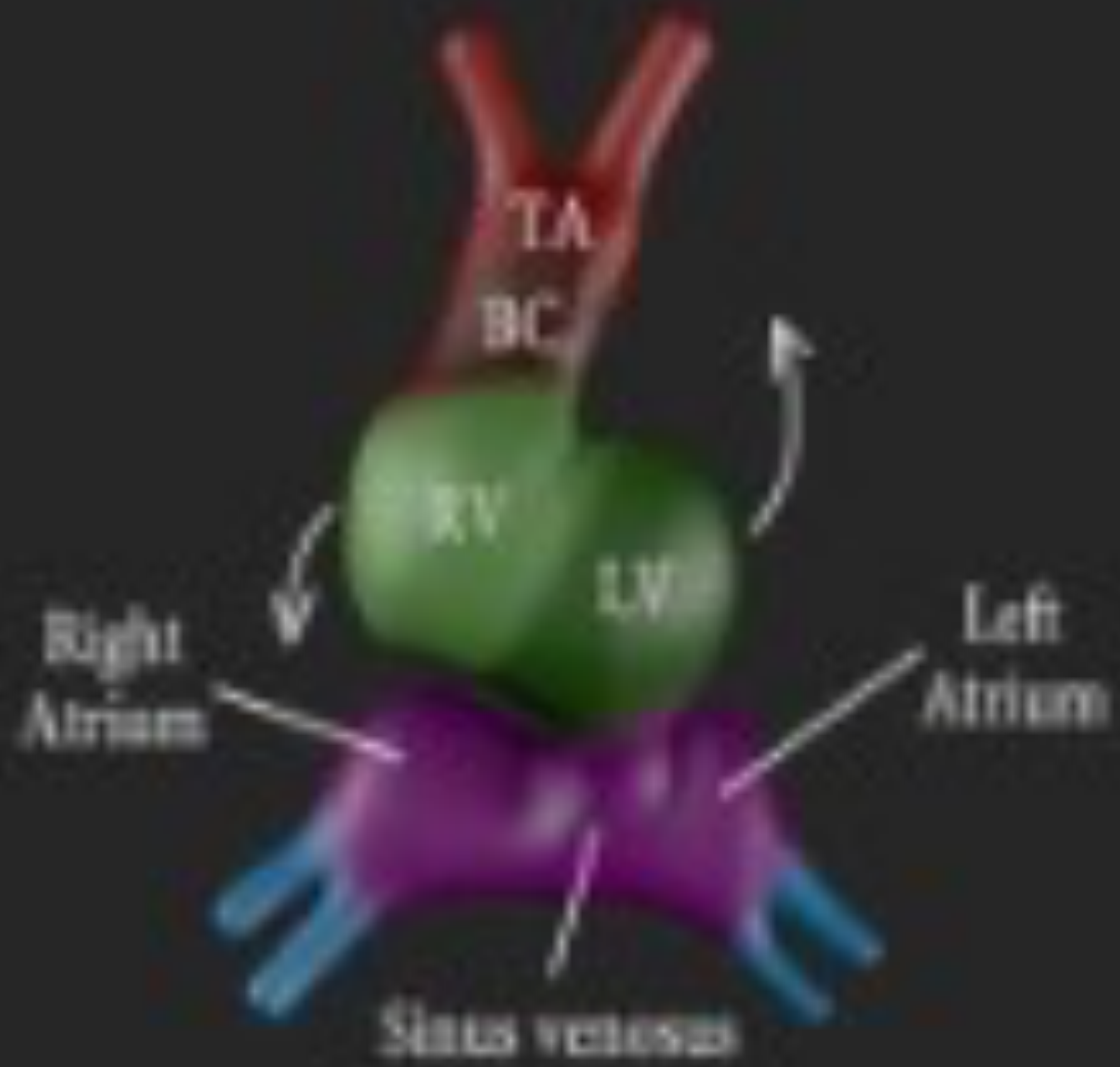
Looping of the heart



24 days

- WHEN? - day 23-28
- WHAT? - the primitive heart tube
- DO WHAT? - cephalic portion bends ventrally, caudally and to the right; caudal portion bends dorsally, cranially and to the left

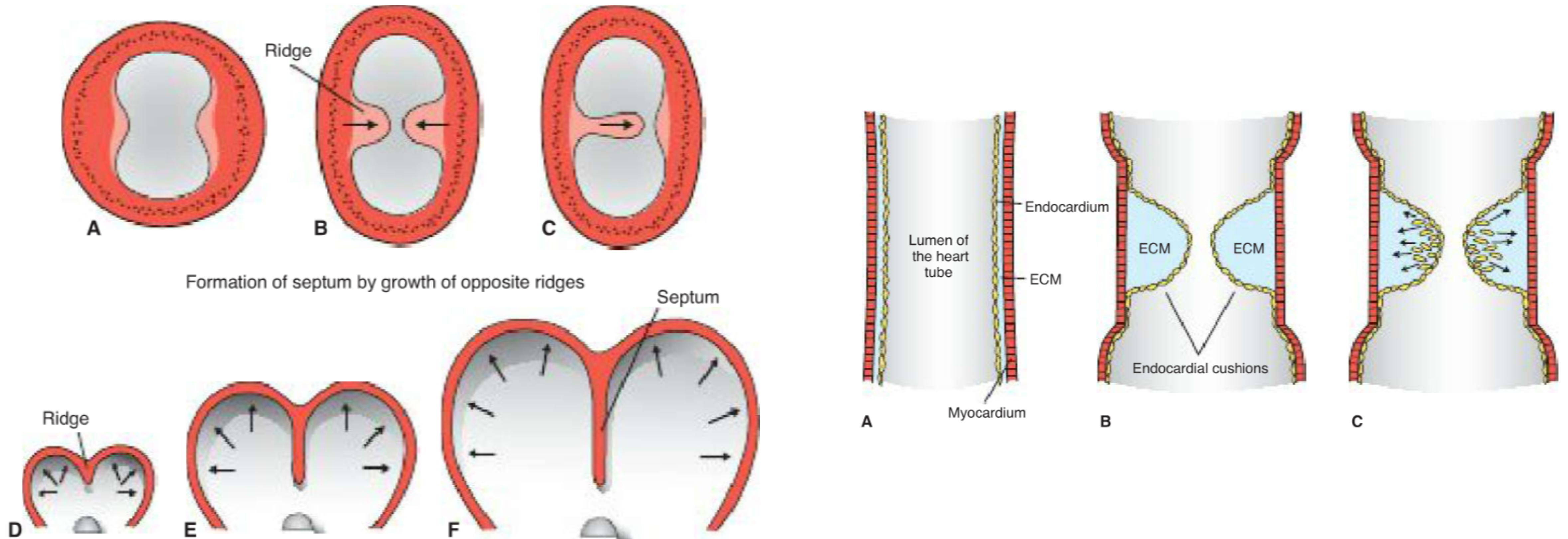




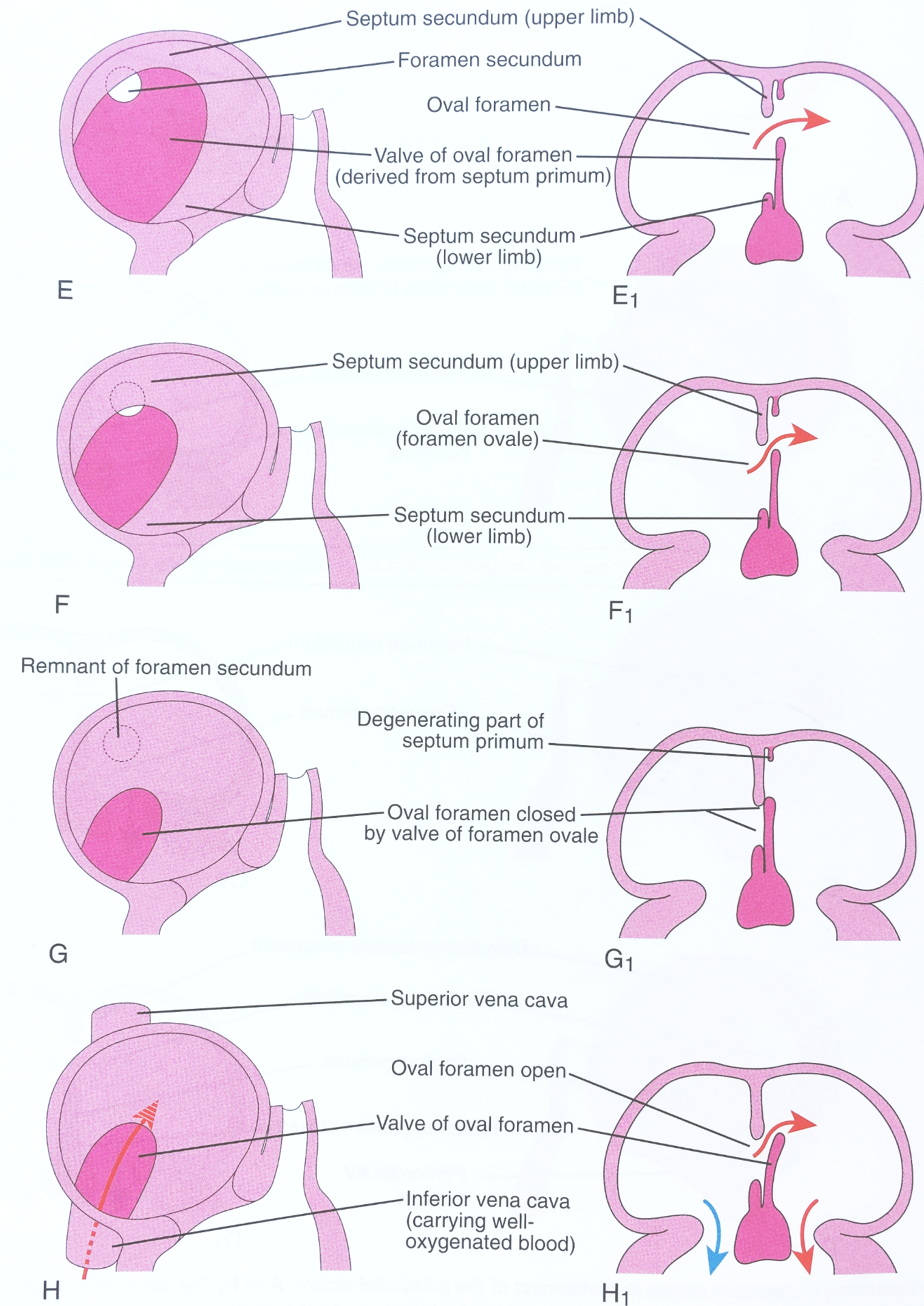
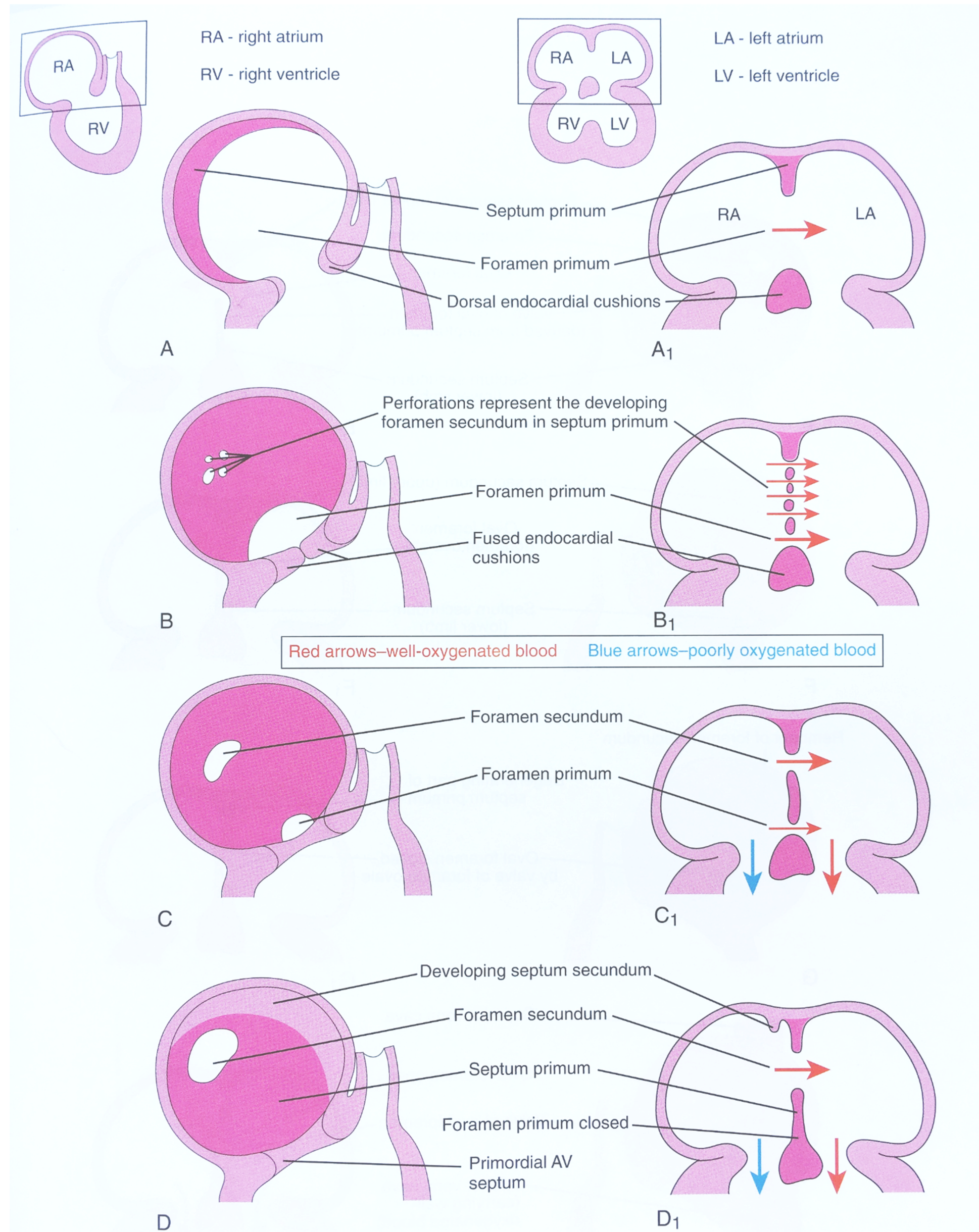
Formation of the cardiac septa

- WHEN? - day 27-37 (size of the embryo 5-16 mm!)
- WHAT? – septum in the common atrium
 - septum in the atrioventricular canal
 - septum in the truncus arteriosus and conus cordis
 - septum in ventricles

Formation of the cardiac septa

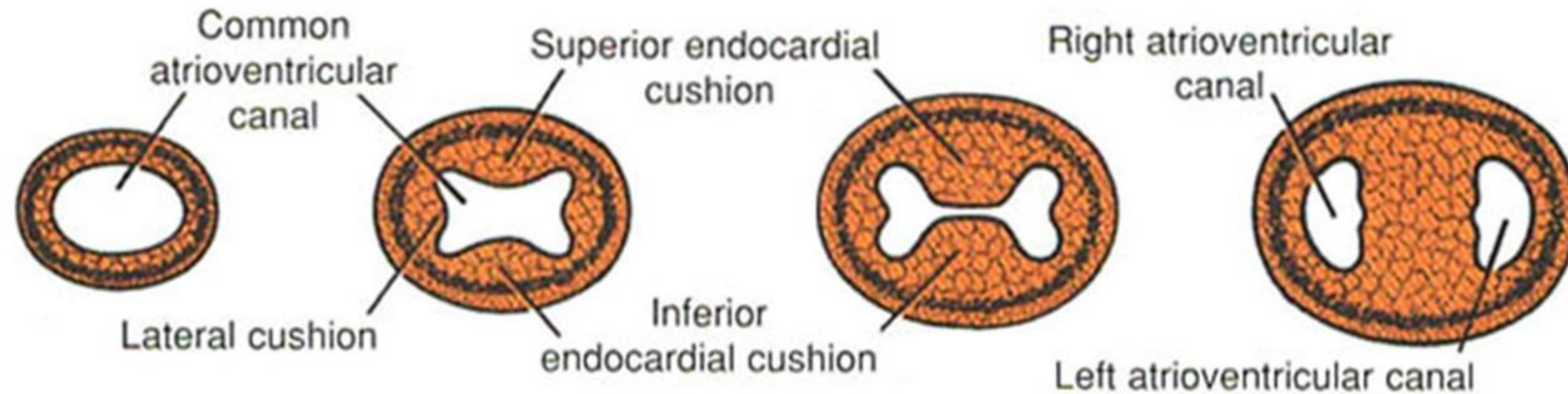
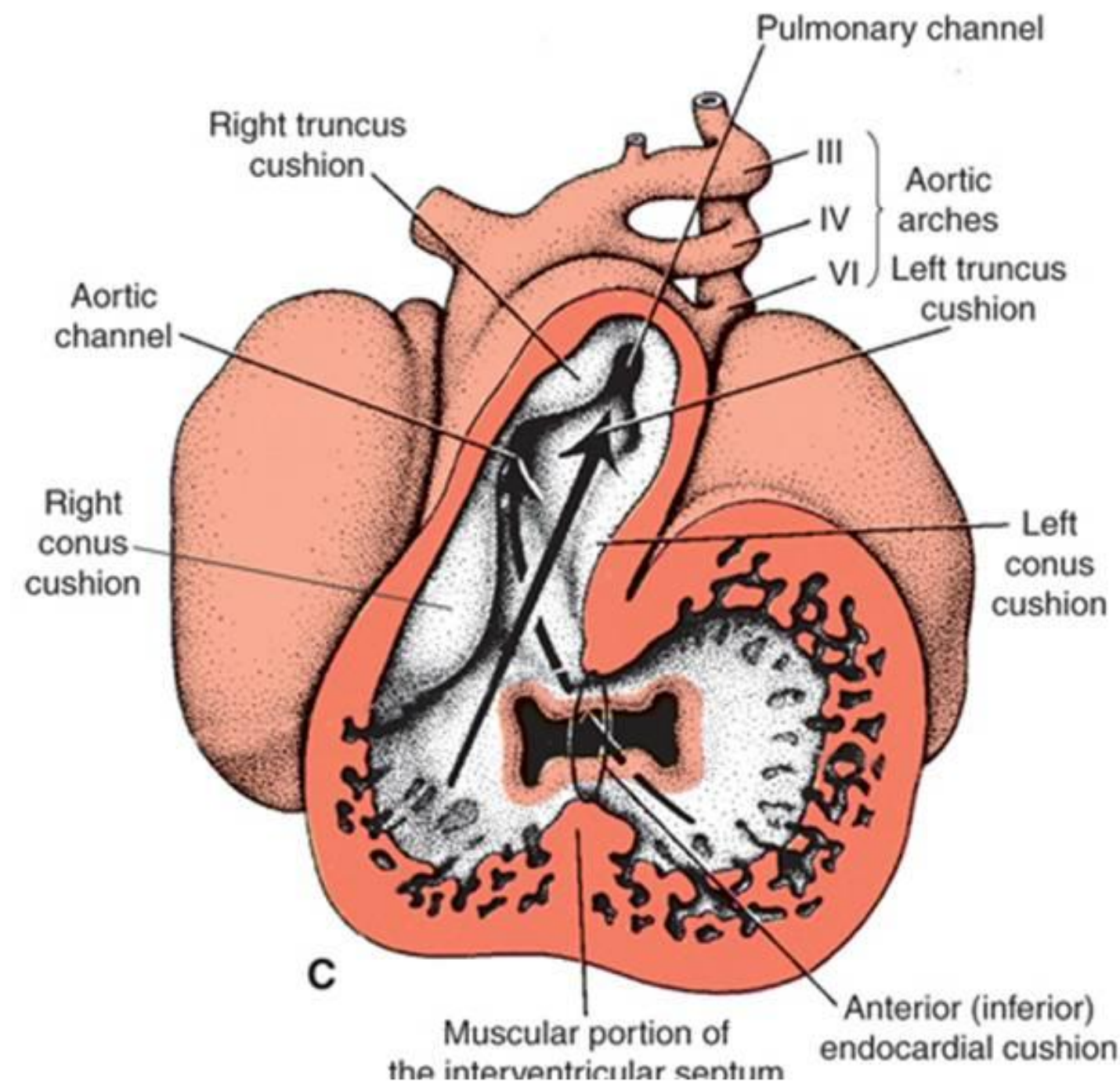


Septum in the common atrium

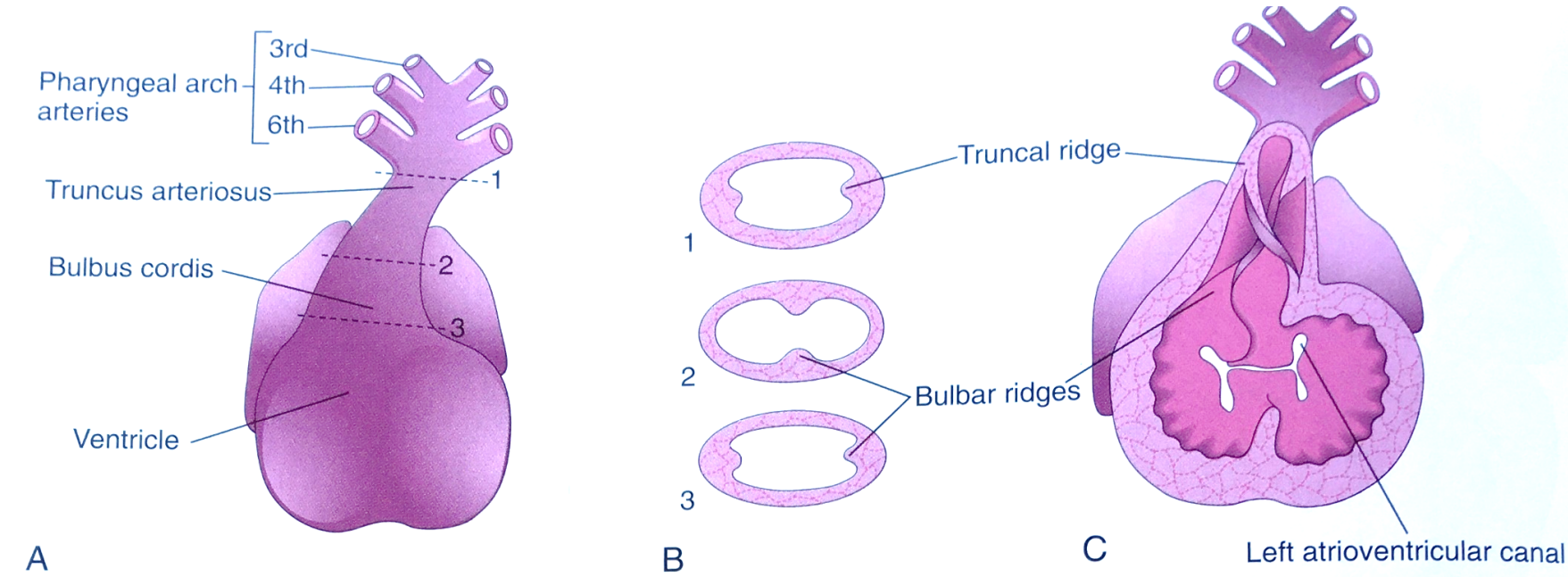


Septum in the atrioventricular canal

End of the 4th till end of the 5th week

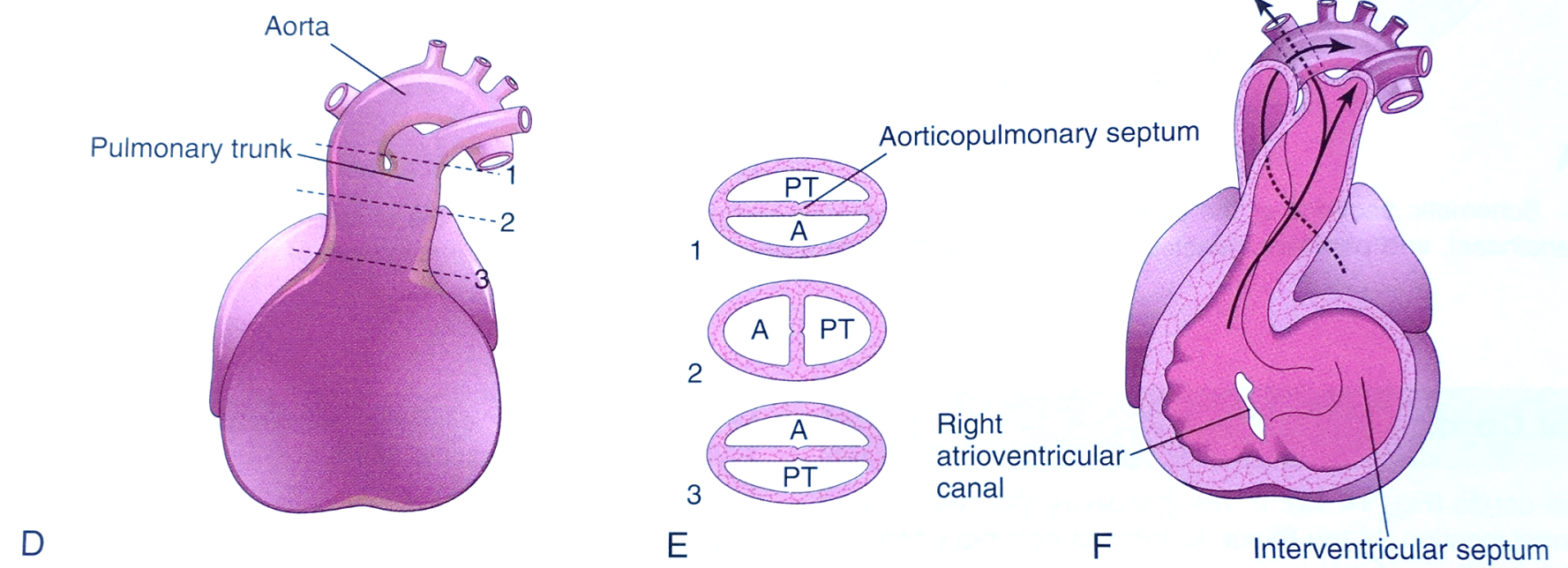


Septum in the truncus arteriosus and conus cordis

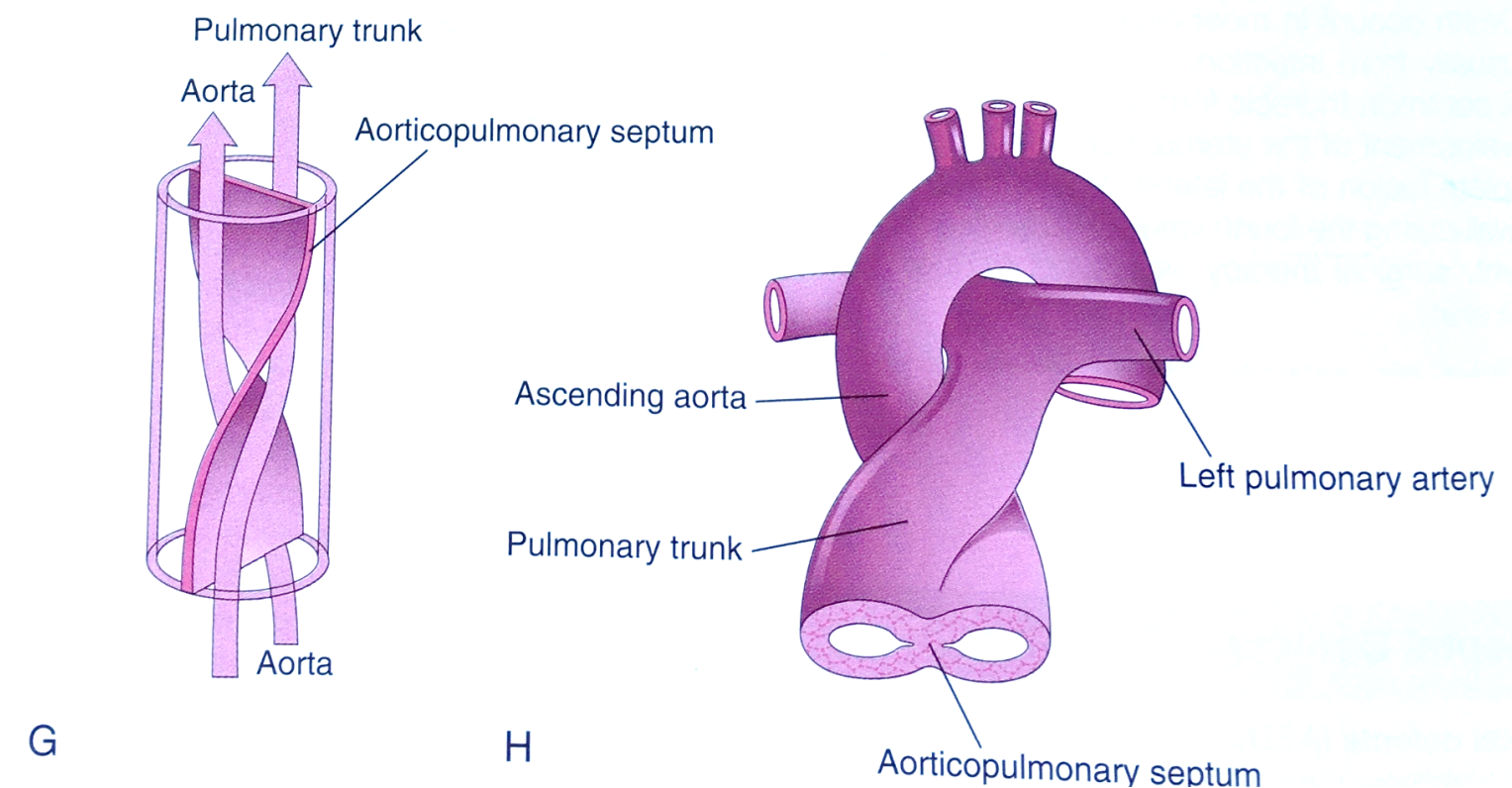


5th week – **truncus swellings**: **right superior** –grows distally to the left
left inferior – grows distally to the right

conus swellings – grow towards each other and distally to fuse with the truncus swellings



NEURAL CREST CELLS



Congenital heart defects (CHDs)

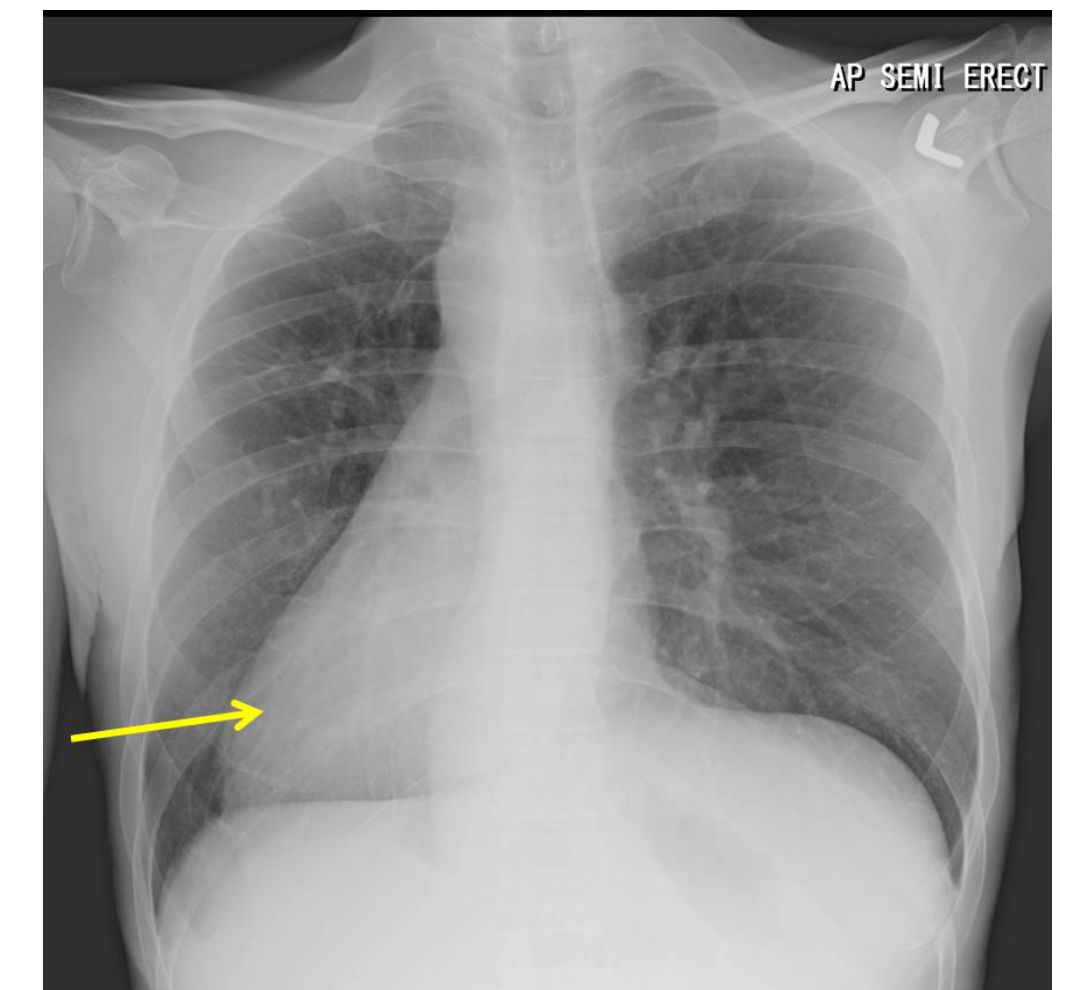
in 1% of live born infants; Rubella, thalidomide, RA, alcohol, maternal insulin-dependent diabetes

Laterality – during the gastrulation, signaling cascade includes serotonin, thus the SSRI class antidepressants are linked to the increase in heart defects:

- dextrocardia (situs inversus, heterotaxy)
- ventricular septal defects (VSDs)
- atrial septal defects (ASDs)
- double outlet right ventricle (DORV)
- transposition of the great vessels
- pulmonary stenosis
- atrial/ventricular isomerism
- inversions



https://en.wikipedia.org/wiki/Chest_radiograph



<http://radiologycases.my/2020/08/08/isolated-dextrocardia/>

Atrial septal defects (ASDs)

6,4/10 000; 2:1 prevalence in F to M; acyanotic

Patent foramen ovale in 10-20% of population

4 clinically significant ASD:

- **ostium secundum ASDs** (90% cases; 10-15% of all CHDs)
- **endocardial cushion defects with a foramen primum** (in 25% of patients with Down syndrome)
- **sinus venosus ASDs**
- **common atrium** (*cor triloculare biventriculare*) - combination of the above

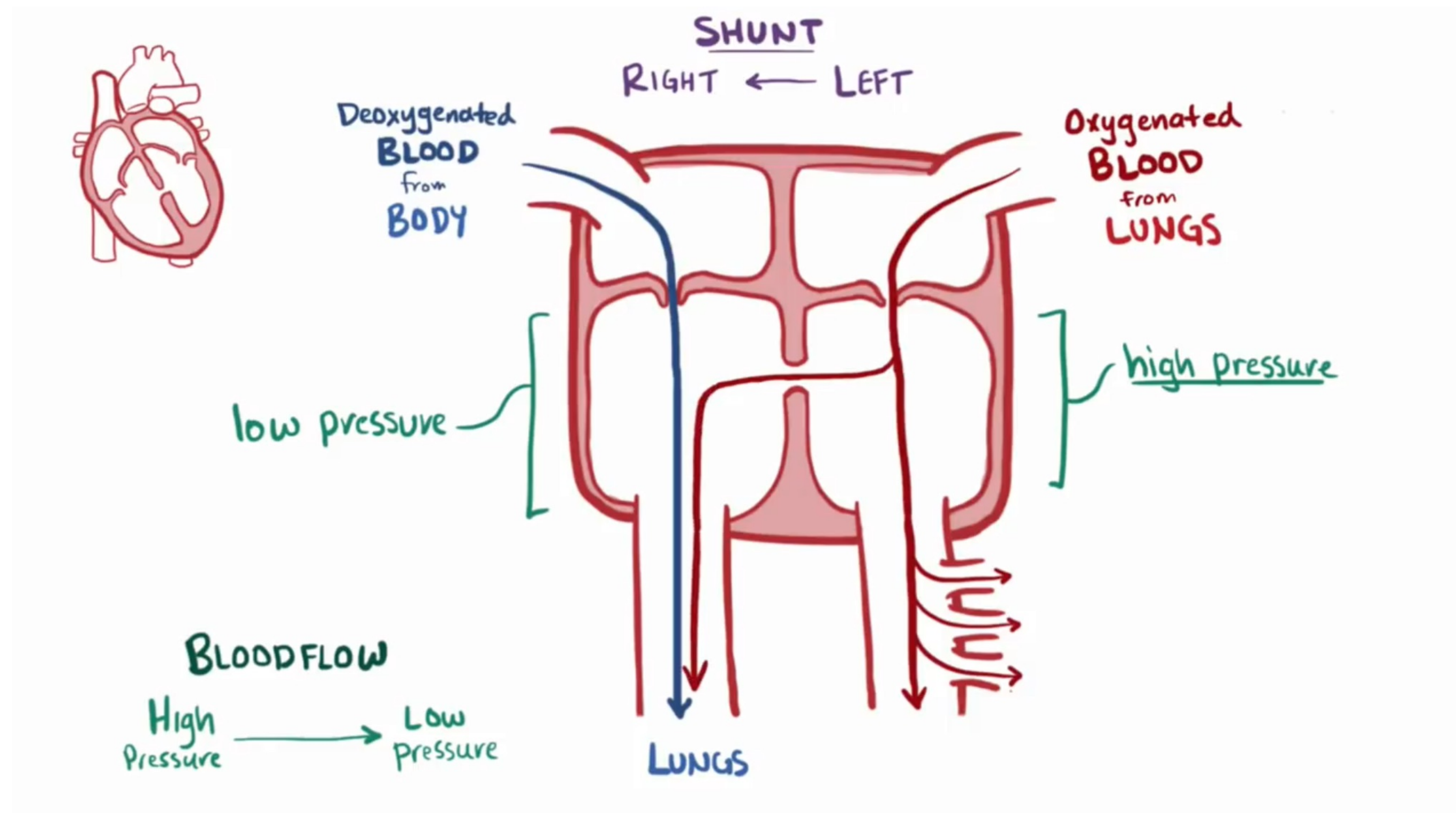
extra blood volume goes to the right side of the heart (delay in the pulmonary valve closure – splitting of the S2 sound), paradoxical embolism

Ventricular septal defects (VSDs)

most common CHDs 12/10 000; acyanotic; 80% in the muscular region and resolve during the childhood

membranous part defects are more severe and associated with other abnormalities

the blood volume carried by pulmonary artery increases (can be 1,2-1,7 times more than aorta) leading to the pulmonary hypertension and can cause Eisenmenger syndrome



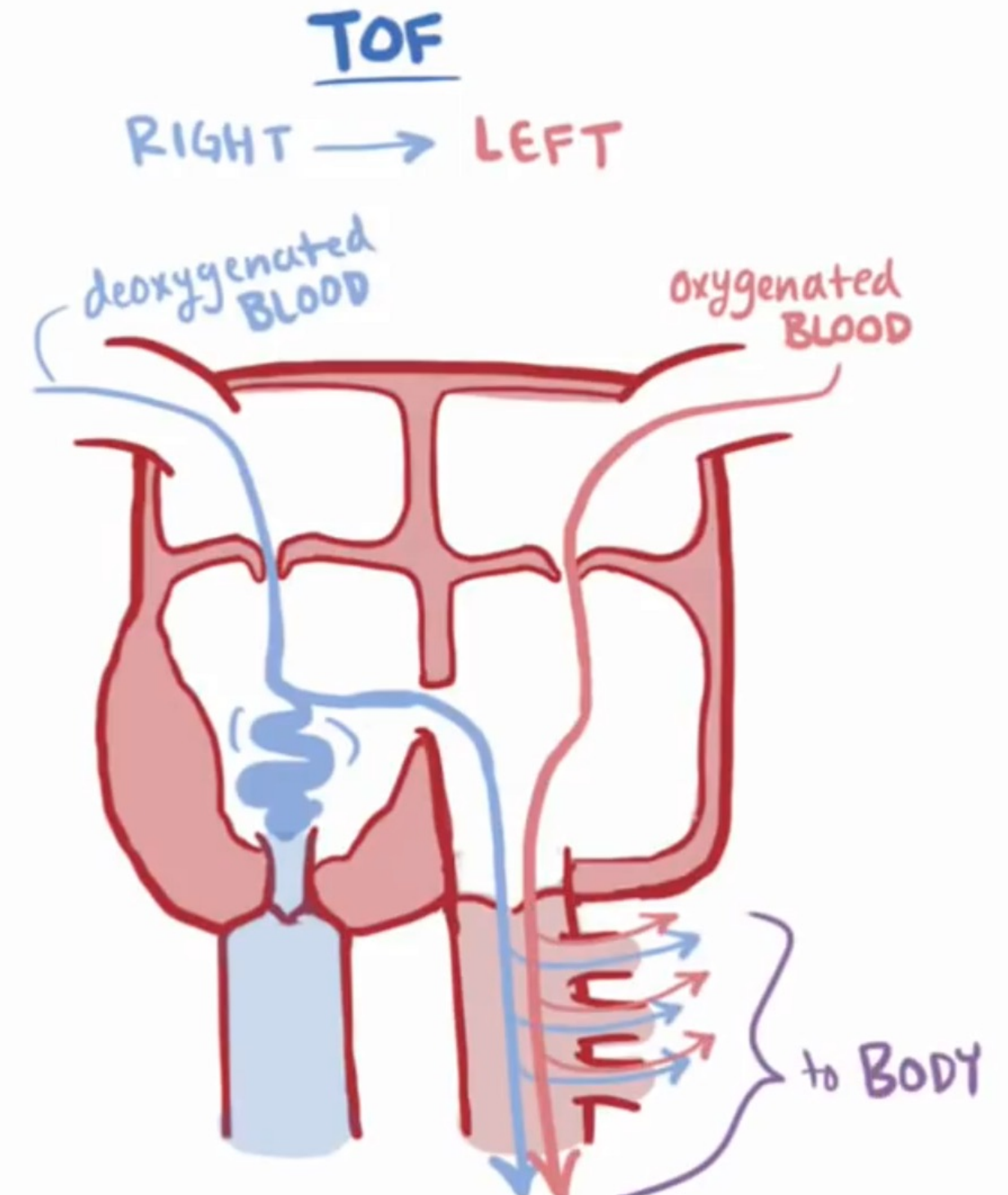
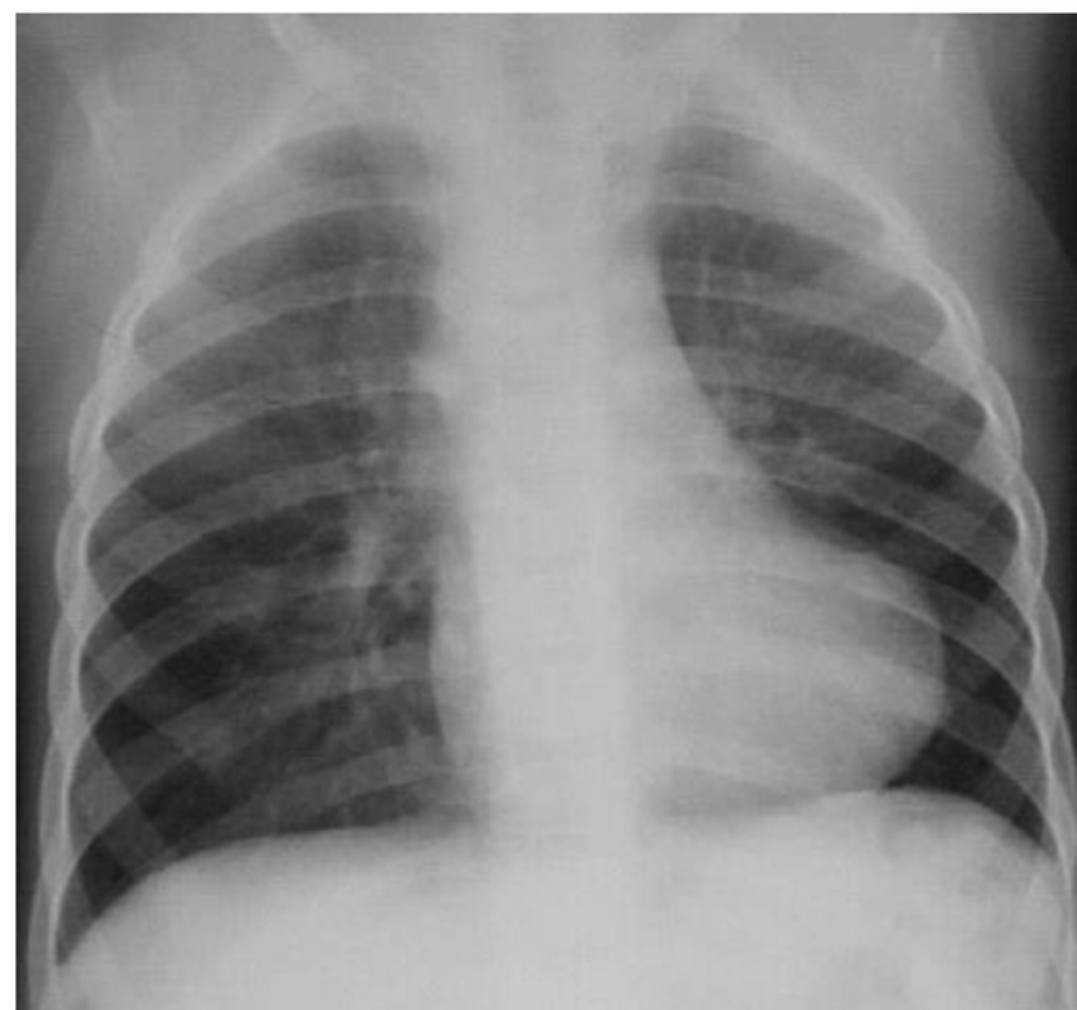
Tetralogy of Fallot (TOF)

results from anterior displacement of conotruncal septum

9,6/10000; 10% of all CHDs; cyanotic

leading to 4 abnormalities:

1. Pulmonary infundibular stenosis
2. VSD
3. overriding aorta
4. hypertrophy of the right ventricle



Congenital heart defects (CHDs)

Ectopia cordis – ventral body wall defect

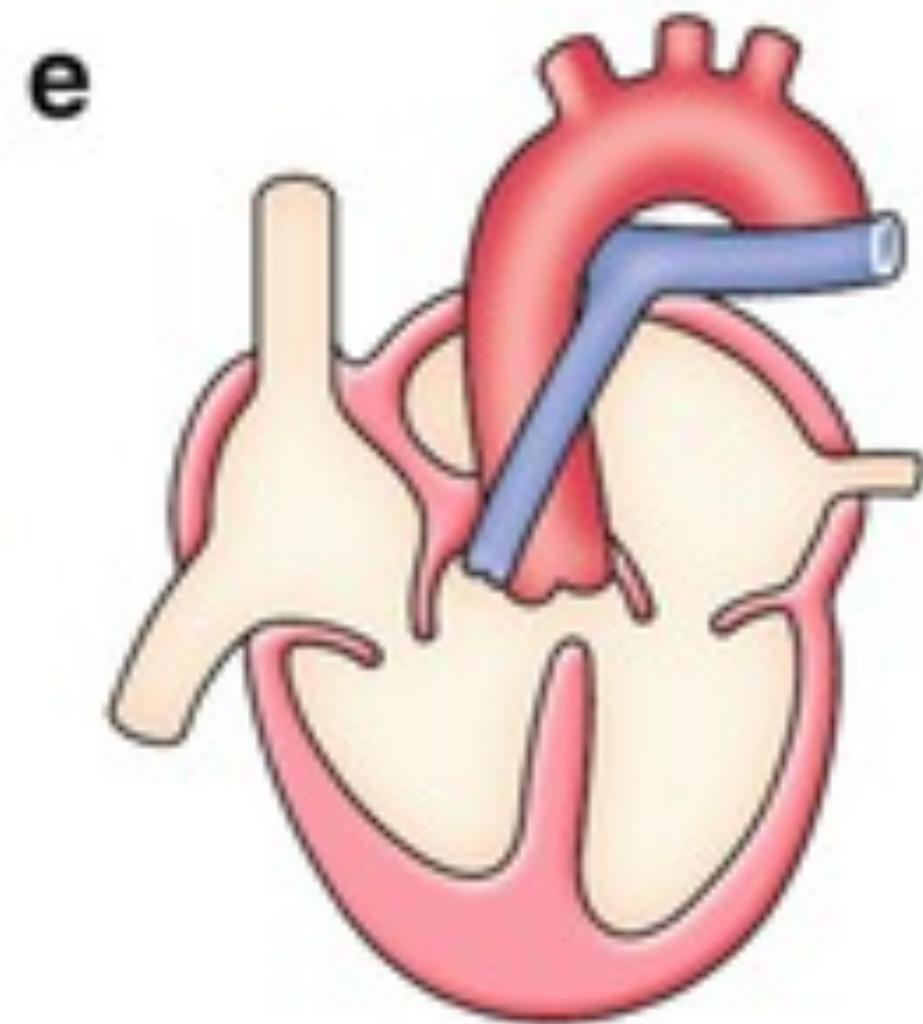
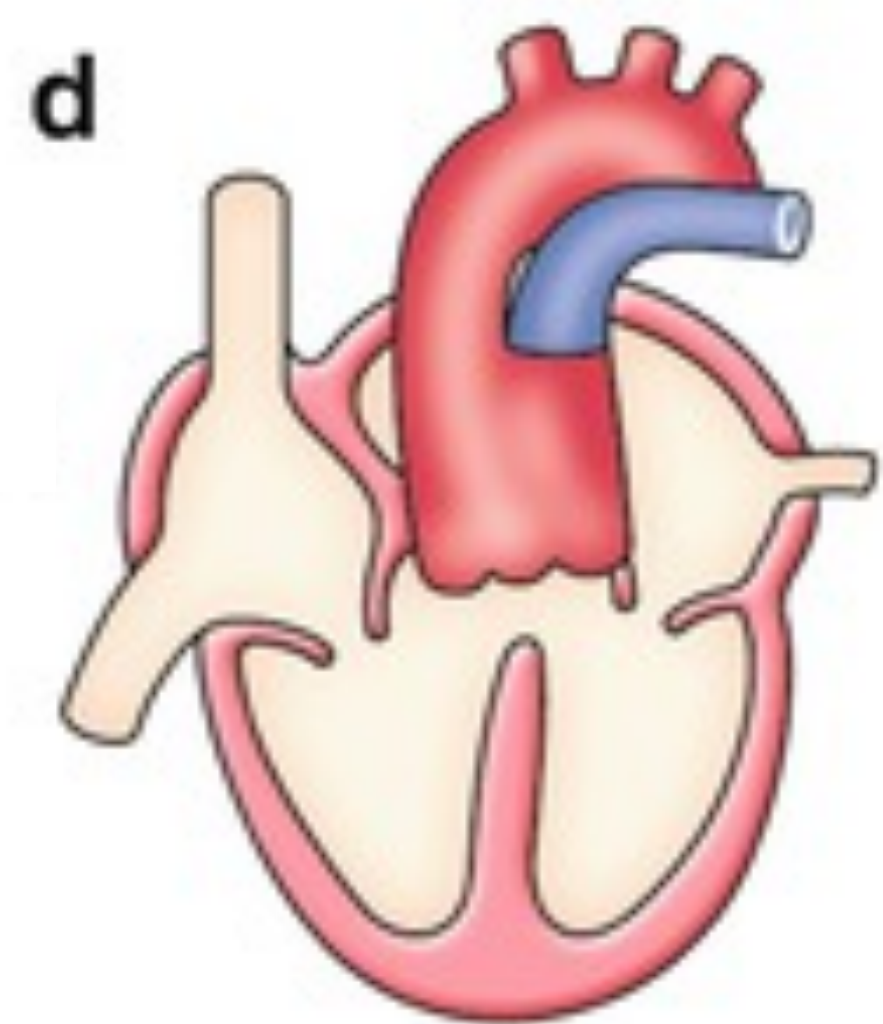
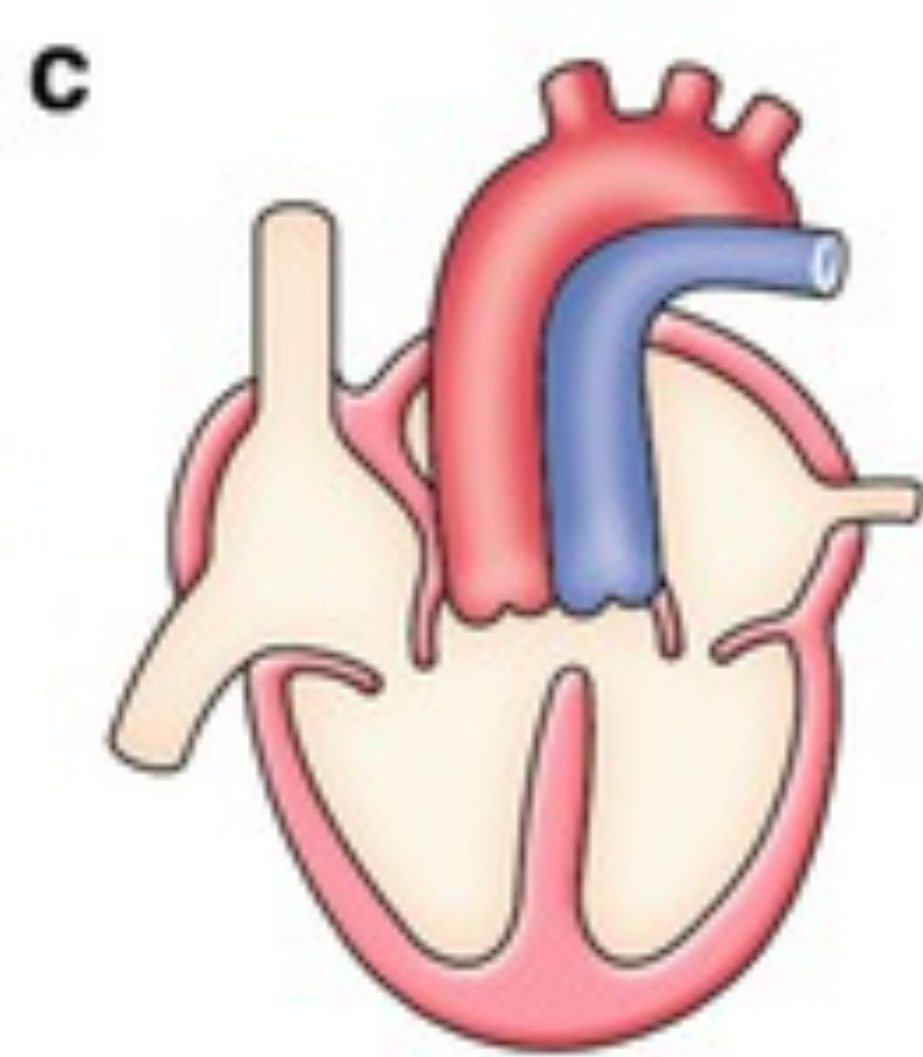
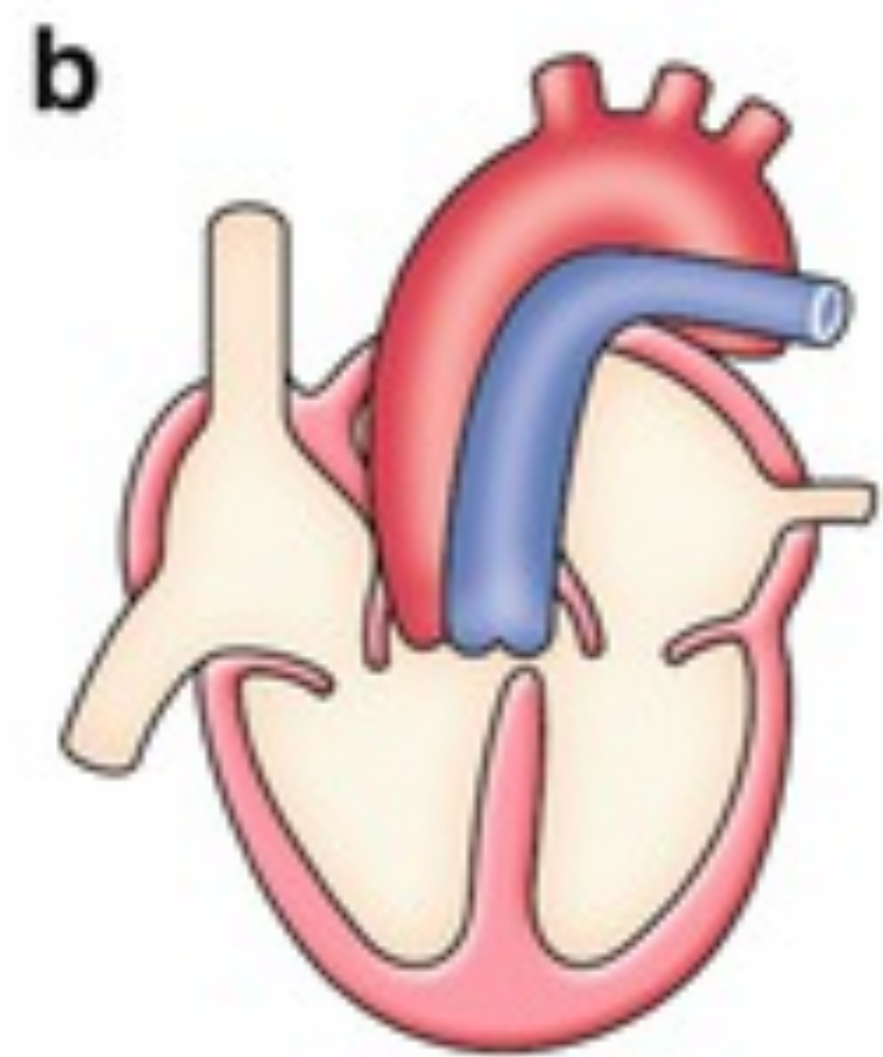
Persistent truncus arteriosus – (0,8/10 000) – always present with VSD

Transposition of great arteries (4,8/10 000)

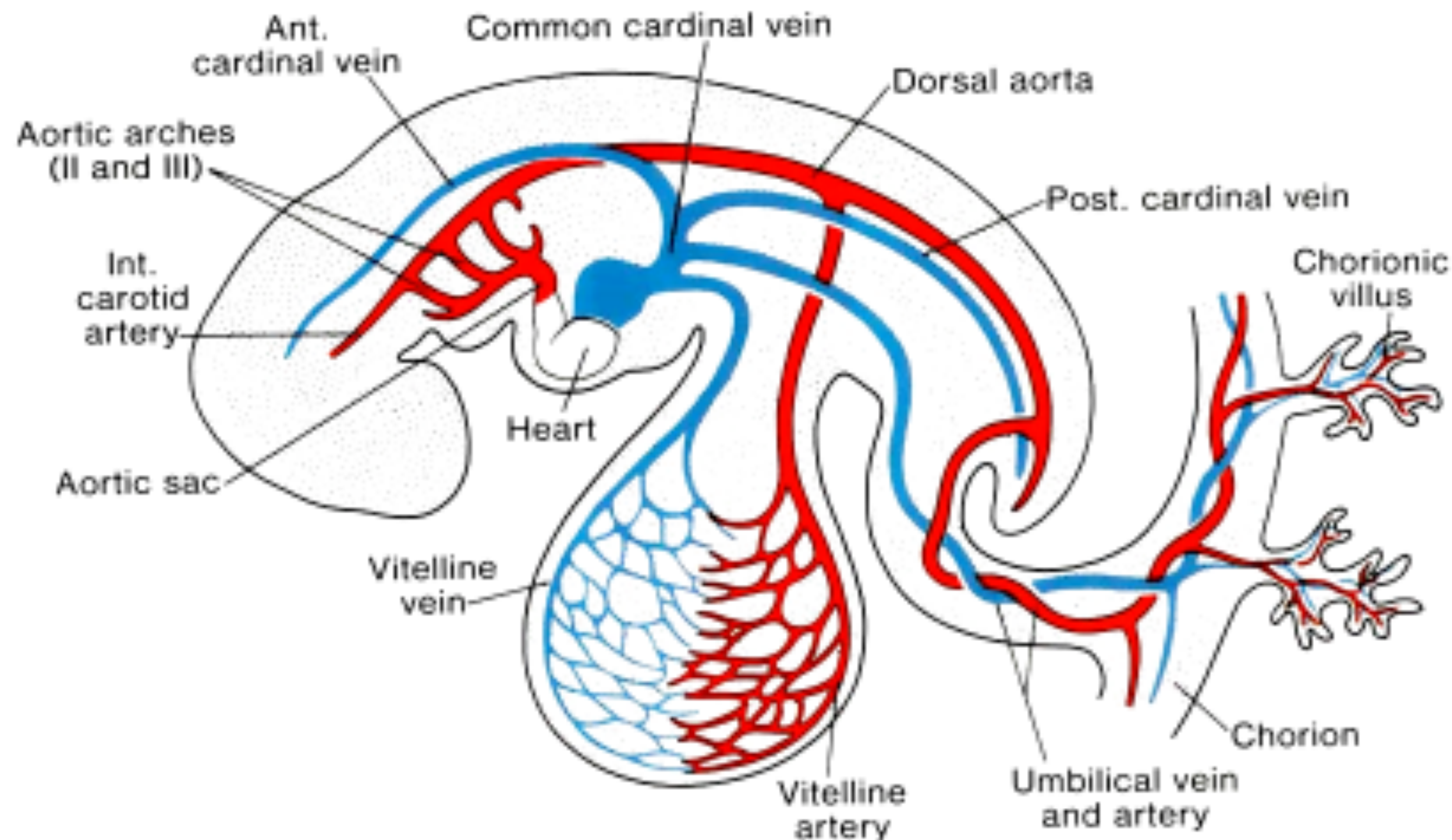
Aortic stenosis and aortic atresia

Pulmonary stenosis and pulmonary atresia

Unequal division of TA



Primitive blood circulation



- ⇒ in the wall of yolk sac (aa. et vv. omphalomesentericae)
- ⇒ in the chorion and connecting stalk (aa. et vv. umbilicales)
- ⇒ in embryo (primary blood circulation – *heart tube, dorsal aortae, cardinal veins*)

Foetal blood circulation

