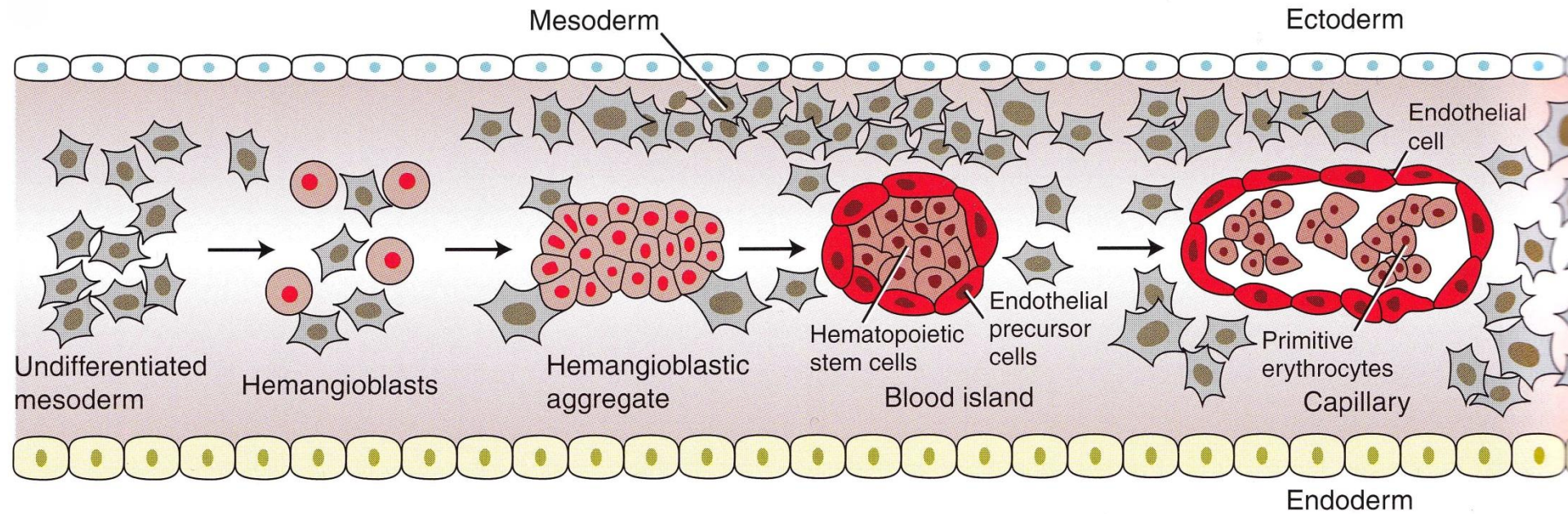
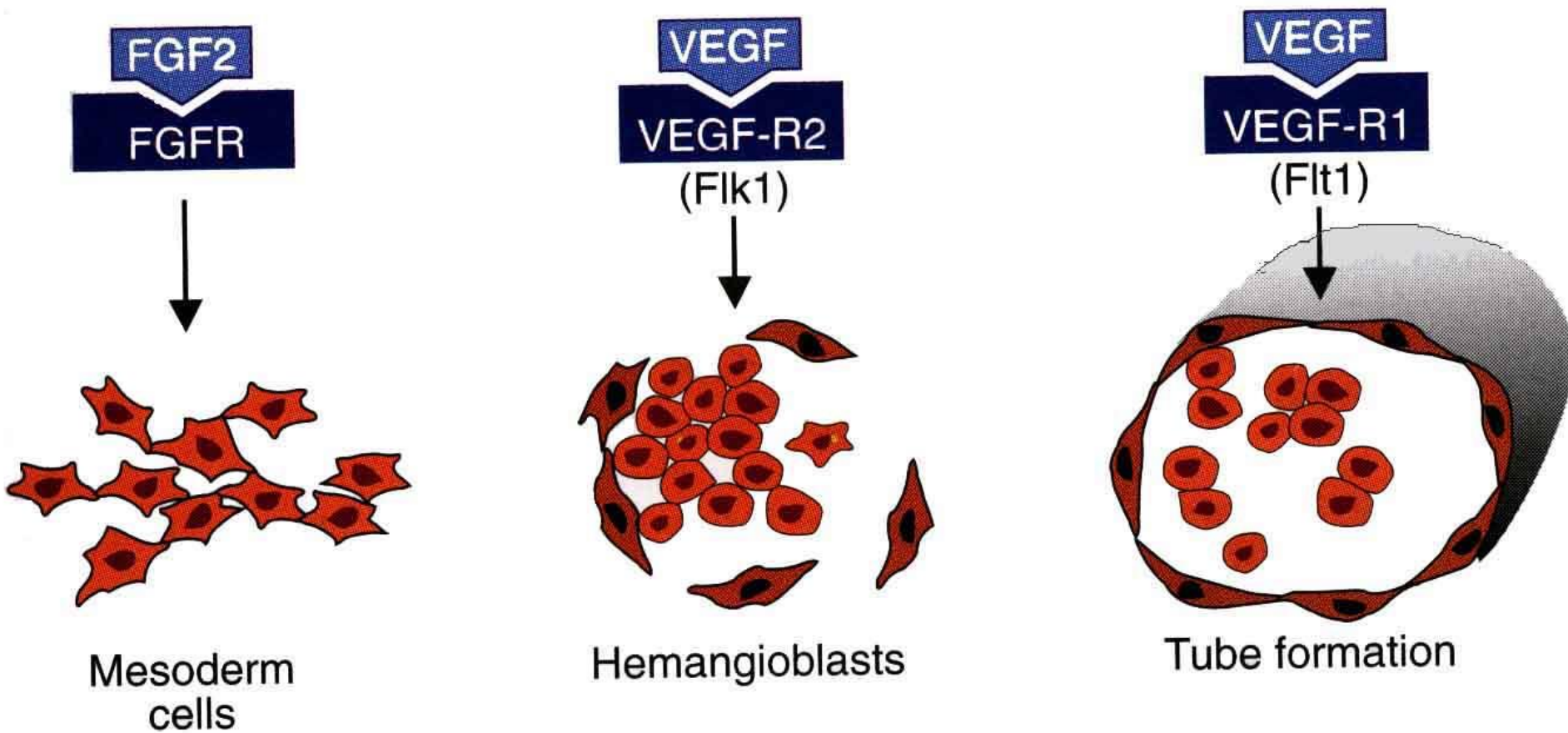


ORGANOGENEZE OBĚHOVÉHO A LYMFATICKÉHO SYSTÉMU

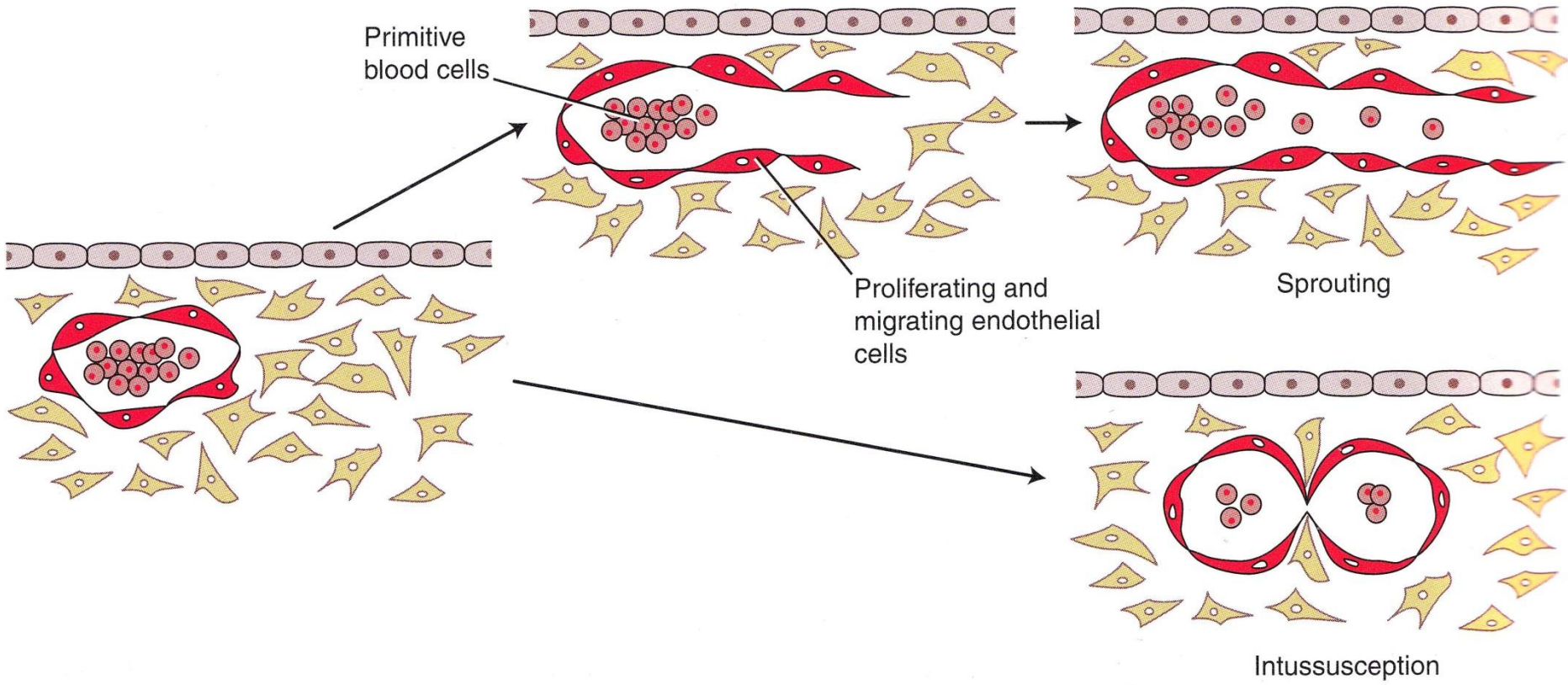
VASKULOGENESE

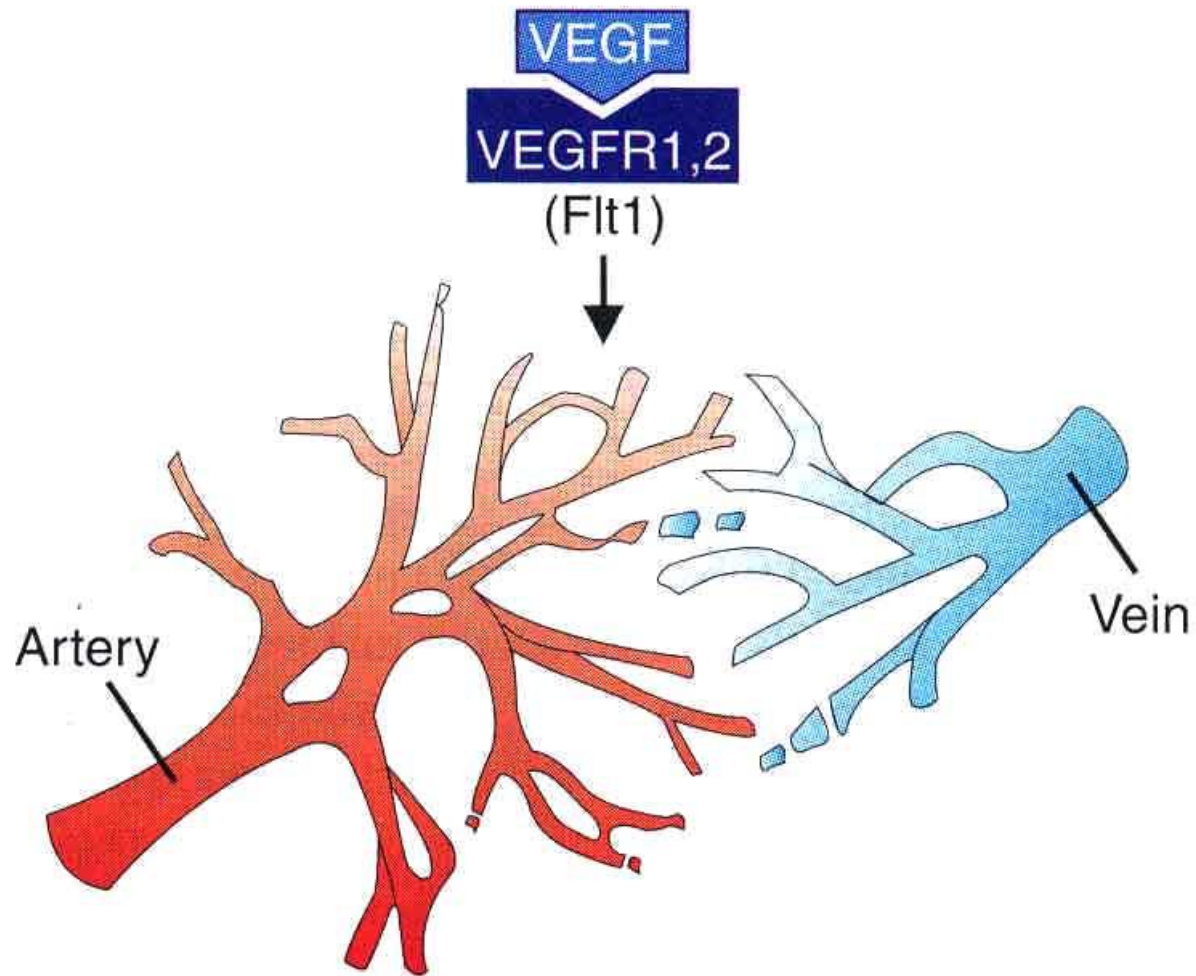




VASKULOGENEZE

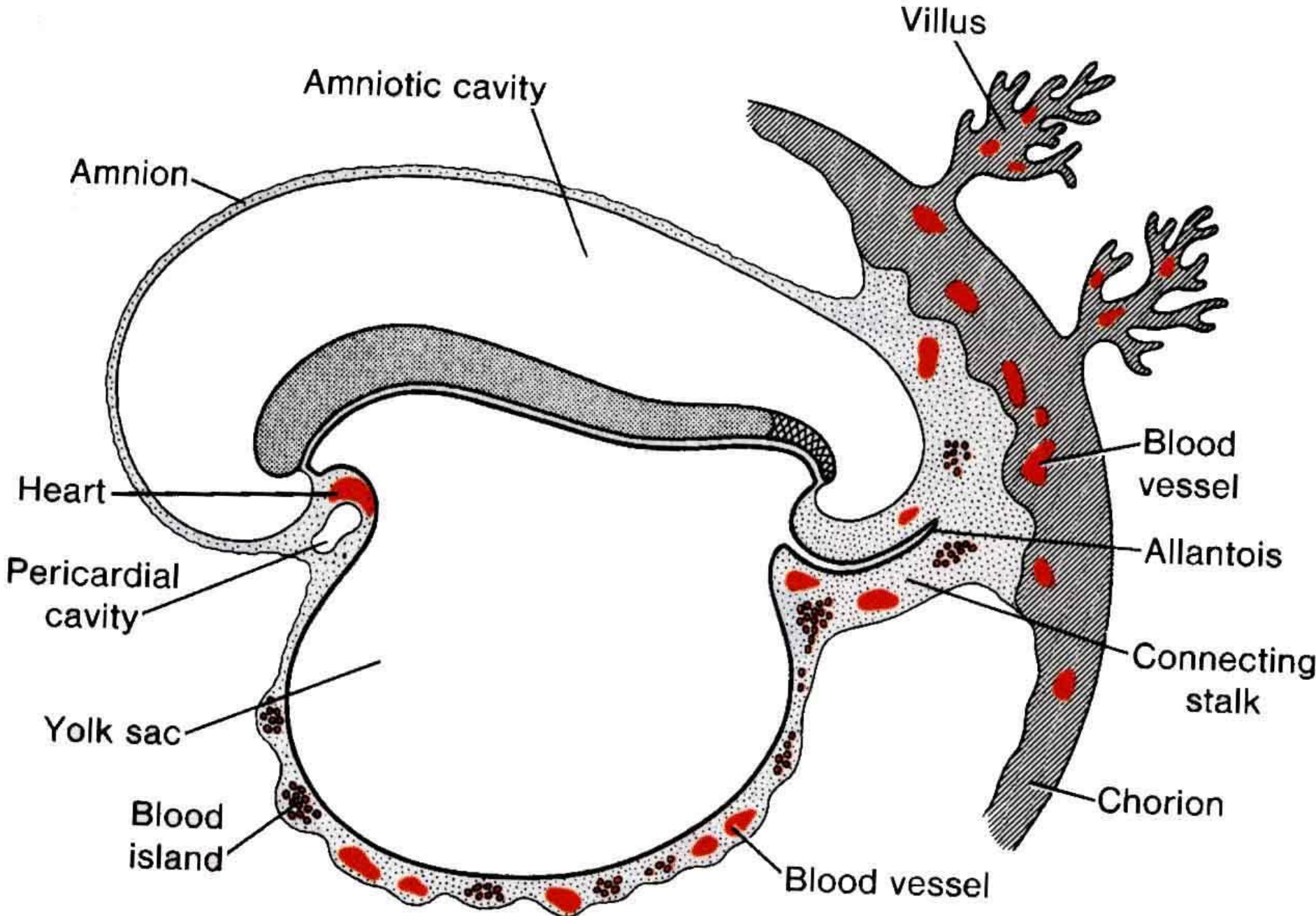
ANGIOGENEZE





ANGIOGENEZE

dále také
TGF β
PDGF



Amniotic cavity

Villus

Amnion

Heart

Pericardial cavity

Yolk sac

Blood island

Blood vessel

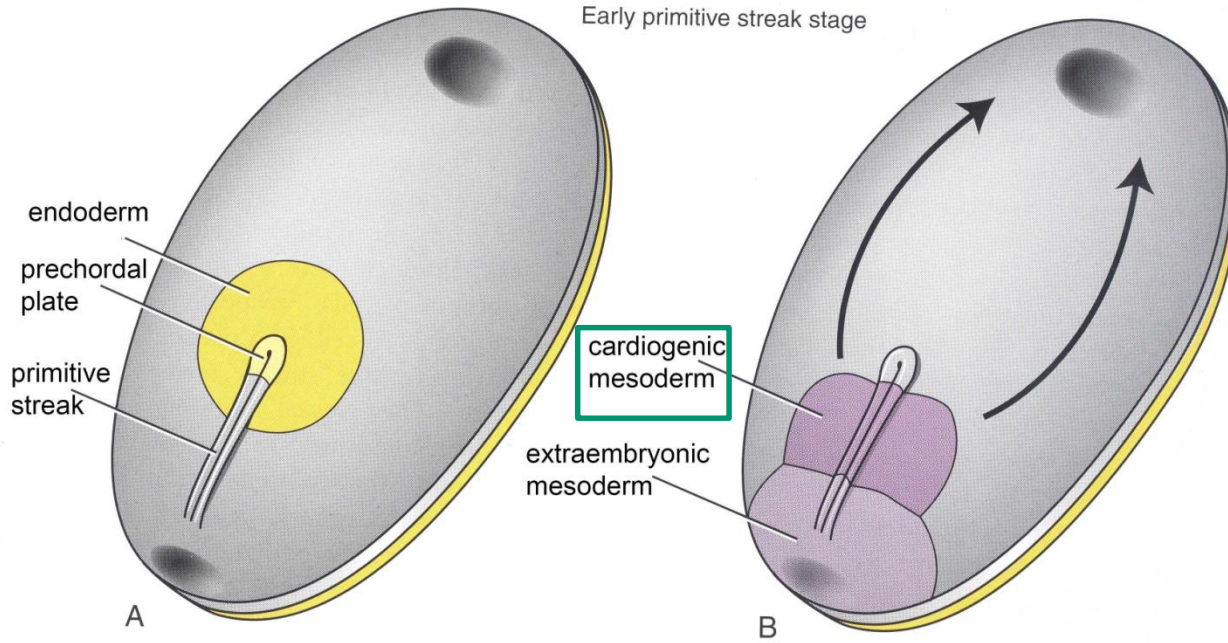
Allantois

Connecting stalk

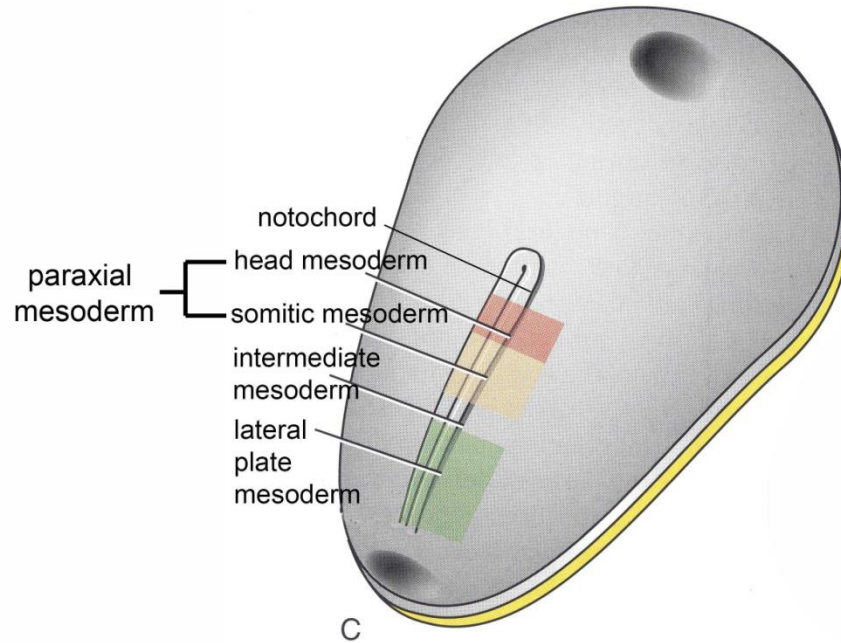
Chorion

Blood vessel

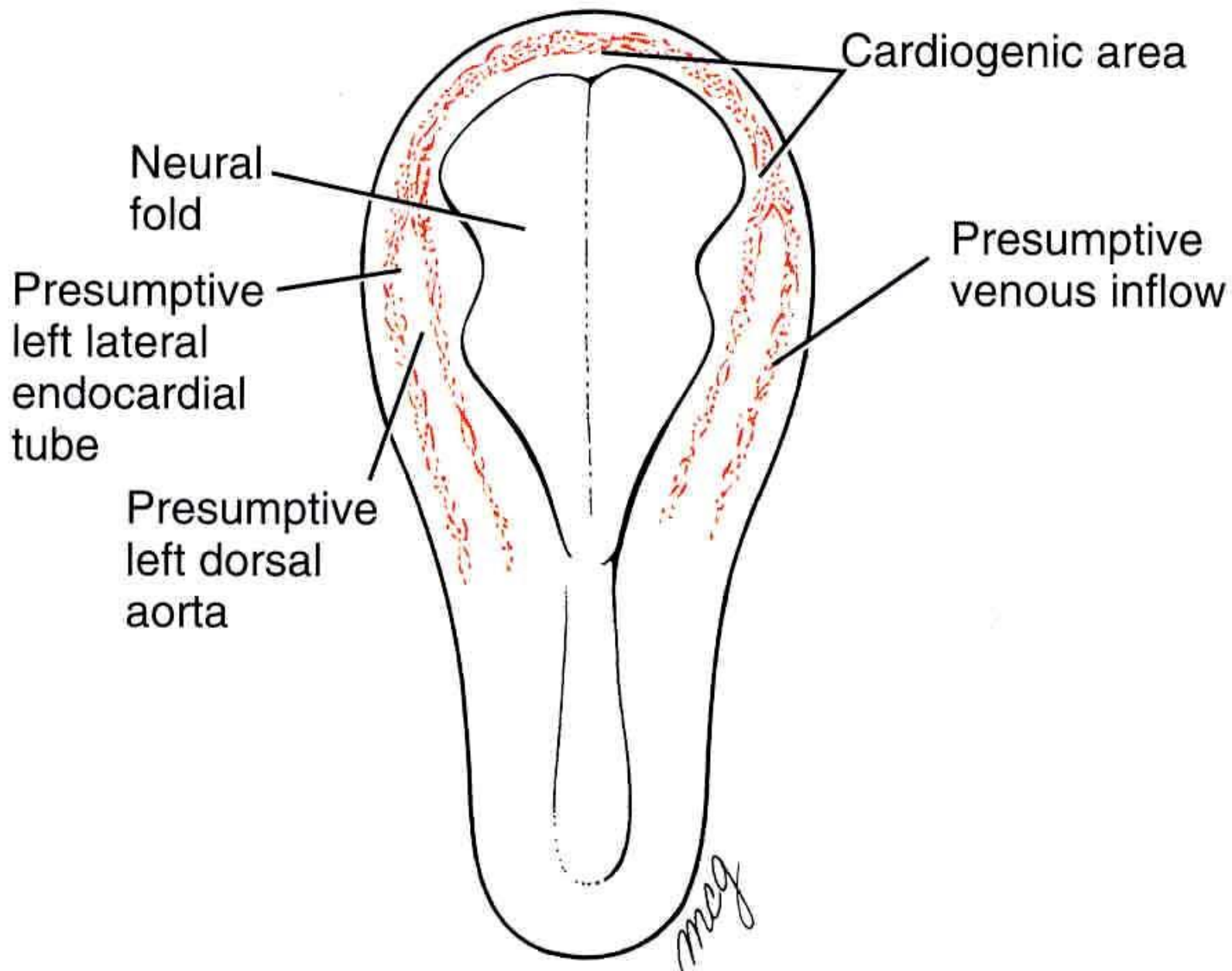
Early primitive streak stage



Mid-primitive streak stage

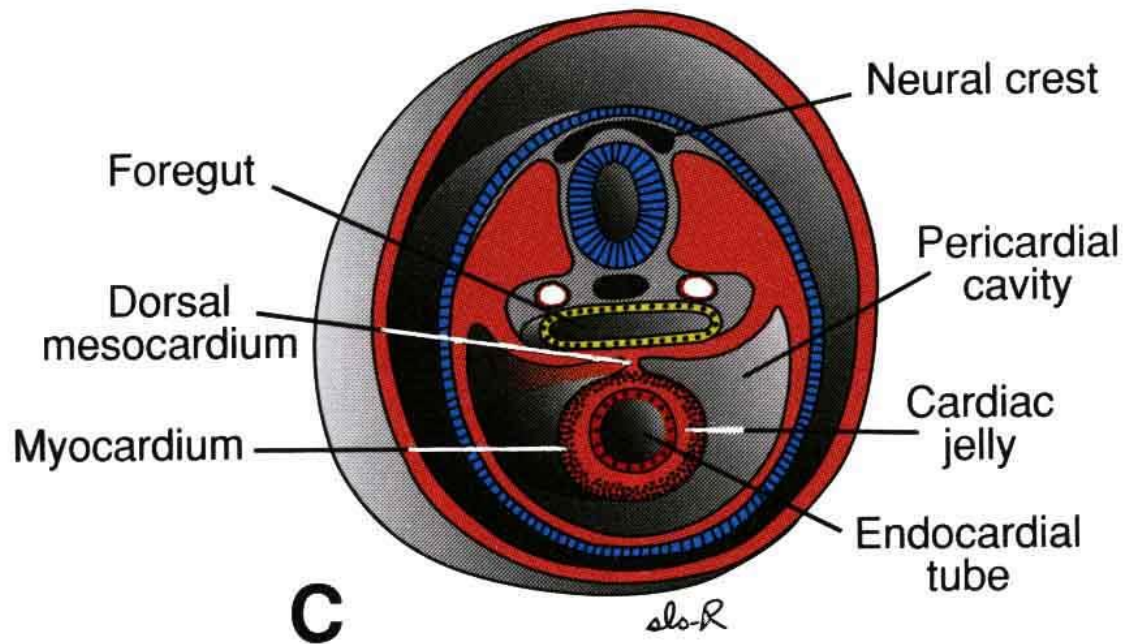
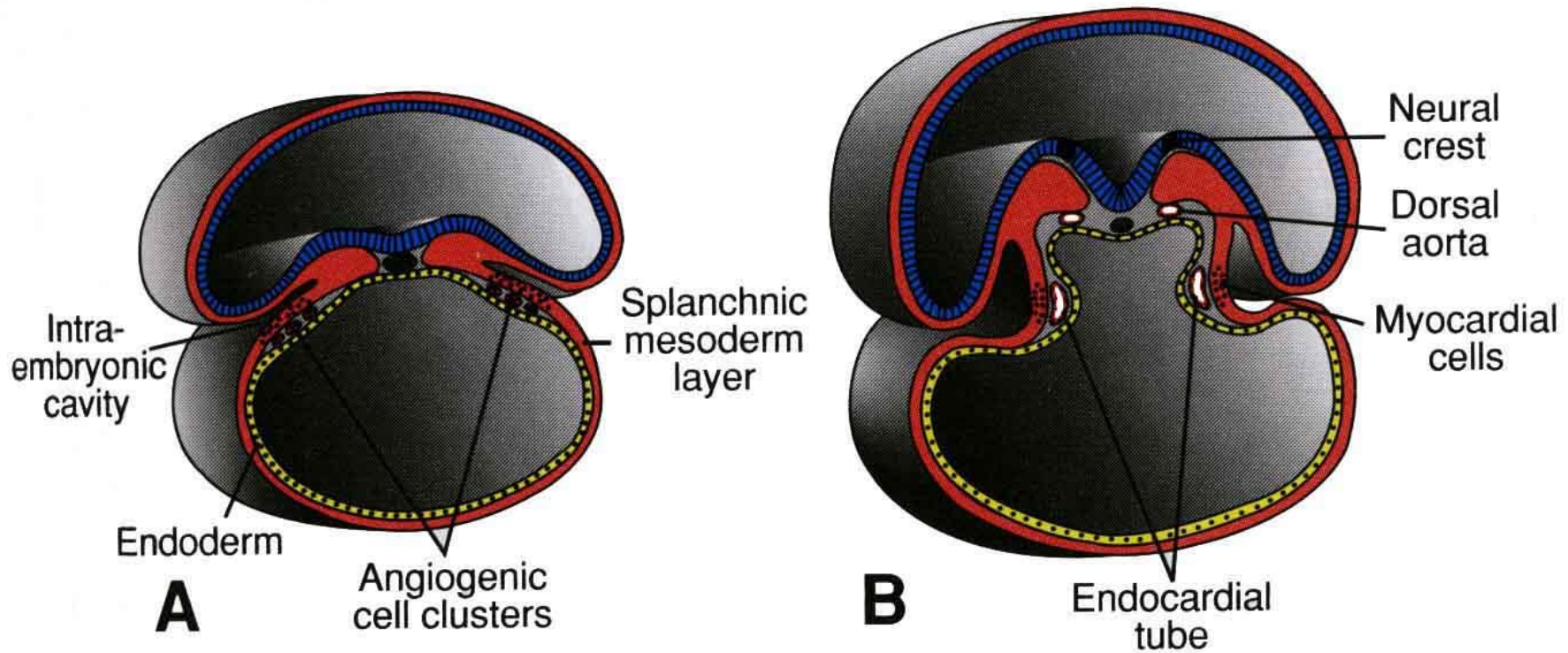


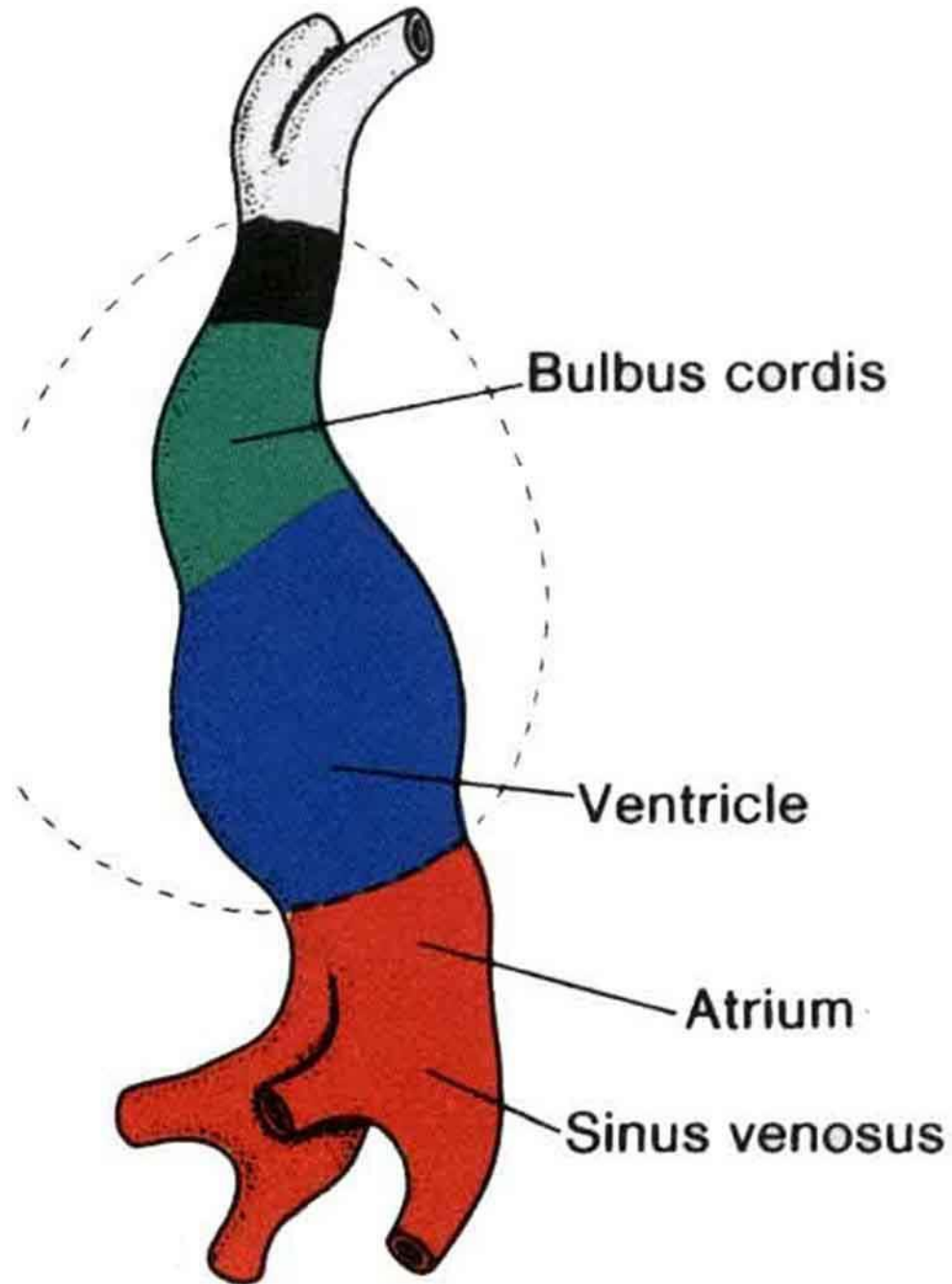
VÝVOJ ARTÉRIÍ



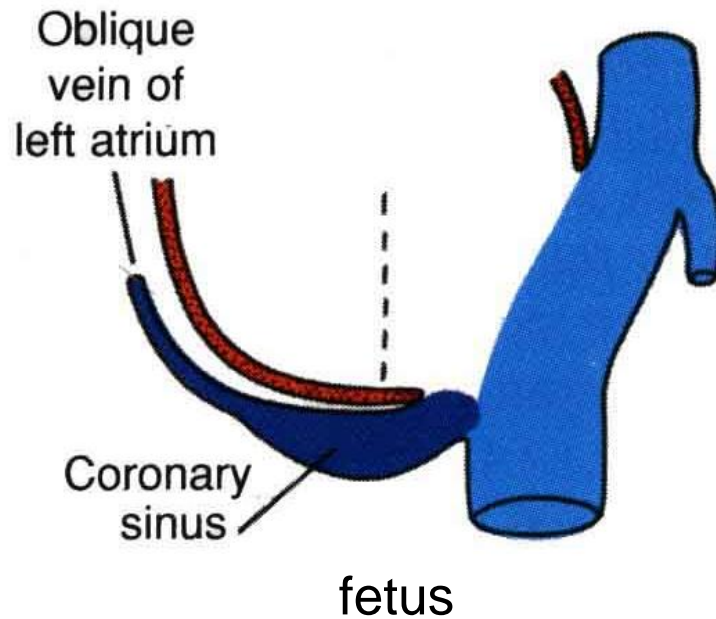
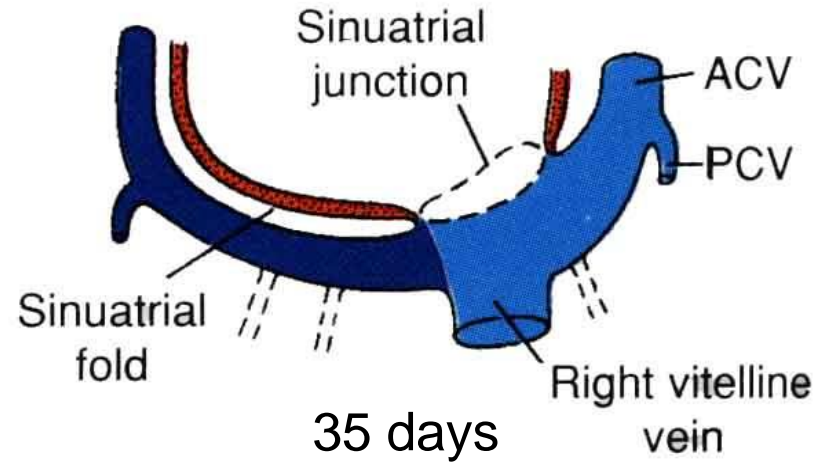
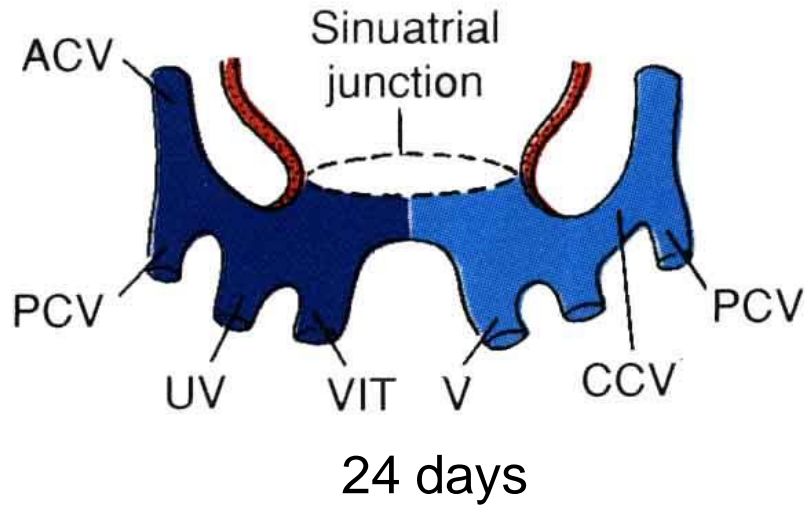
A

19 days



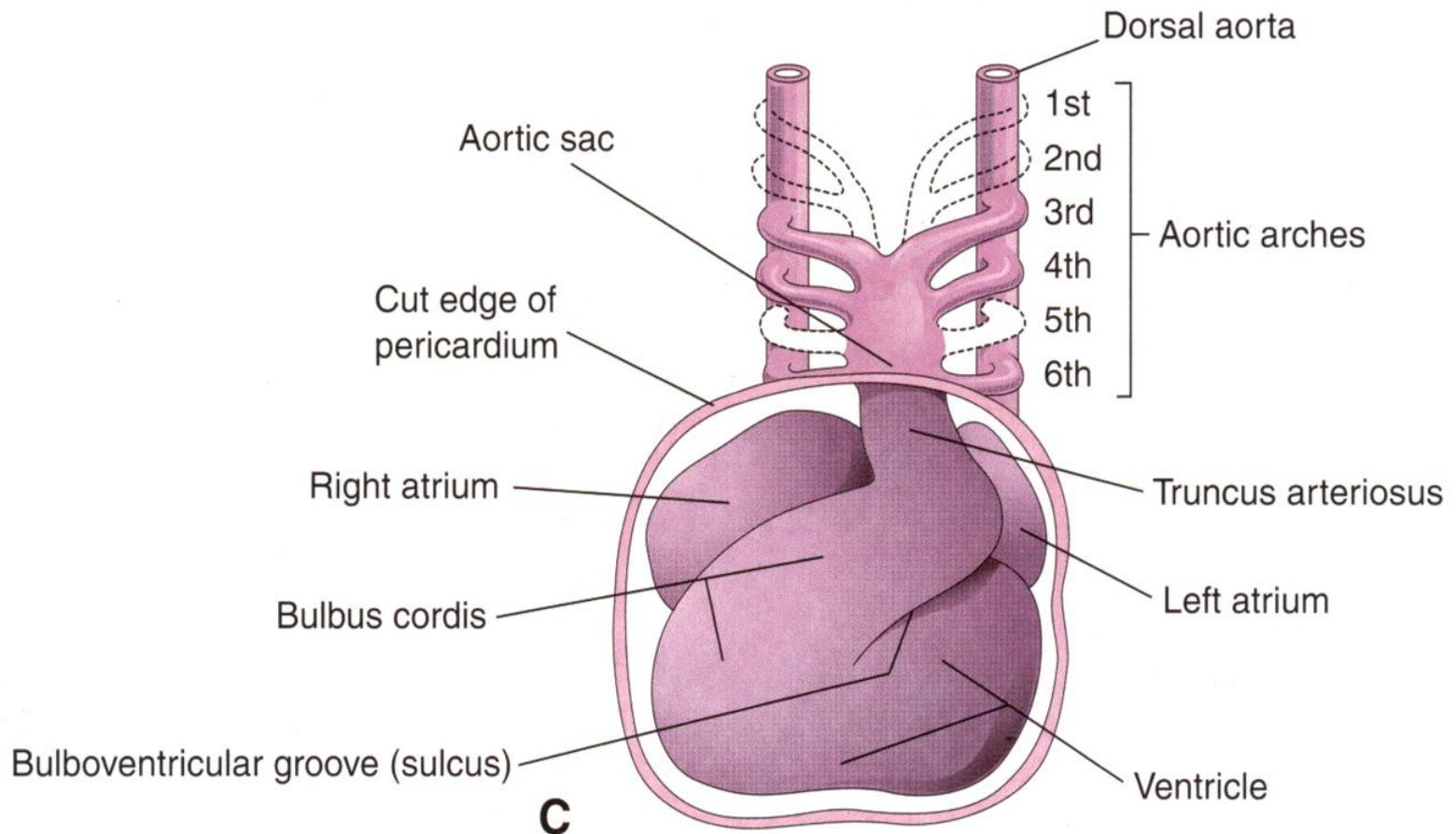


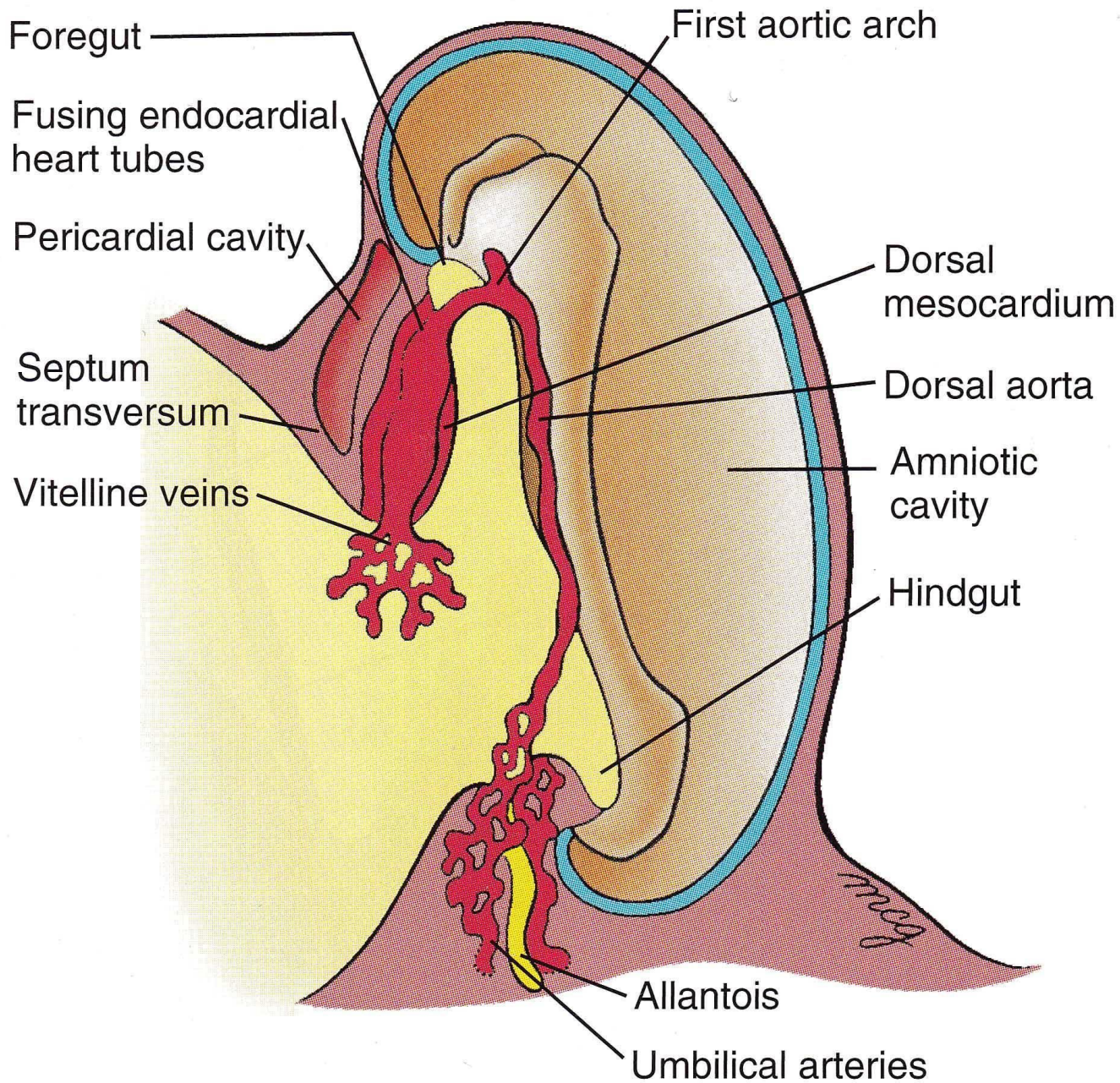
Sinus venosus

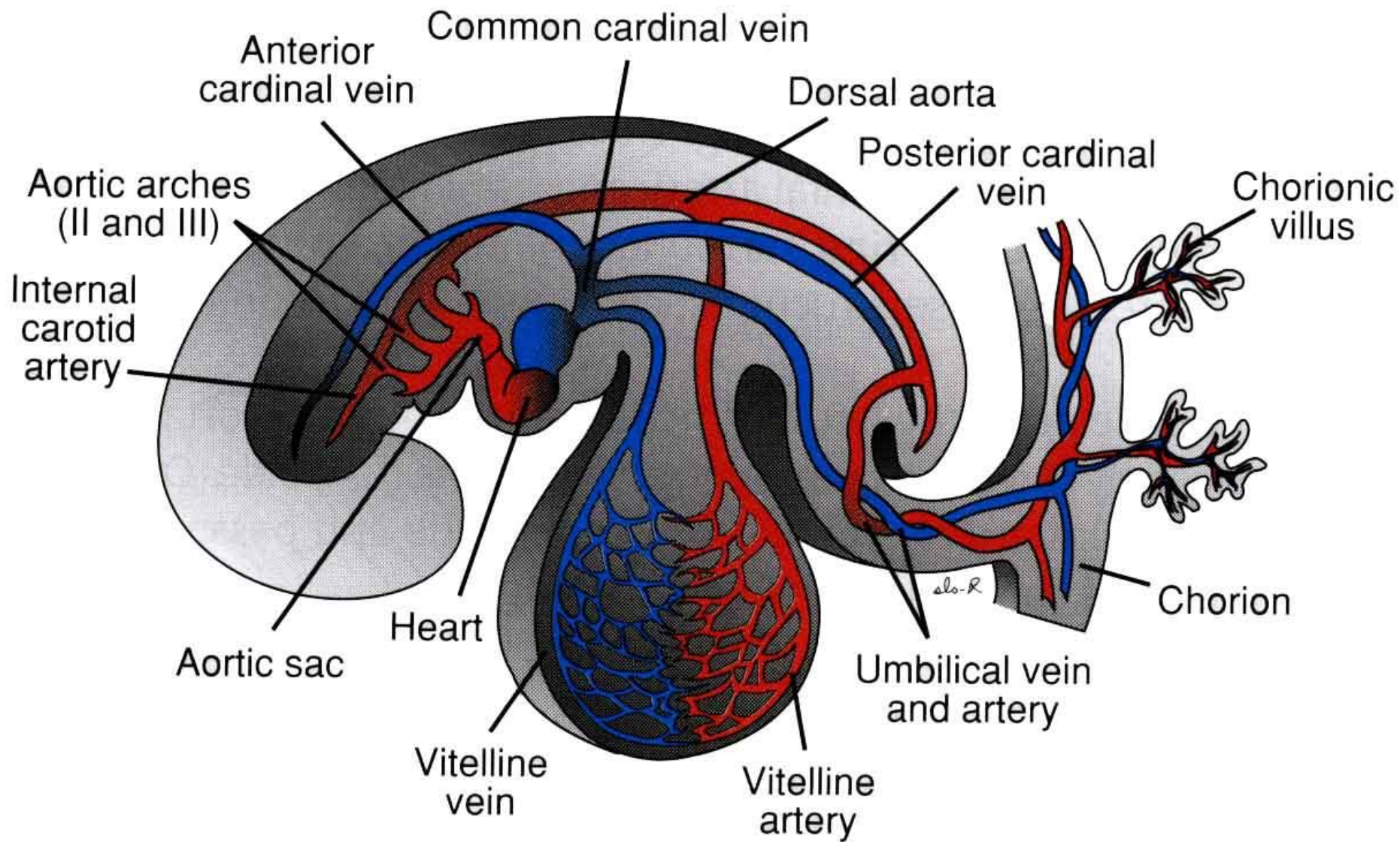


Tepny vystupující ze srdce

- truncus arteriosus → saccus aorticus → aa. arcuum pharyngeorum (aortální oblouky)

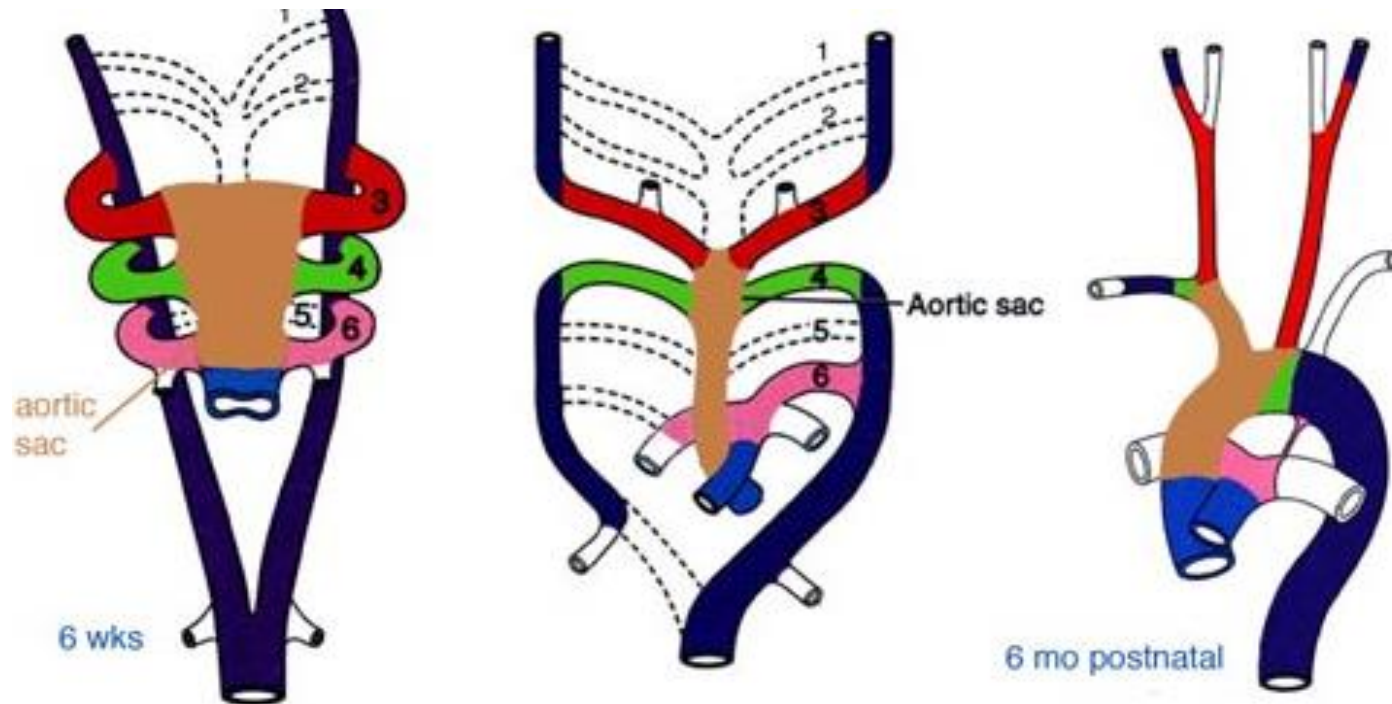






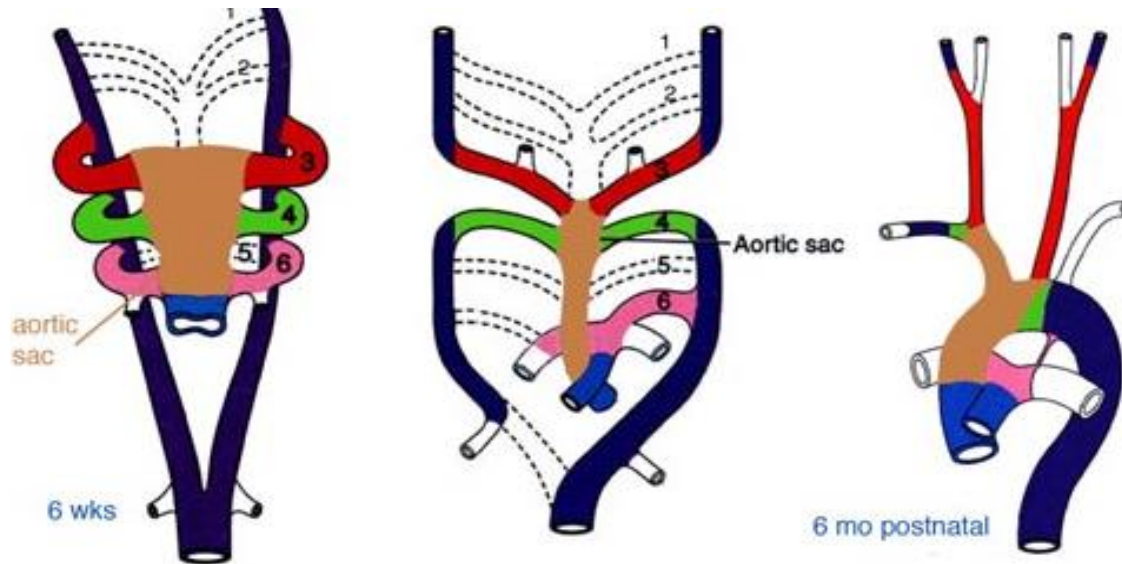
Deriváty tepen žaberních oblouků

- 1. pár – arteria maxillaris (22.-24.den)
- 2. pár – a.stapedia
- 3. pár – centrálně – *arteria carotis communis*
– periferně – *arteria carotis interna (prox.část)*



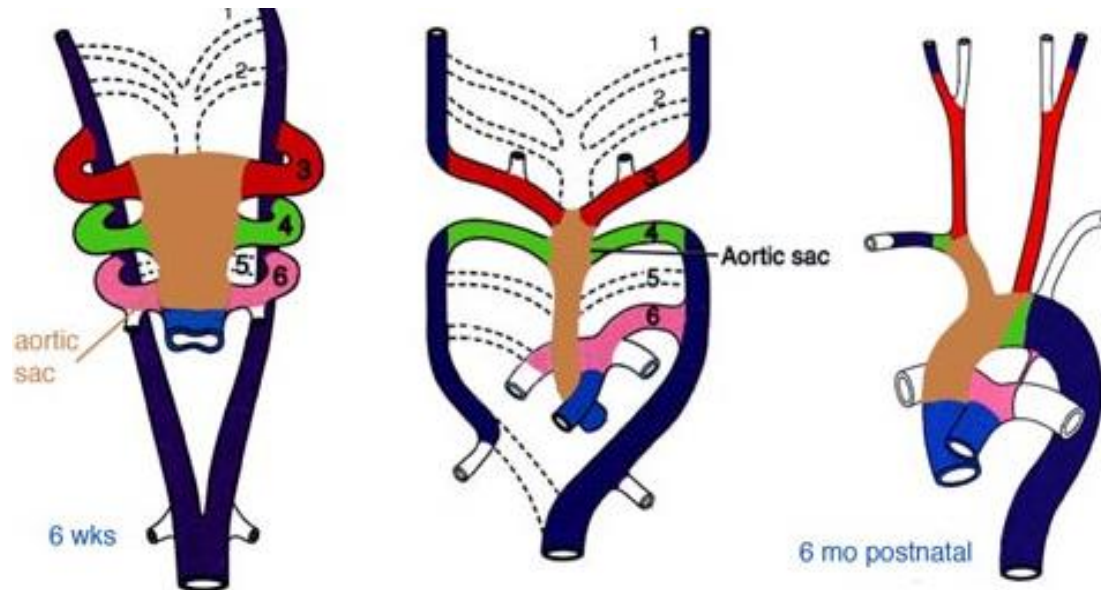
Deriváty tepen žaberních oblouků

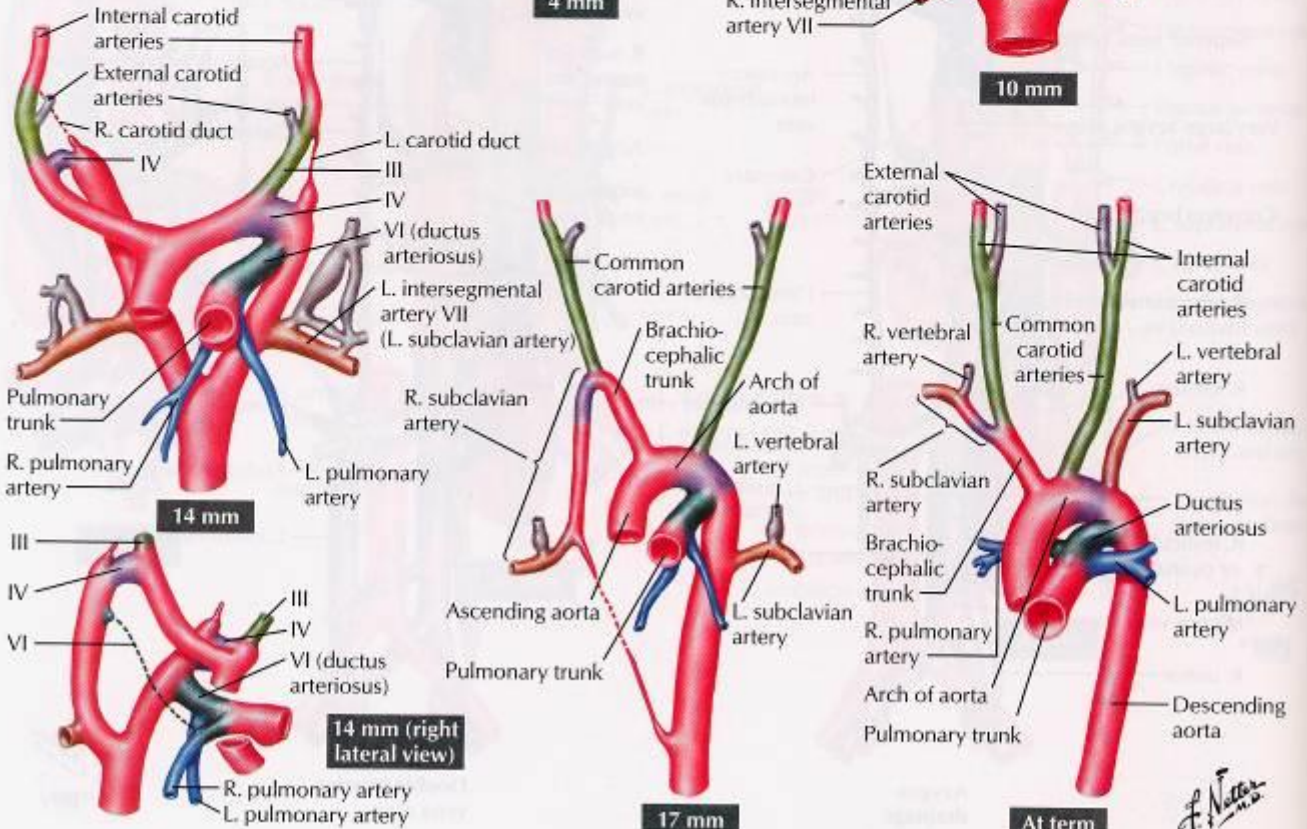
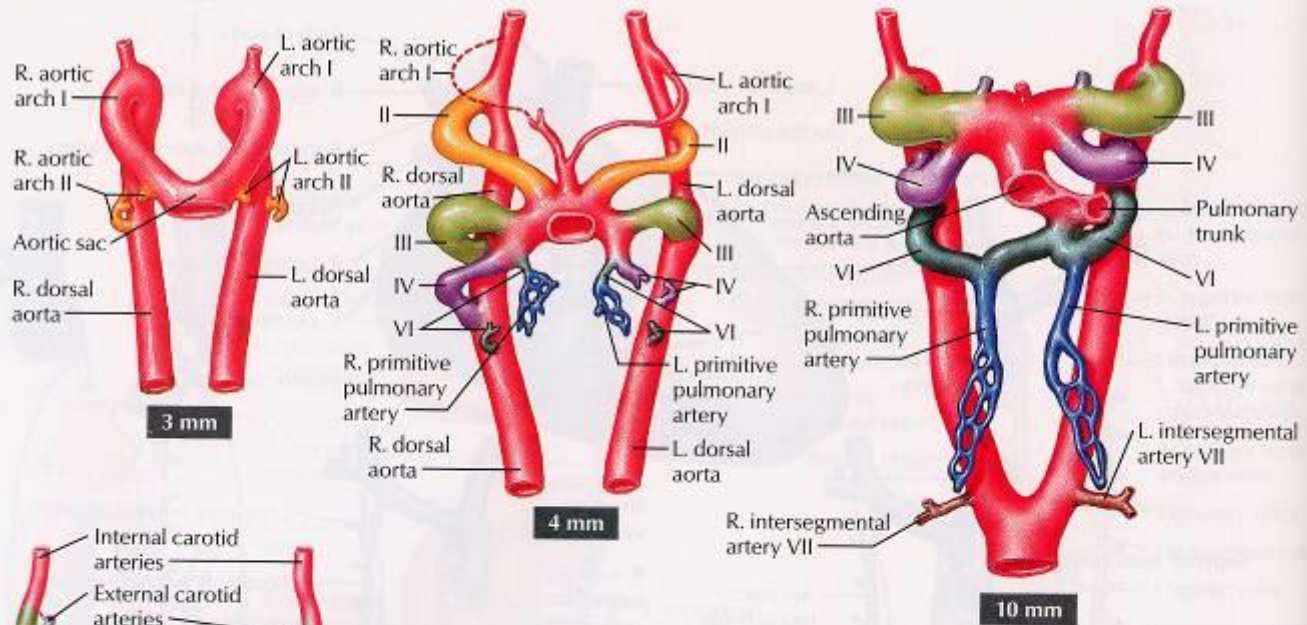
- **4. pár**
 - vlevo – část *arcus aortae*
 - vpravo – *a. subclavia dx.*
 - *periferní část a. subclavia dx. se tvoří z aorta dorsalis dextra, pravá intersegmentální arterie*
 - *a. subclavia sin.* není derivátem *arcus aortae*, nýbrž z **7. arteria intersegmentalis**

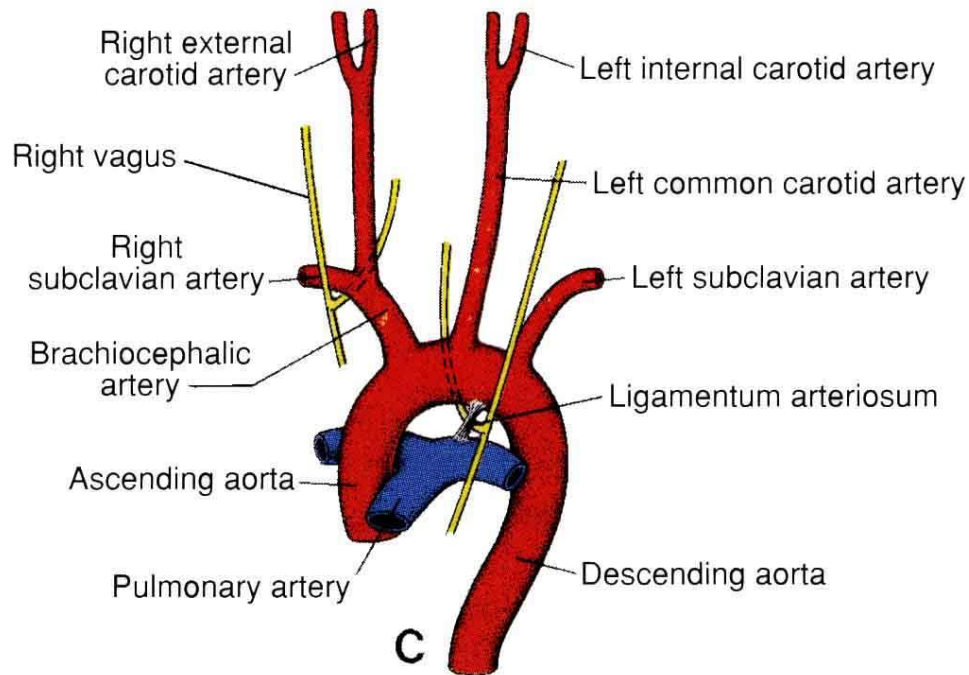
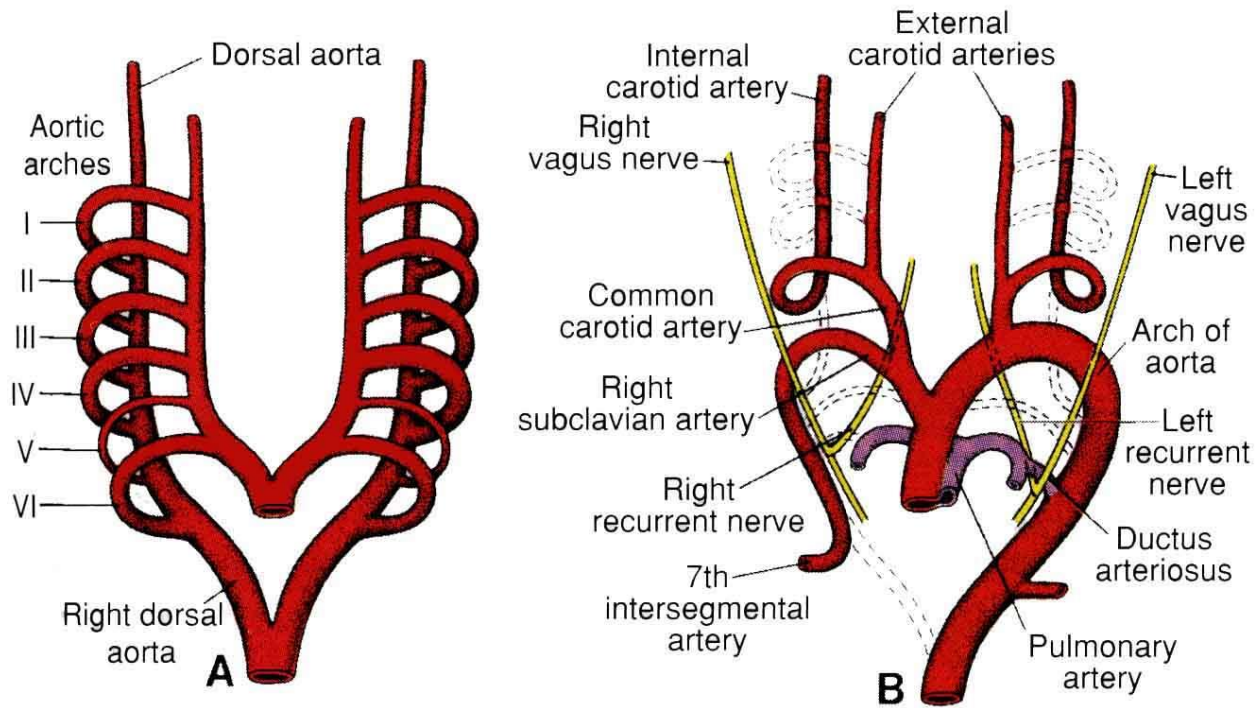


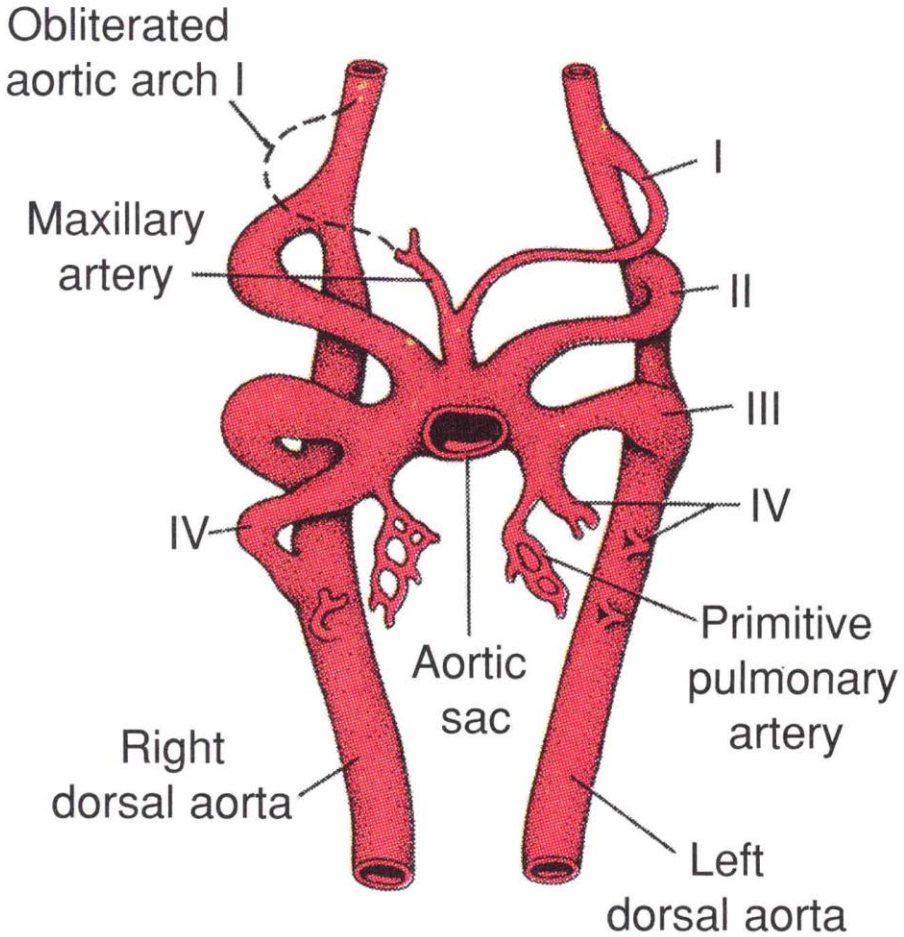
Deriváty tepen žaberních oblouků

- 5. pár – Ø
- 6. pár
 - vlevo centrálně *arteria pulmonalis sinistra*
periferně *ductus arteriosus (Botalli)*
 - vpravo centrálně *arteria pulmonalis dextra*
periferně Ø



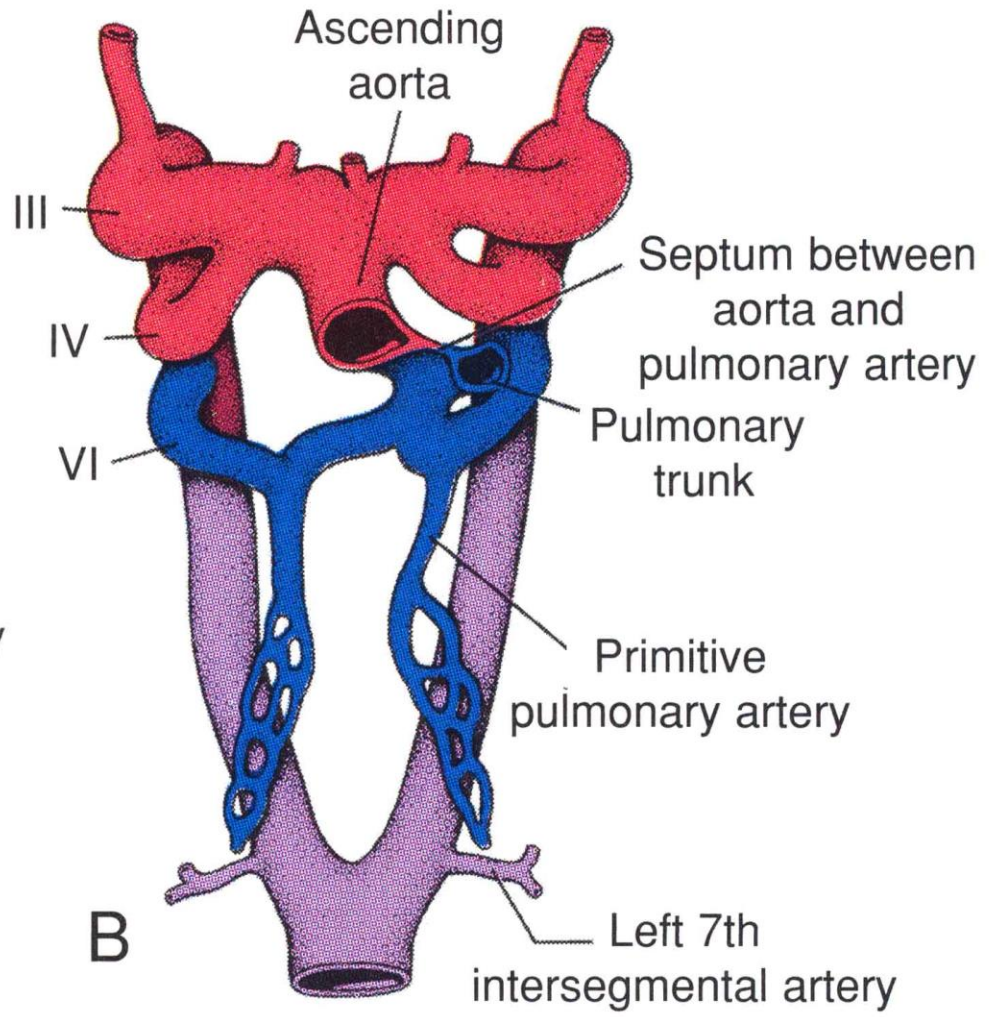






A

4-mm stage

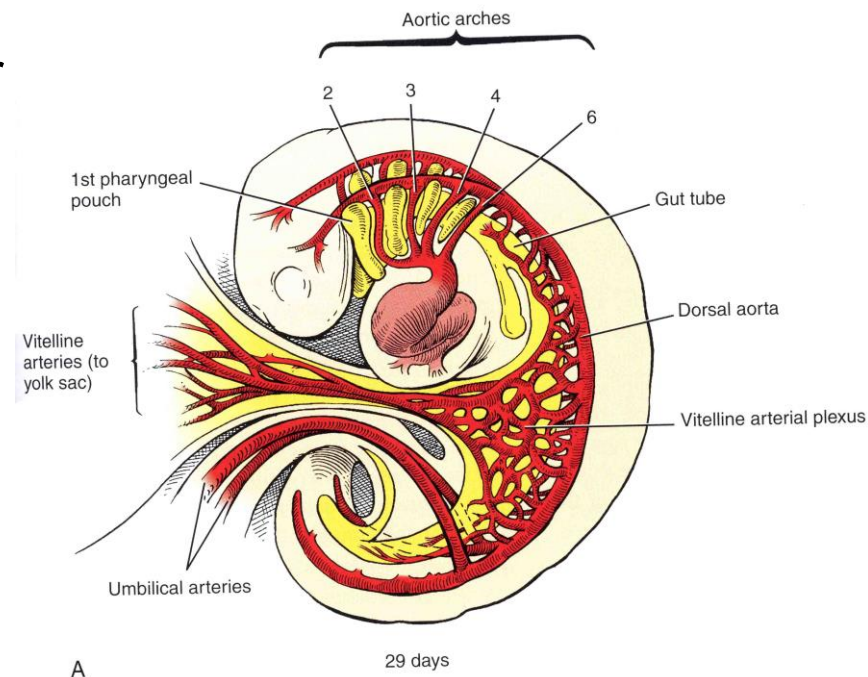


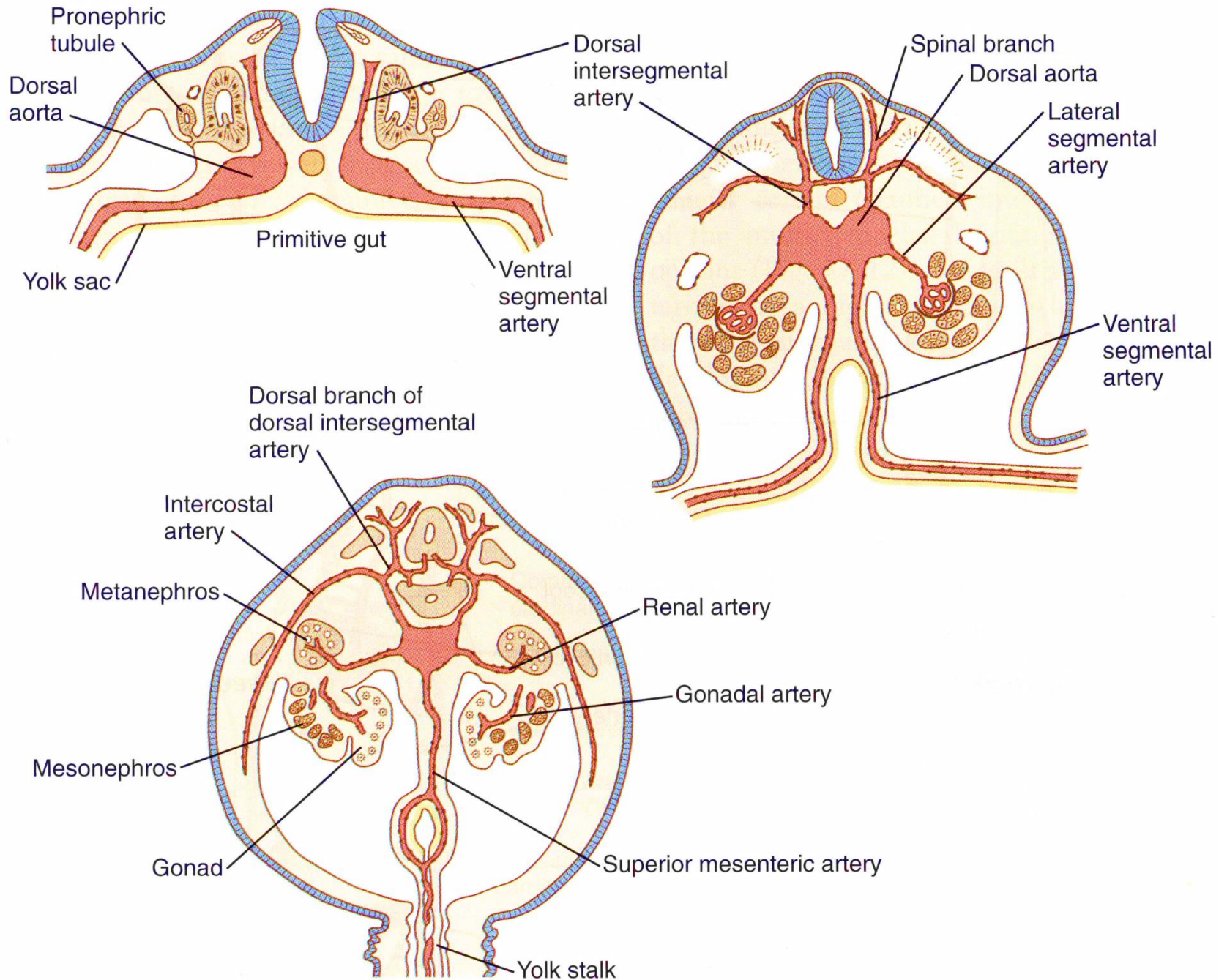
B

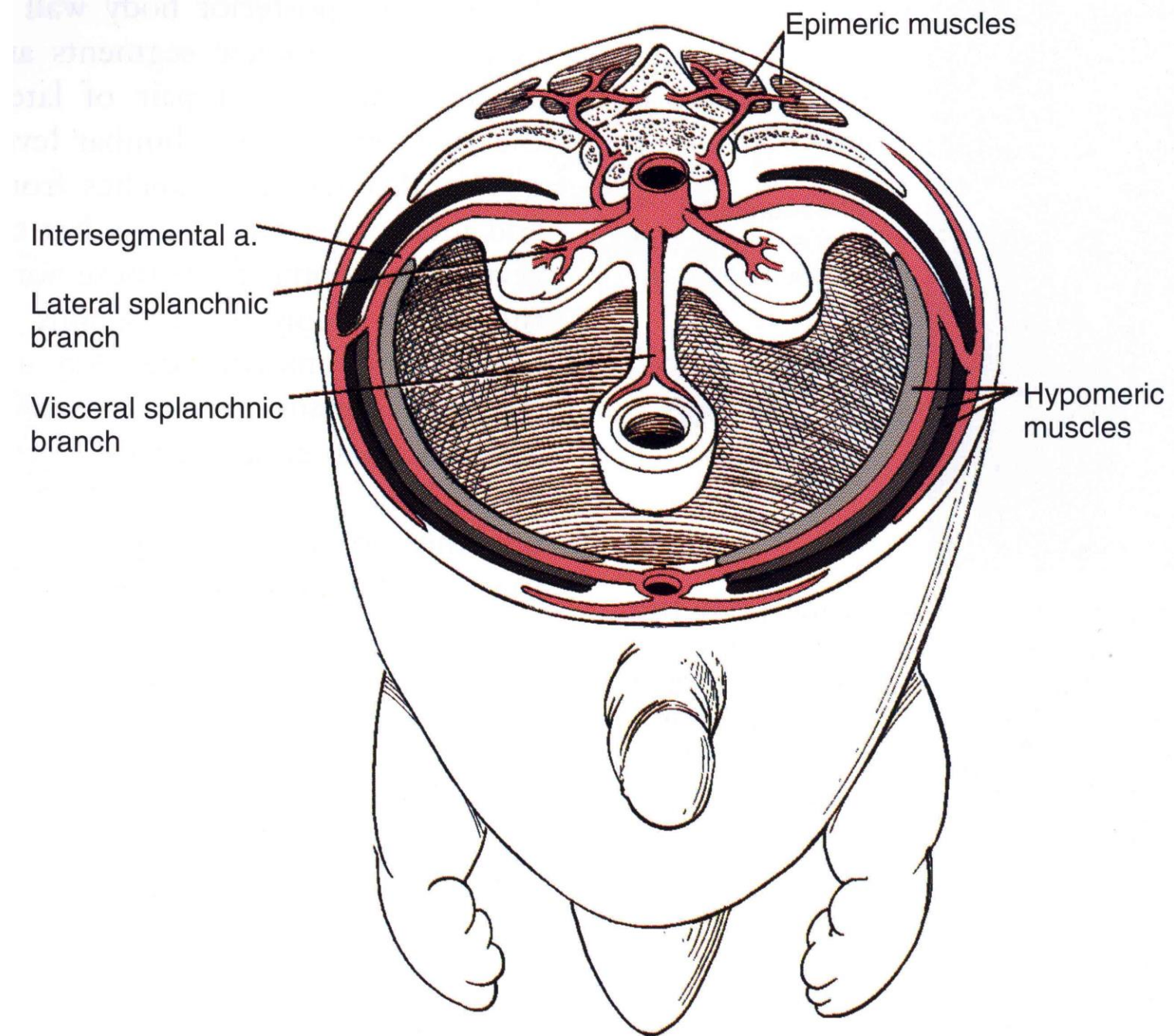
10-mm stage

Větve dorzální aorty

- aa. segmentales ventrales
 - aa. omphalomesentericae (vitellinae) → truncus coeliacus, a. mesenterica superior et inferior
 - aa. umbilicales → trunci umbilicales → aa. iliaca
- aa. segmentales laterales → aa. renales, suprarenales, testiculares, ovaricae
- aa. intersegmentales → aa. vertebrales, subclaviae (whole left, peripheral part of right), intercostales, hypogastricae, epigastricae.....
- a. sacralis mediana





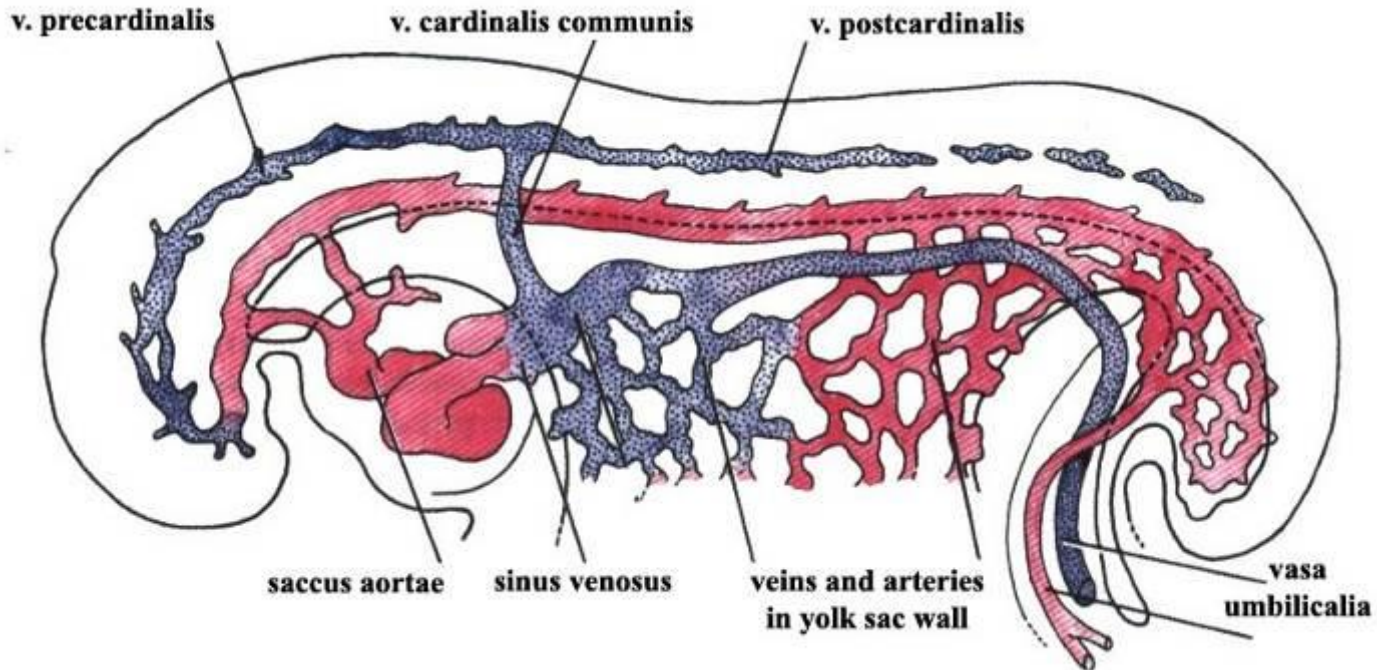


A

7 weeks

Arteriae omphalomesentericae (vitellinae)

- více párových tepen
- zásobují žloutkový vak
- rozvoj během zásobení střeva z aa. segmentales ventrales
→ truncus coeliacus, arteriae mesentericae



Arteriae umbilicales

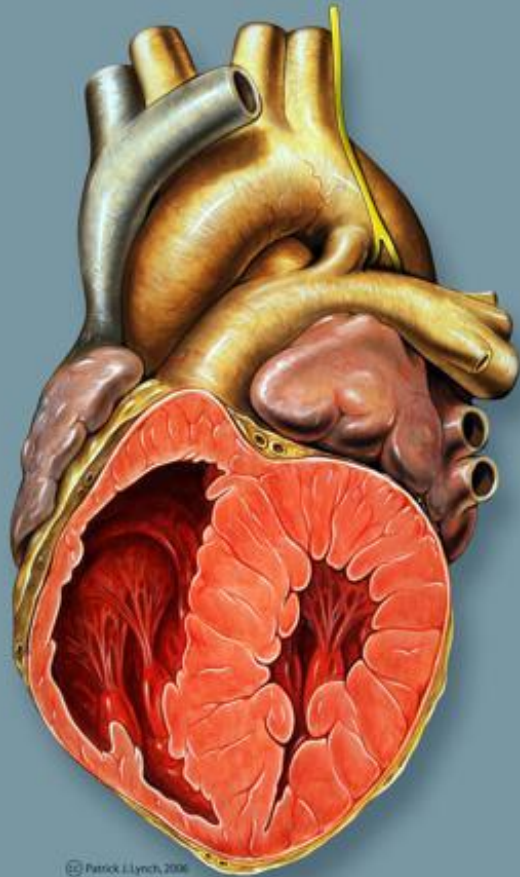
- párové větve:
- vedou k placentě v zárodečném stvolu, později v pupečníku
- zůstávají jako aa. iliacaе internaе a aa. vesicales superiores
 - centrálně pars patens
 - periferně ligamentum umbilicale laterale = pars occlusa

Vývojové vady tepen

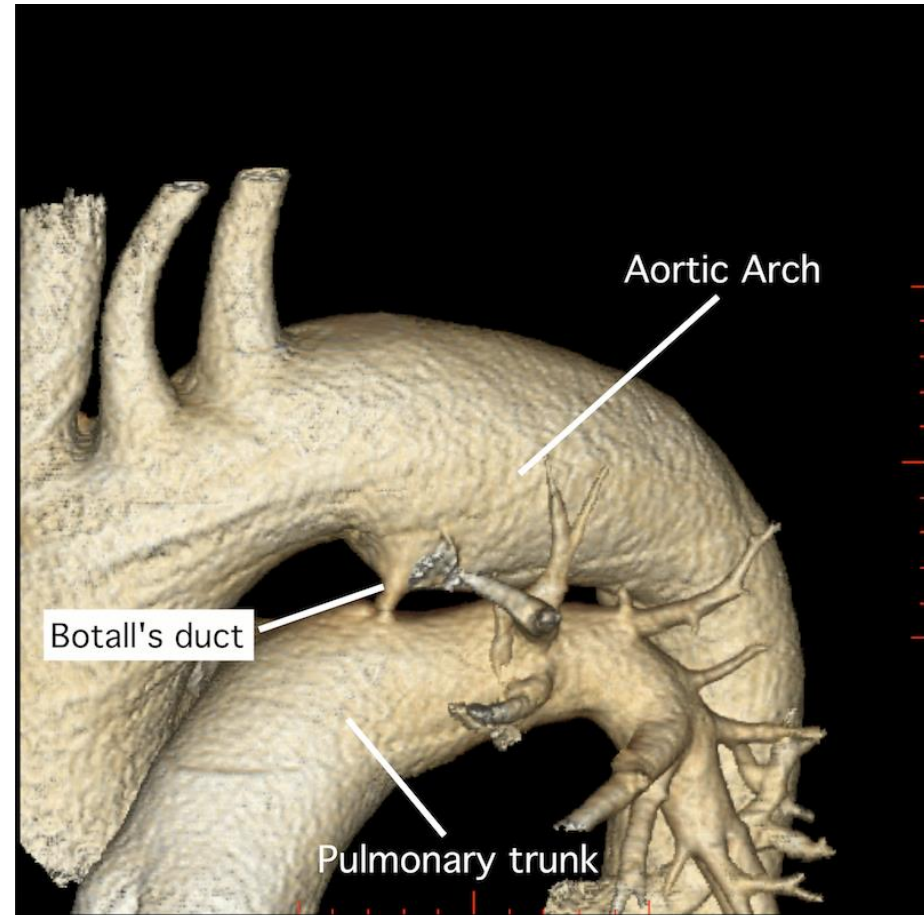
- Ductus arteriosus patens
- Coarctatio aortae
- Arcus aortae duplex
- Arcus aortae dexter
- Arteria lusoria
 - abnormální odstup a. subclavia dextra – obliterace pravého aortálního oblouku – odstup 7. a. segmentalis

Ductus arteriosus Botalli

Tepenná (Botallova) dučej

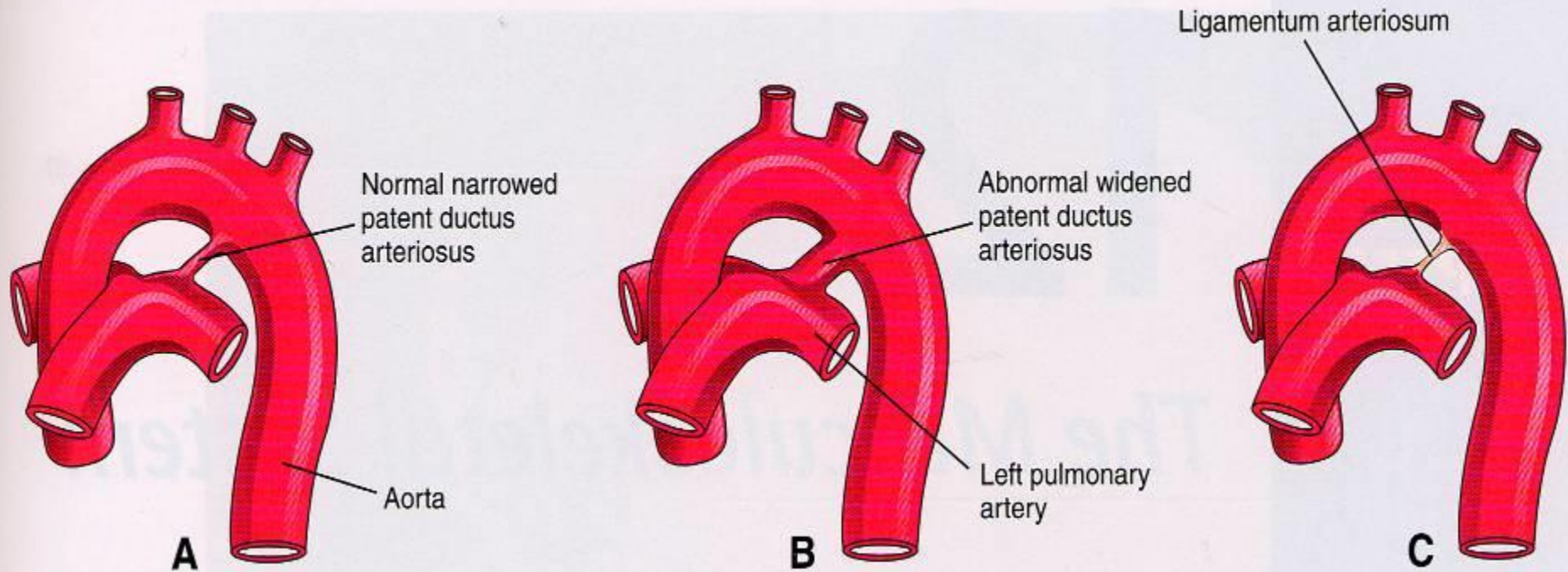


http://images.radiopaedia.org/images/25225/2f0aae3edc1fc18ff46cff5a40bb39_gallery.jpg

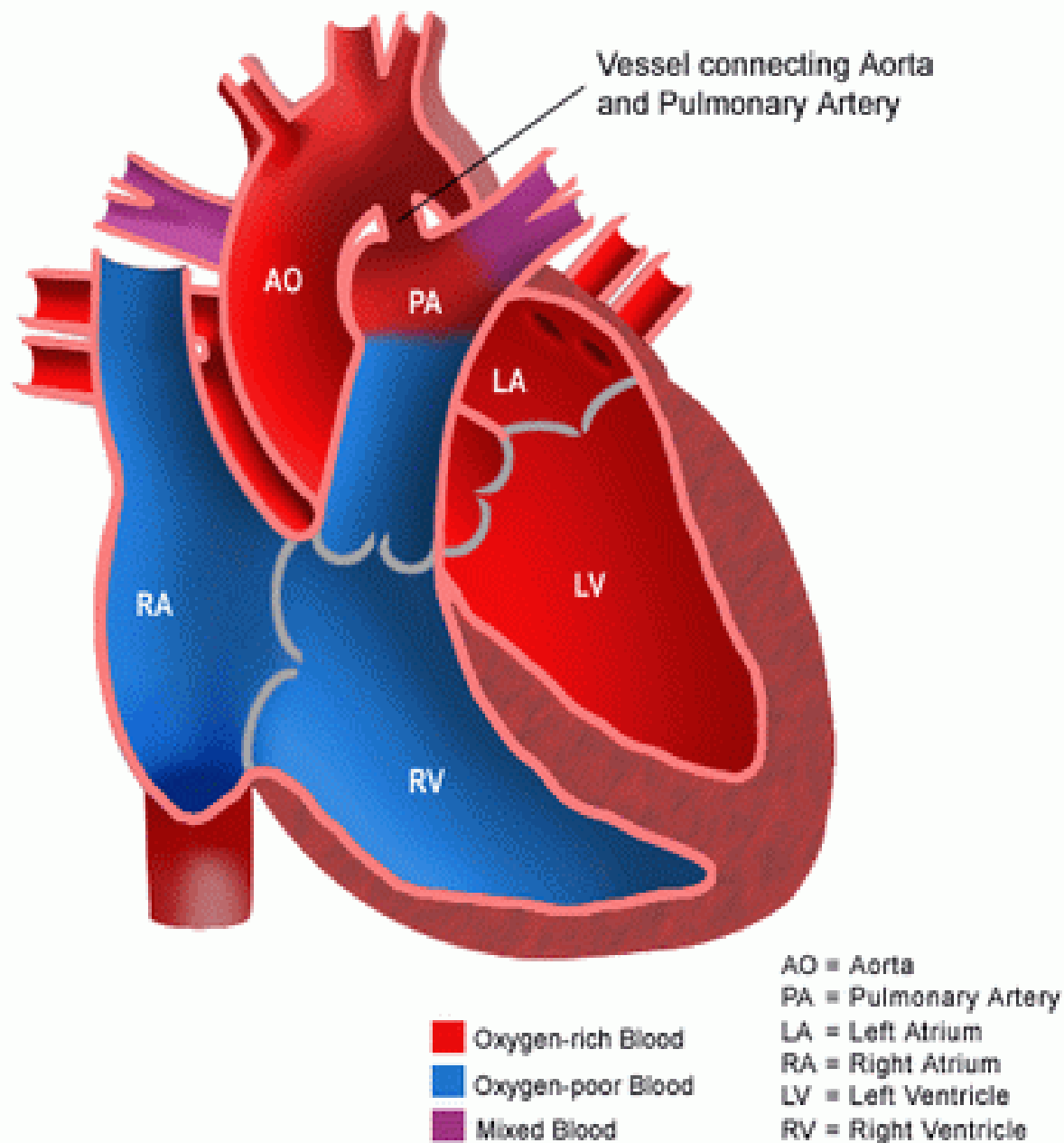


http://posterng.netkey.at/esr/viewing/index.php?module=viewimage&task=&mediafile_id=366756&201101302145.gif

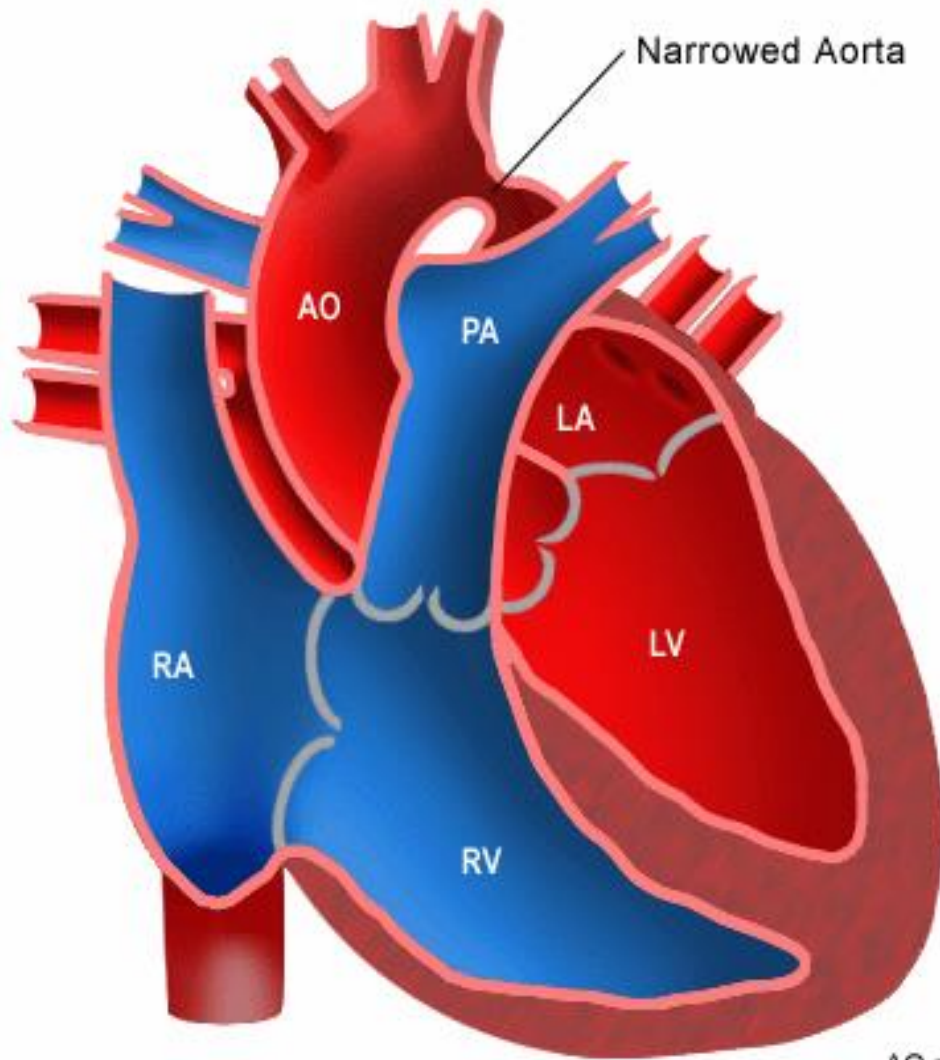
Ductus arteriosus patens





Patent Ductus Arteriosus (PDA)



Coarctation of the Aorta

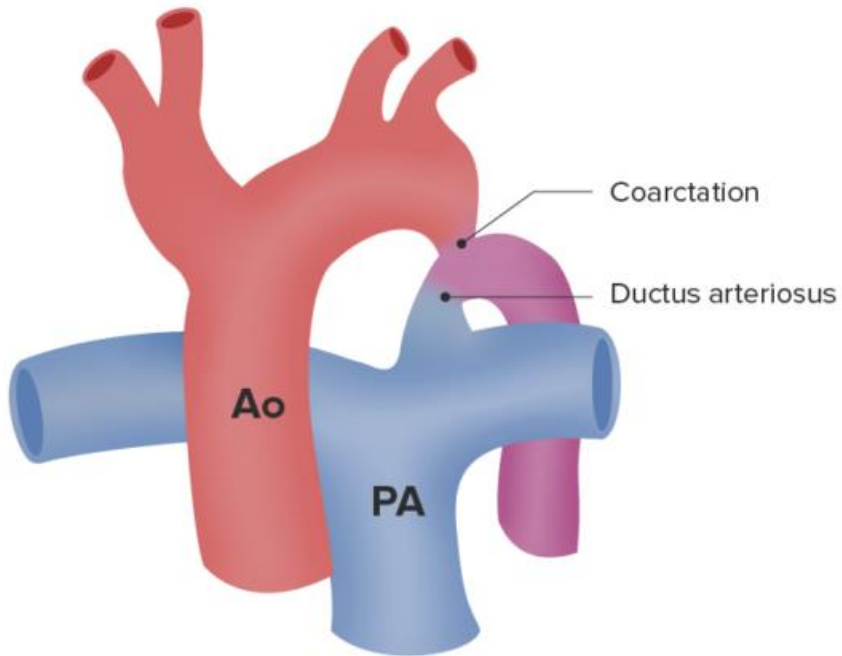


 Oxygen-rich Blood
 Oxygen-poor Blood

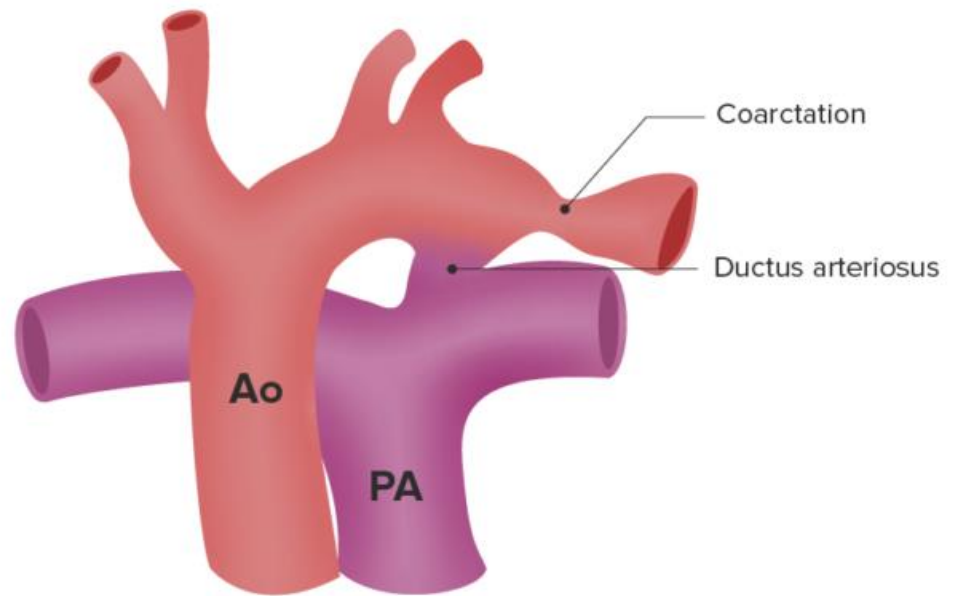
AO = Aorta
PA = Pulmonary Artery
LA = Left Atrium
RA = Right Atrium
LV = Left Ventricle
RV = Right Ventricle

Coarctatio aortae

Preductal coarctation

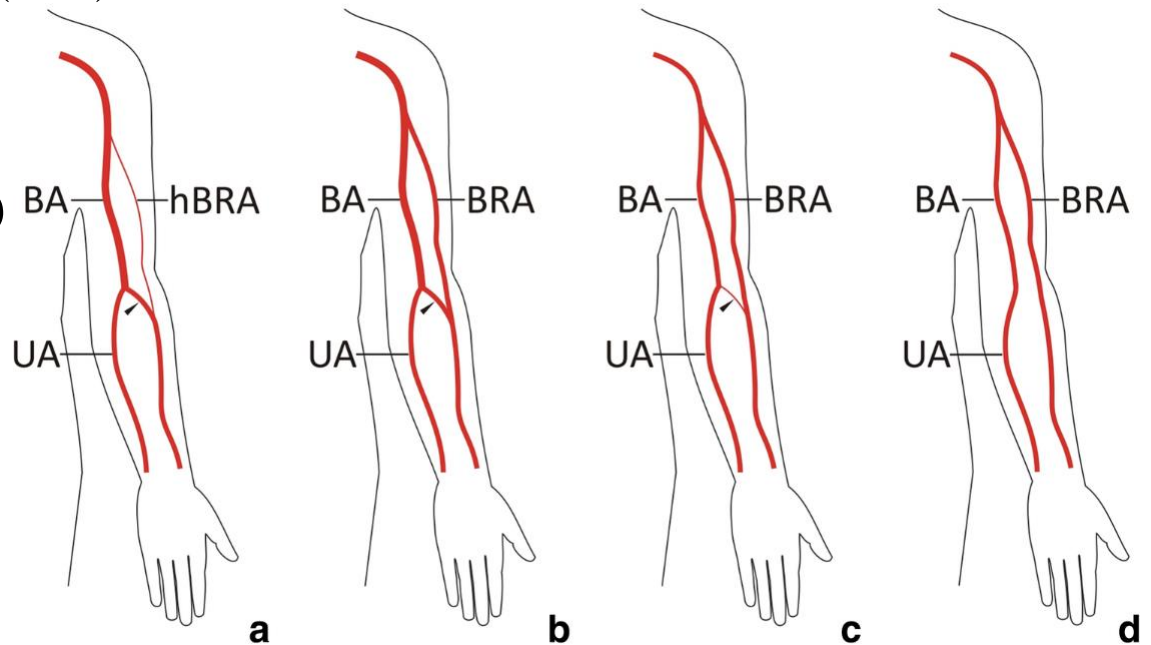


Postductal coarctation

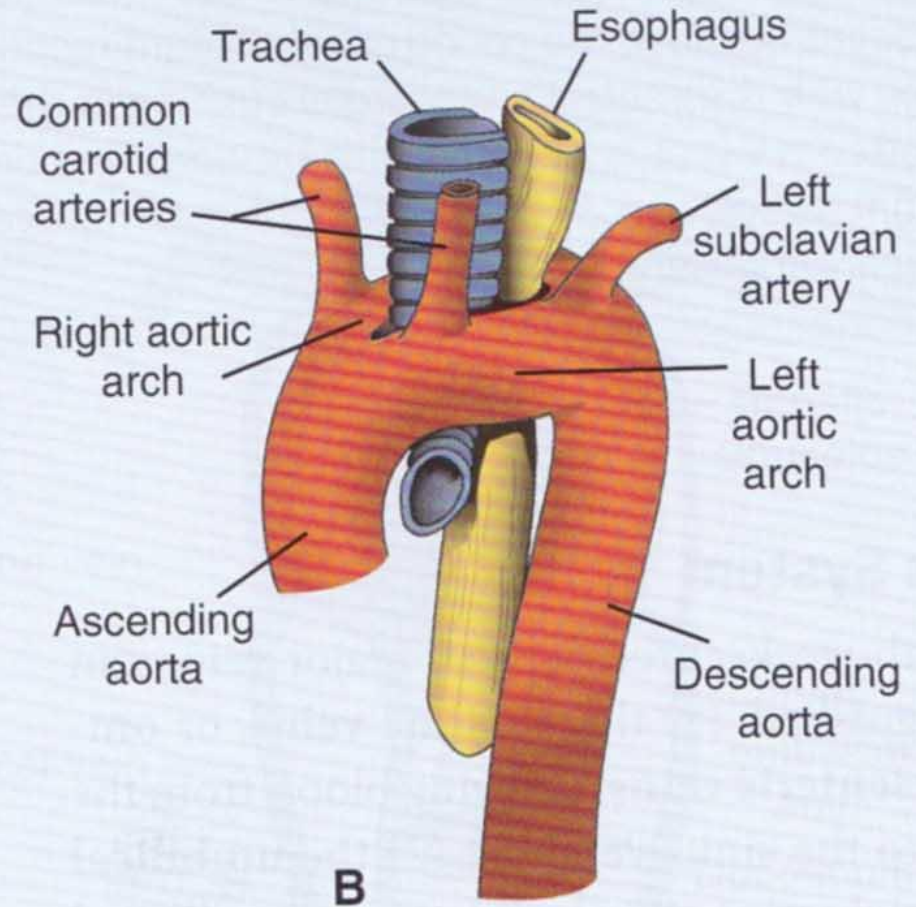
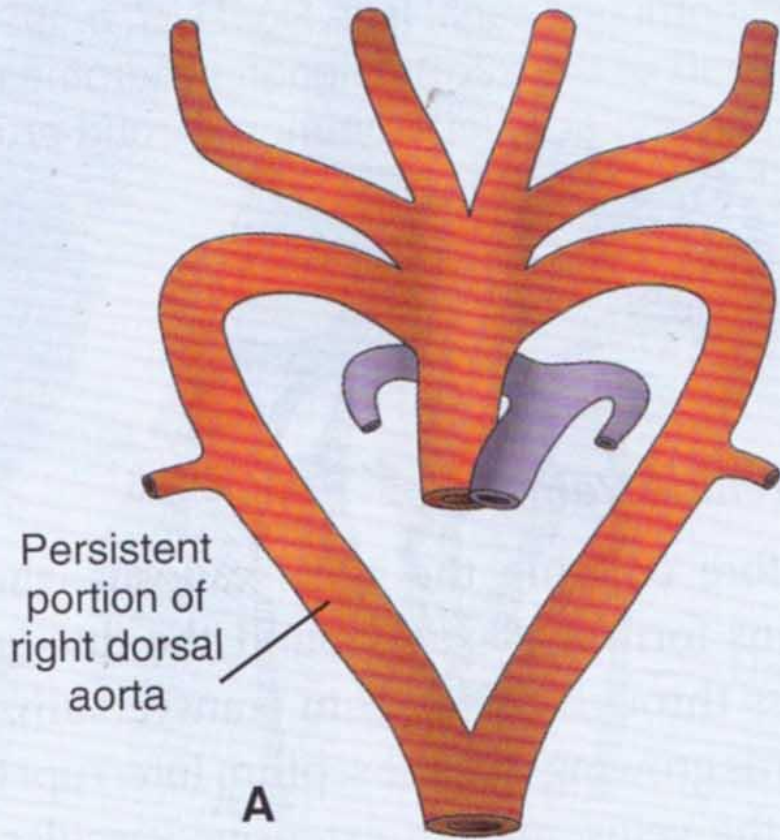


Vývojové vady tepen

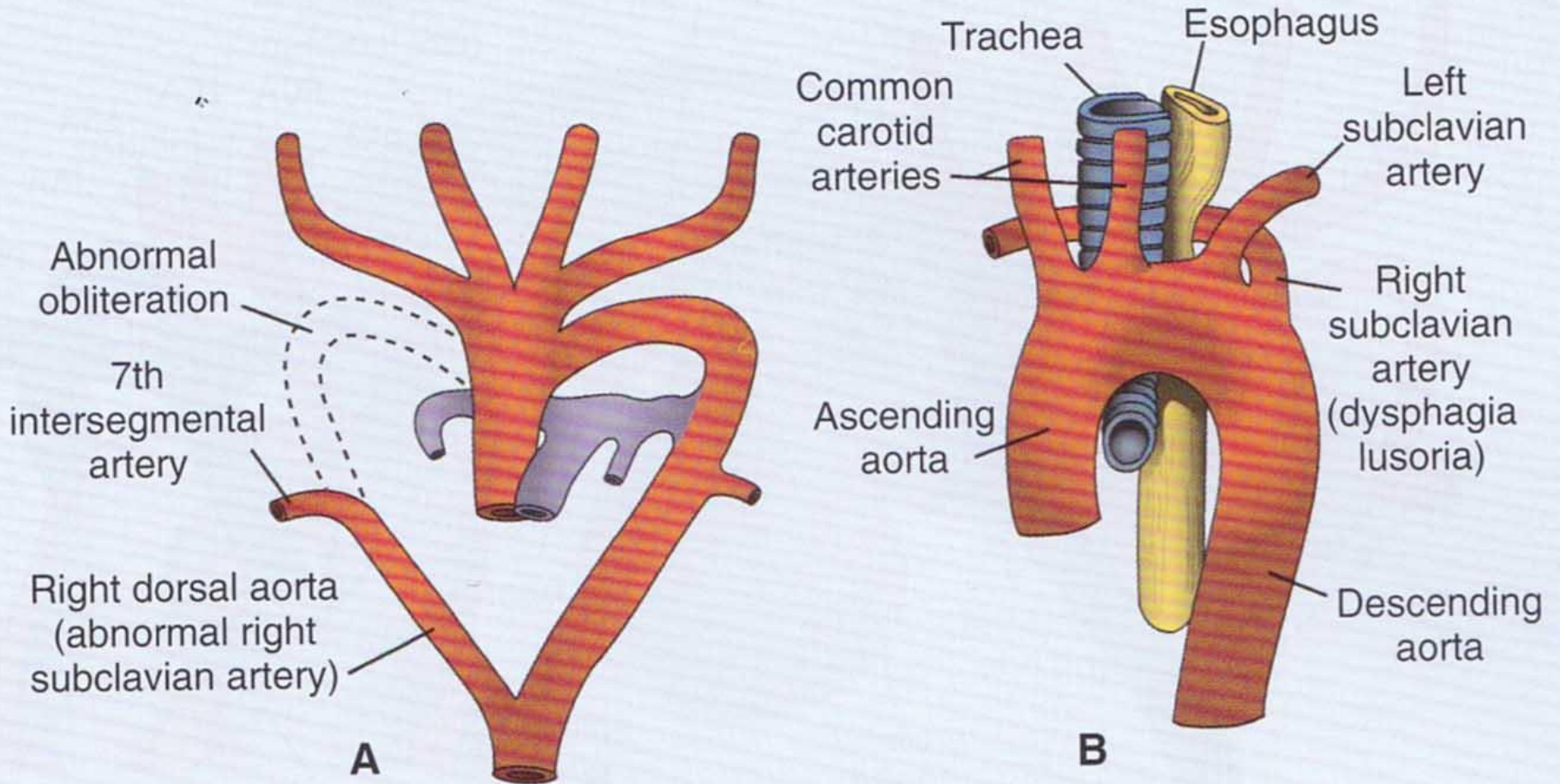
- změny v průběhu
- klinicky významné:
 - a. radialis
 - a. brachioradialis (7 %)
 - a. ulnaris
 - a. brachioulnaris superficialis (3 %)



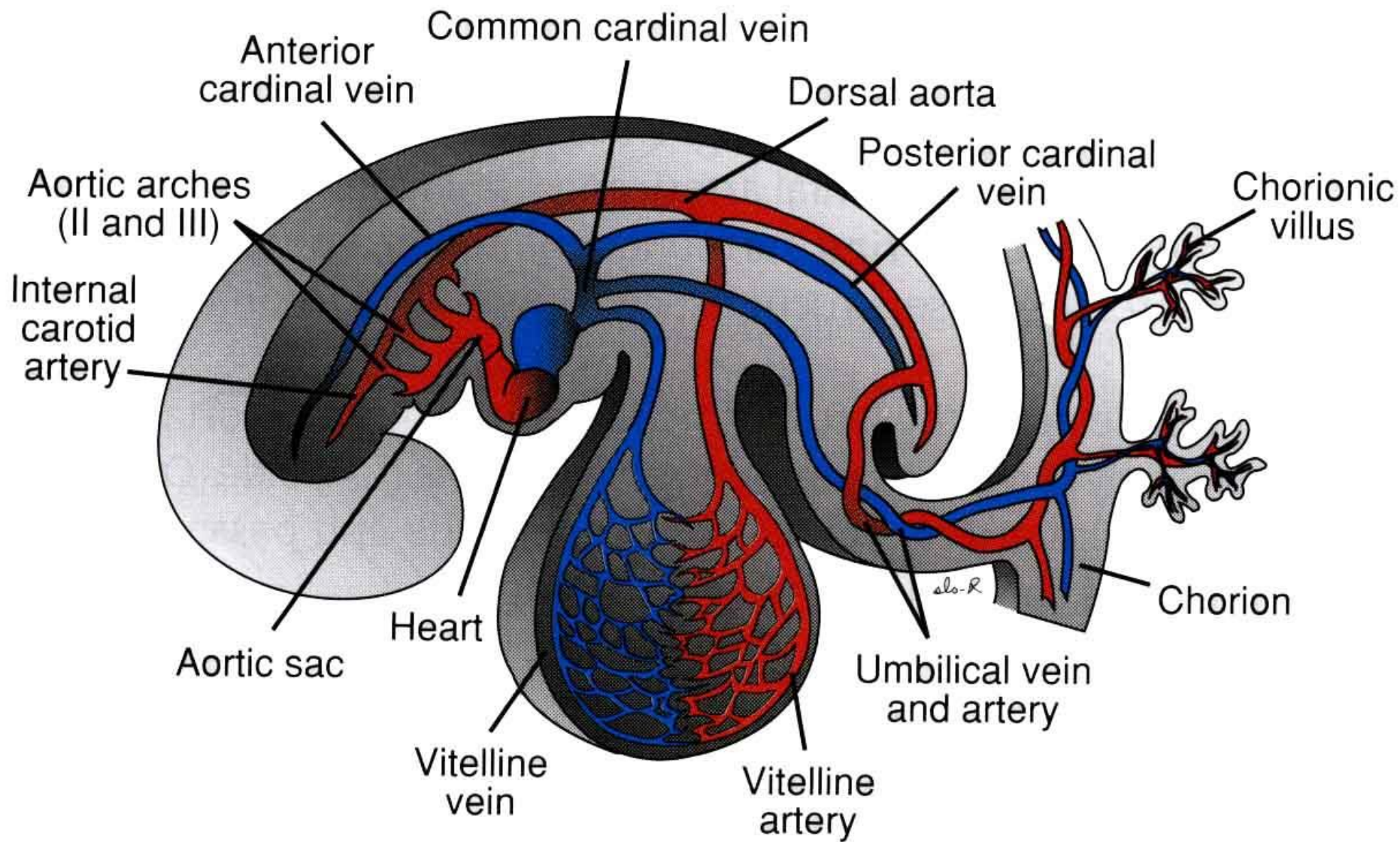
Double aortic arch



Arteria lusoria



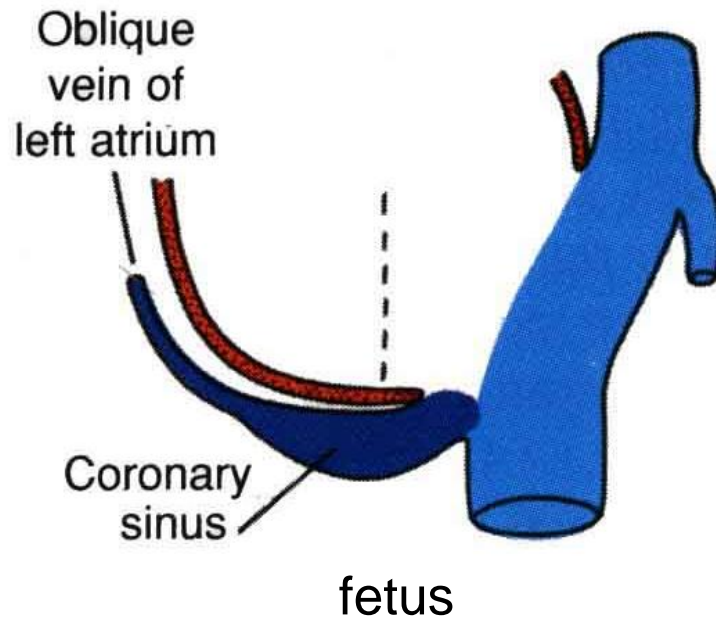
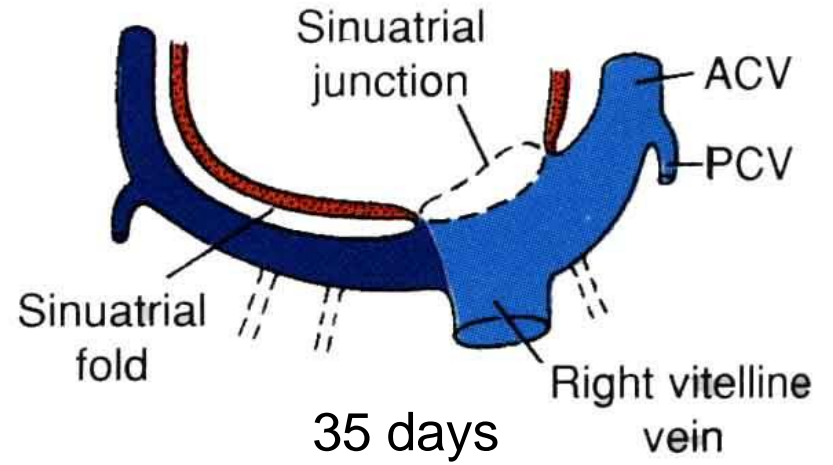
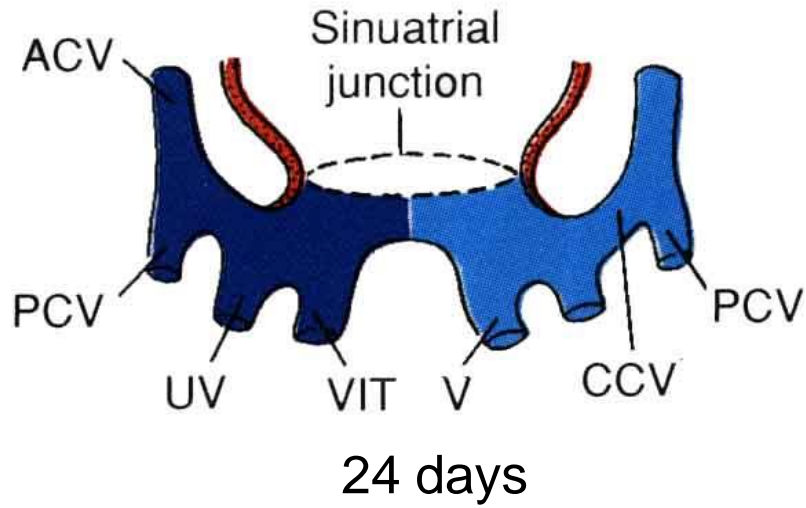
VÝVOJ ŽIL

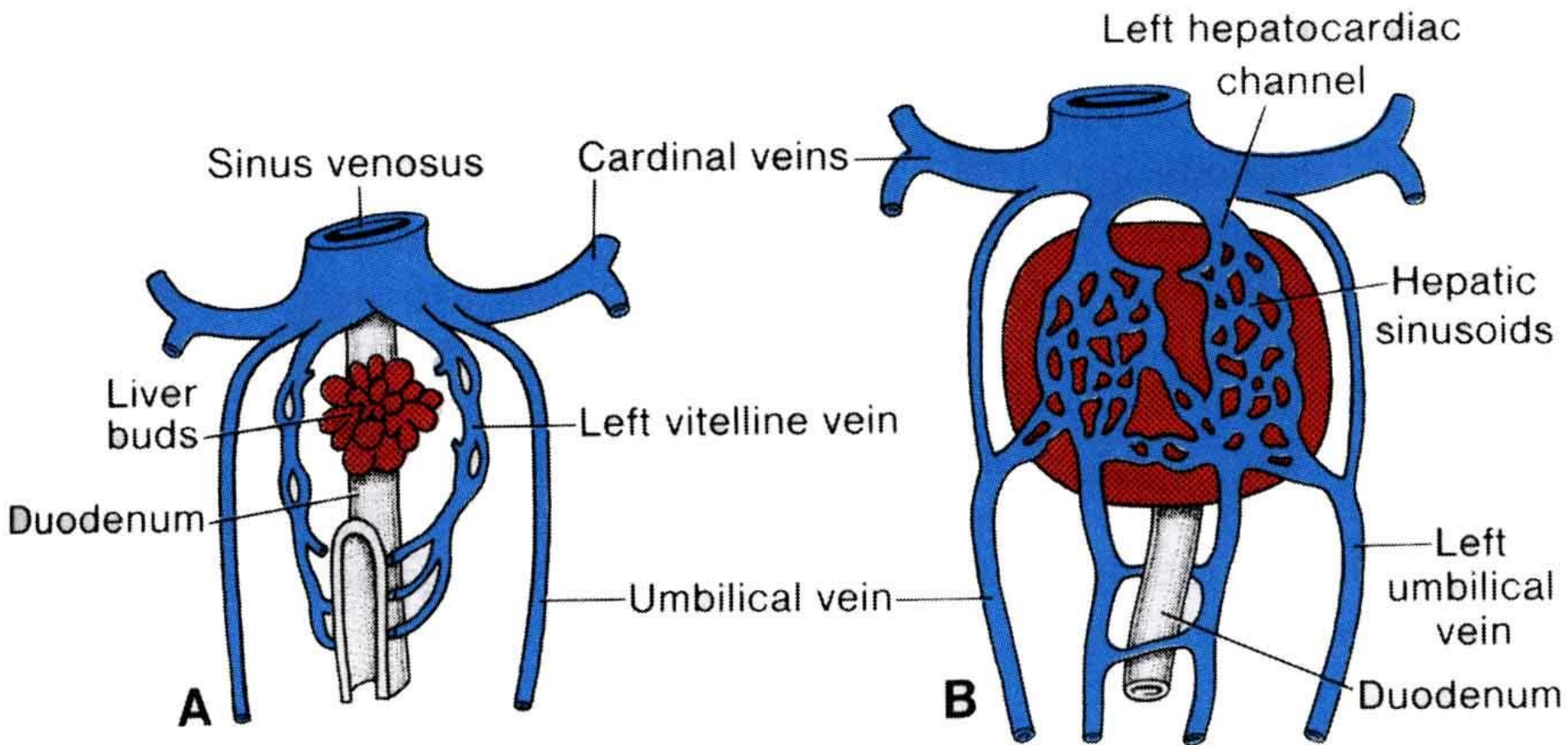


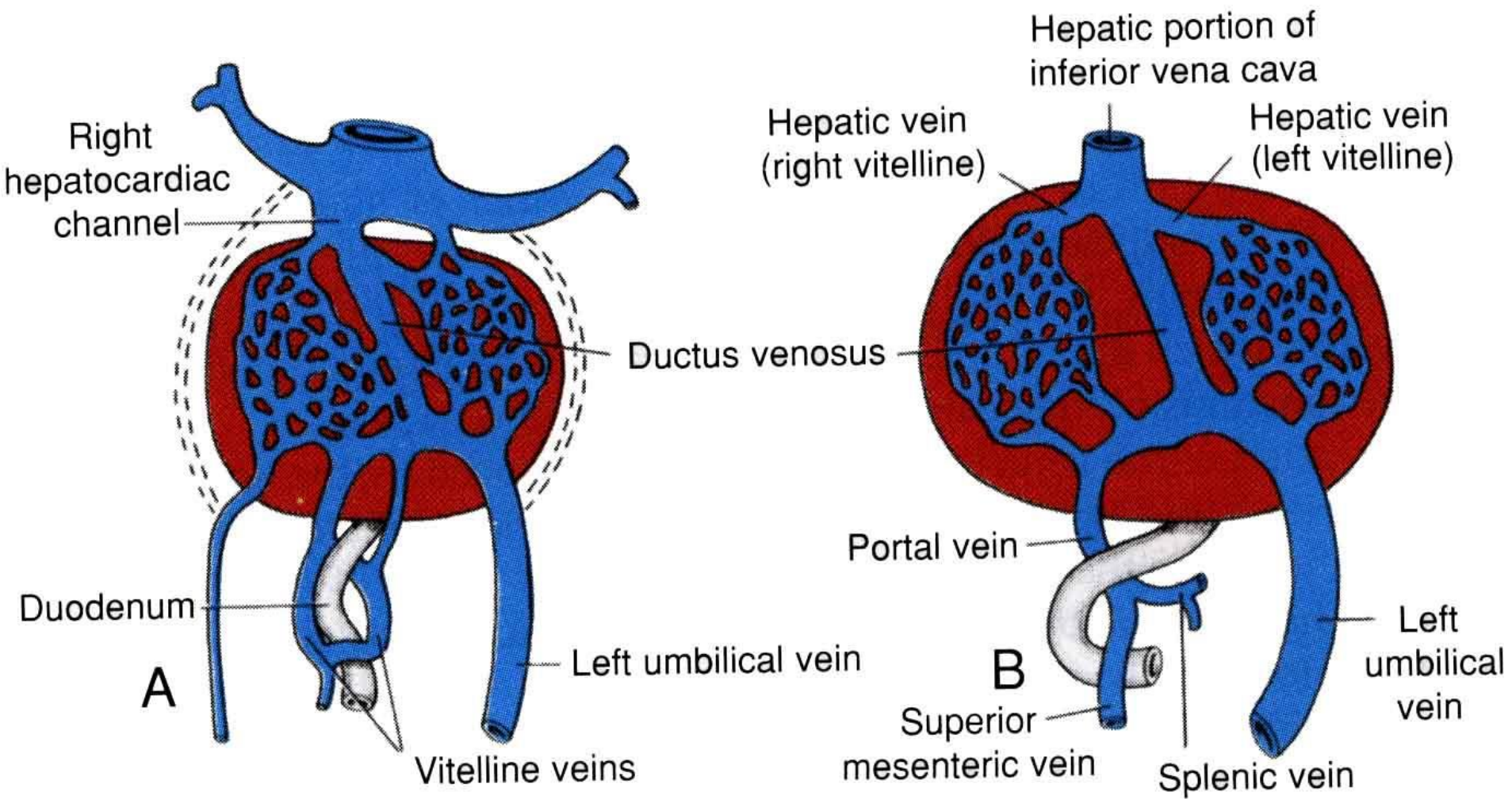
Žíly ústící do srdce

- *venae omphalomesentericae* (vv. *vitellinae*)
 - odkysličená krev ze žloutkového váčku
- *venae umbilicales*
 - okysličená krev z choriových klků placenty
- *venae cardinales communes* (**ductus Cuvieri**)
 - odkysličená krev z těla zárodku

Sinus venosus







Venae omphalomesentericae

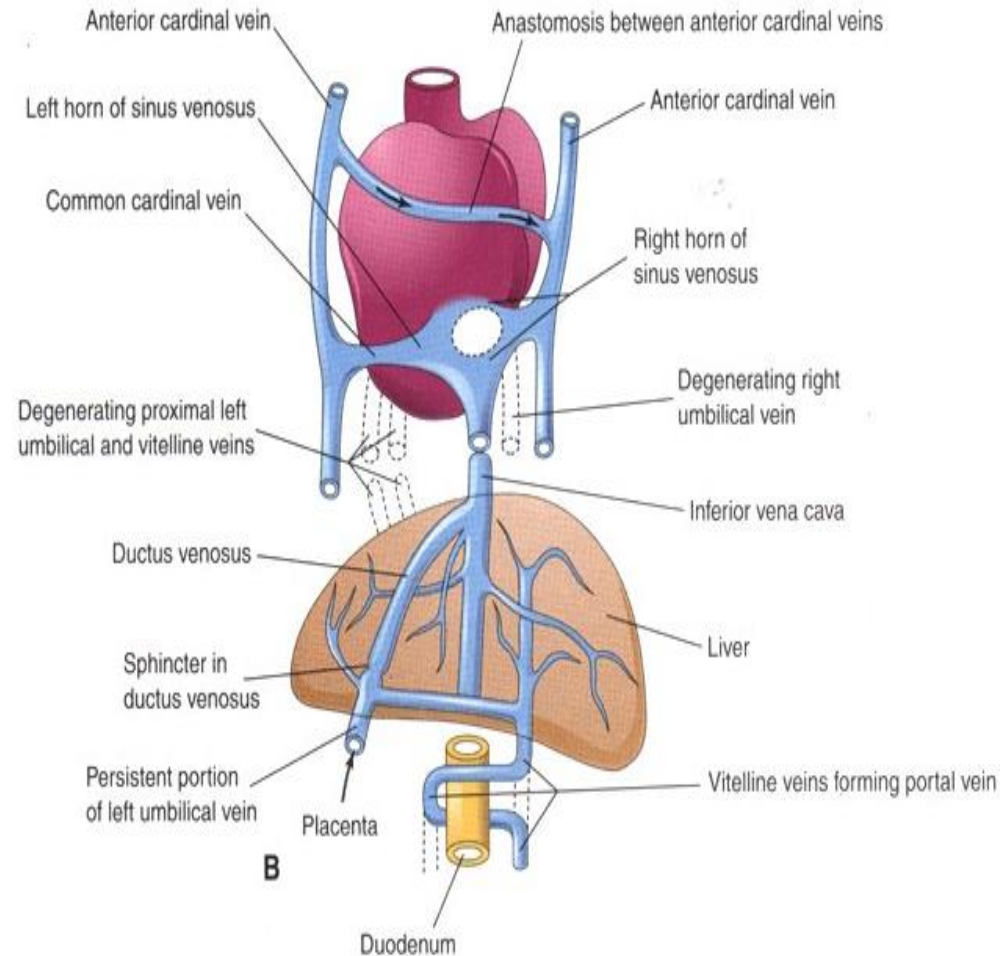
→ základ jaterních sinusoid

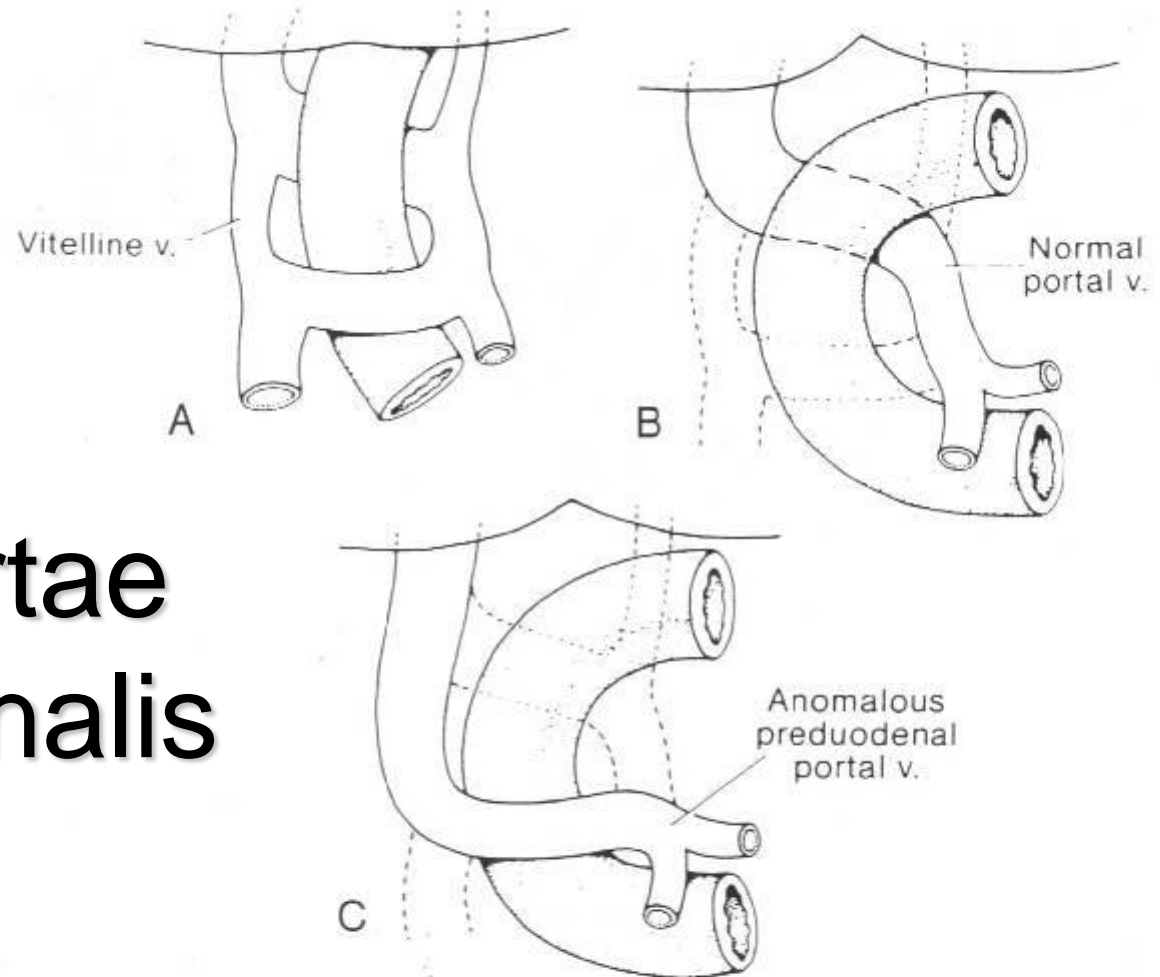
v. omphalomesenterica dx.

→ venae hepaticae

→ hepatokardiální úsek v. cava inferior

vena portae vzniká z anastomotické sítě kolem dvanáctníku





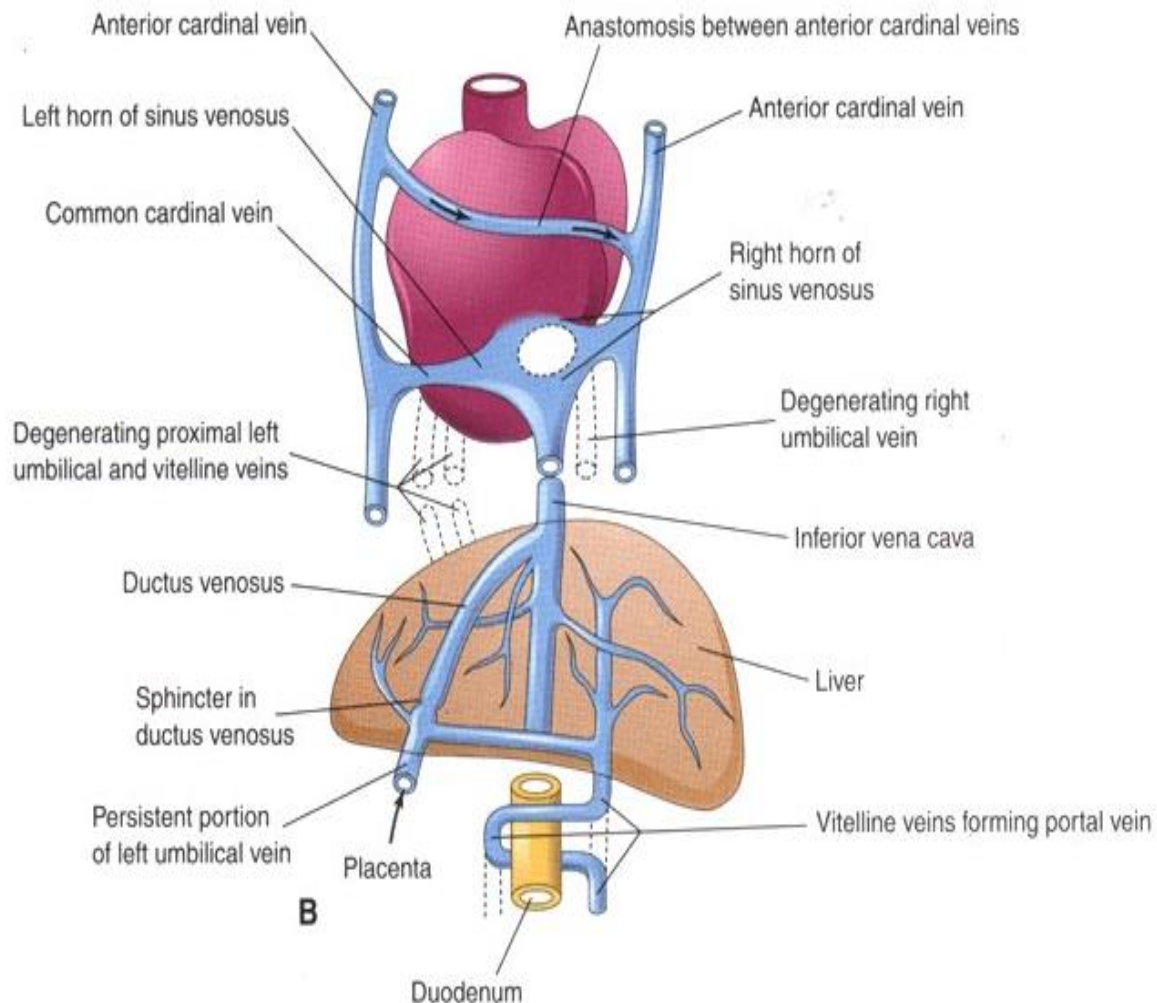
Vena portae preduodenalis

rare

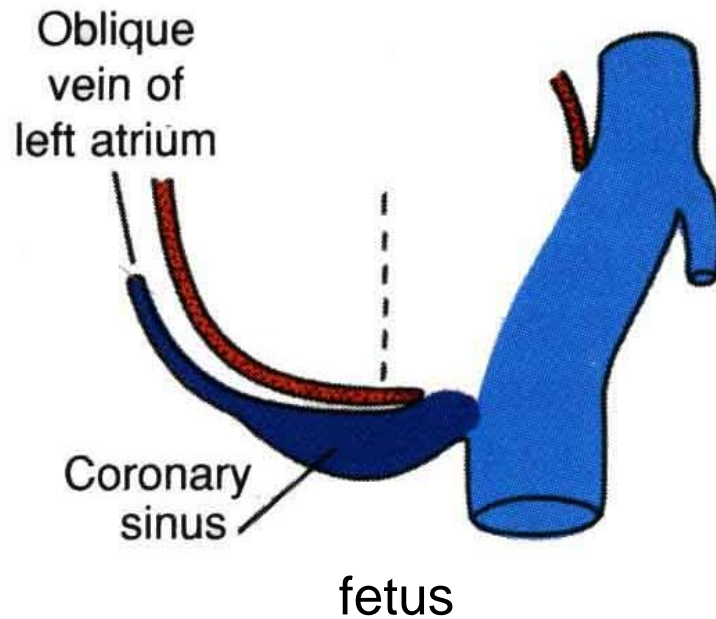
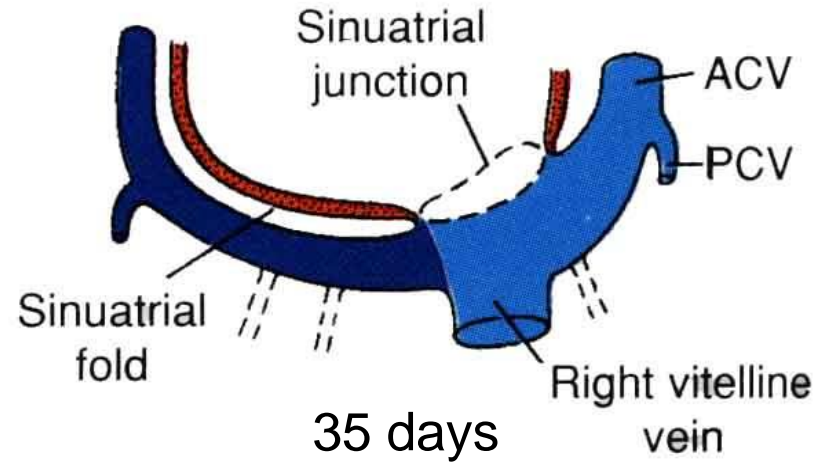
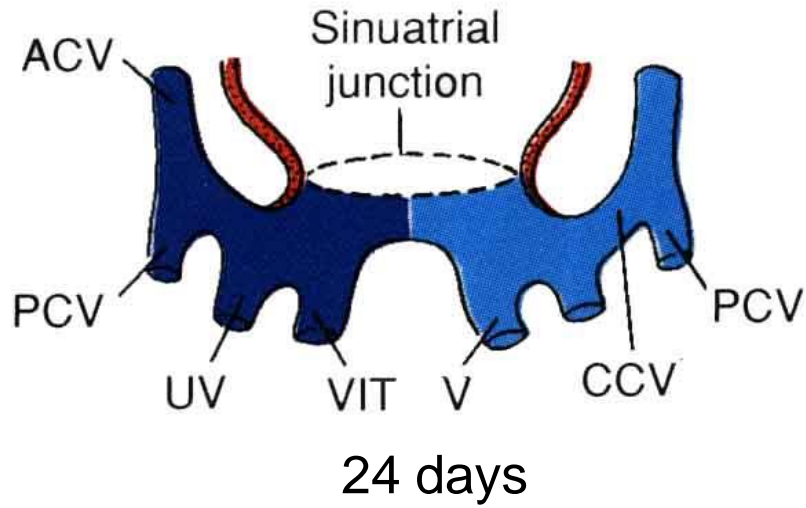
Figure 6. Embryonic origin of preduodenal portal vein. *A*, Embryonic extrahepatic communications between vitelline veins (V). *B*, Normal development; persistent superior communicating vein forms a part of normal, postduodenal portal vein. *C*, Anomalous persistent inferior communicating vein forms a part of an anomalous preduodenal portal vein. (From Colborn GL, Gray SW, Pemberton LB, et al: The duodenum. Am Surg 55(part 3):469, 1989; with permission.)

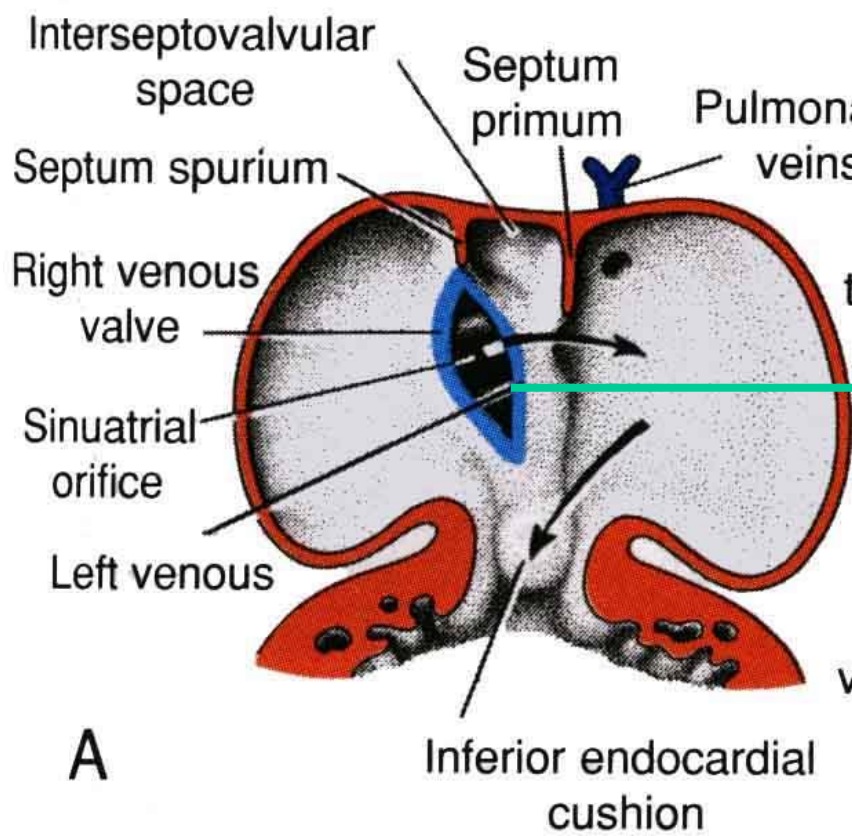
Venae umbilicales

- pravá zaniká
- část levé zaniká
- druhá část levé se udrží jako plodová vena umbilicalis
- žilní zkrat obcházející játra — ductus venosus



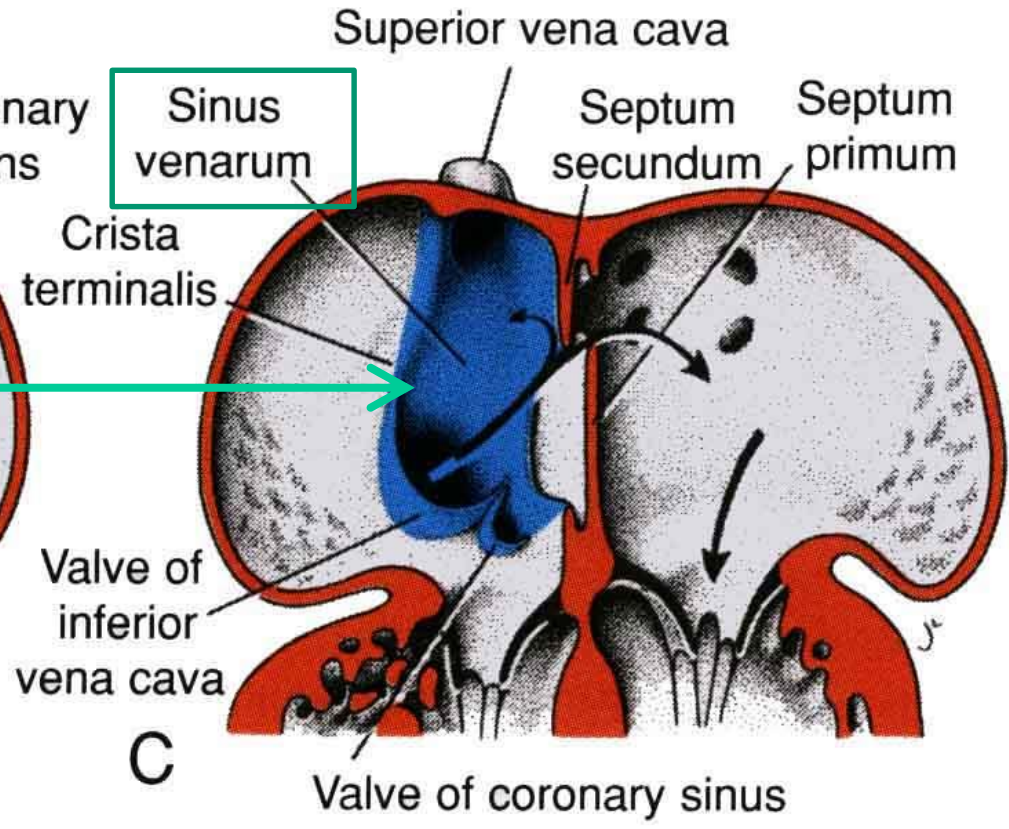
Sinus venosus





A

5th week

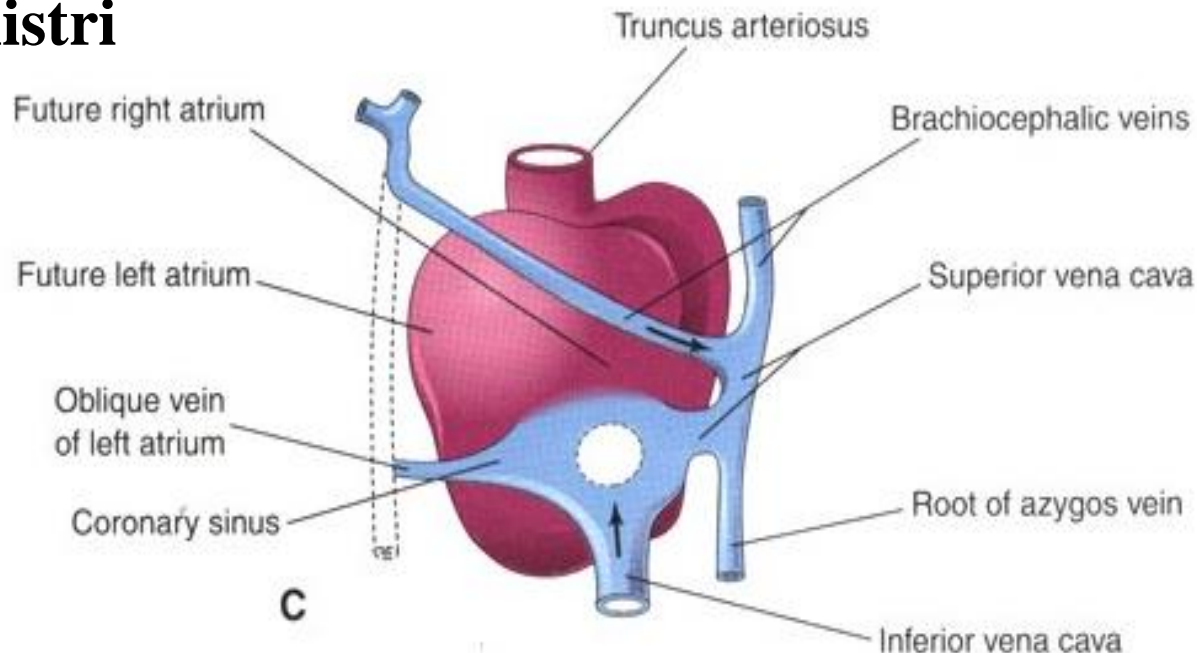


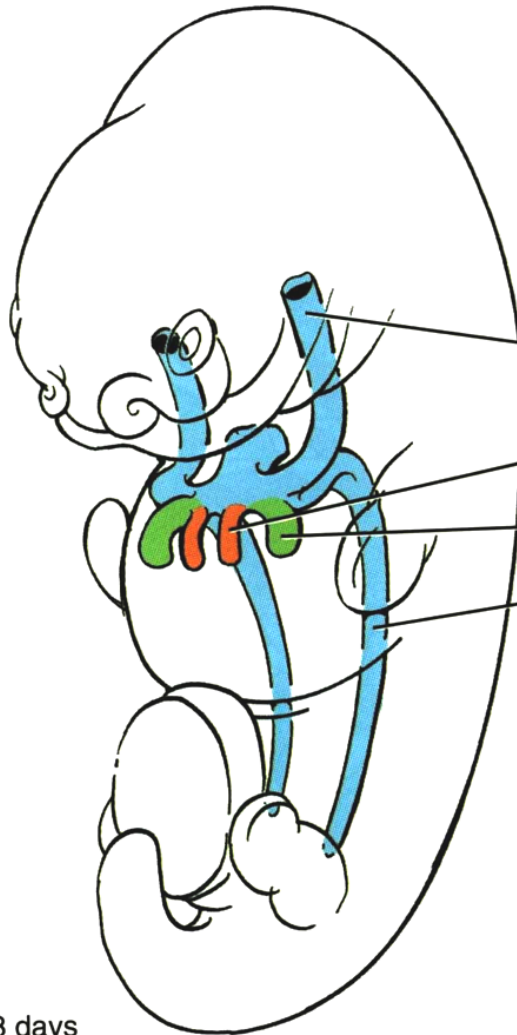
C

fetus

Venae cardinales

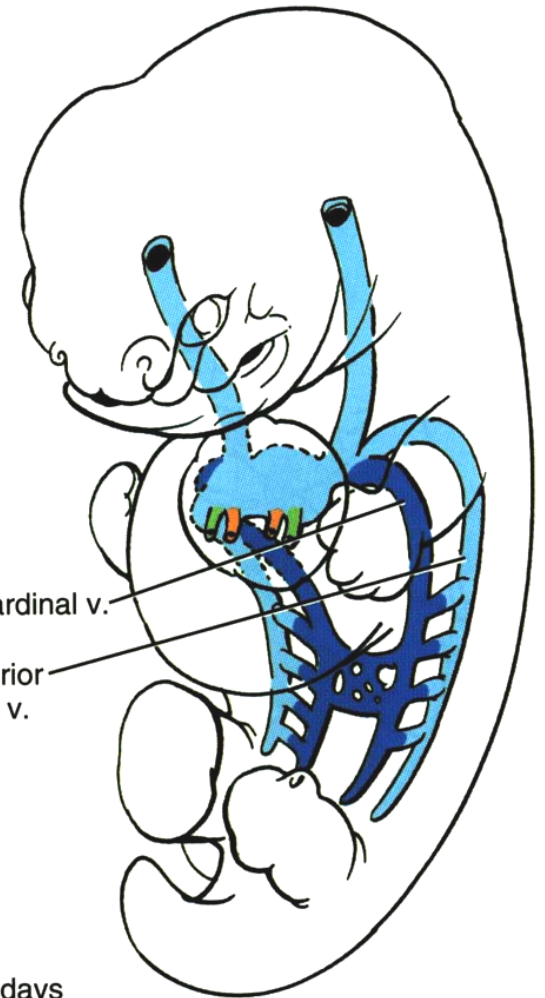
- v. precardinalis + v. postcardinalis →
v. cardinalis communis (ductus Cuvieri)
- šikmá anastomóza převádí krev zleva doprava → **v. brachiocephalica sinistra**
- v. precardinalis dextra a v. cardinalis communis dextra → **v. cava superior**
- v. cardinalis communis sinistra → **sinus coronarius+v.obliqua atrii sinistri**





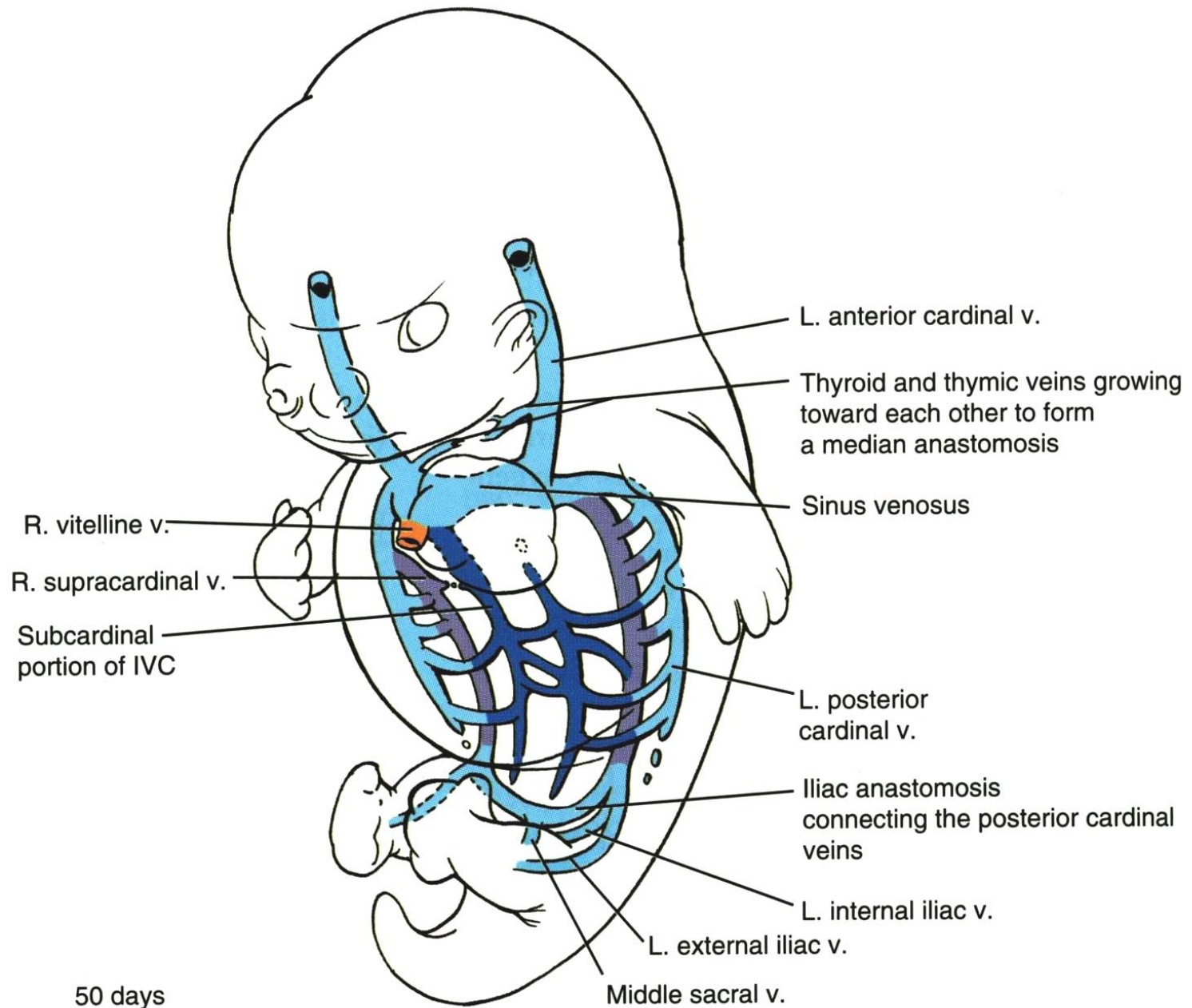
- L. anterior cardinal v.
- L. vitelline v.
- L. umbilical v.
- L. posterior cardinal v.

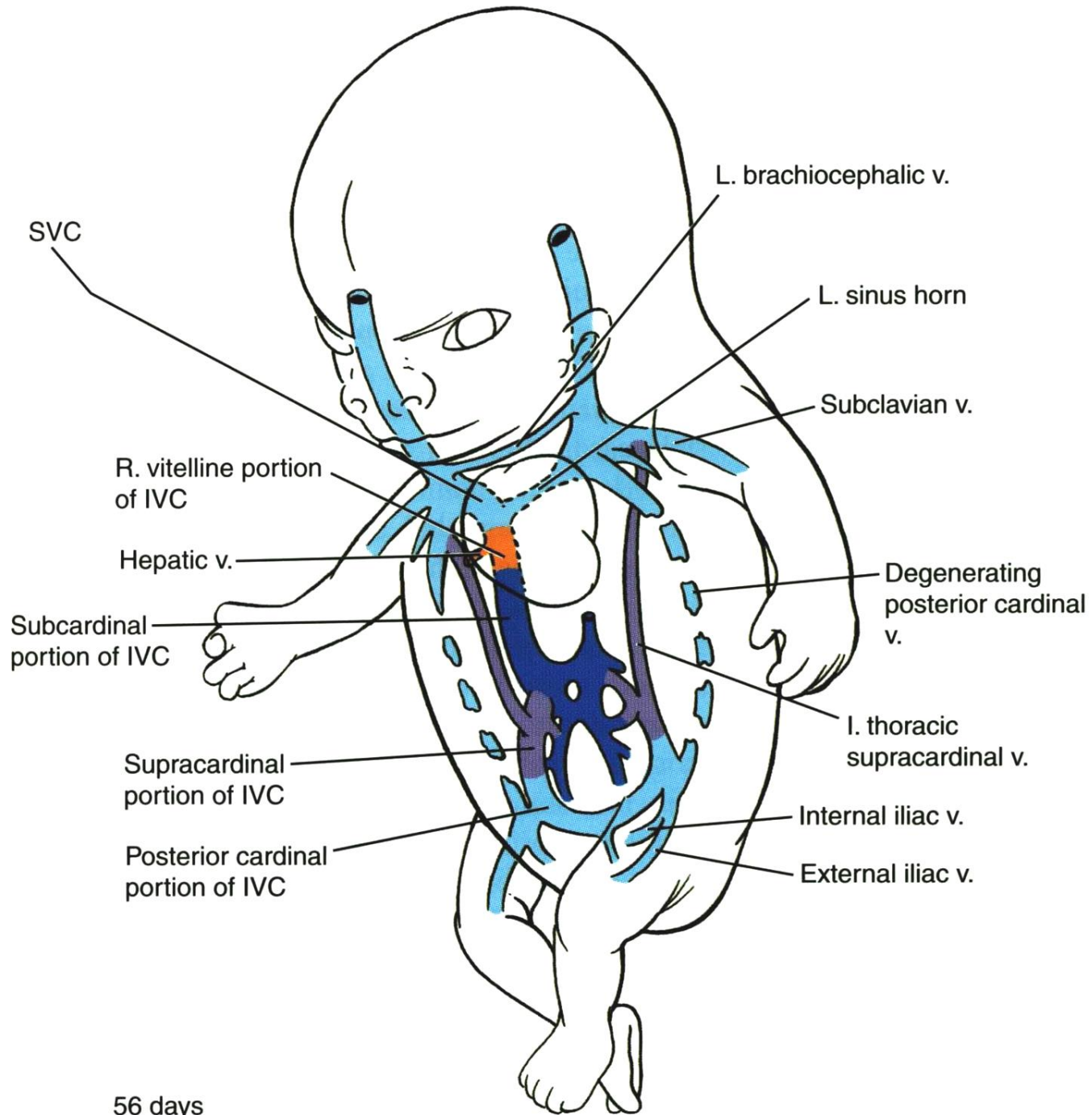
28 days



- L. subcardinal v.
- L. posterior cardinal v.

35 days





SVC

L. brachiocephalic v.

L. sinus horn

Subclavian v.

R. vitelline portion of IVC

Hepatic v.

Degenerating posterior cardinal v.

Subcardinal portion of IVC

I. thoracic supracardinal v.

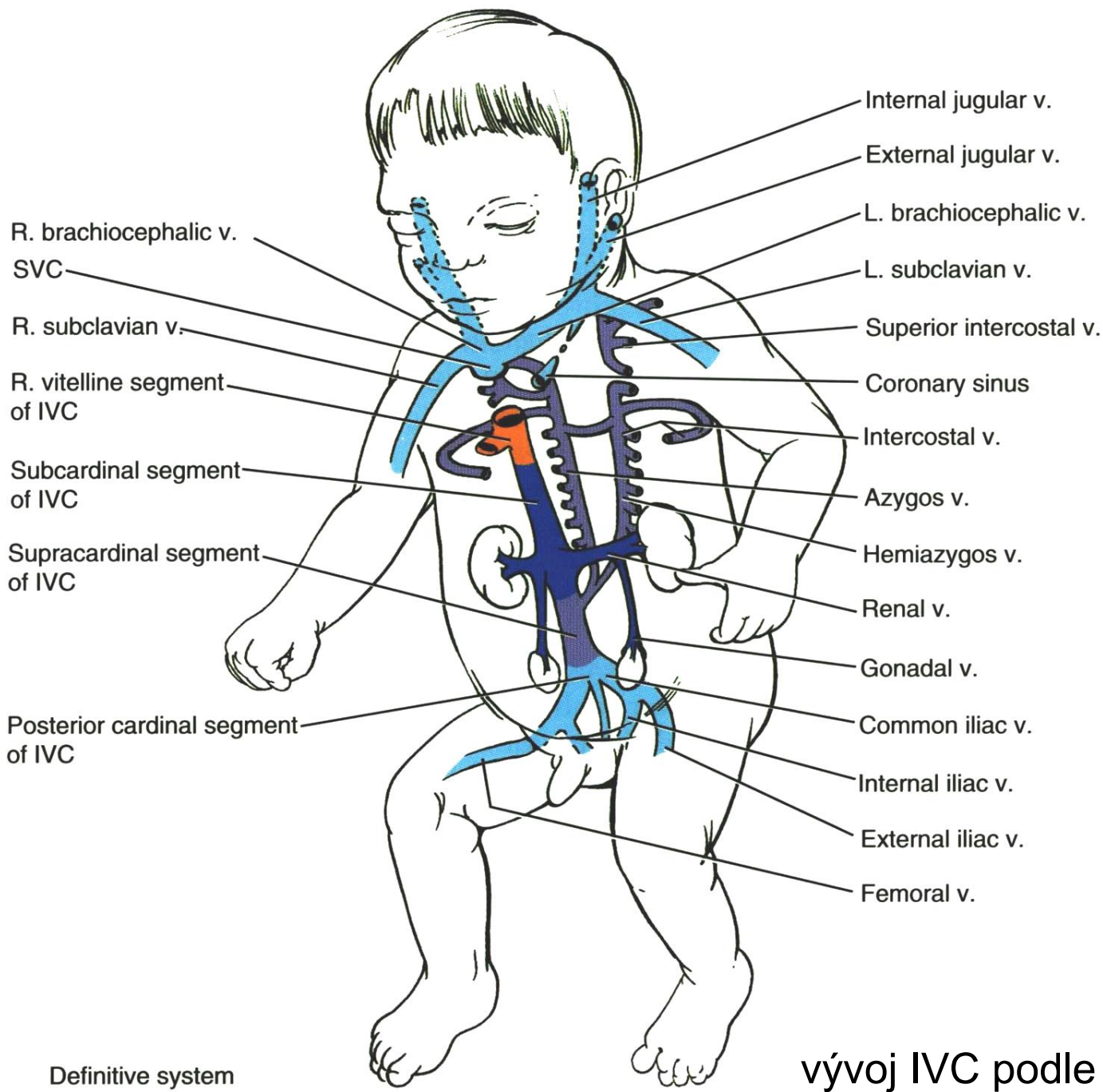
Supracardinal portion of IVC

Internal iliac v.

Posterior cardinal portion of IVC

External iliac v.

56 days

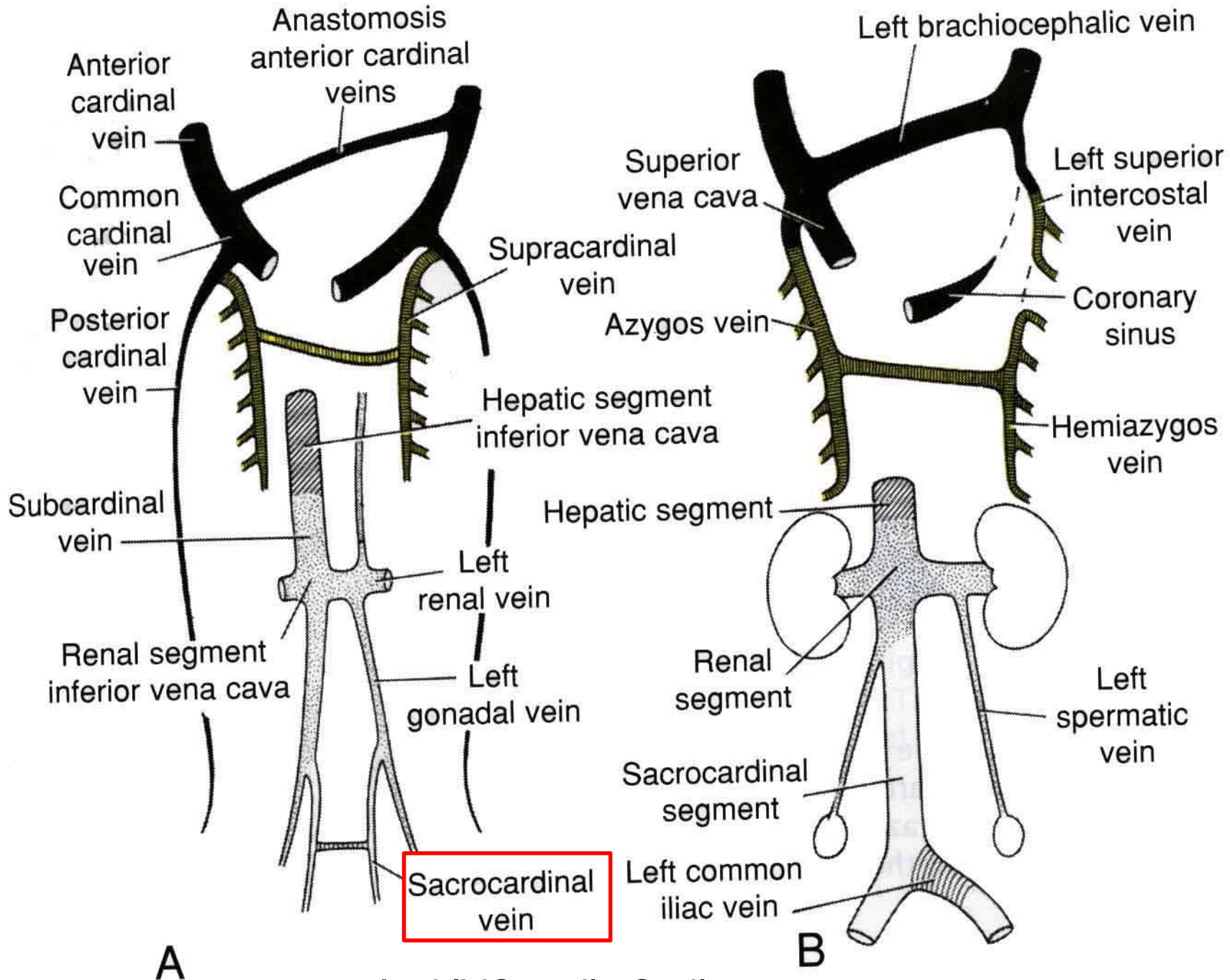


R. brachiocephalic v.
SVC
R. subclavian v.
R. vitelline segment
of IVC
Subcardinal segment
of IVC
Supracardinal segment
of IVC
Posterior cardinal segment
of IVC

Internal jugular v.
External jugular v.
L. brachiocephalic v.
L. subclavian v.
Superior intercostal v.
Coronary sinus
Intercostal v.
Azygos v.
Hemiazygos v.
Renal v.
Gonadal v.
Common iliac v.
Internal iliac v.
External iliac v.
Femoral v.

Definitive system

vývoj IVC podle Larsena



A

B

vývoj IVC podle Sadlera

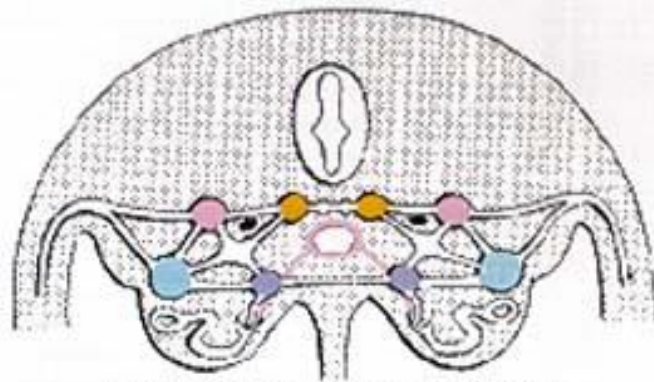
Vývojové žíly

vv. somaticae

- **v. cardinalis communis** = ductus *Cuvieri*
- **v. precardinalis** (→ v. jugularis int.+ ext.)
- **v. postcardinalis** (→ v. azygos + hemiazygos)
- anastomosis subcardinalis
 - vv. subcardinales
- **vv. intersegmentales** – v. marginalis membri + v. axialis m.s./m.i.(→ vv. subclaviae + povrchové a hluboké žíly končetin)

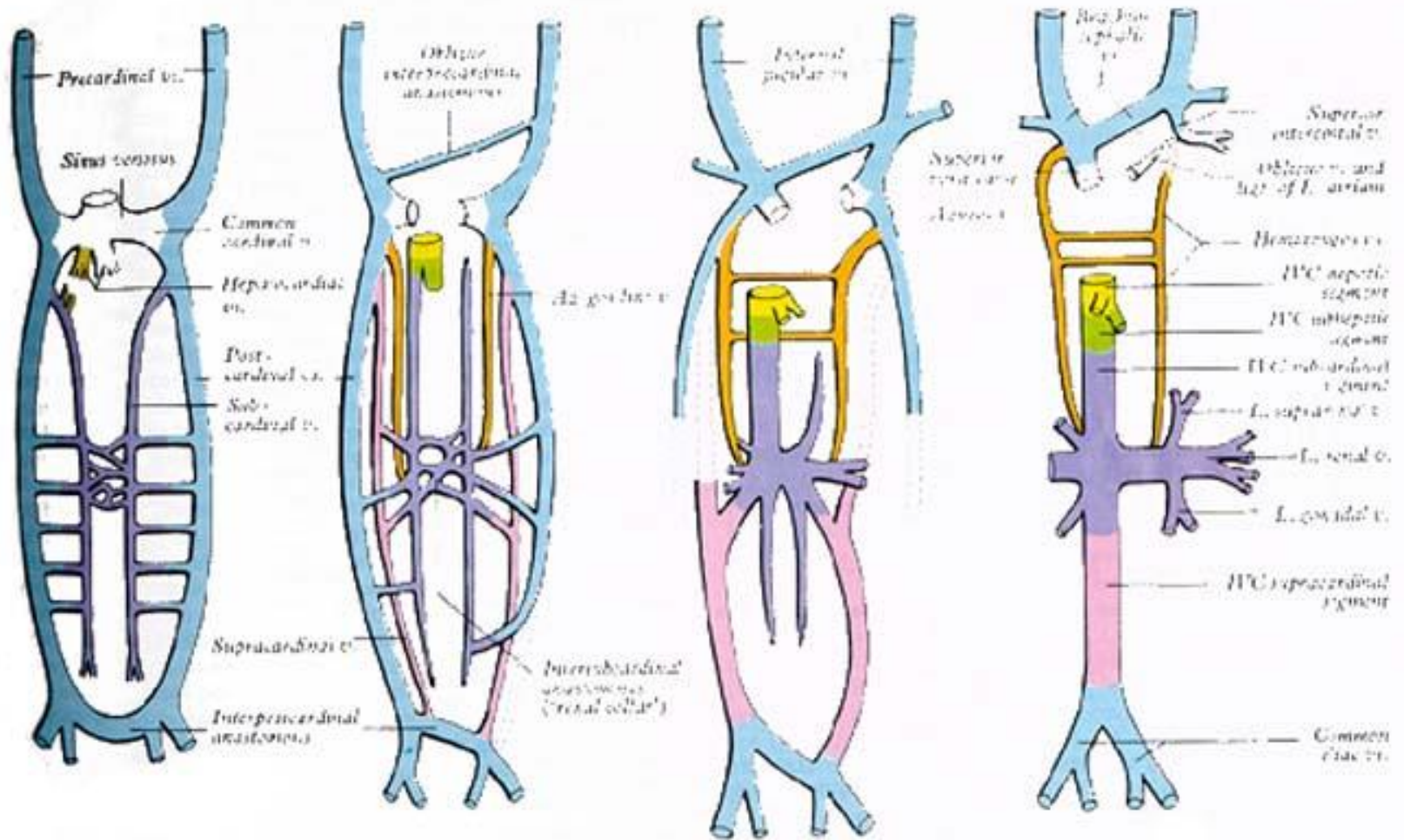
vv. viscerales

- **vv. omphalomesentericae** (vitellinae)
- **v. umbilicalis** (původně 2, pravá zaniká)
- v. pulmonalis communis

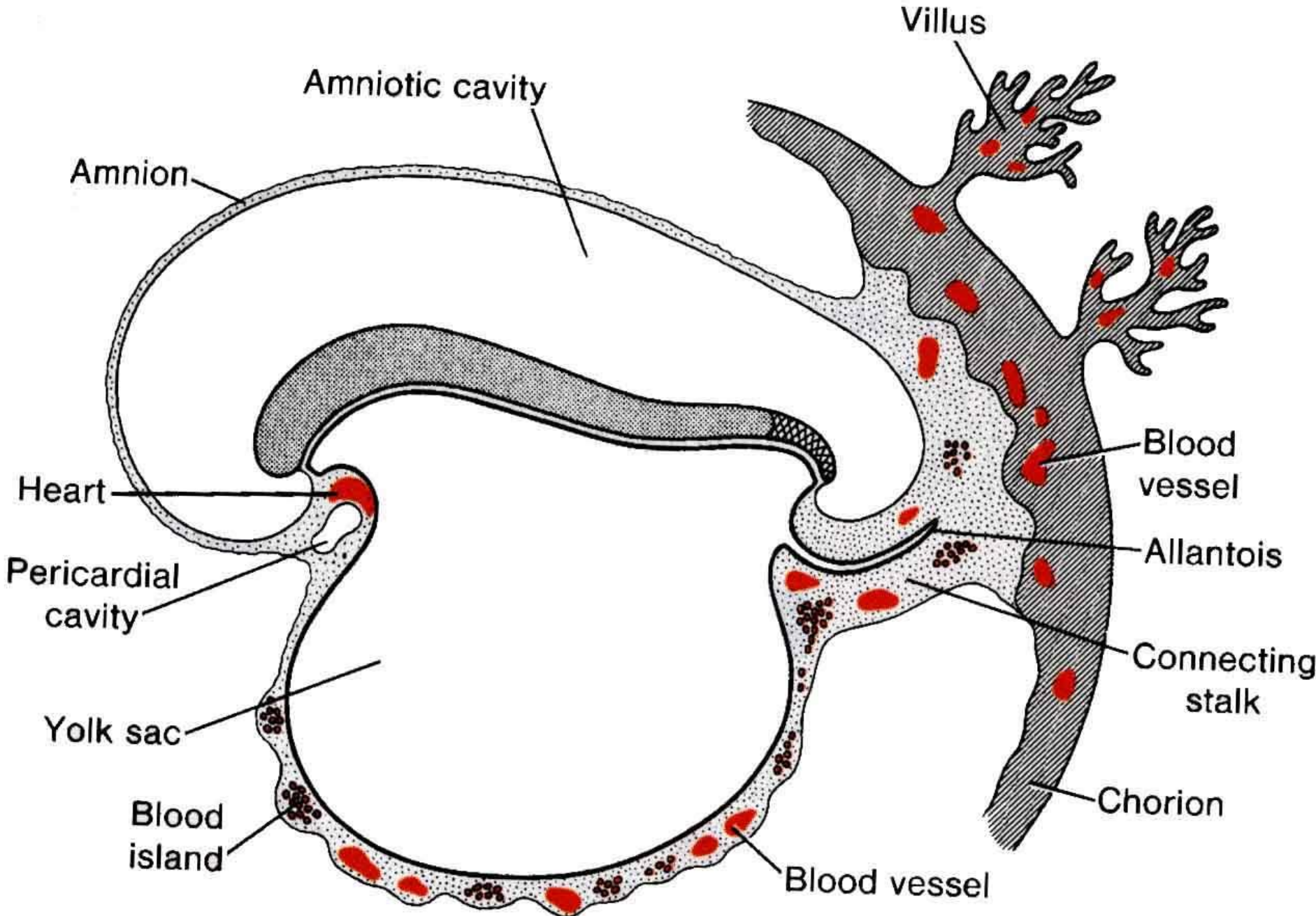


SCHEMATIC TRANSVERSE SECTION
THROUGH EMBRYONIC TRUNK

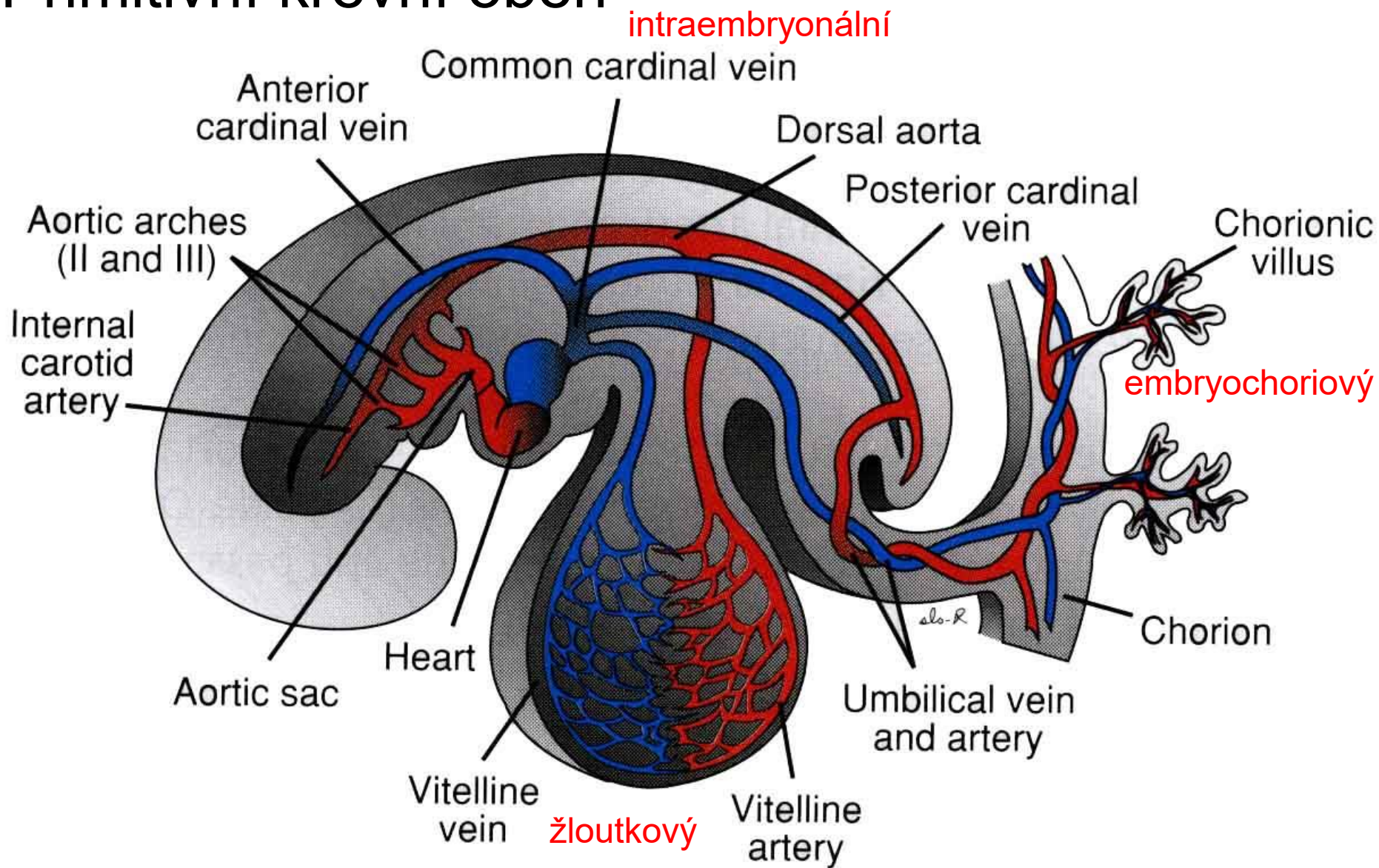
- Pre-cardinal v.
- Supra-cardinal v. (intercostal line v.)
- Azygos line v. (metasympathetic line v.)
- Sub-cardinal v.
- ◊ Sub-central v.
- Hepatic segment of IVC (near right testis v.)
- Subhepatic segment of IVC.



PRIMITIVNÍ A FETÁLNÍ KREVNÍ OBĚH



Primitivní krevní oběh

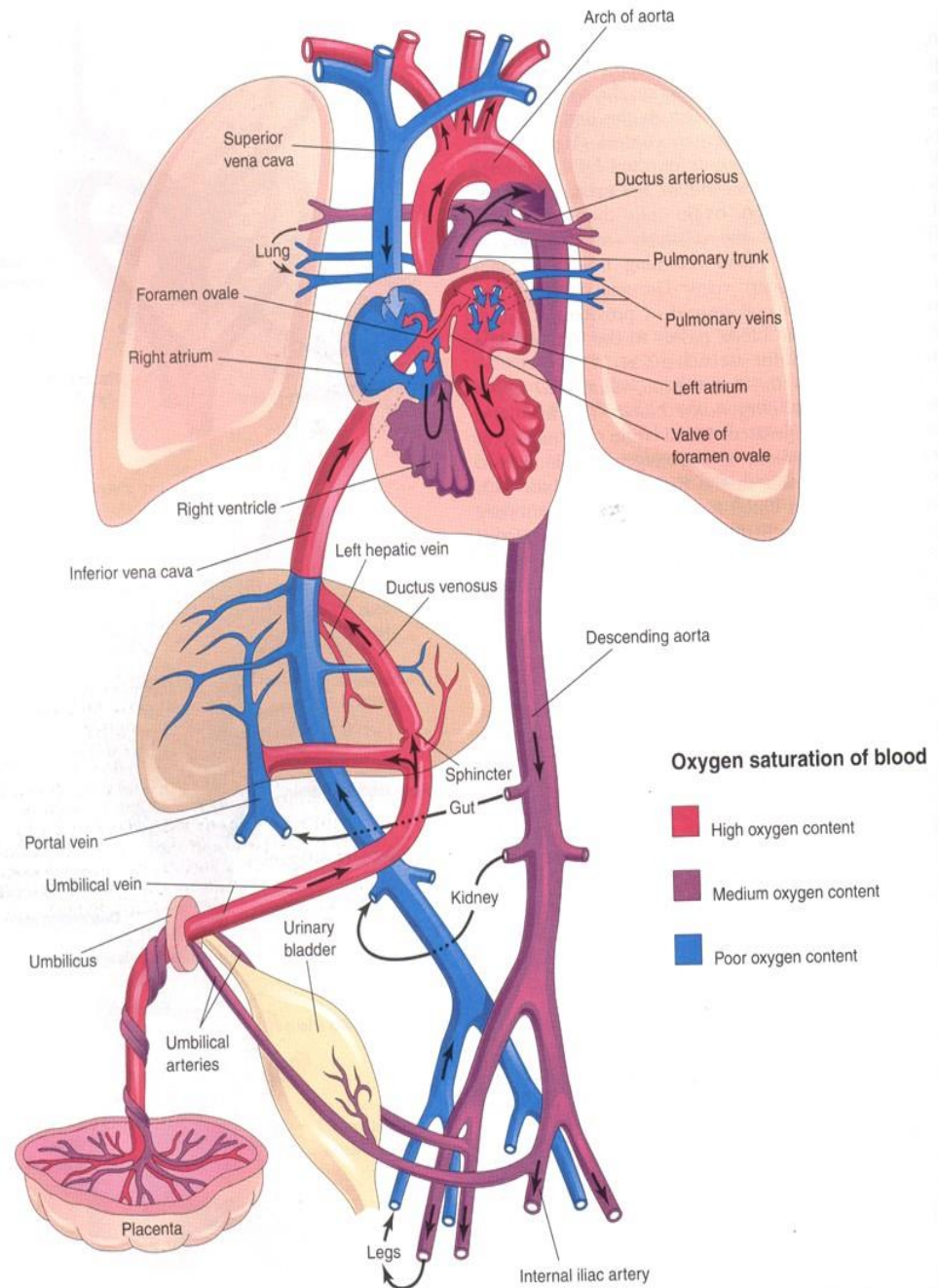


embryochoriový oběh



Fetální oběh

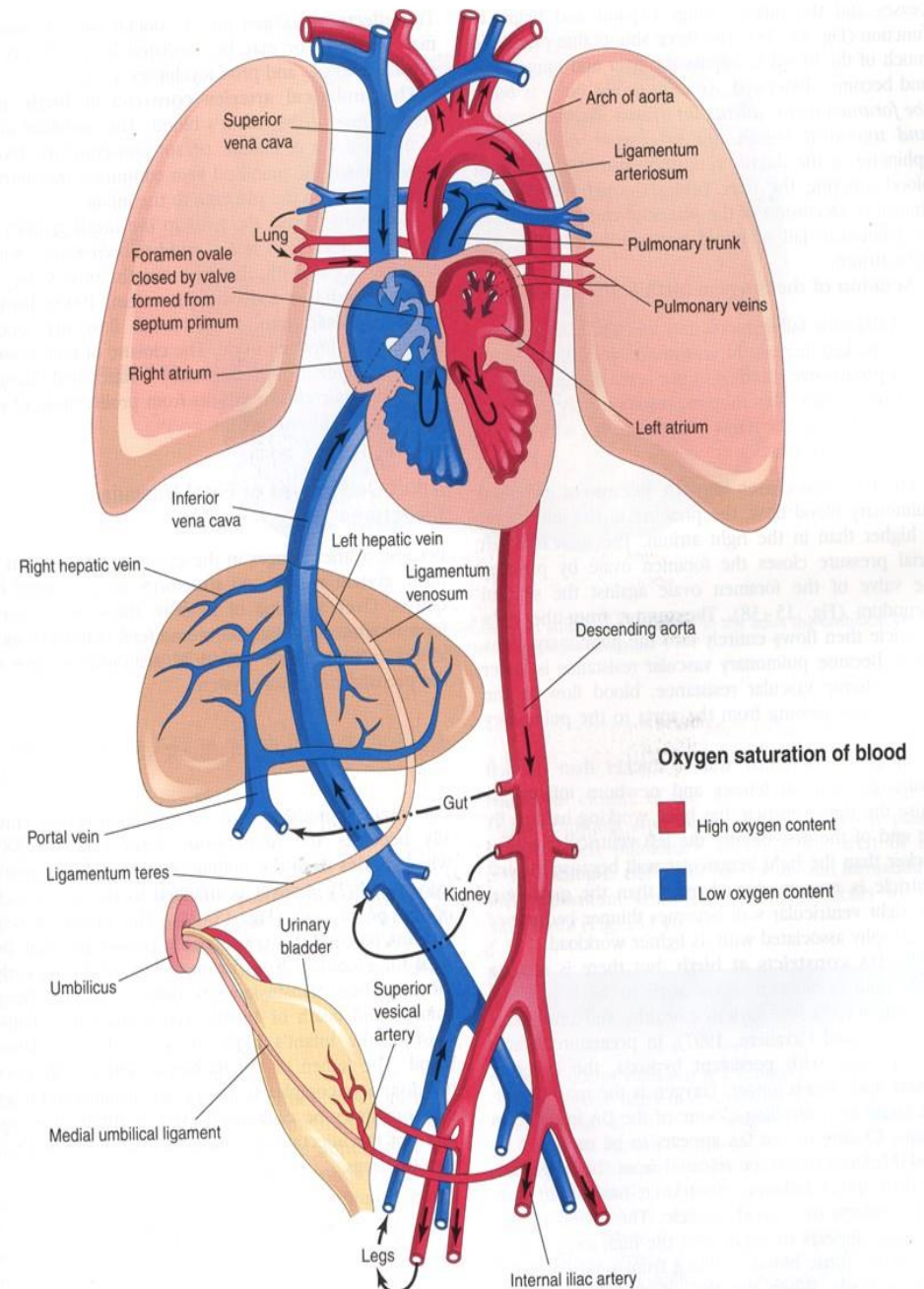
- ductus venosus (Arantii)
- foramen ovale
- ductus arteriosus (Botalli)



■ **Figure 15-37.** Schematic illustration of the fetal circulation. The colors indicate the oxygen saturation of the blood, and the arrows show the course of the blood from the placenta to the heart. The organs are not drawn to scale. Observe that three shunts permit most of the blood to bypass the liver and lungs: (1) ductus venosus, (2) foramen ovale, and (3) ductus arteriosus. The poorly oxygenated blood returns to the placenta for oxygen and nutrients through the umbilical arteries.

Novorozenecký oběh

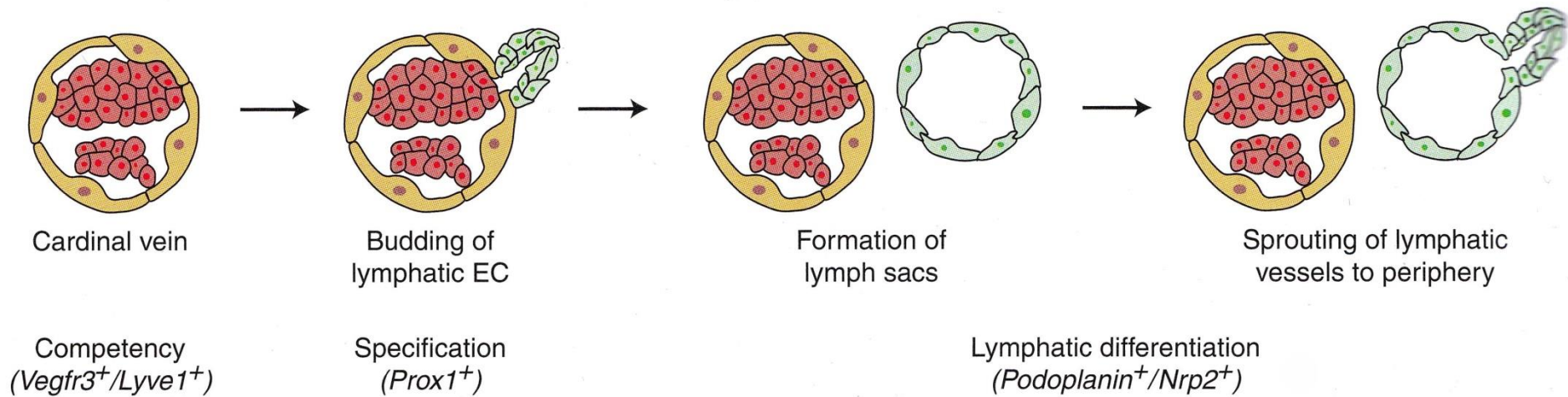
- rozvinutí plic
- stáhne se svěrač v ductus venosus
- foramen ovale se uzavírá zvýšeným tlakem krve v levé síni
- ductus venosus a aa. umbilicales se stáhnou
- ductus arteriosus se reflexně stáhne

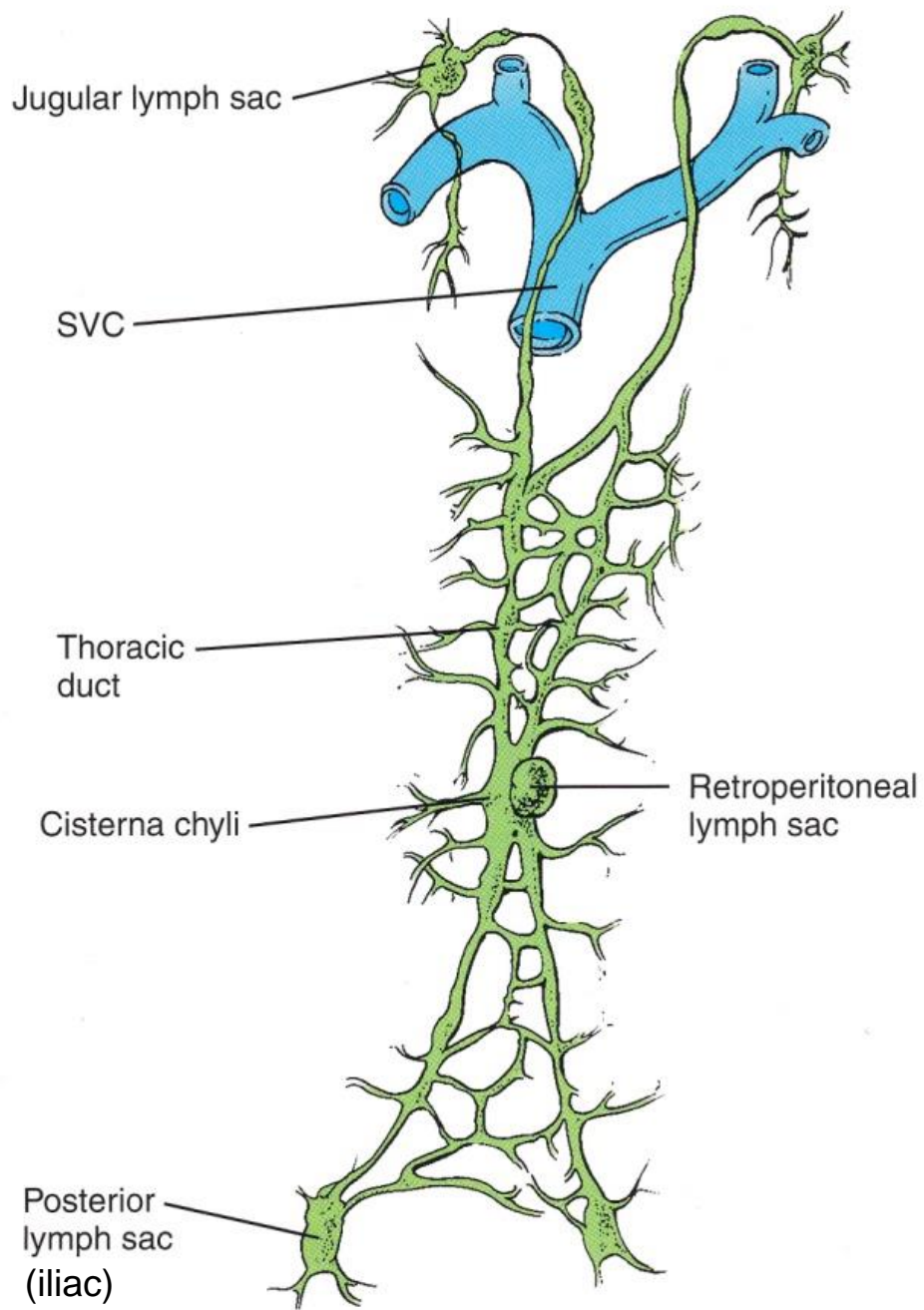


■ **Figure 15-38.** Schematic illustration of the neonatal circulation. The adult derivatives of the fetal vessels and structures that become nonfunctional at birth are also shown. The arrows indicate the course of the blood in the infant. The organs are not drawn to scale. After birth the three shunts that short-circuited the blood during fetal life cease to function, and the pulmonary and systemic circulations become separated.

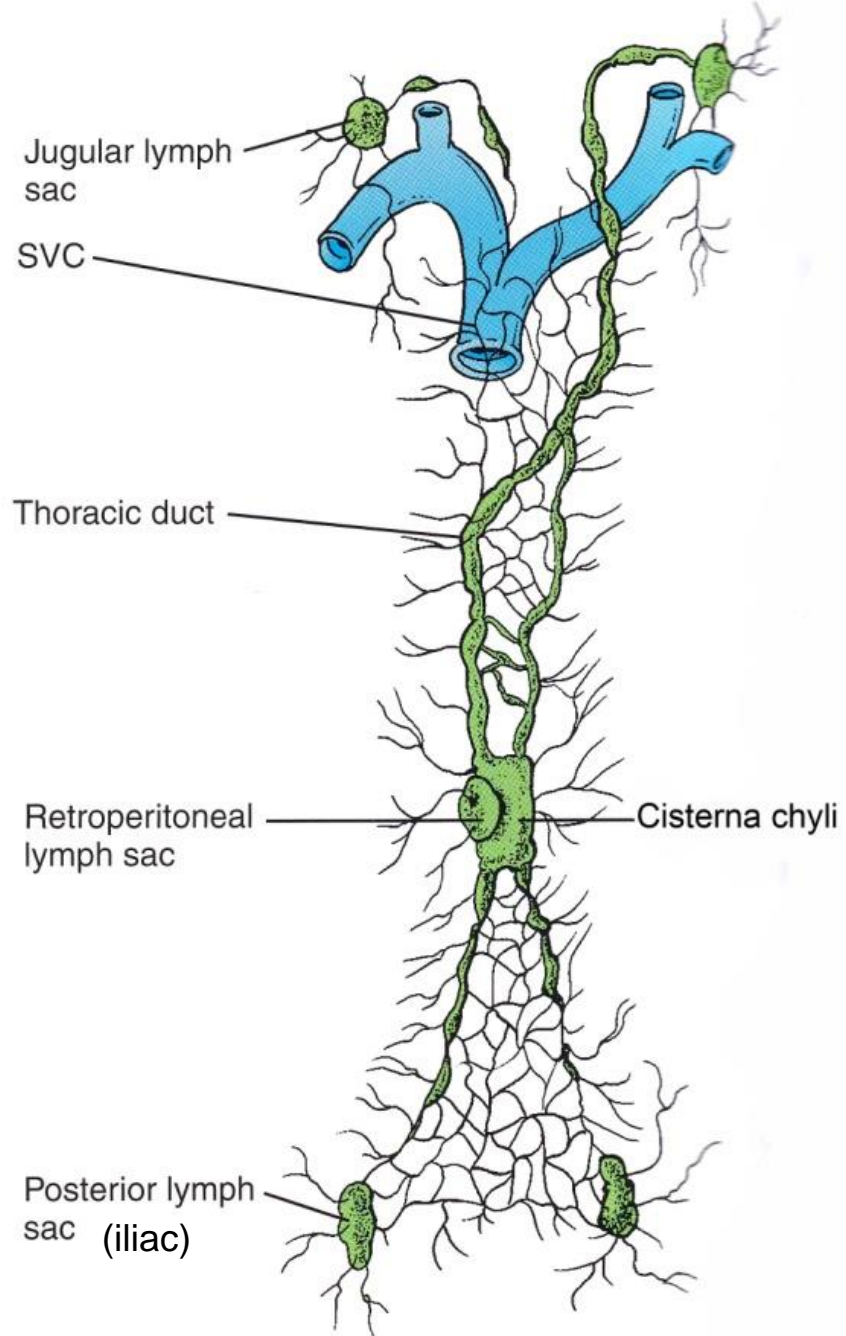
VÝVOJ LYMFATICKÝCH CÉV, UZLIN A SLEZINY

LYMFATICKÉ VAKY A CÉVY





B 56 days



C 16 weeks

SLEZINA

