Cardio-Vascular System 4

- Basis of vascular development
- Development of arterial system
- Development of venous system

Cockroach (“Karapoththa”)

VS

Human

Questions

- How many aortic arteries are present in 6 weeks old embryo?
    A. 12 aortic arteries
    B. 10 aortic arteries
    C. 8 aortic arteries
    D. 6 aortic arteries
    E. 5 aortic arteries

Questions

- Why is the aorta in the left side?

- Why the IVC is in right side?

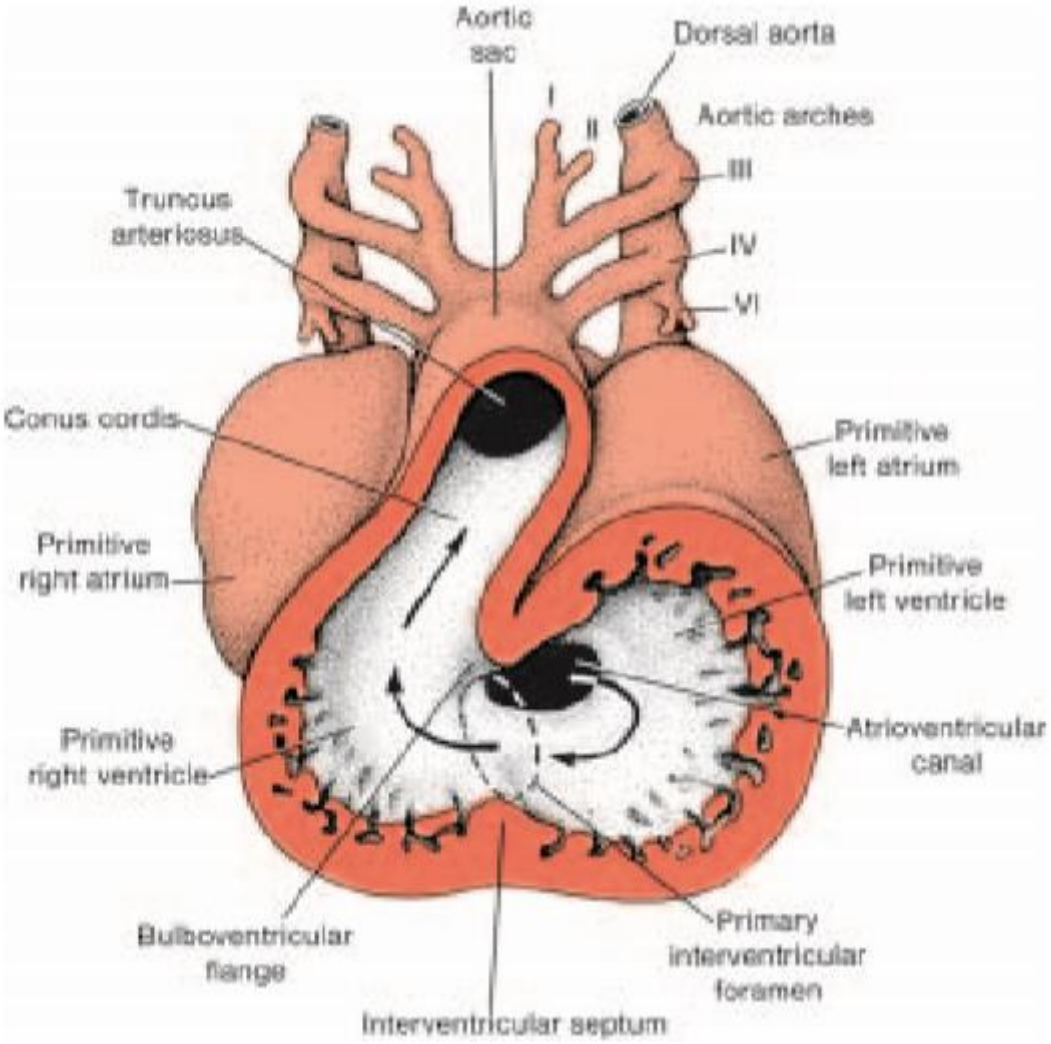
Development of the arterial system

- Development is discussed under
  - Aortic arches
  - Vitelline arteries
  - Umbilical arteries
  - Limb arteries

Aortic arches

- Begins during 4^{th} & 5^{th} weeks of development
- Each pharyngeal arch receives individual Aortic arch
- Six pairs of Aortic arches (5^{th} arch is absent or incomplete)

30 days embryo



- Changes that occur

-Initial symmetrical , paired structure will become left sided definitive aortic arch with its branches

-Regression of some aortic arches

First,second,fifth aortic arches

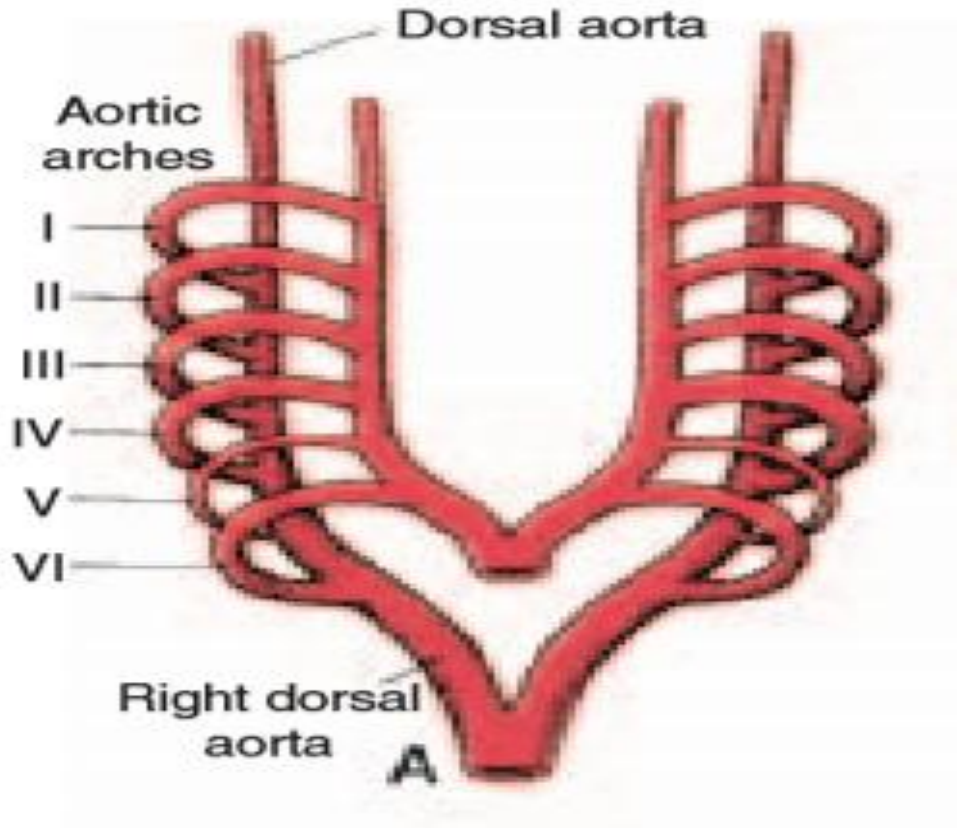
-Branching of some aortic arches

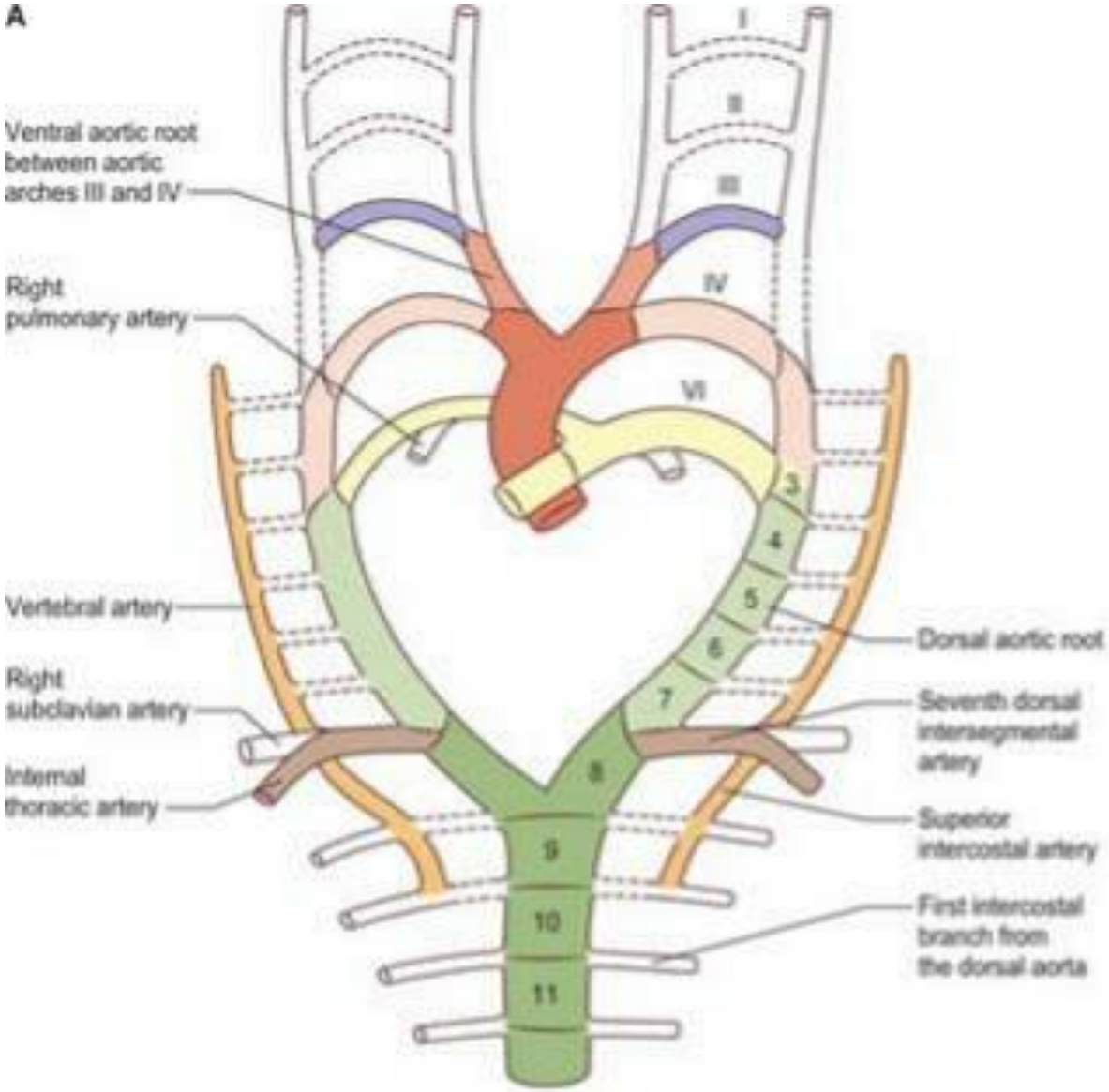
Part of third artic arch-external carotid artery

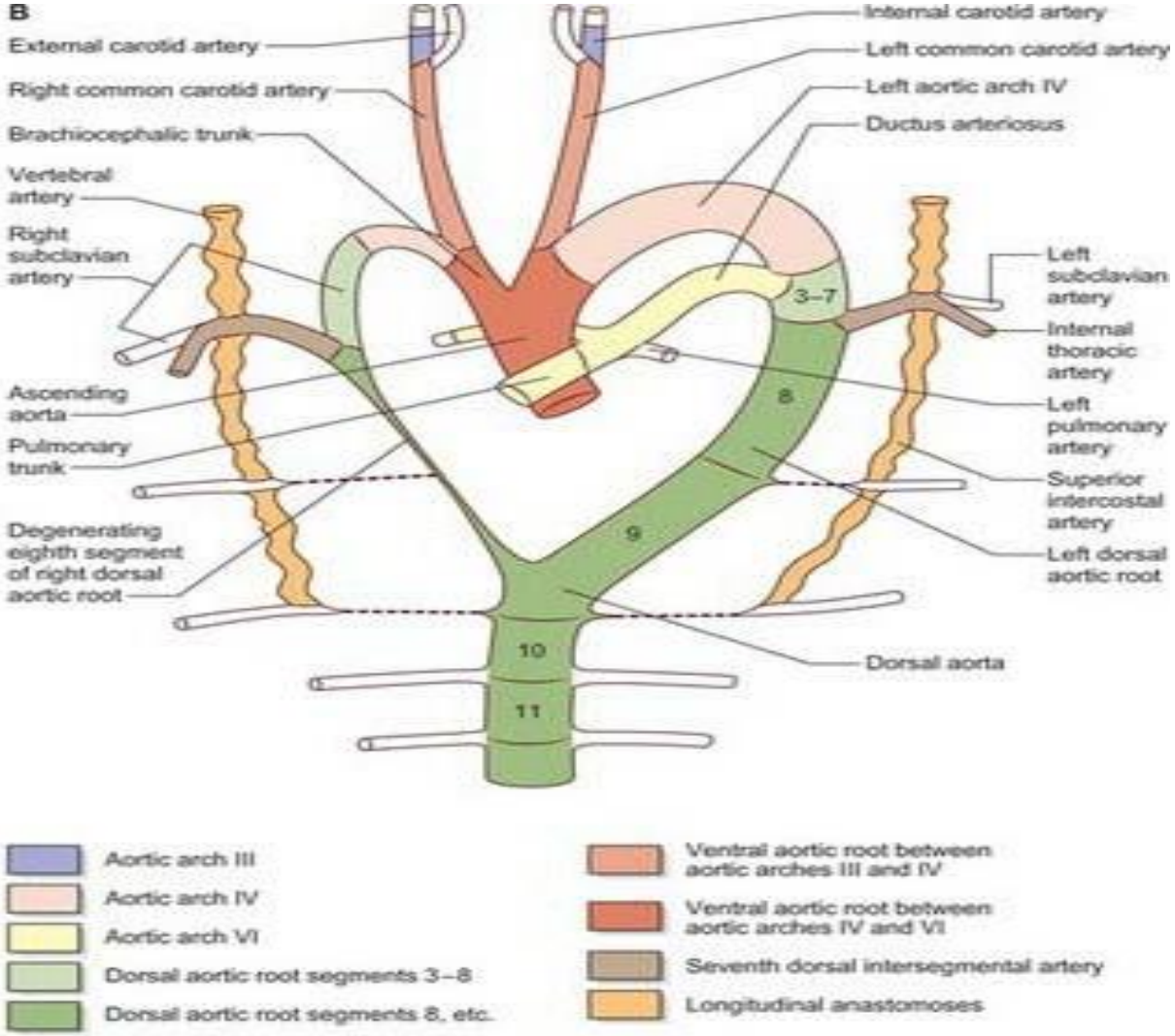
-Shortening of some aortic arches

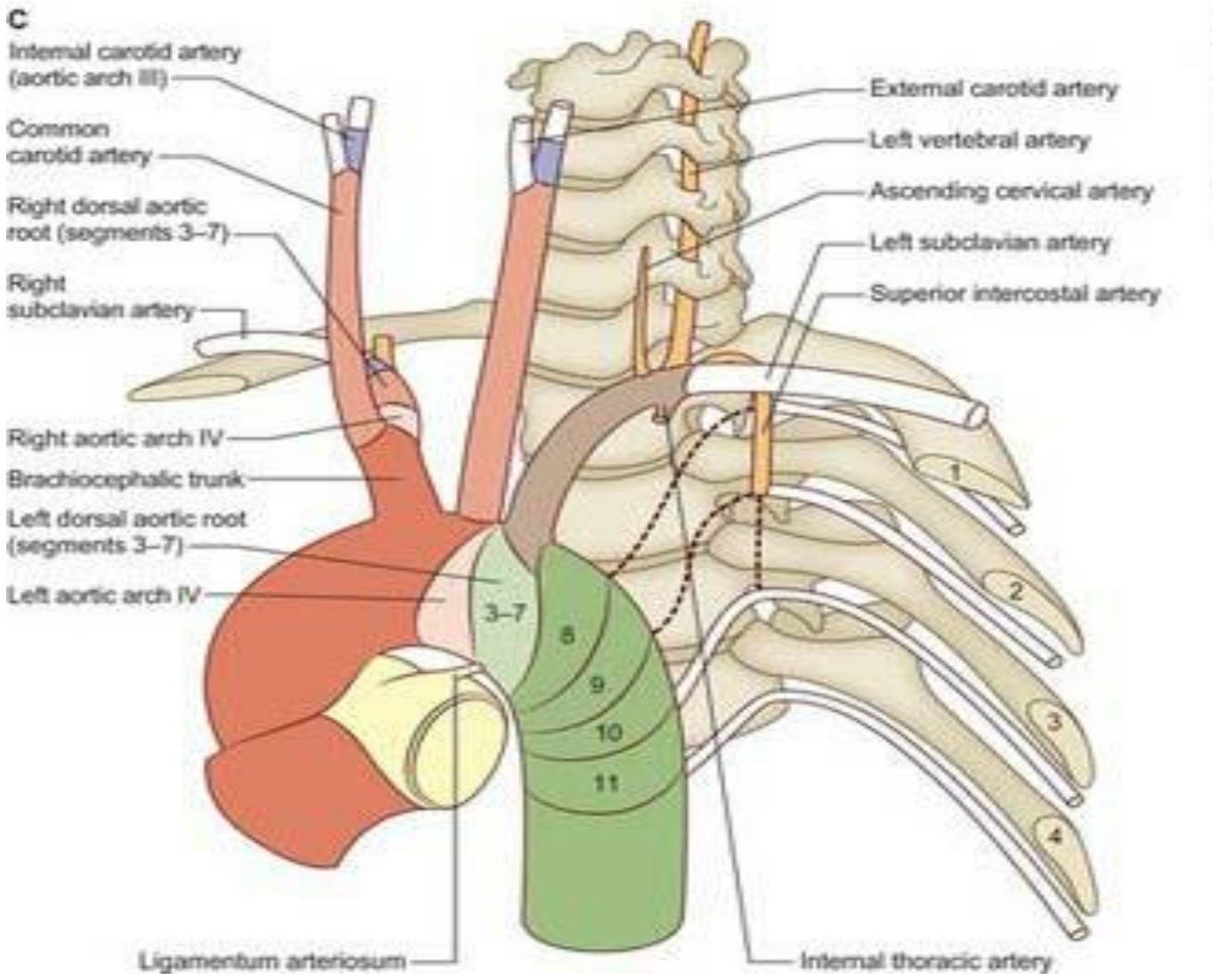
Segment of 4^{th} arch

Basic pattern of aortic arches




A
Ventral aortic root between aortic arches III and IV
Right pulmonary artery
Vertebral artery
Right subclavian artery
Internal thoracic artery
I
II
III
IV
VI
3
4
5
6
7
8
9
10
11
Dorsal aortic root
Seventh dorsal intersegmental artery
Superior intercostal artery
First intercostal branch from the dorsal aorta


B
External carotid artery
Right common carotid artery
Brachiocephalic trunk
Vertebral artery
Right subclavian artery
Ascending aorta
Pulmonary trunk
Degenerating eighth segment of right dorsal aortic root
Internal carotid artery
Left common carotid artery
Left aortic arch IV
Ductus arteriosus
Left subclavian artery
Internal thoracic artery
Left pulmonary artery
Superior intercostal artery
Left dorsal aortic root
Dorsal aorta
3–7
8
9
10
11
Aortic arch III
Aortic arch IV
Aortic arch VI
Dorsal aortic root segments 3–8
Dorsal aortic root segments 8, etc.
Ventral aortic root between aortic arches III and IV
Ventral aortic root between aortic arches IV and VI
Seventh dorsal intersegmental artery
Longitudinal anastomoses


C
Internal carotid artery (aortic arch III)
Common carotid artery
Right dorsal aortic root (segments 3–7)
Right subclavian artery
Right aortic arch IV
Brachiocephalic trunk
Left dorsal aortic root (segments 3–7)
Left aortic arch IV
Ligamentum arteriosum
External carotid artery
Left vertebral artery
Ascending cervical artery
Left subclavian artery
Superior intercostal artery
Internal thoracic artery
3–7
8
9
10
11
1
2
3
4

Positioning of recurrent laryngeal nerve

-Recurrent laryngeal nerve supply 6^{th} pharyngeal arch

-It hooks around 6^{th} aortic arch

-Right side 5^{th} & 6^{th} arches regresses & nerve hooks around distal part of aortic arch 4^{th} aortic arch (R.subclavian A)

-Left side nerve hooks around distal part of 6^{th} aortic arch (ductus arteriosus)

Development of veins

- By 5 th week 3 tributaries are present at each sinus horn.

Vitelline vein

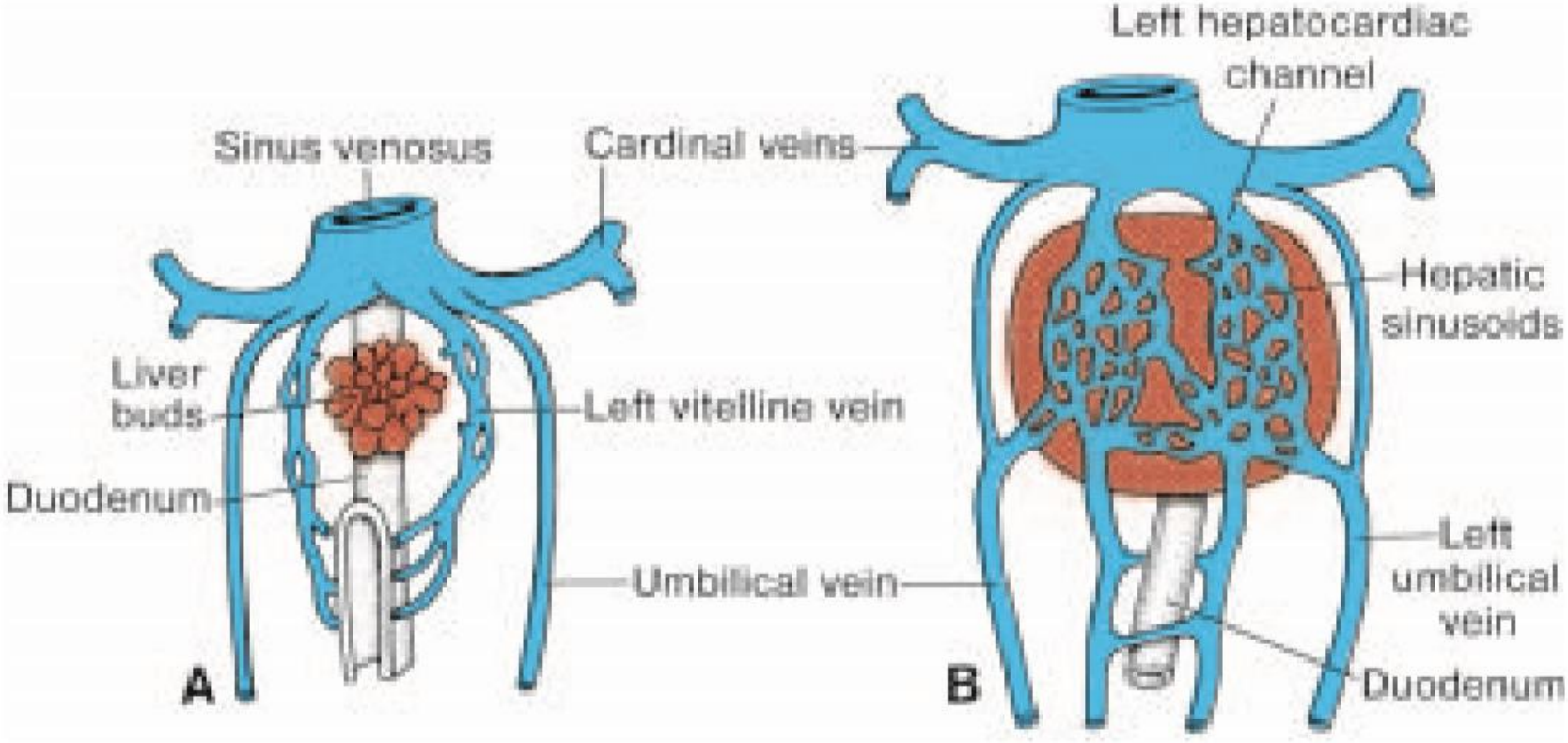
Umbilical vein

Cardinal vein

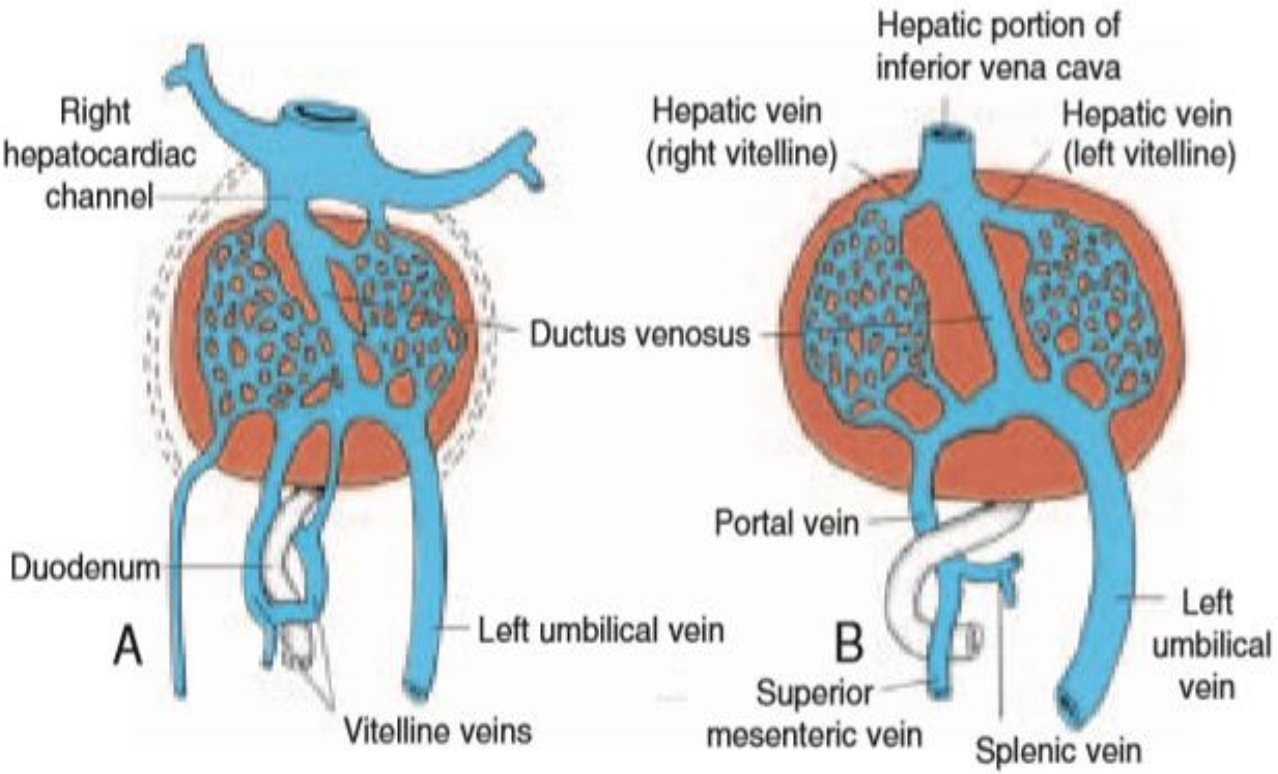
Vitelline vein

- Vitelline veins form plexus around duodenum & pass through septum transversum.
- Liver cords grow & interrupt the vein.
- Vitelline vein joins hepatic sinusoids.

Vitelline vein



Vitelline vein



Cardinal Veins

- Has 3 tributaries
  - -Common cardinal vein
  - -Anterior cardinal vein
  - -Posterior cardinal vein
- Initially symmetrical system
- Later anastomoses between right & left sides and shunting of blood from left to right side.

- Additional veins form during 6^{th} to 7^{th} weeks.

  - Sub cardinal veins - drain kidneys
  - Sacro cardinal veins - drain lower extremities
  - Supra cardinal vein - drain body wall by intercostal vein.

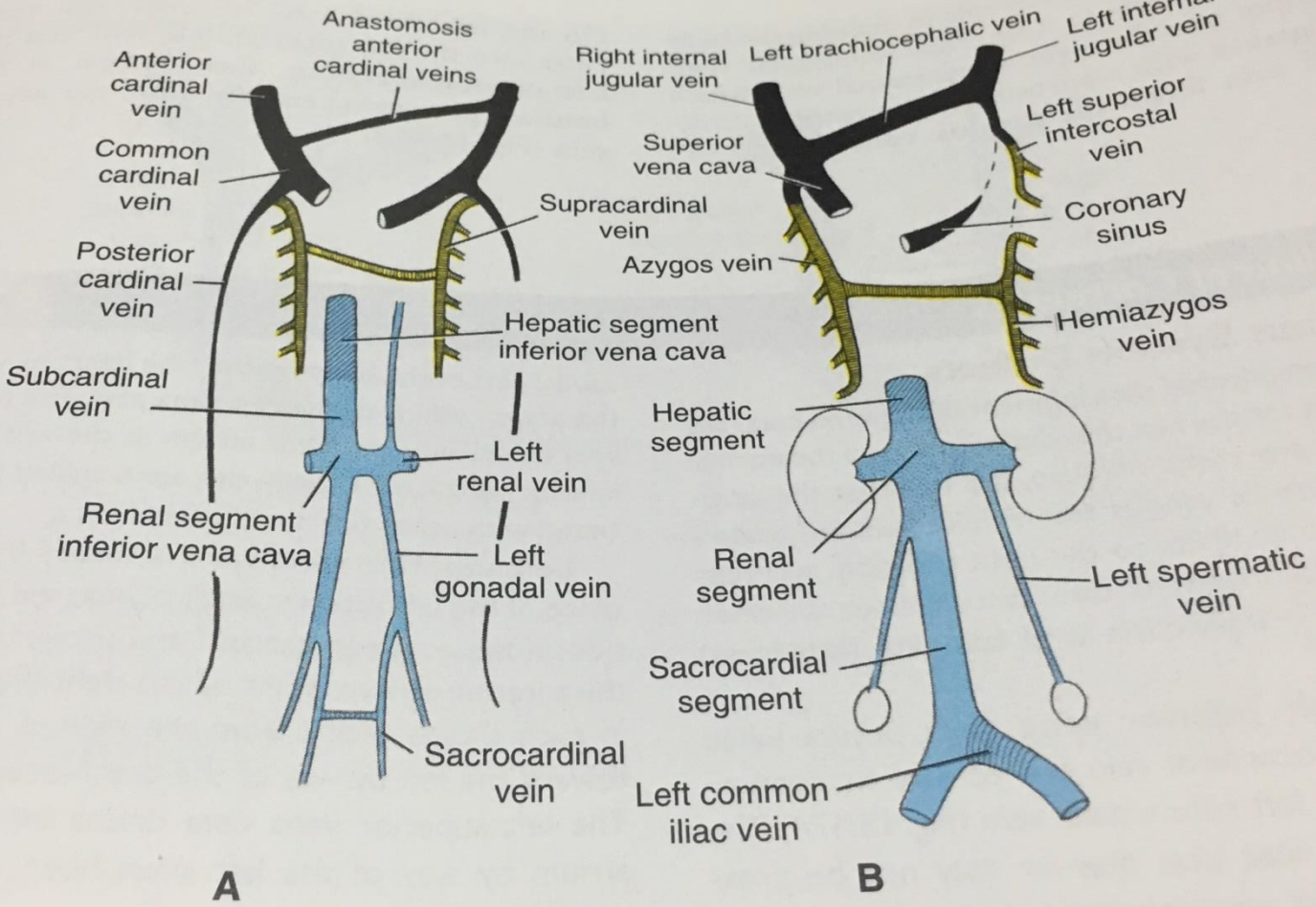


Figure 13.46 *Development of the inferior vena cava, azygos vein, and superior vena cava.* **A.** Seventh week. The anastomosis lies between the subcardinals, supracardinals, sacrocardinals, and anterior cardinals. **B.** The venous system at birth showing the three components of the inferior vena cava.

Venecaval formation

Umbilical veins

- Umbilical veins pass each side of liver
- When liver enlarges umbilical veins get connected to hepatic sinusoids.
- Proximal connection in both sides and complete right umbilical vein regresses.
- Direct communication of left umbilical vein and inferior vena cava is **ductus venosus**

Formation of ductus venosus

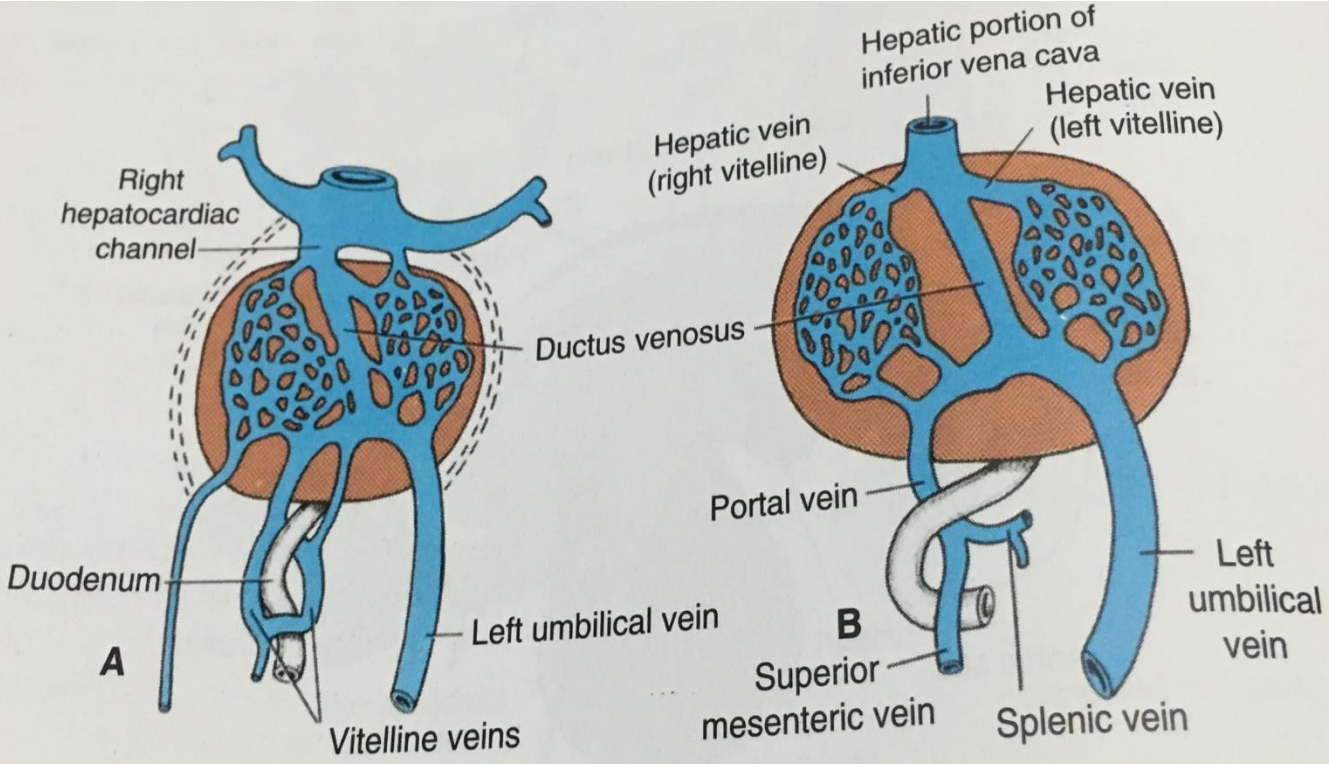


Figure 13.45 *Development of vitelline and umbilical veins in the* **A** *second and* **B** *third months. Note formation of the ductus venosus, portal vein, and hepatic portion of the inferior vena cava. The splenic and superior mesenteric veins enter the portal vein.*

Summery

- We have discussed
  - Basis of vascular development
  - Development of arterial system
    - Aortic arches
    - Vitelline arteries
    - Umbilical arteries
    - Limb arteries
  - Development of venous system
    - Vitelline vein
    - Umbilical vein
    - Omphalomesentaric vein