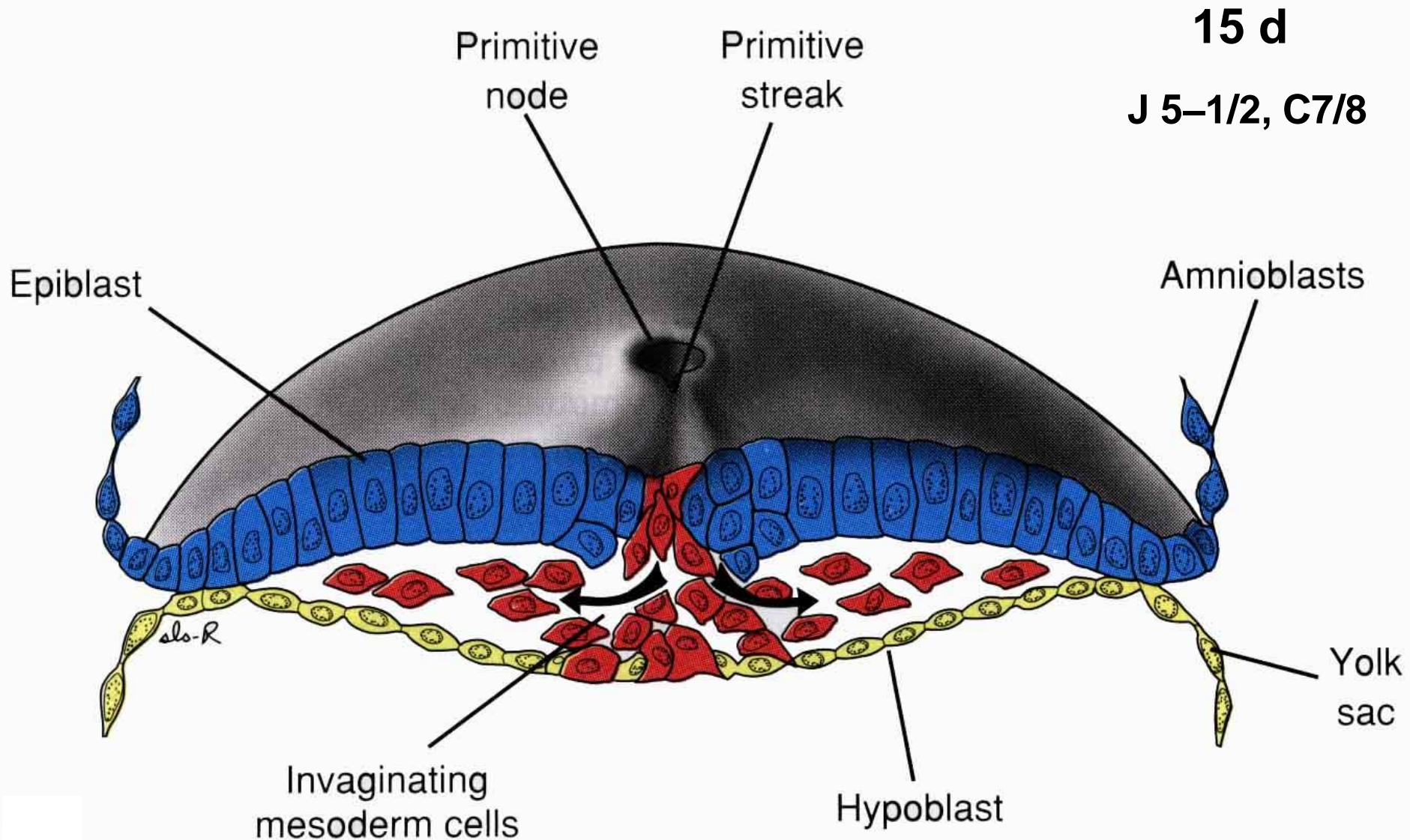


GENERAL EMBRYOLOGY III

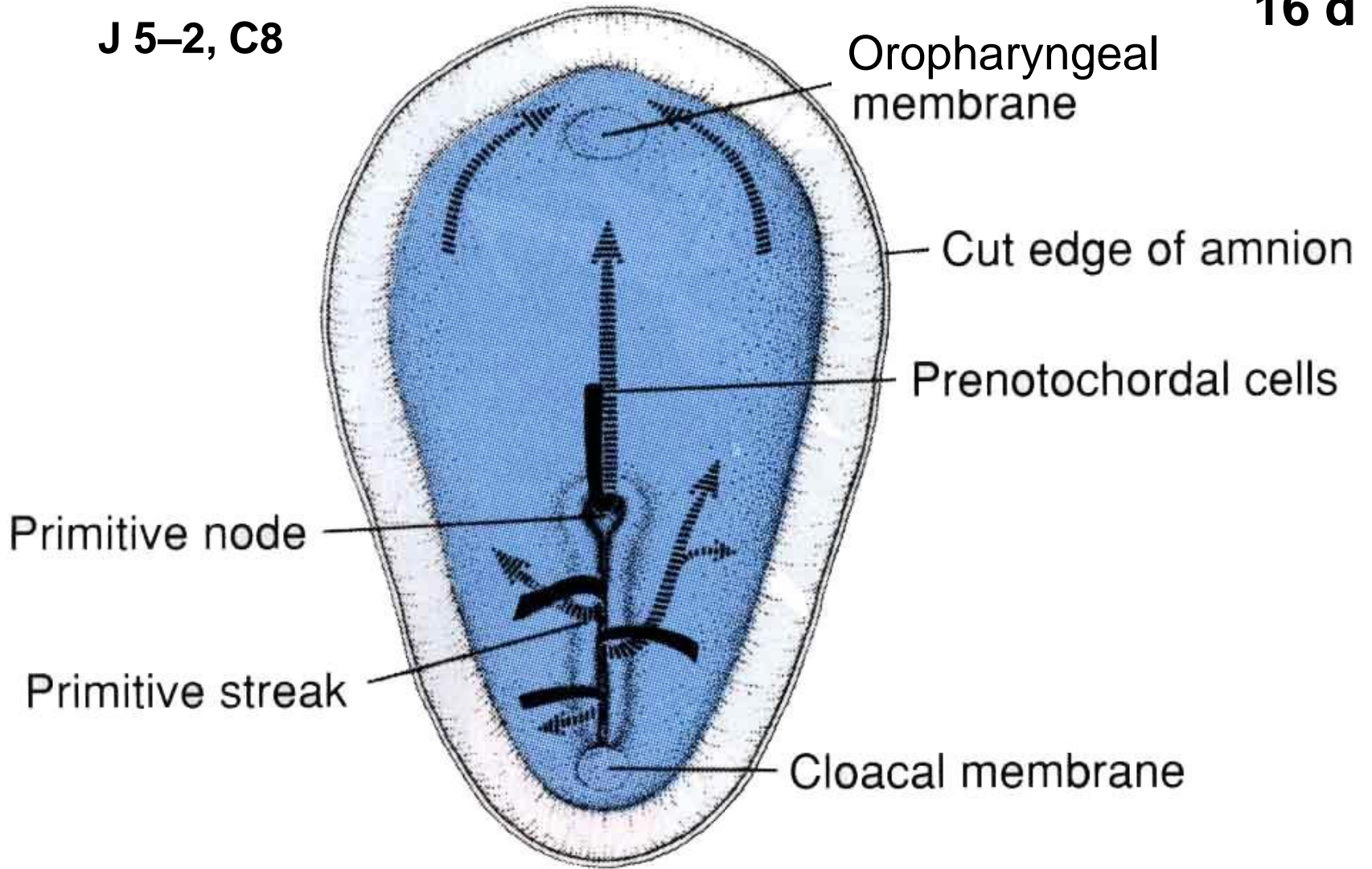
DIFFERENTIATION OF THE INTRAEMBRYONIC MESODERM

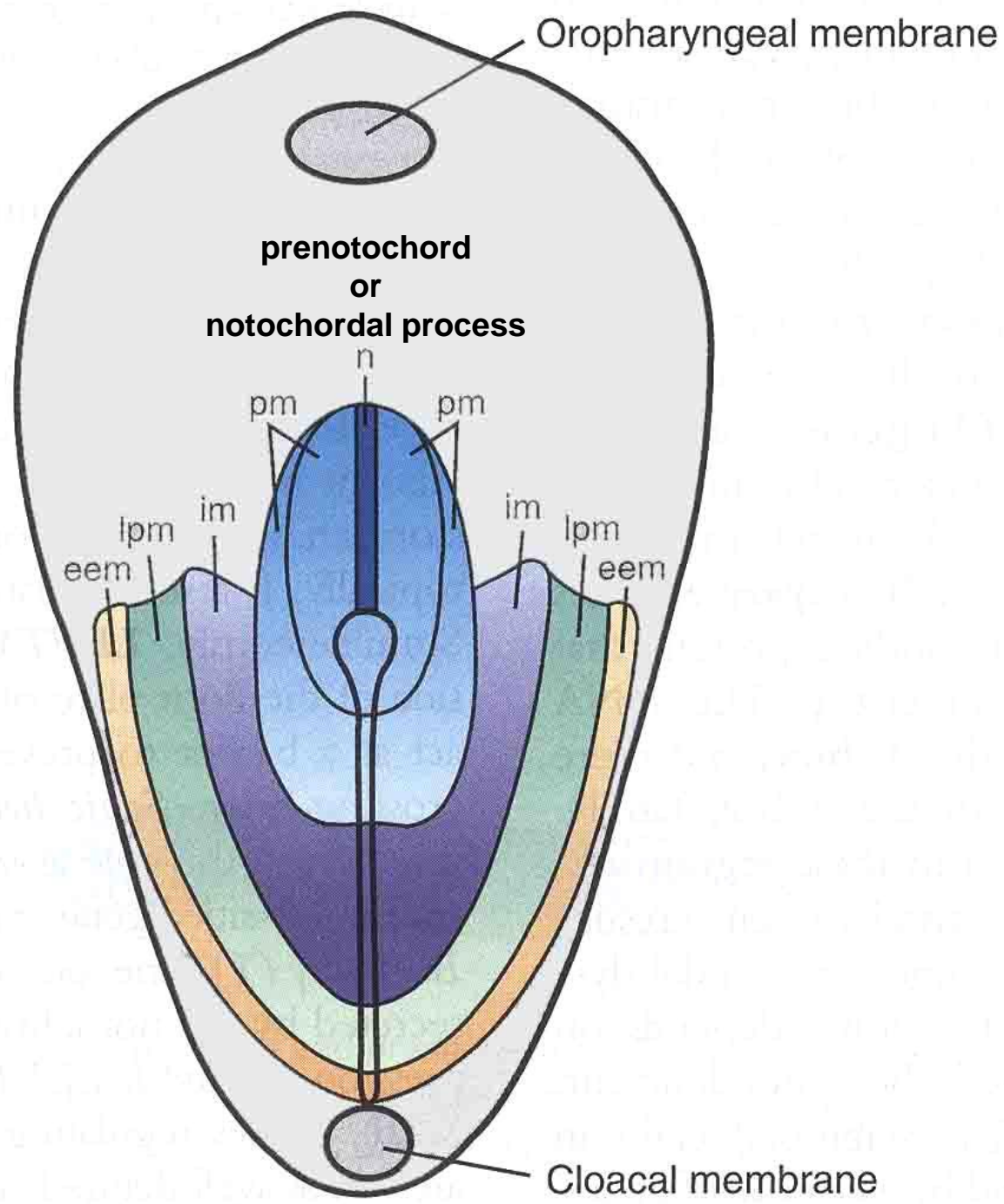
Gastrulation



J 5-2, C8

16 d





Oropharyngeal membrane

**prenotochord
or
notochordal process**

n

pm

pm

lpm

im

im

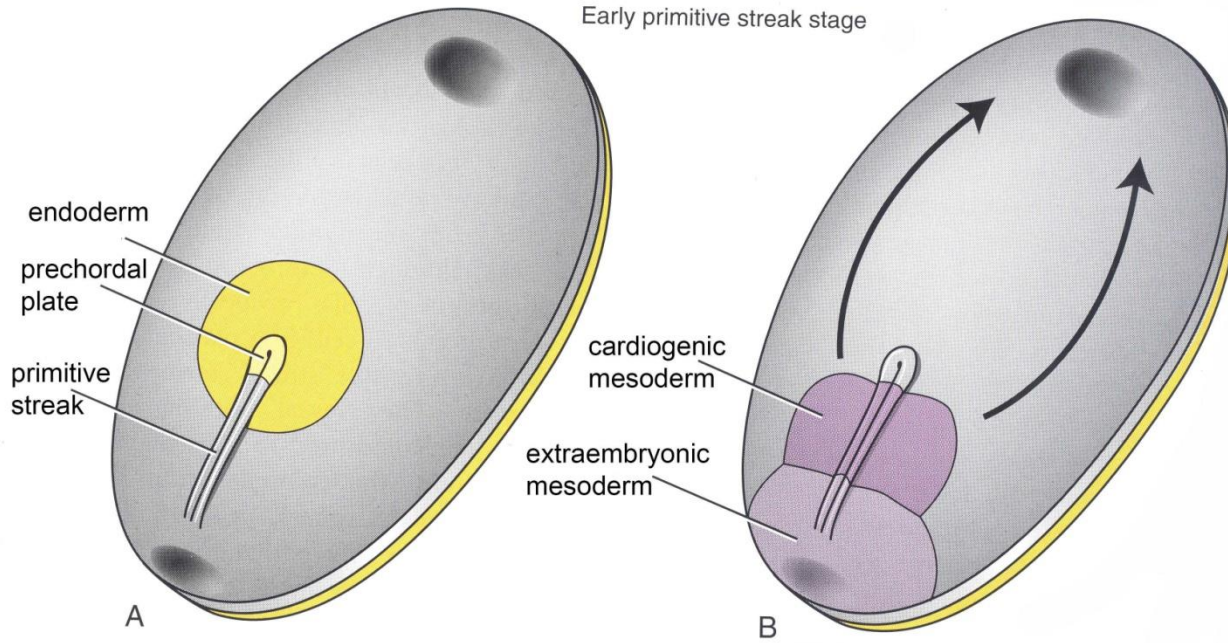
lpm

eem

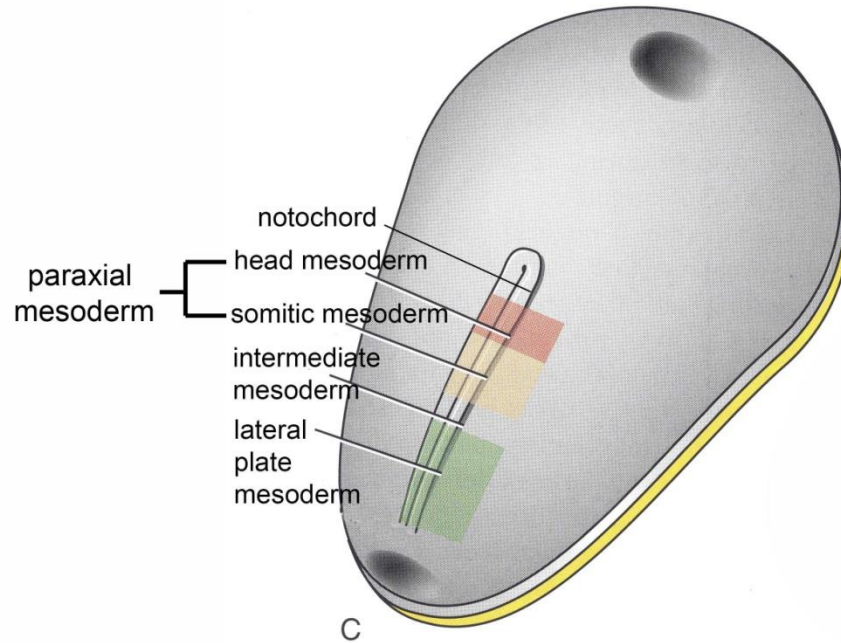
eem

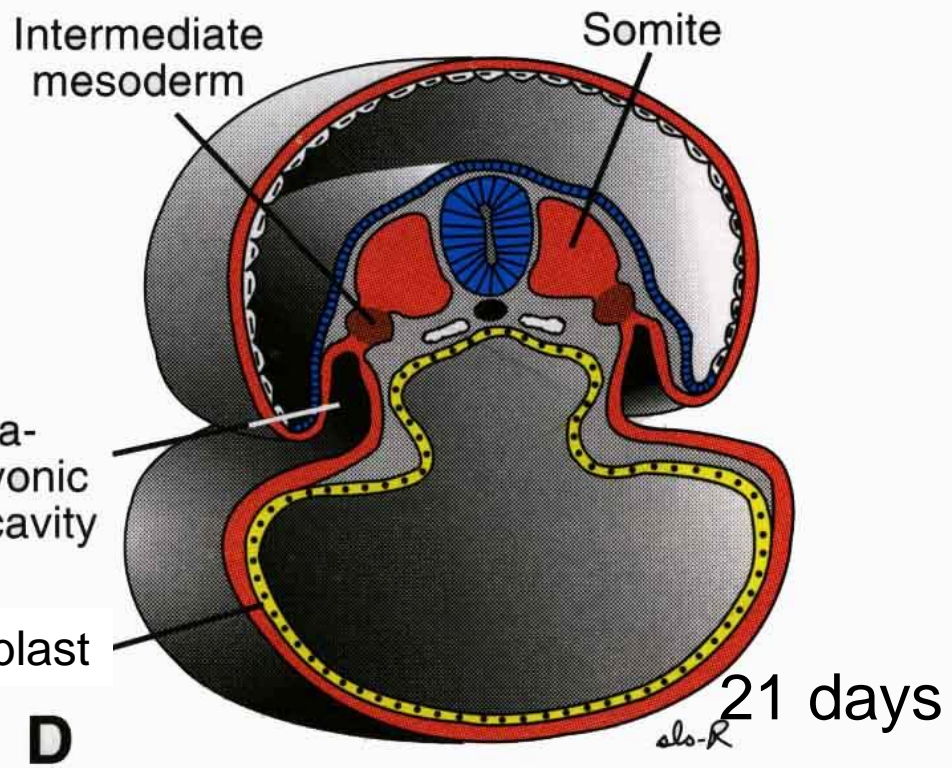
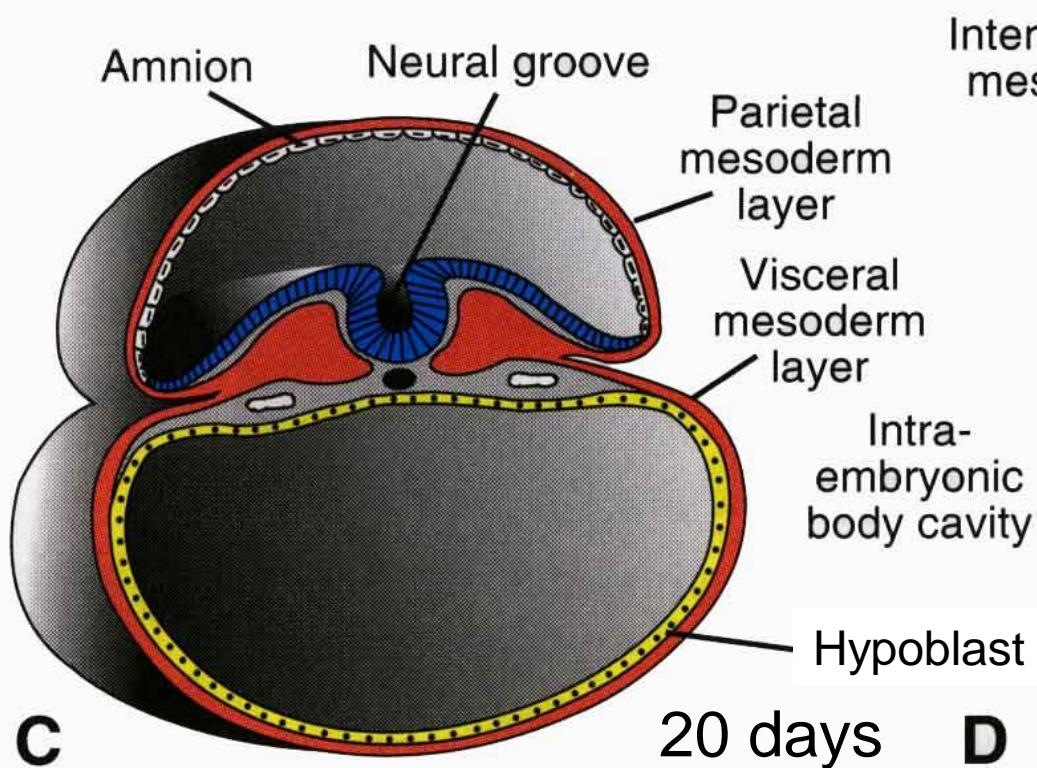
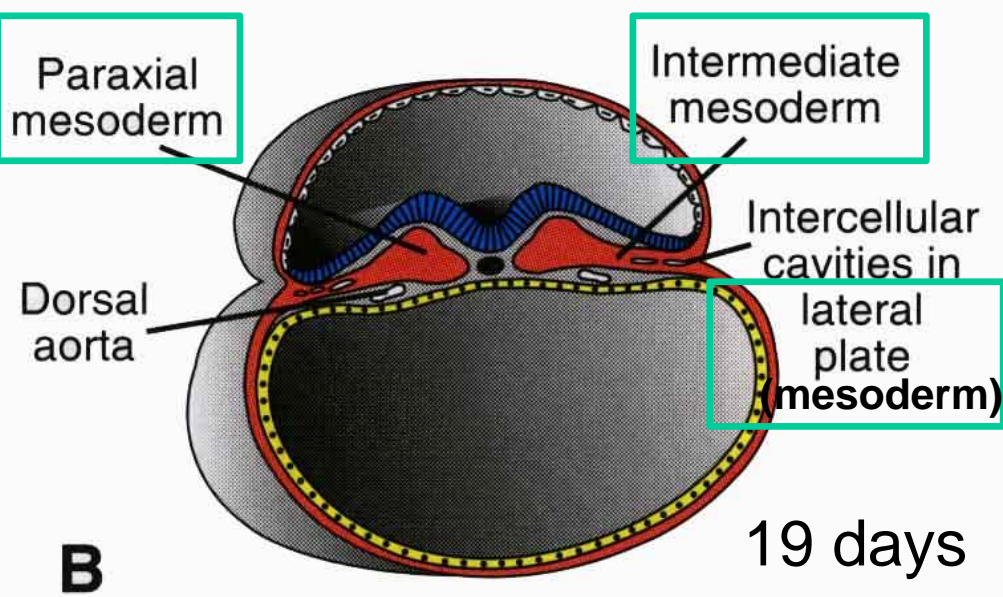
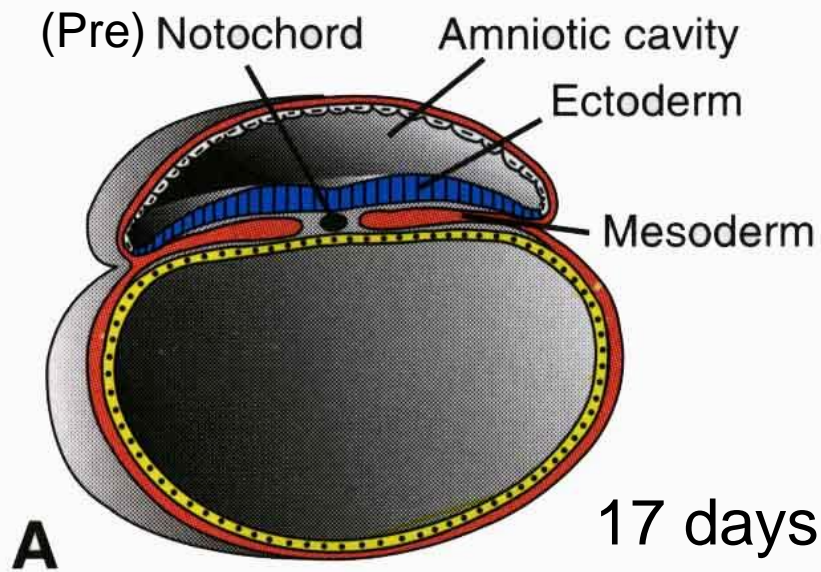
Cloacal membrane

Early primitive streak stage

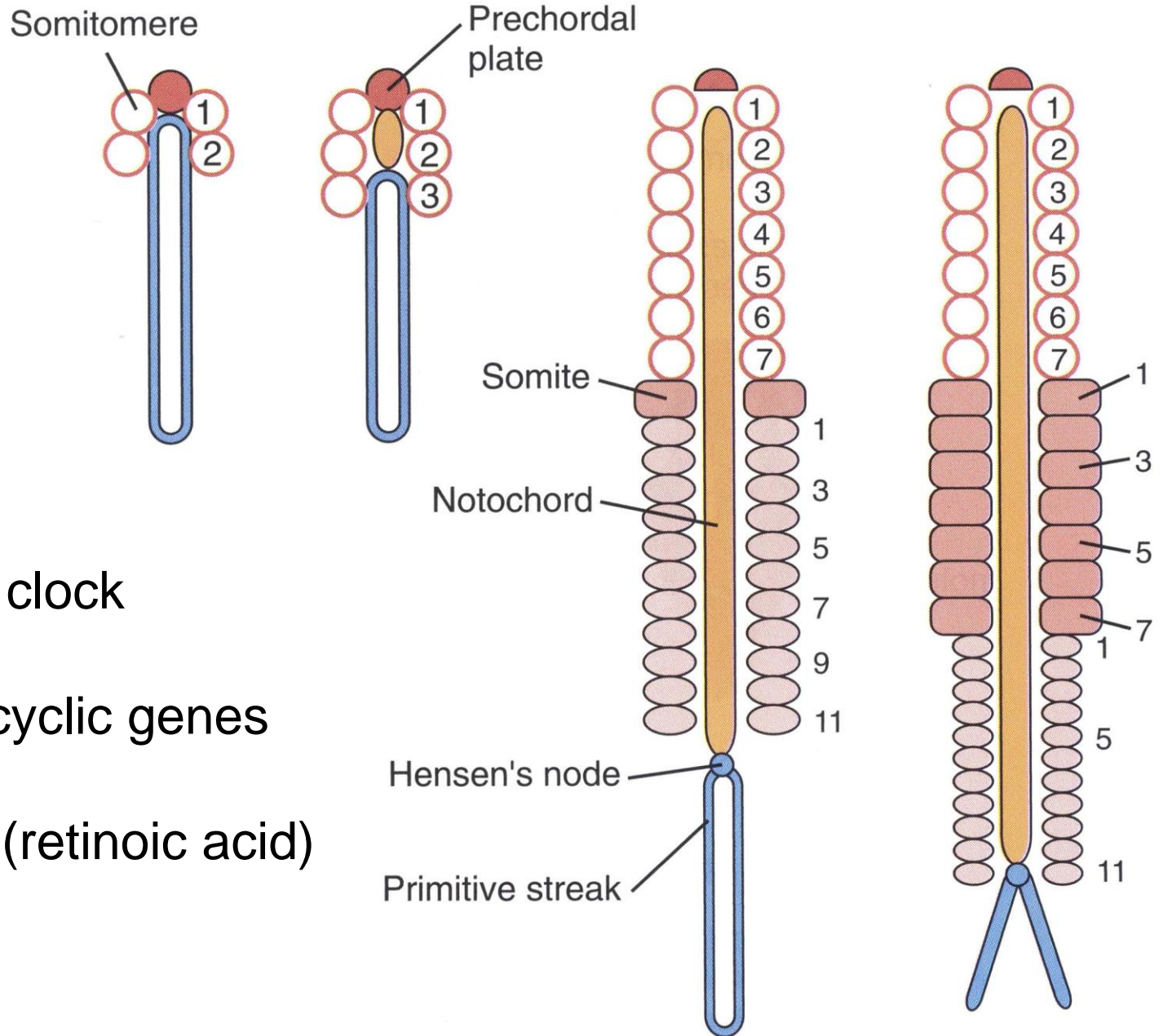


Mid-primitive streak stage





Paraxial mesoderm



Segmentation clock

Wnt, Notch – cyclic genes

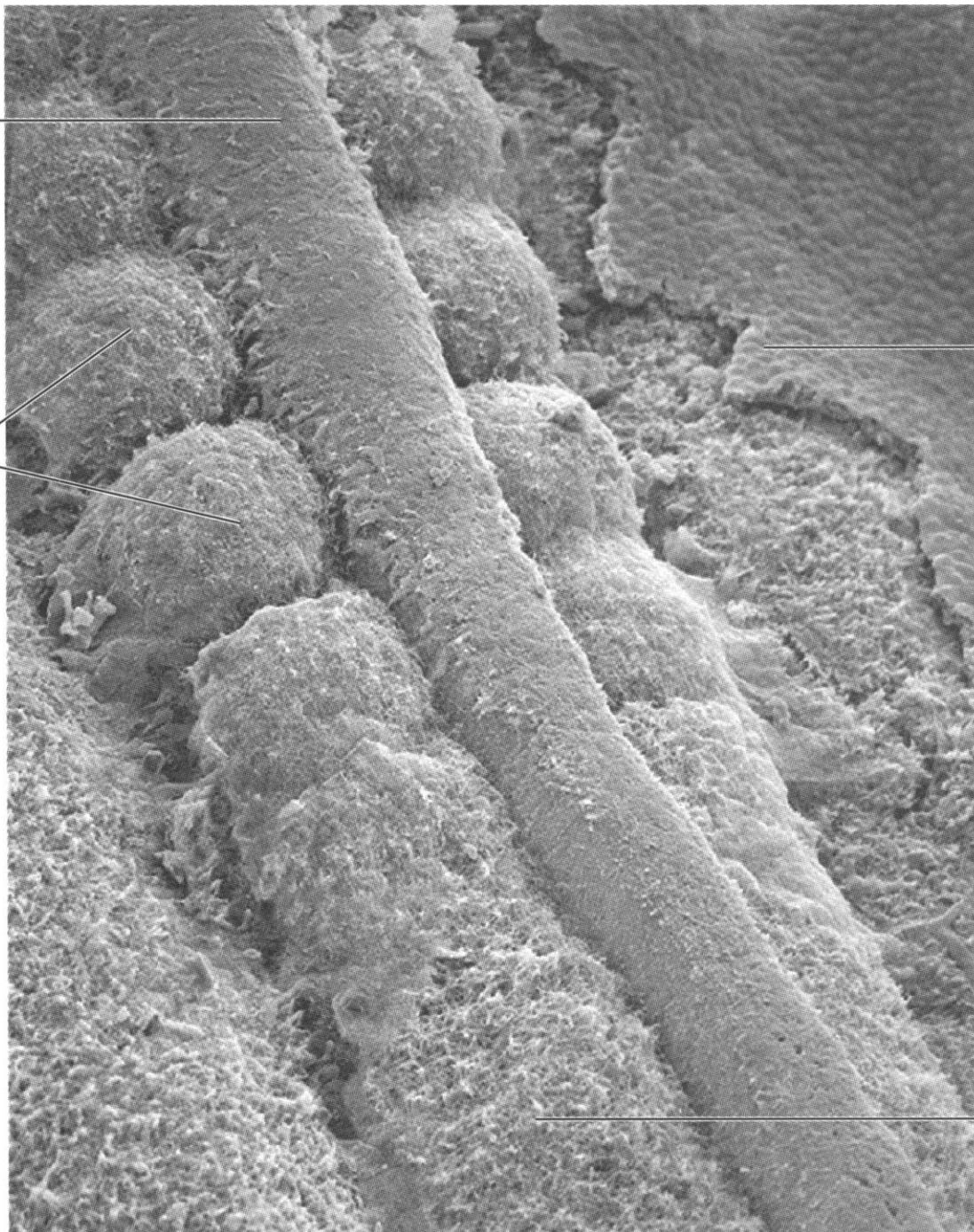
↓ FGF8 ↑ RA (retinoic acid)

Neural tube

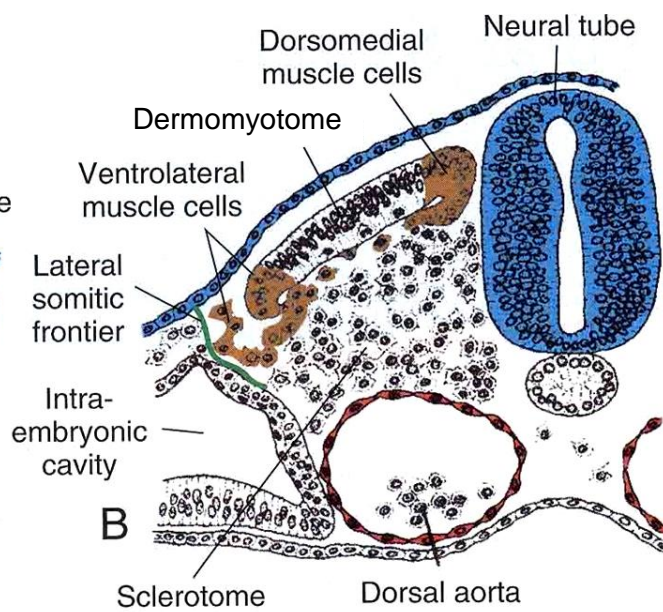
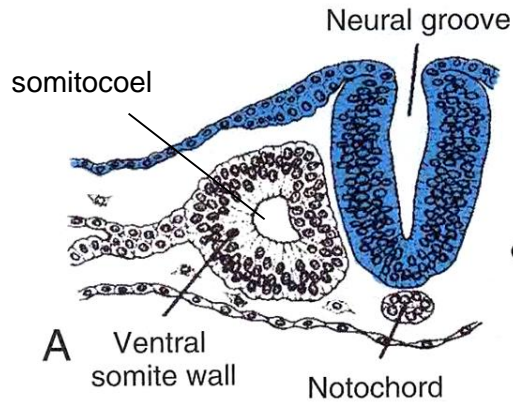
Somites

Ectoderm

Presomites
mesoderm

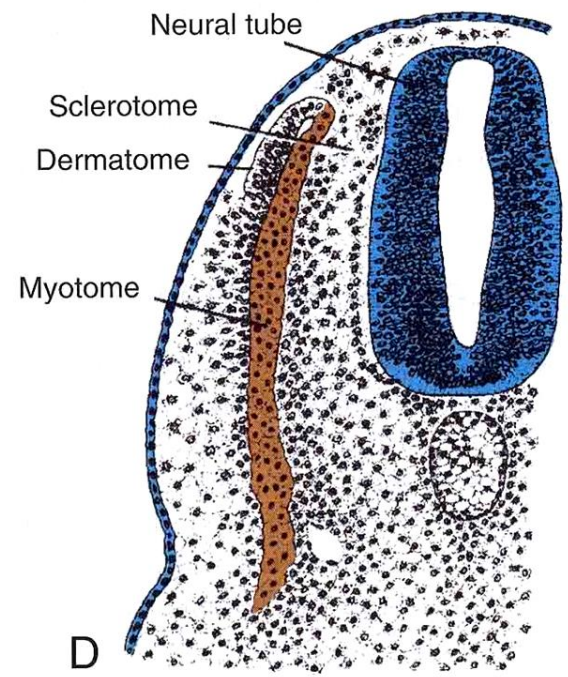
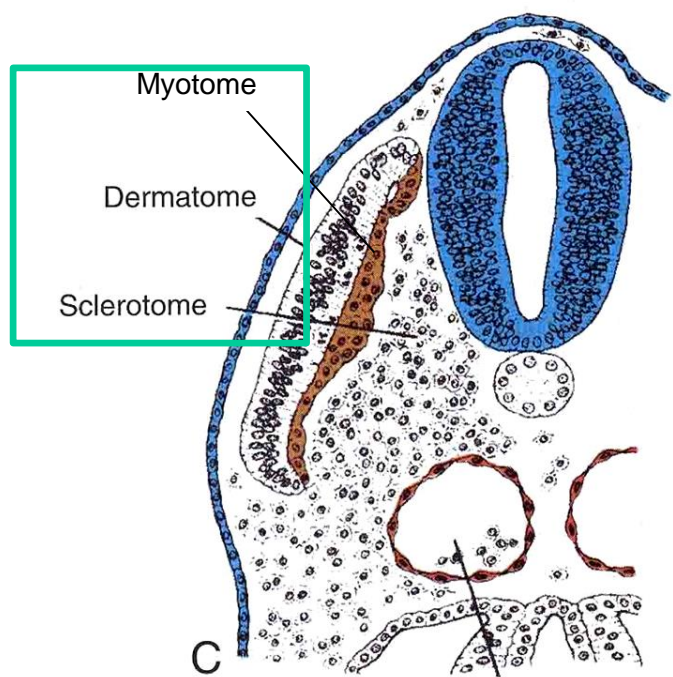


Somites

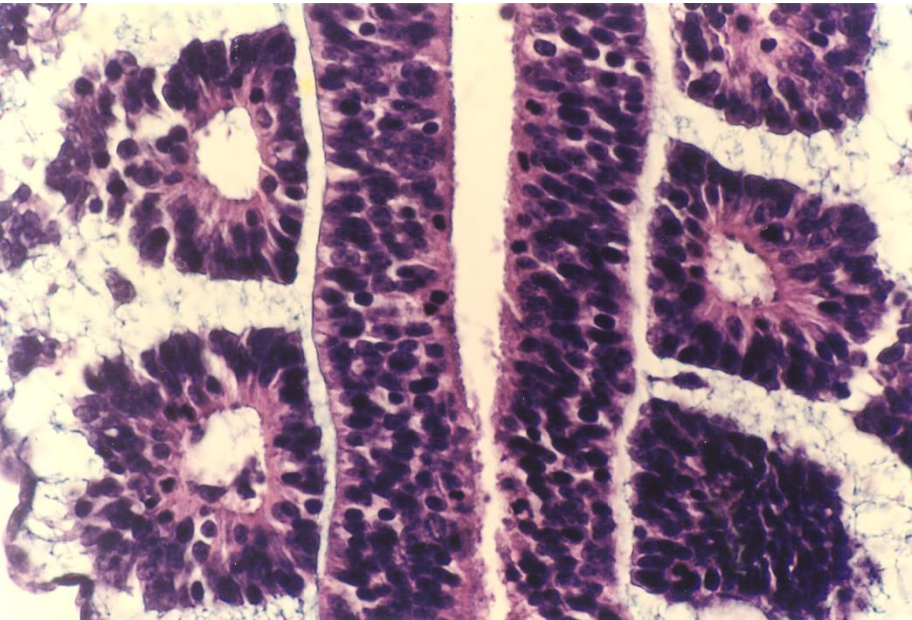
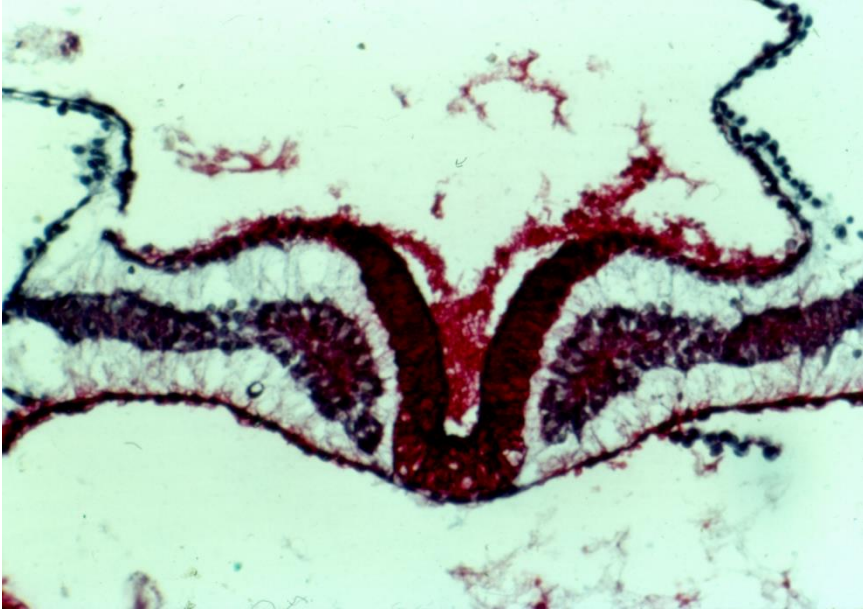


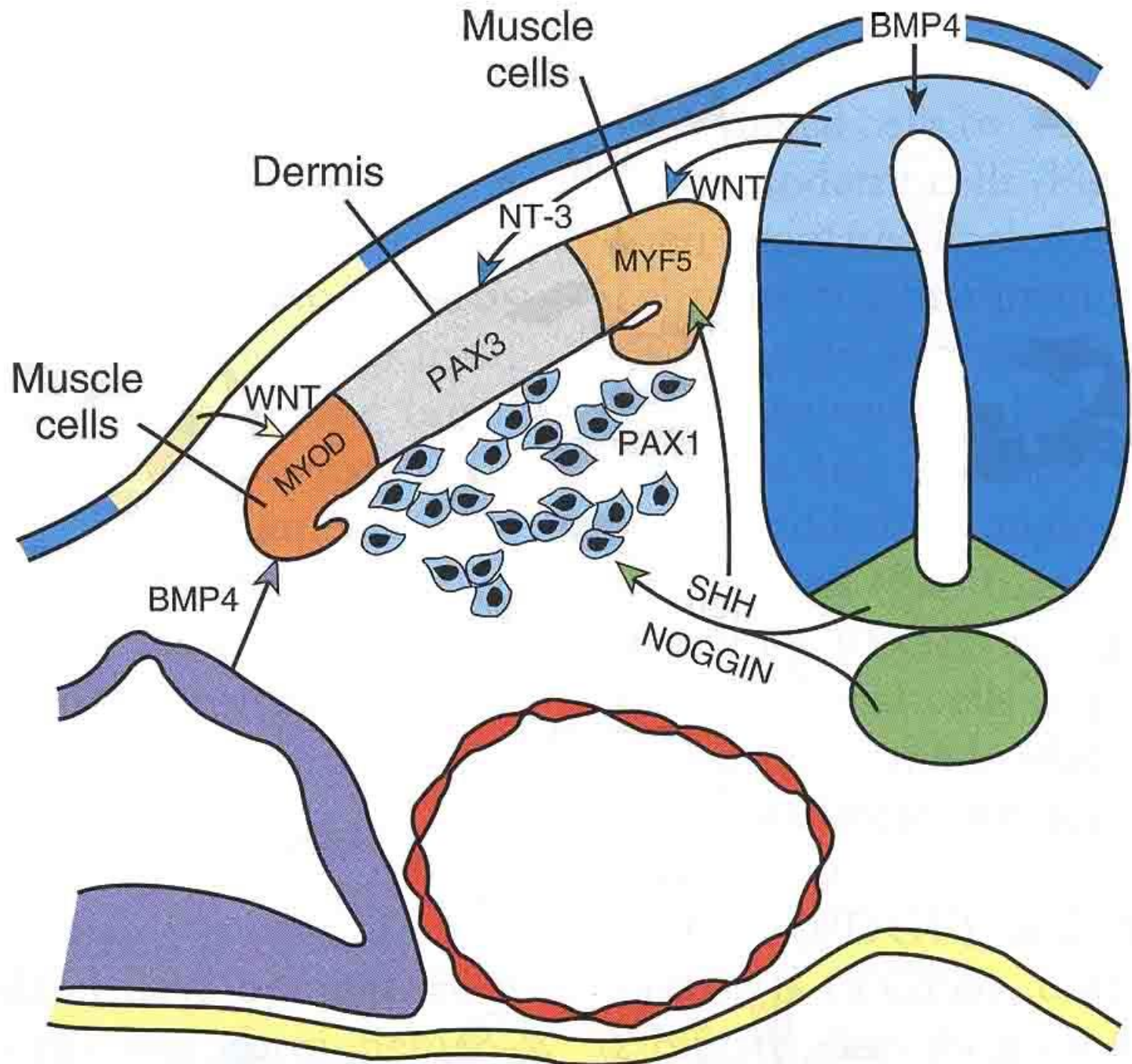
1st pair of somites on the day 20
 till the end of the 5th week 42-44 somite pairs

- 4 O
- 8 C
- 12 T
- 5 L
- 5 S
- 8-10 Co

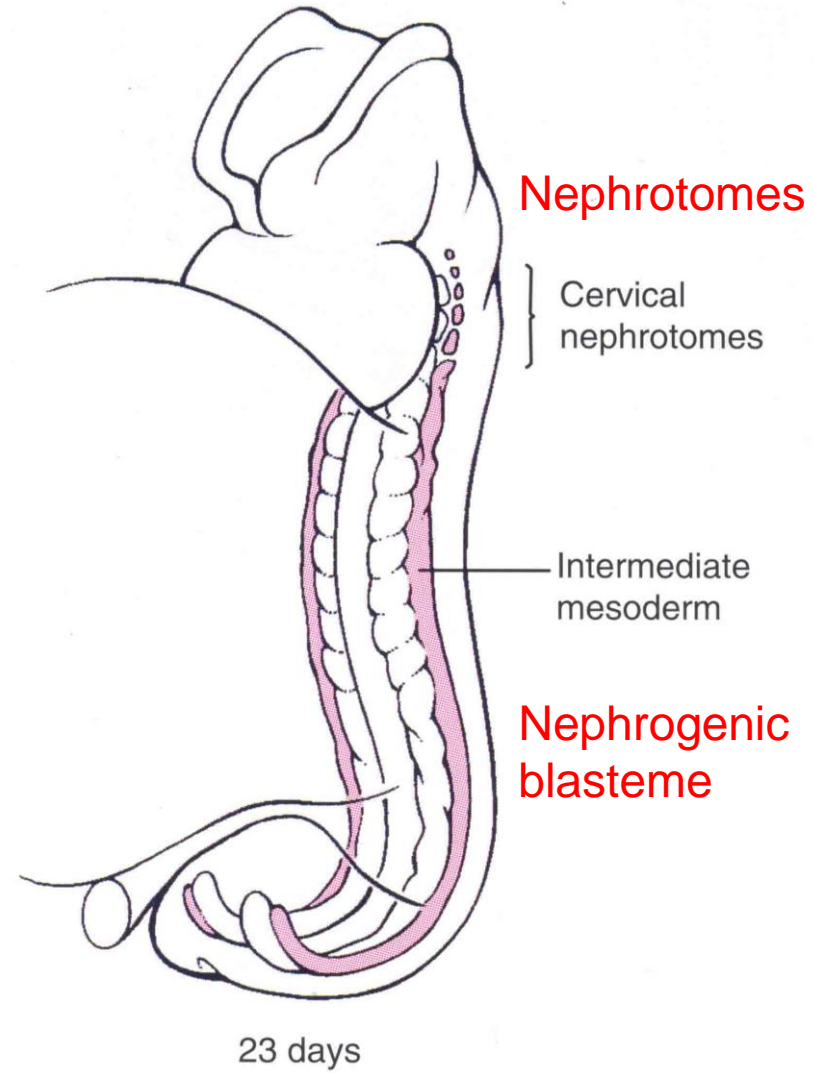
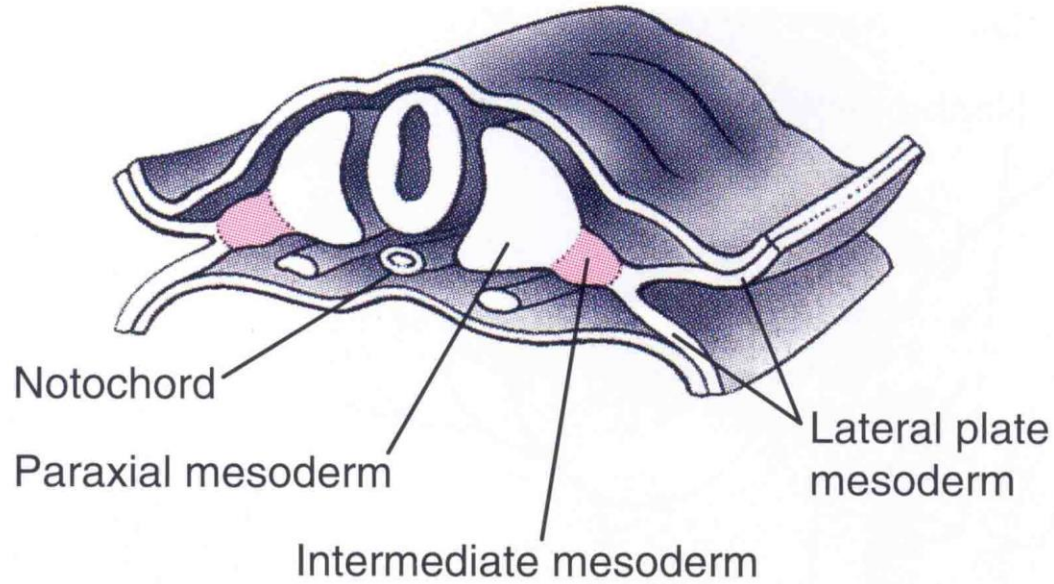


Somites

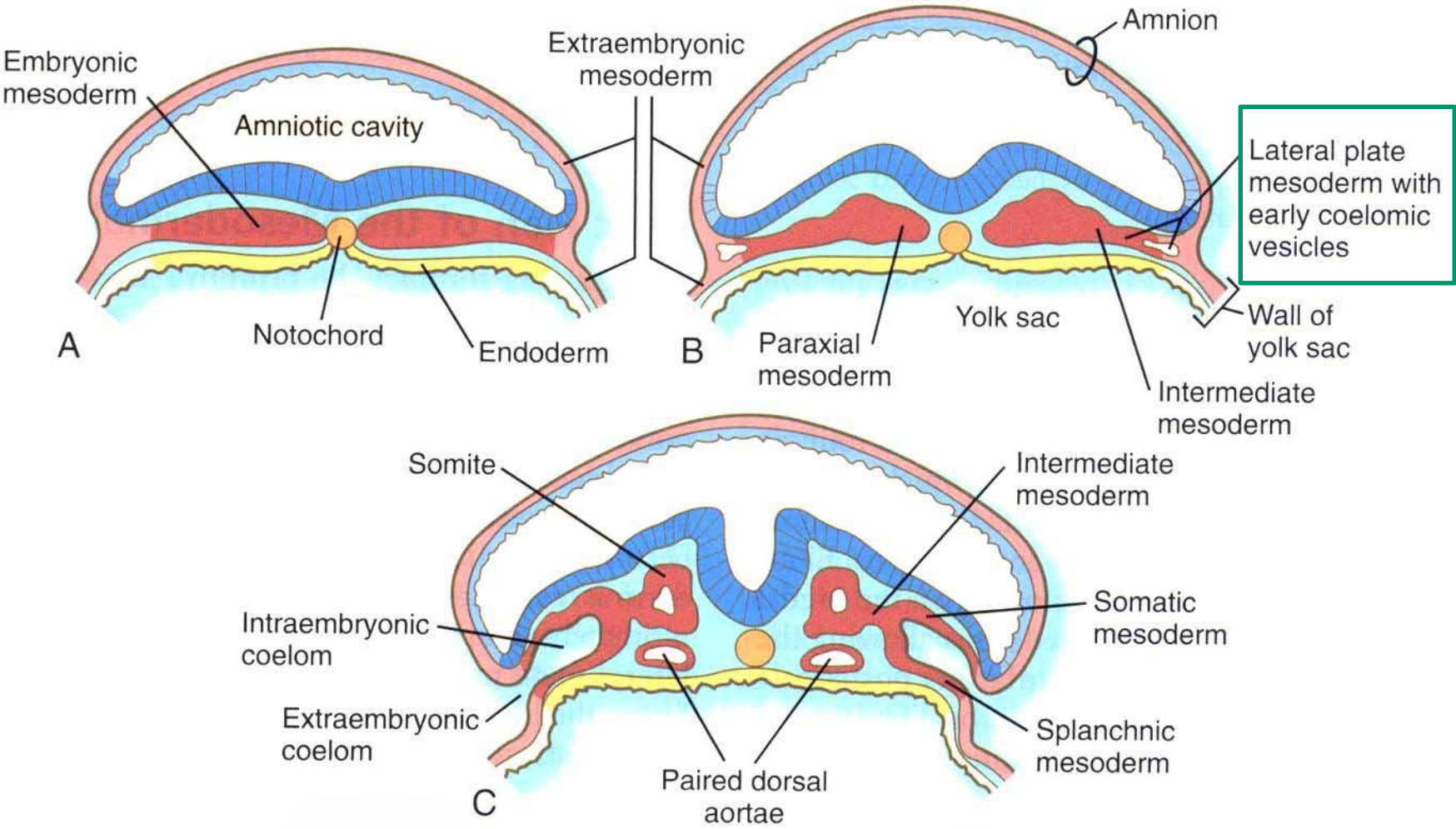




Intermediate mesoderm

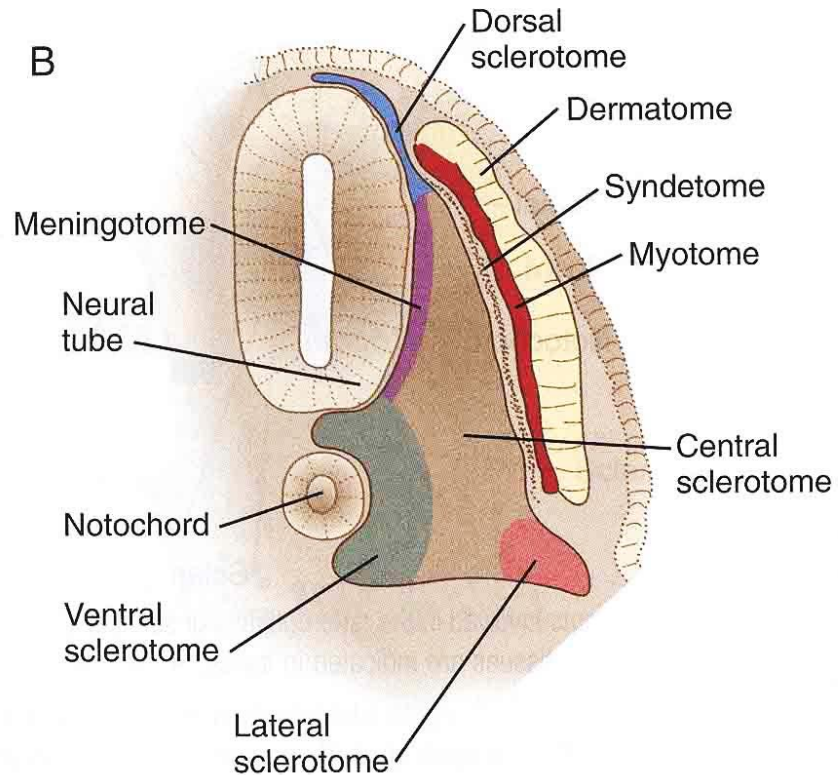
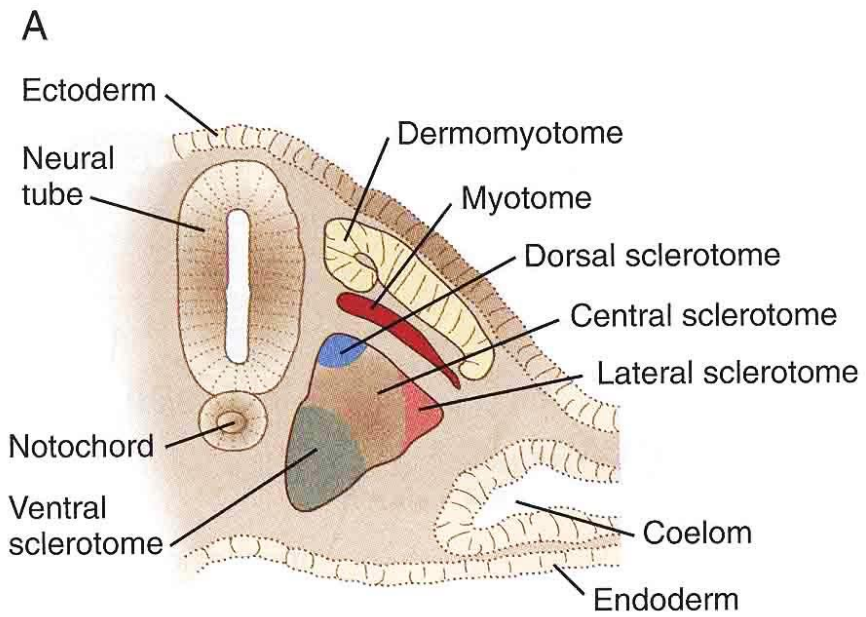


Mesoderm of the lateral plate



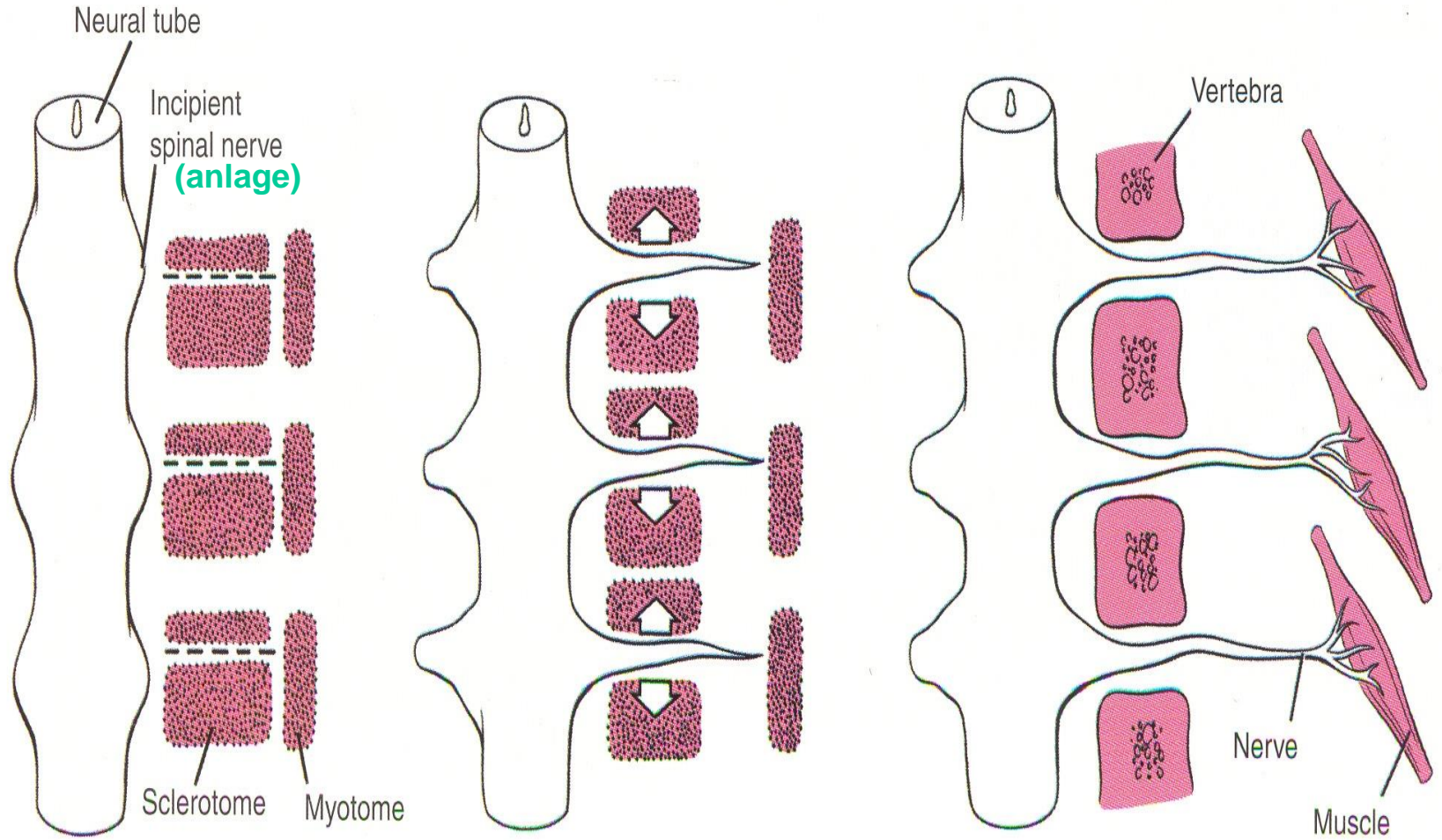
DEVELOPMENT OF THE SKELETAL SYSTEM

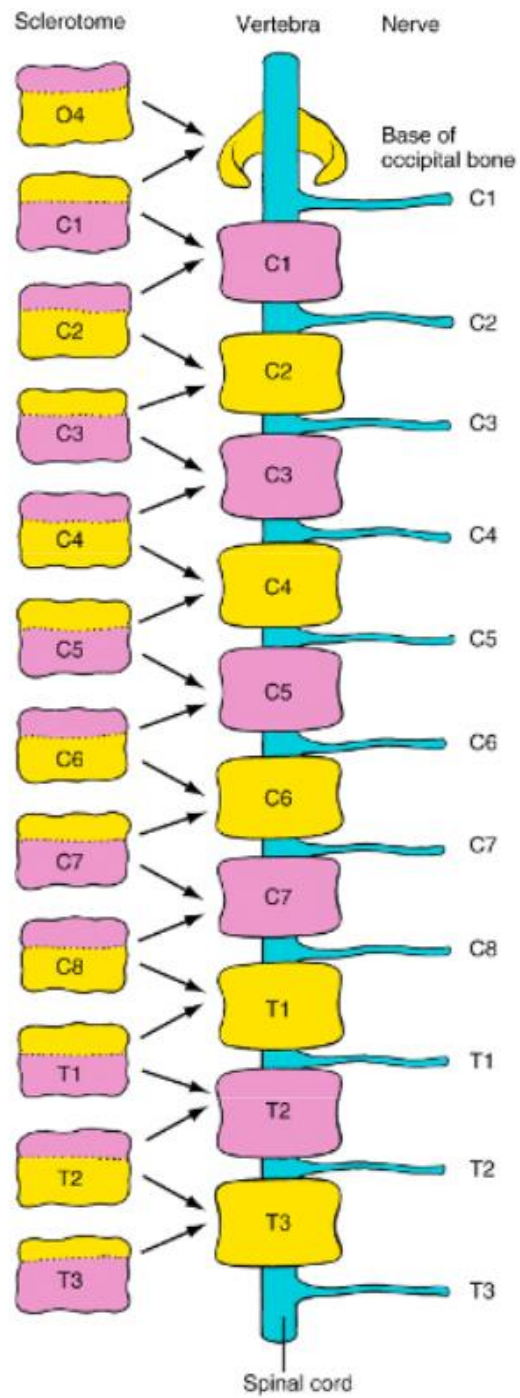
Sclerotome

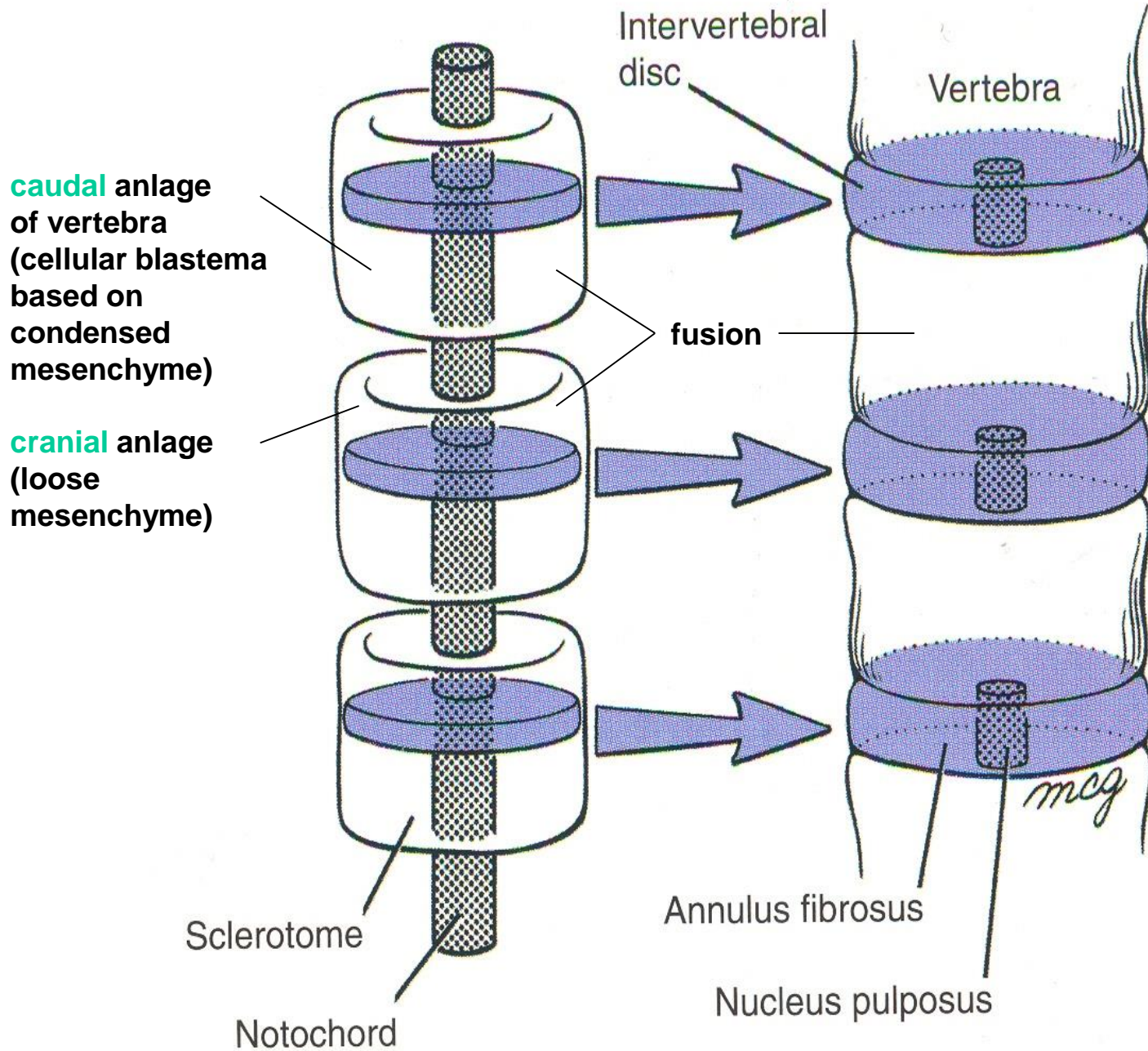


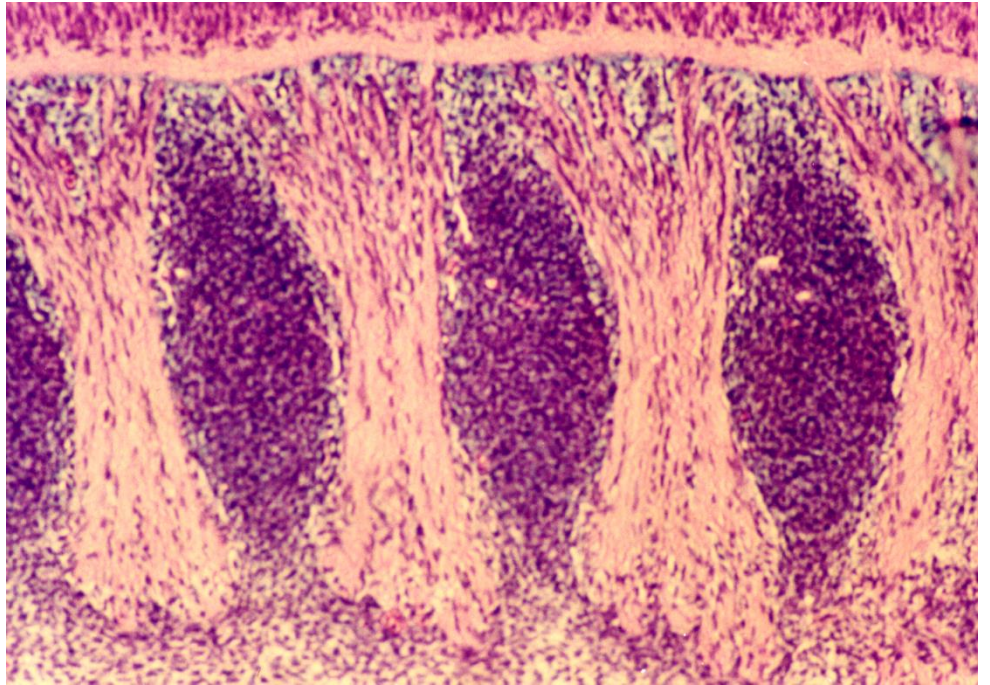
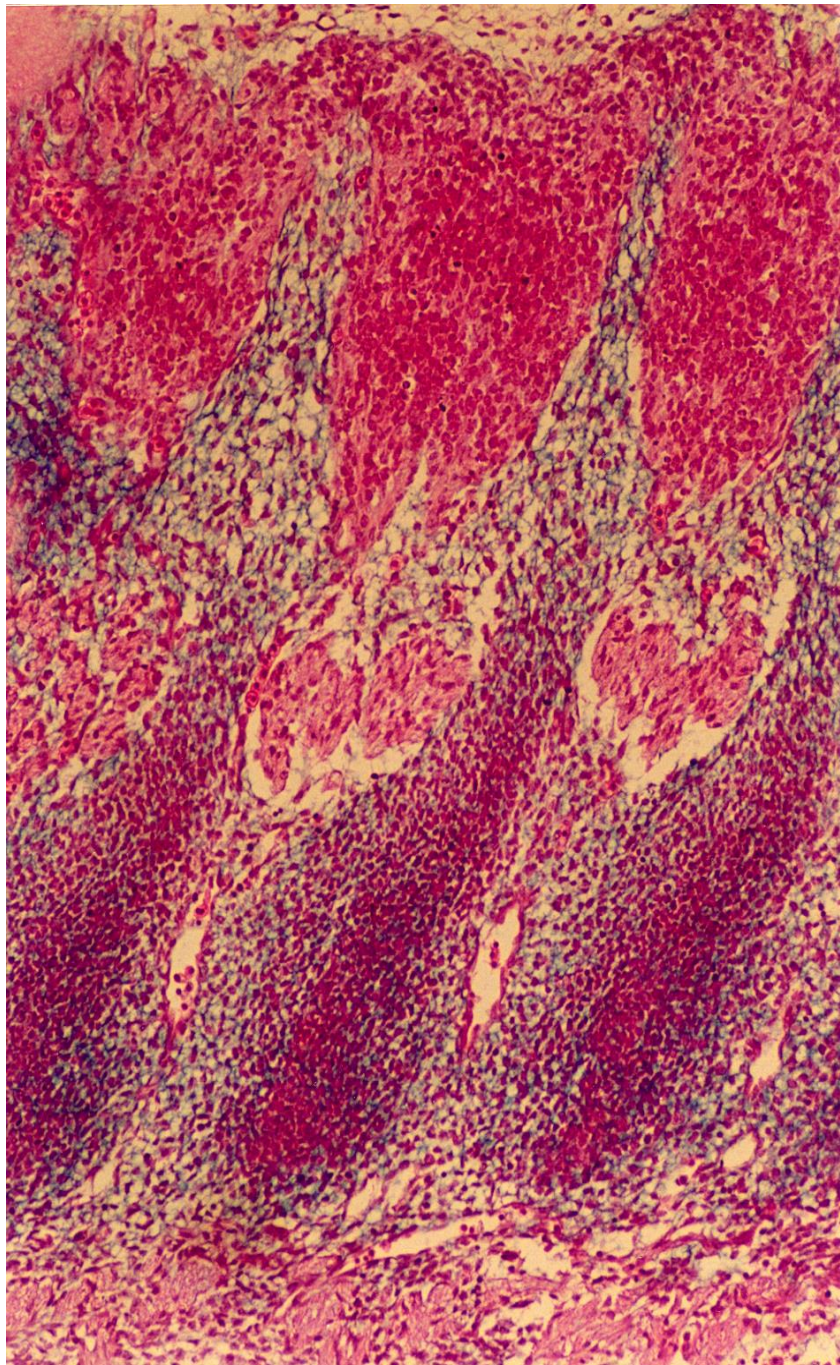
Sclerotome resegmentation

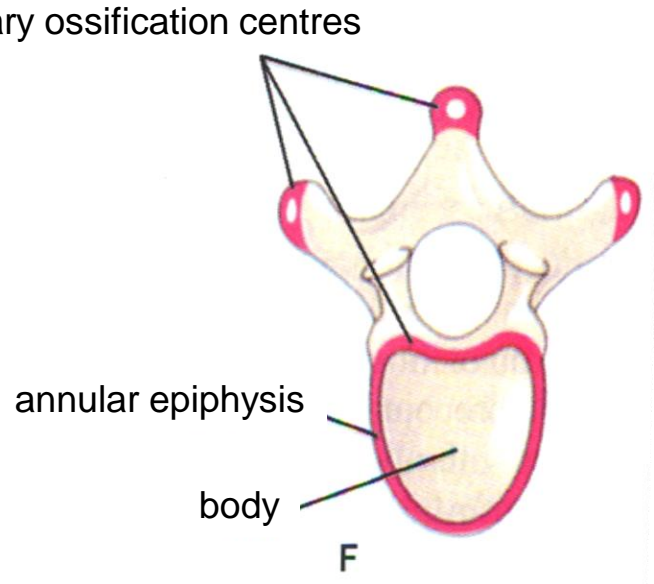
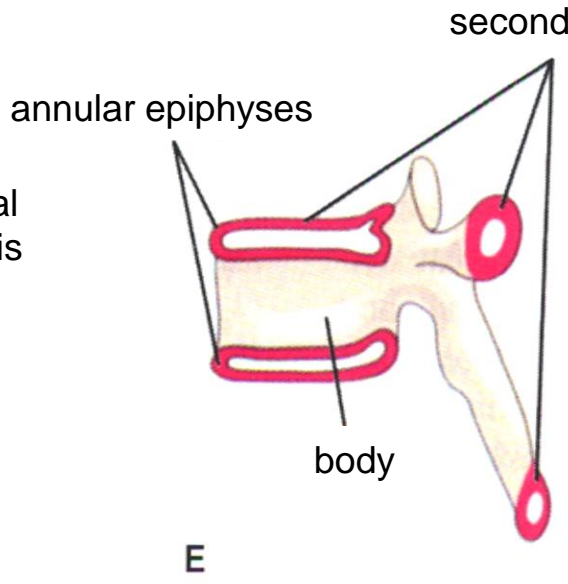
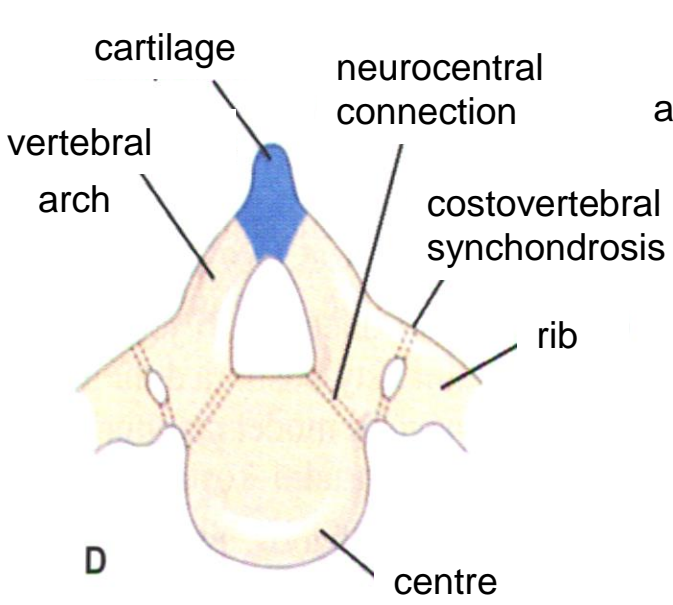
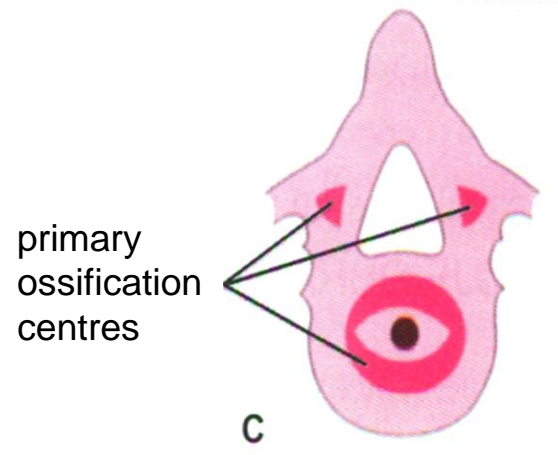
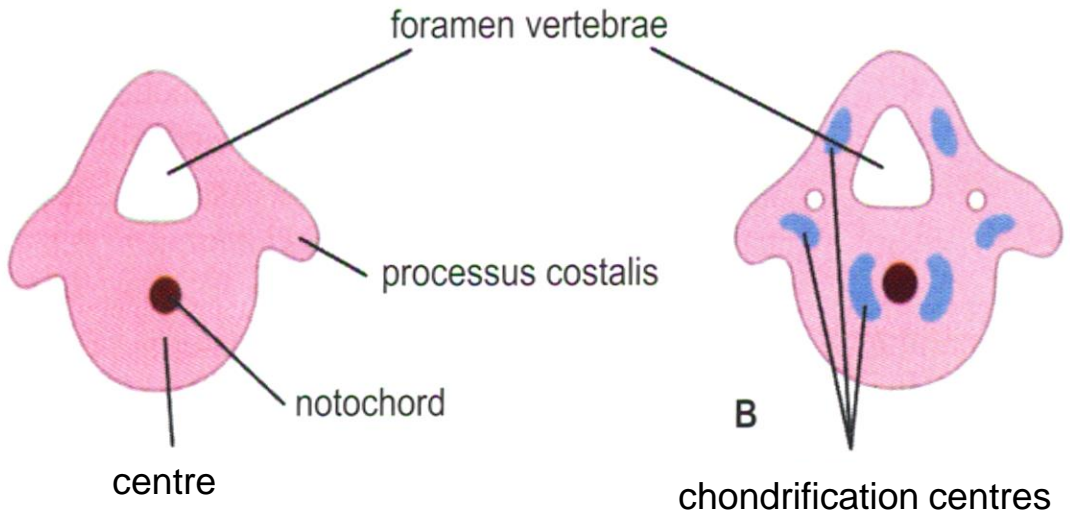
neural tube is inductive to development of sclerotome

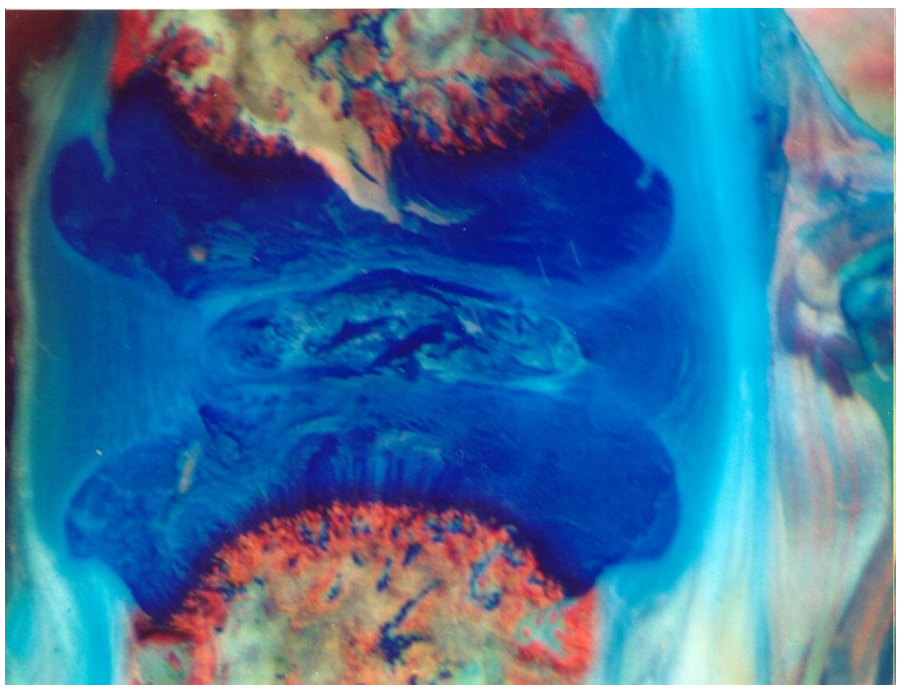
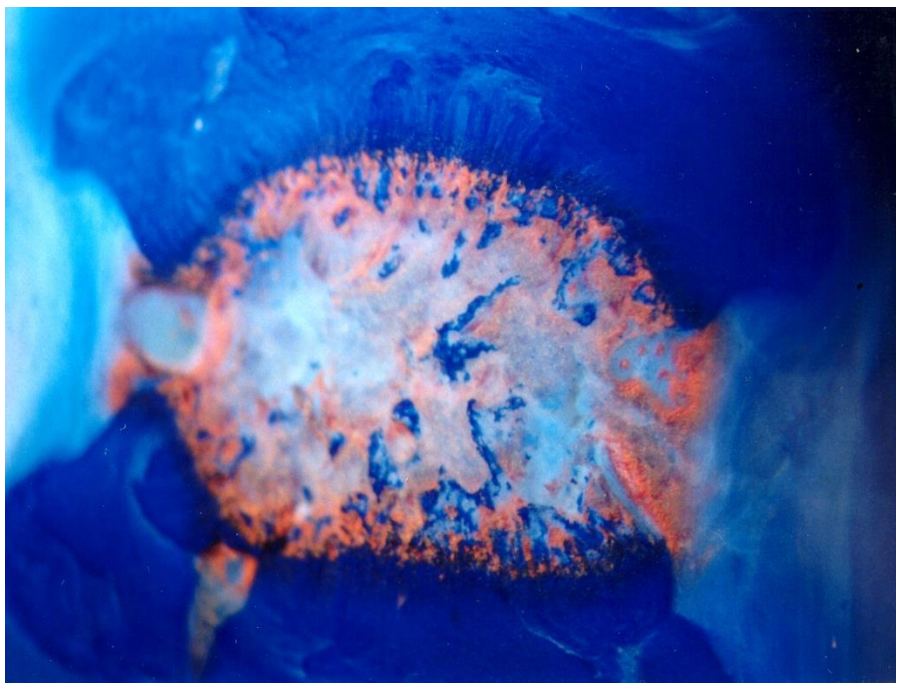
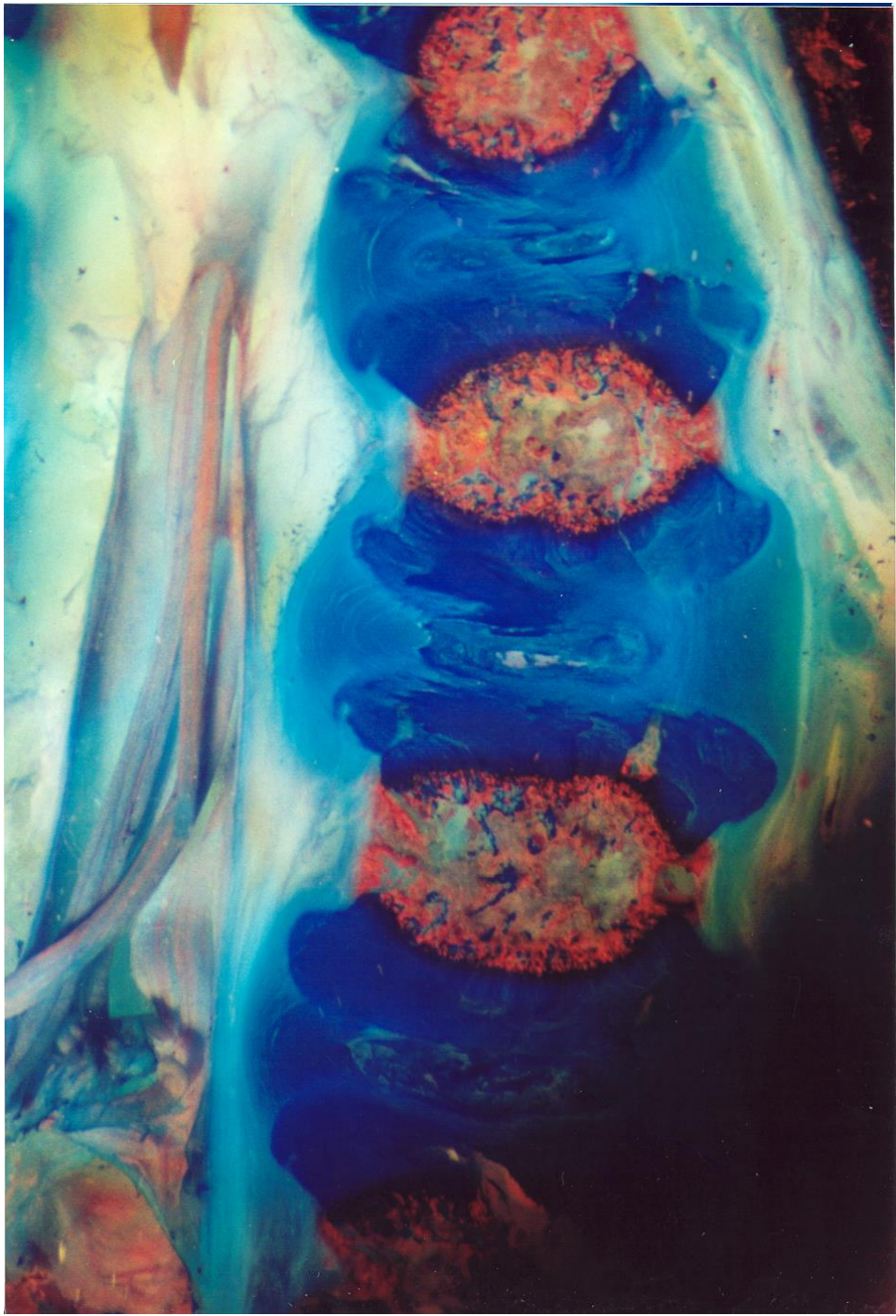


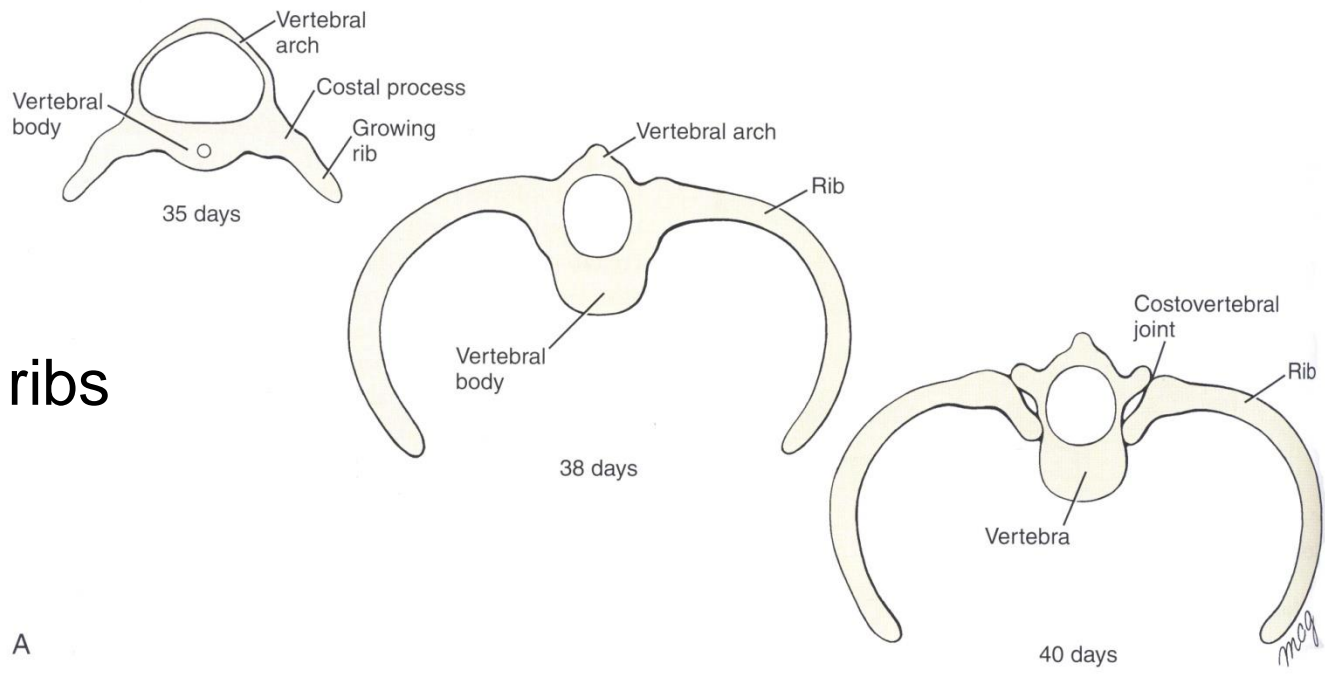








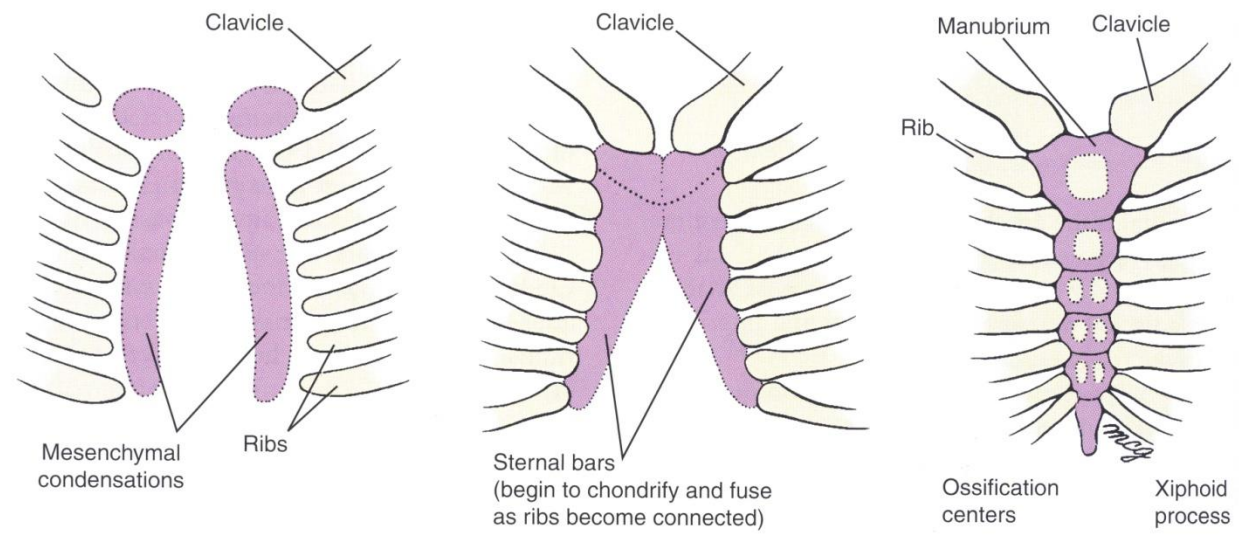




ribs

A

sternum



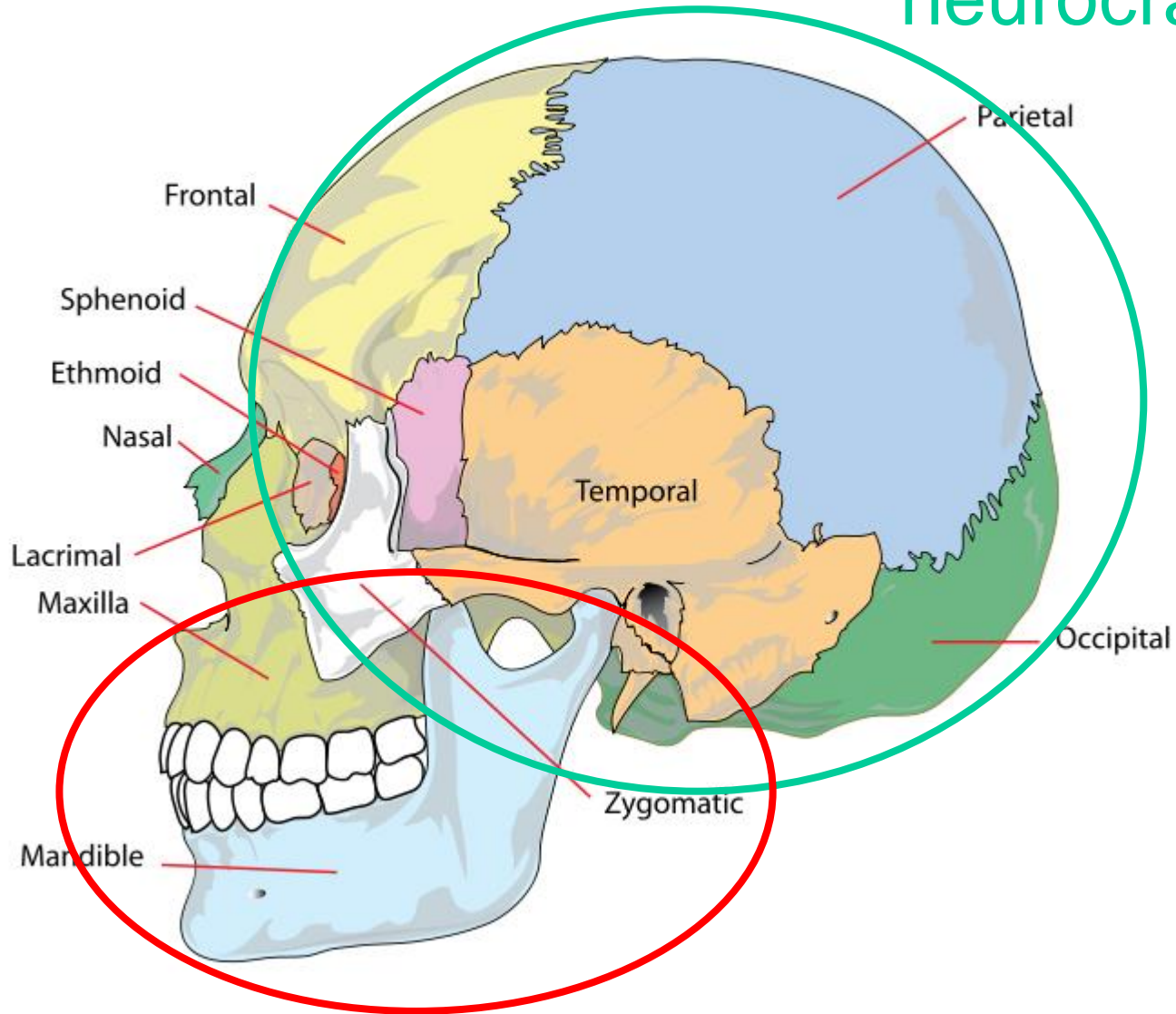
B

43 days

45 days

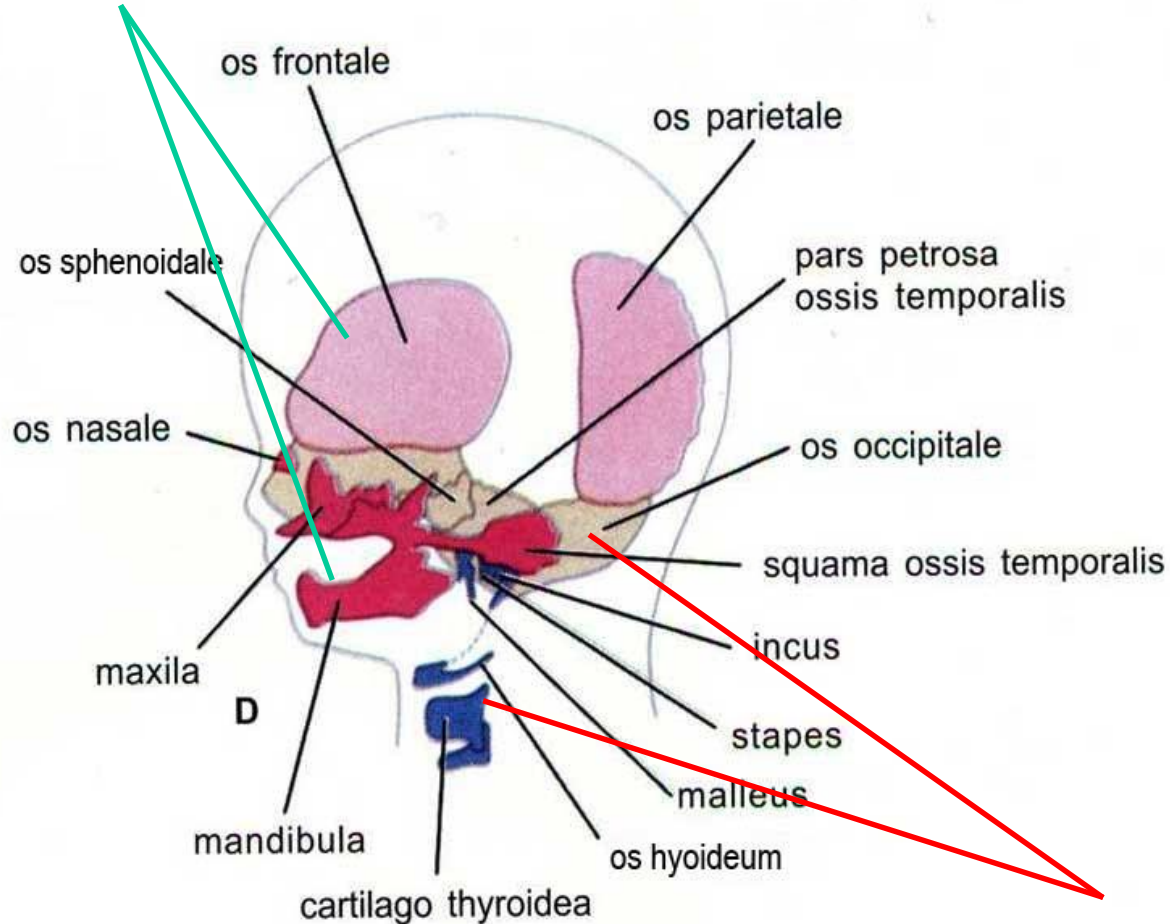
Birth

neurocranium

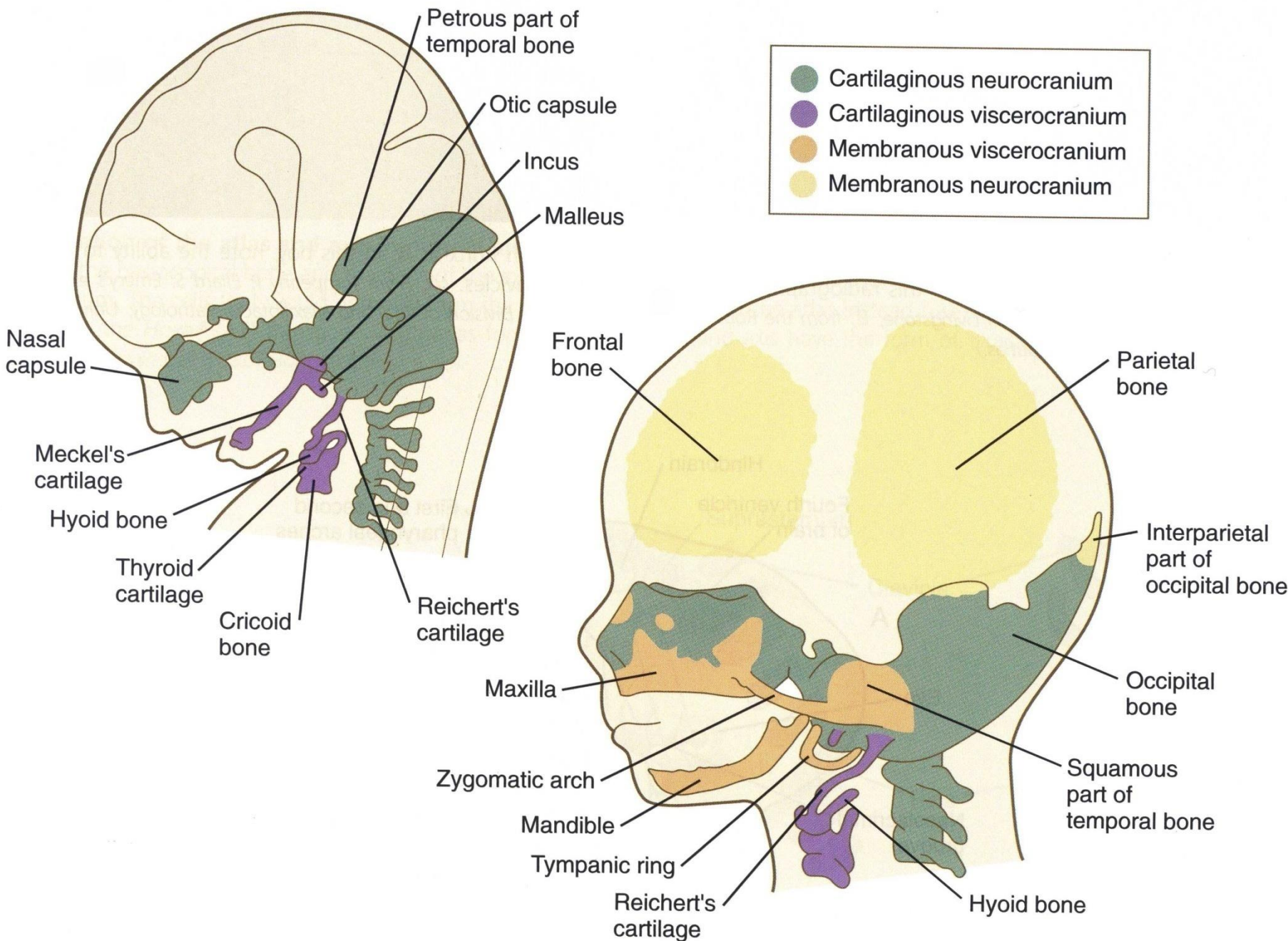


splanchnocranium (viscerocranium)

desmocranium



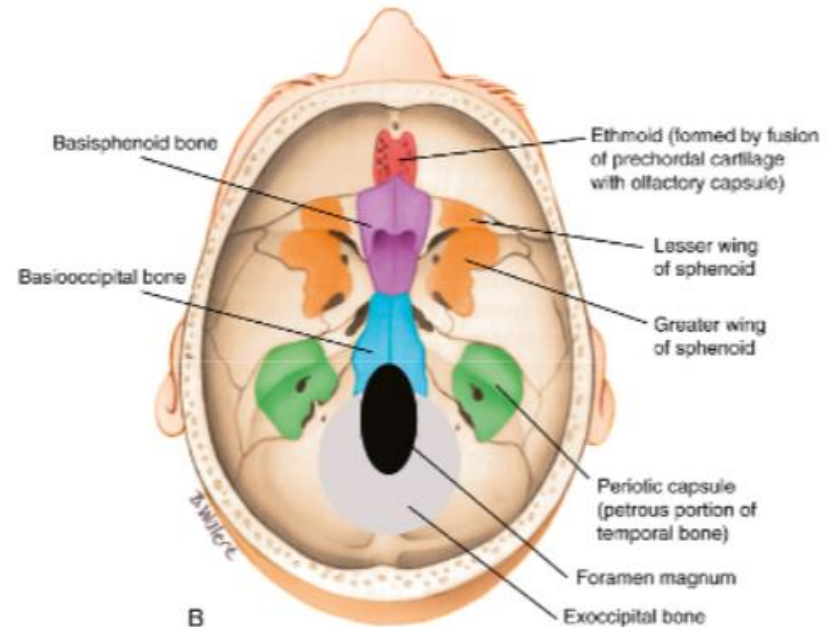
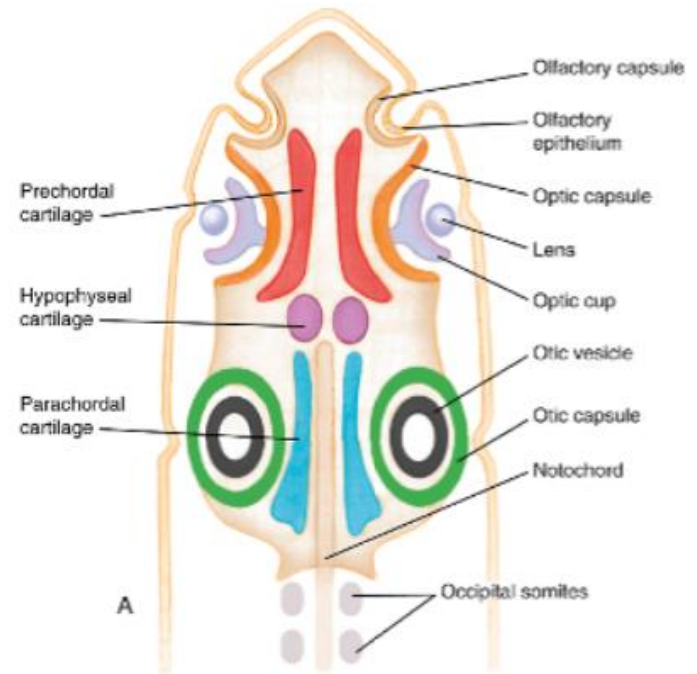
chondrocranium





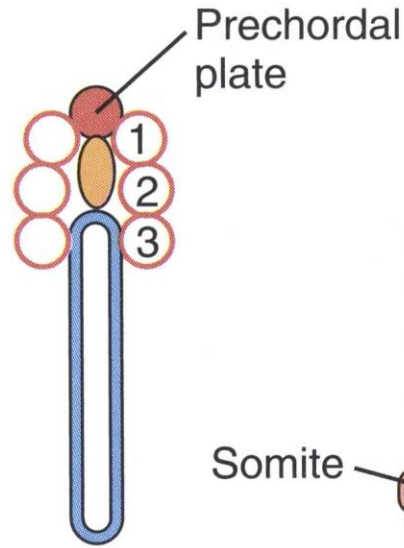
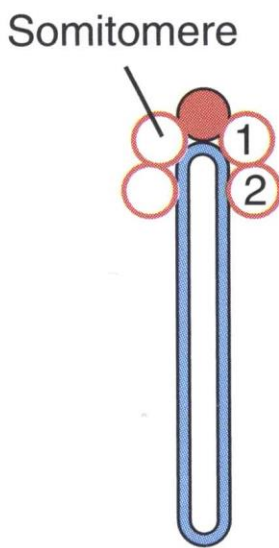
Cartilaginous neurocranium

- Capsula olfactoria
- Prechordal cart.
- Capsula optica
- Hypophyseal cart.
- Parachordal cart.
- Capsula otica

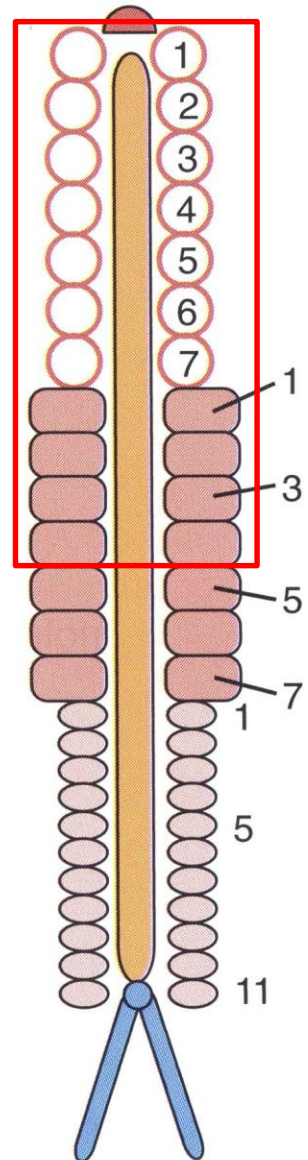
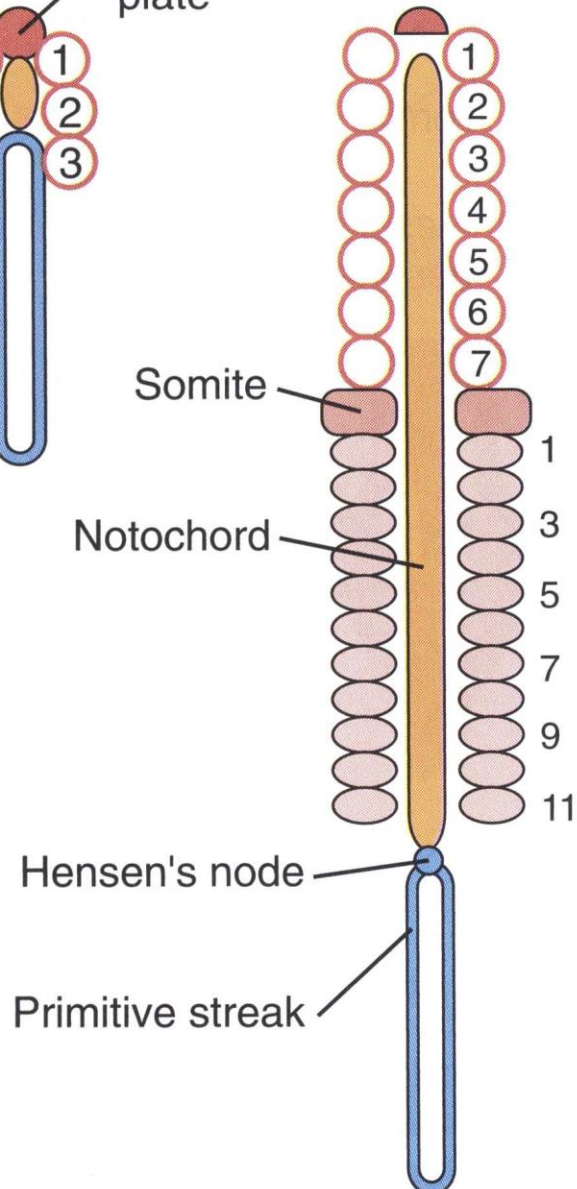


Sources of mesenchyme:

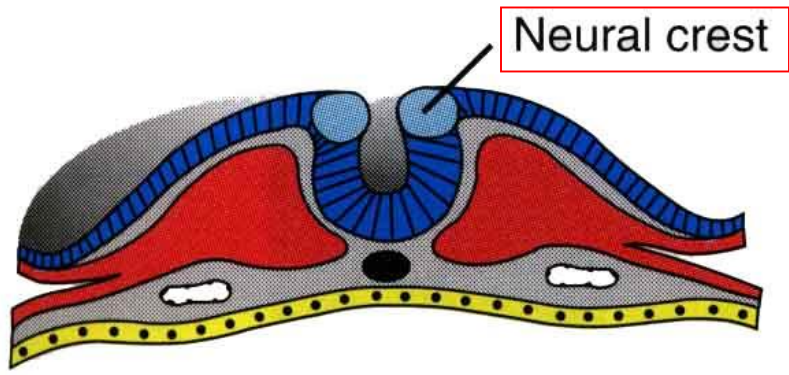
1) paraxial mesoderm



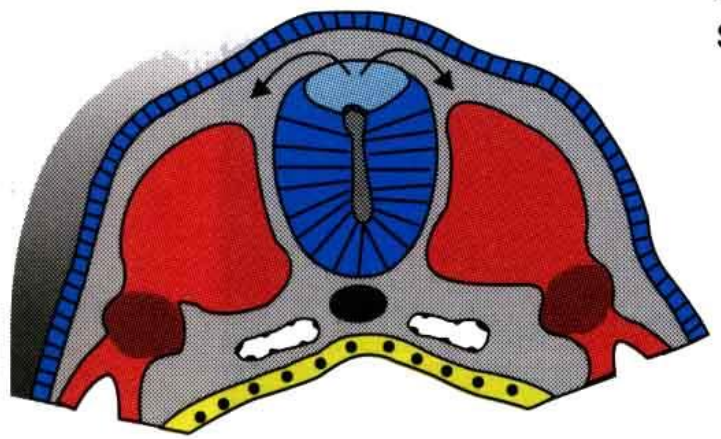
somitomeres
occipital somites



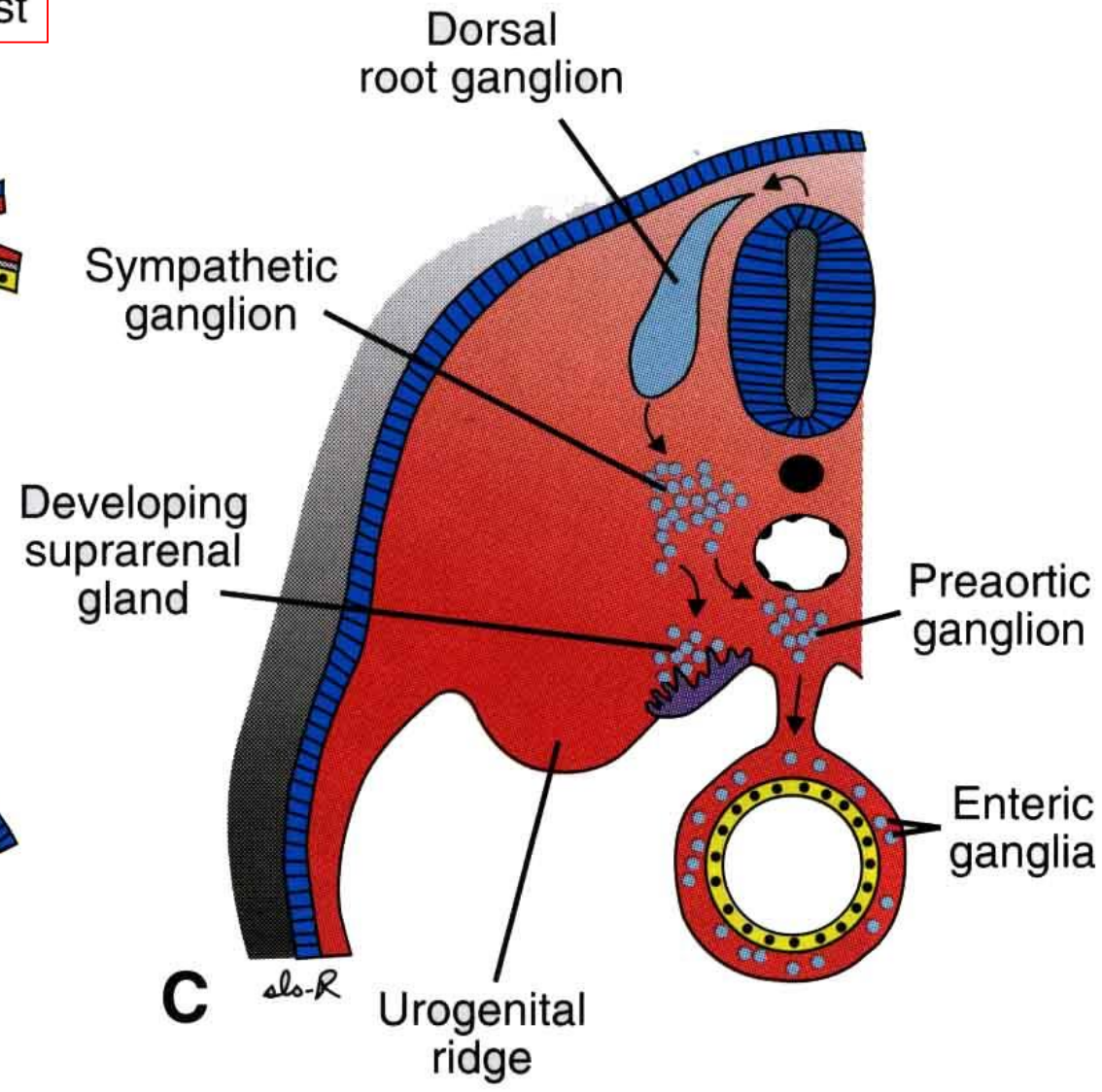
Sources of mesenchyme: 2) neural crest



A



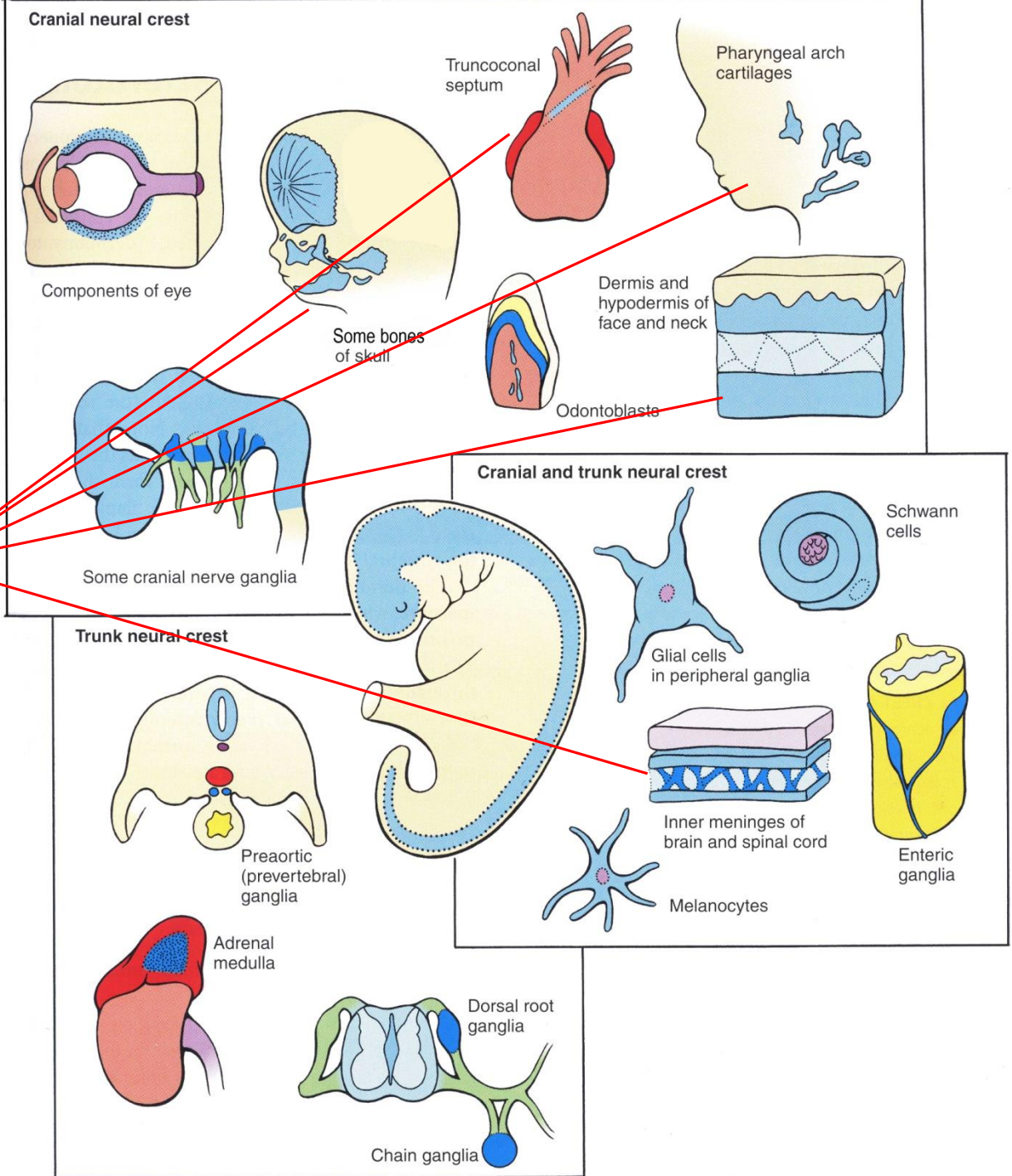
B

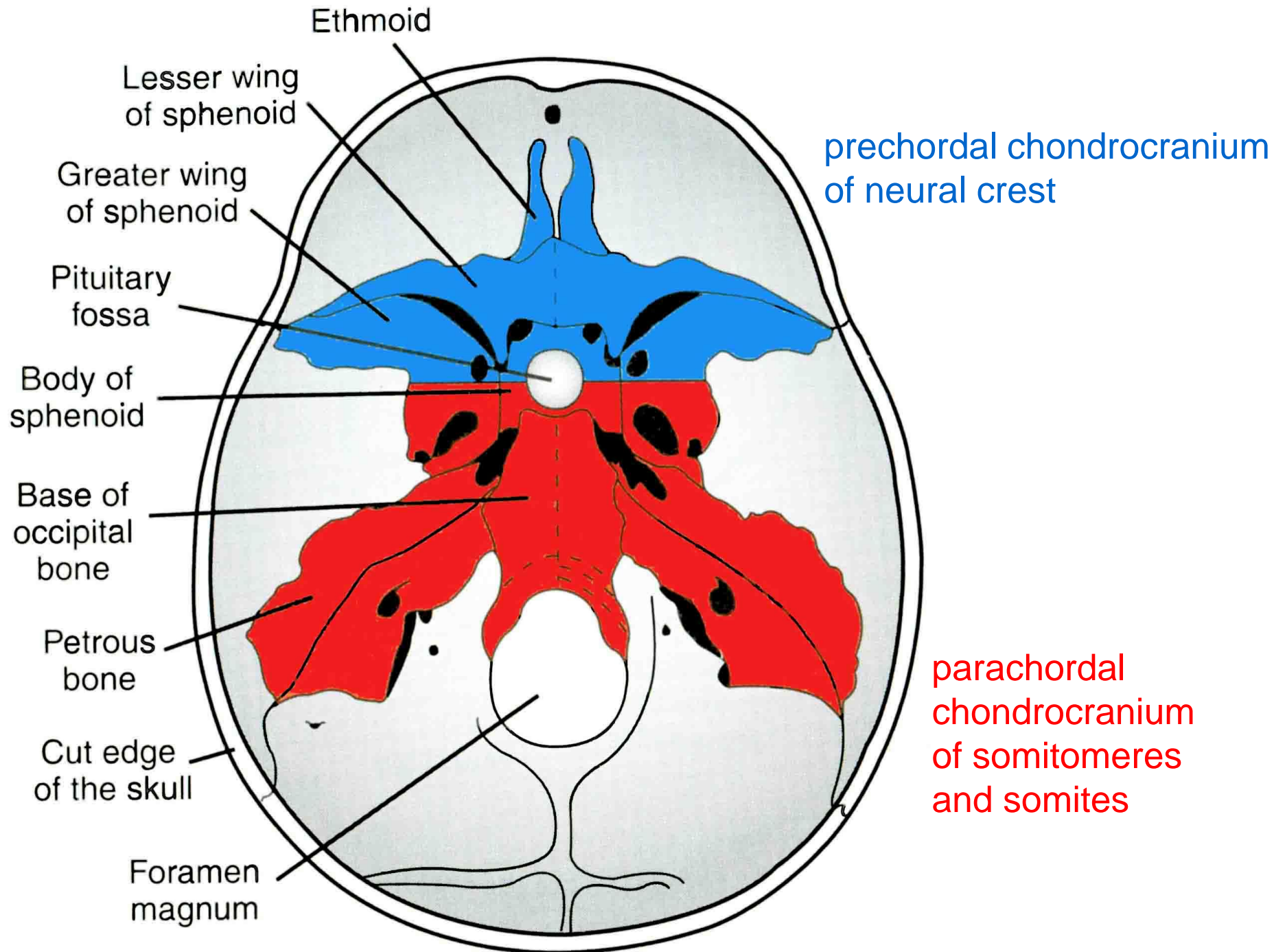


C

Derivatives of the neural crest

ectomesenchyme





neural crest

somitomes and somites

Frontal

Parietal

Nasal

Lacrimal

Zygomatic

Maxilla

Incisive

Mandible

Sphen

Sq. temp.

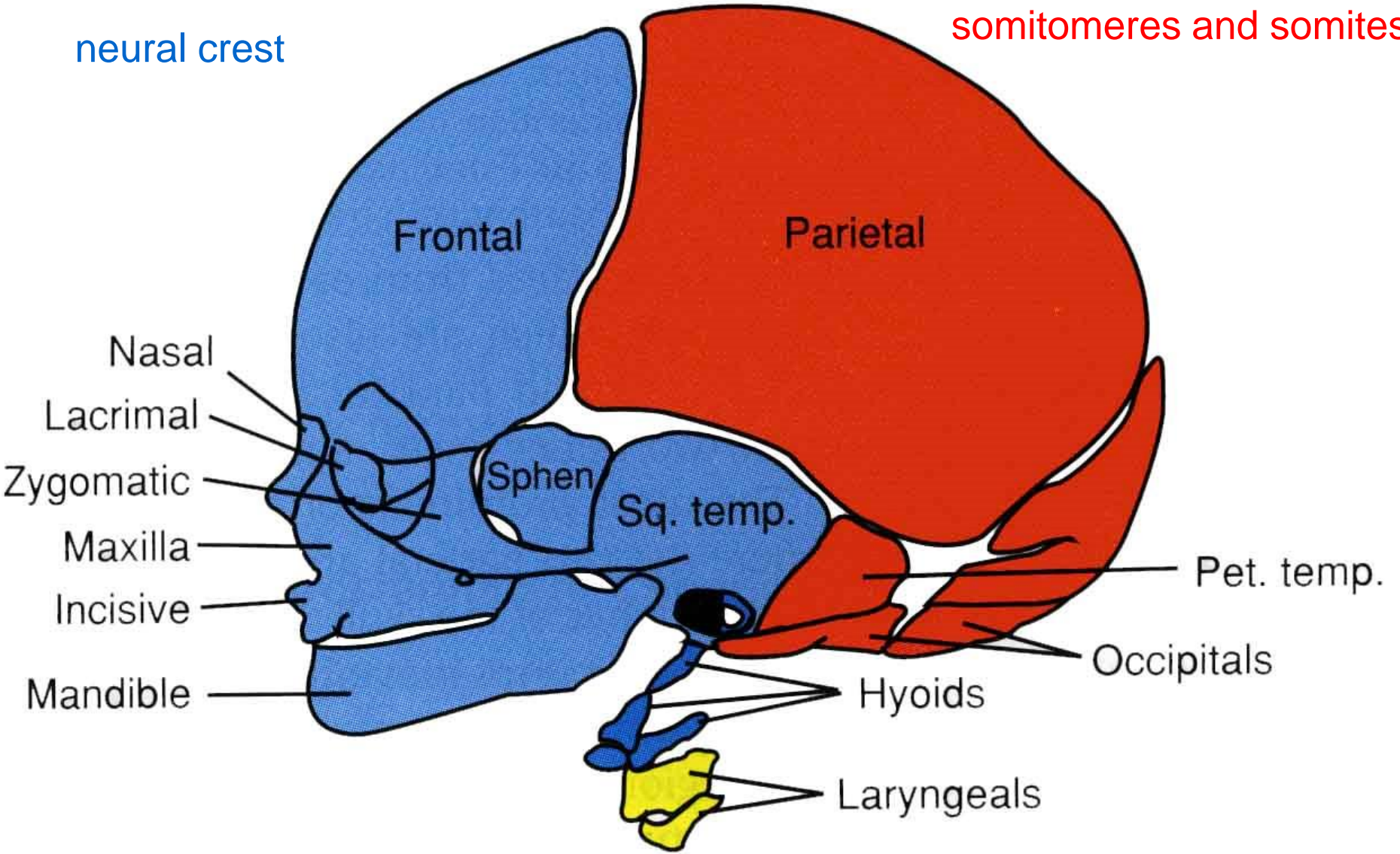
Pet. temp.

Occipitals

Hyoids

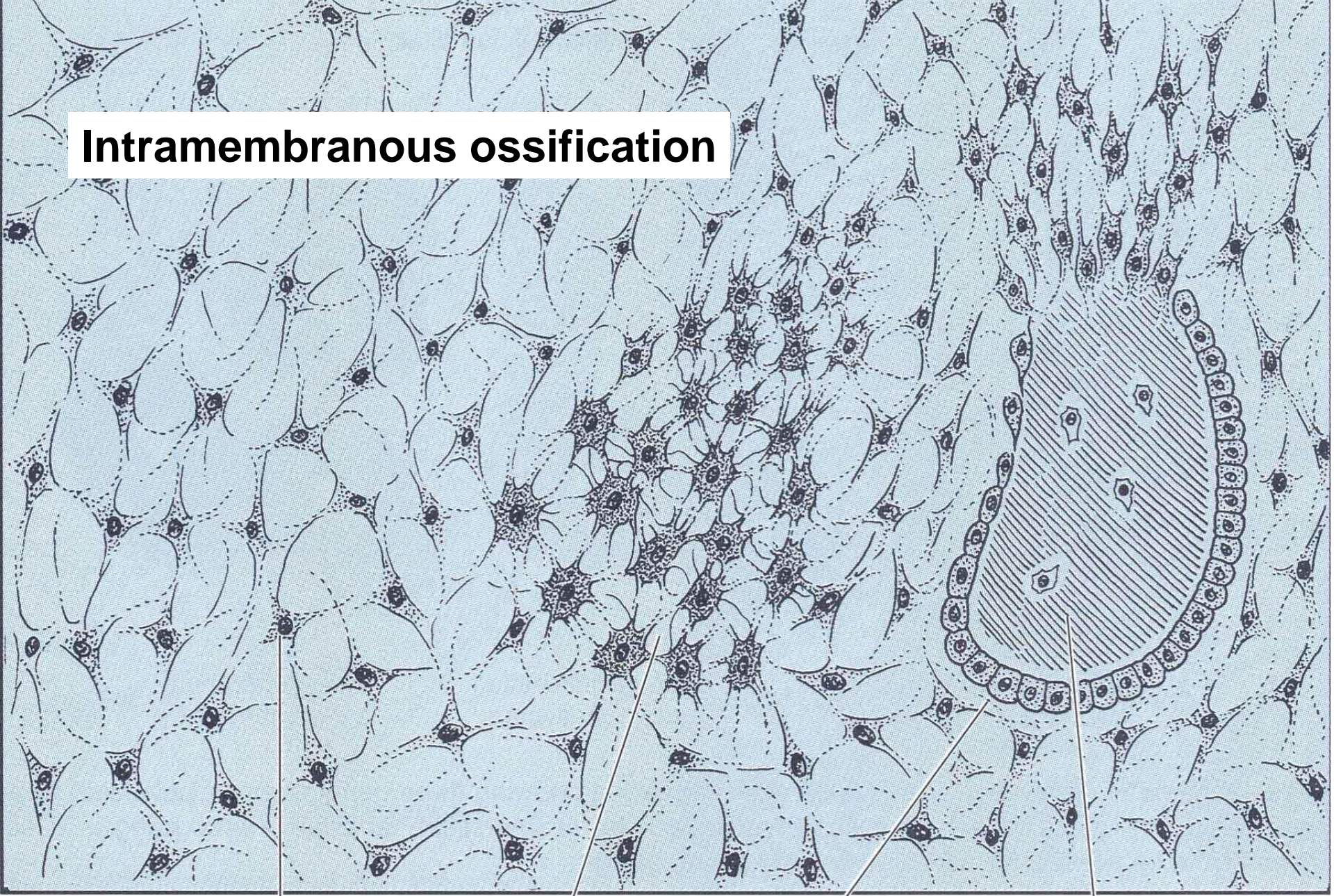
Laryngeals

lateral plate mesoderm





Intramembranous ossification

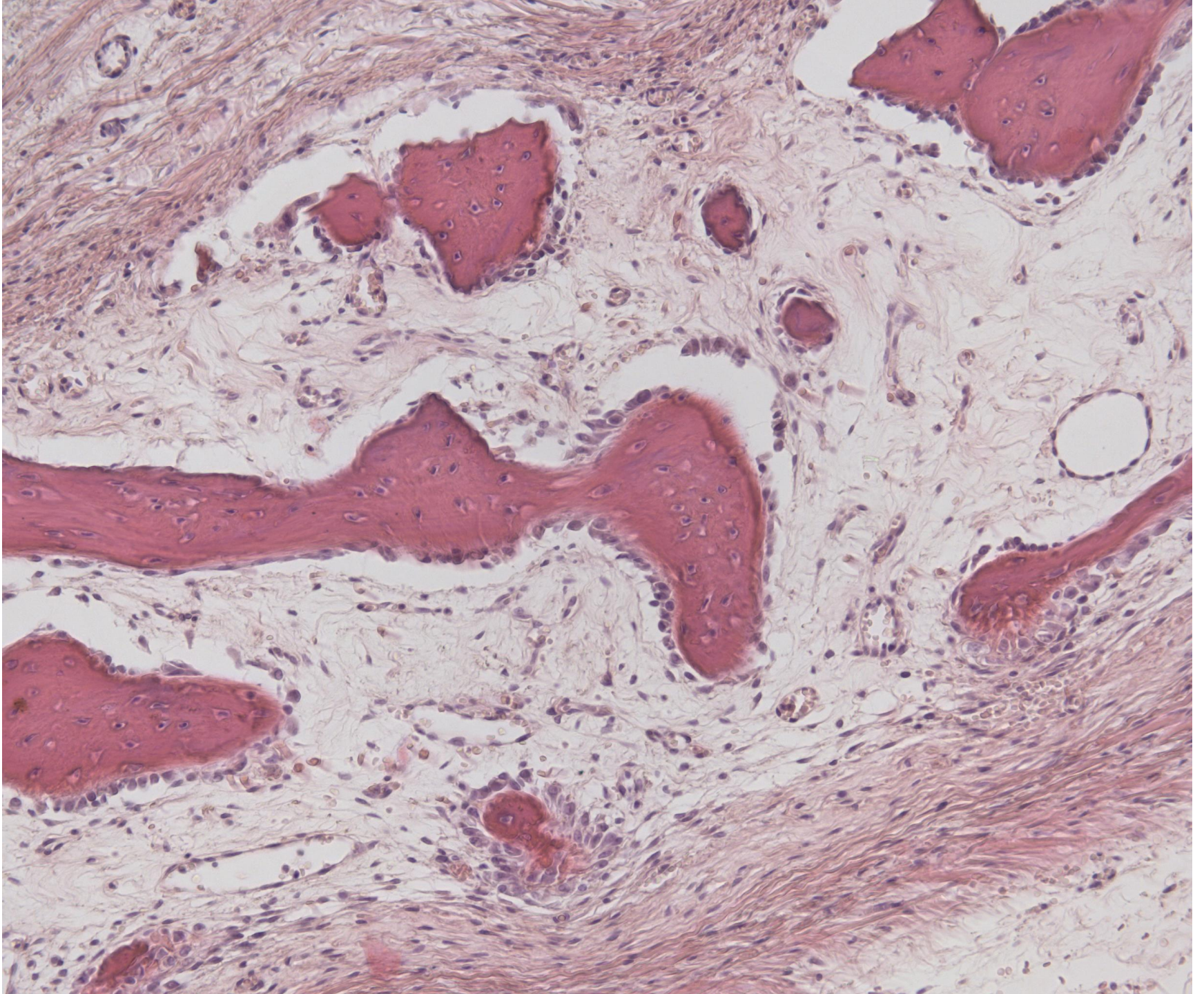


Mesenchyme

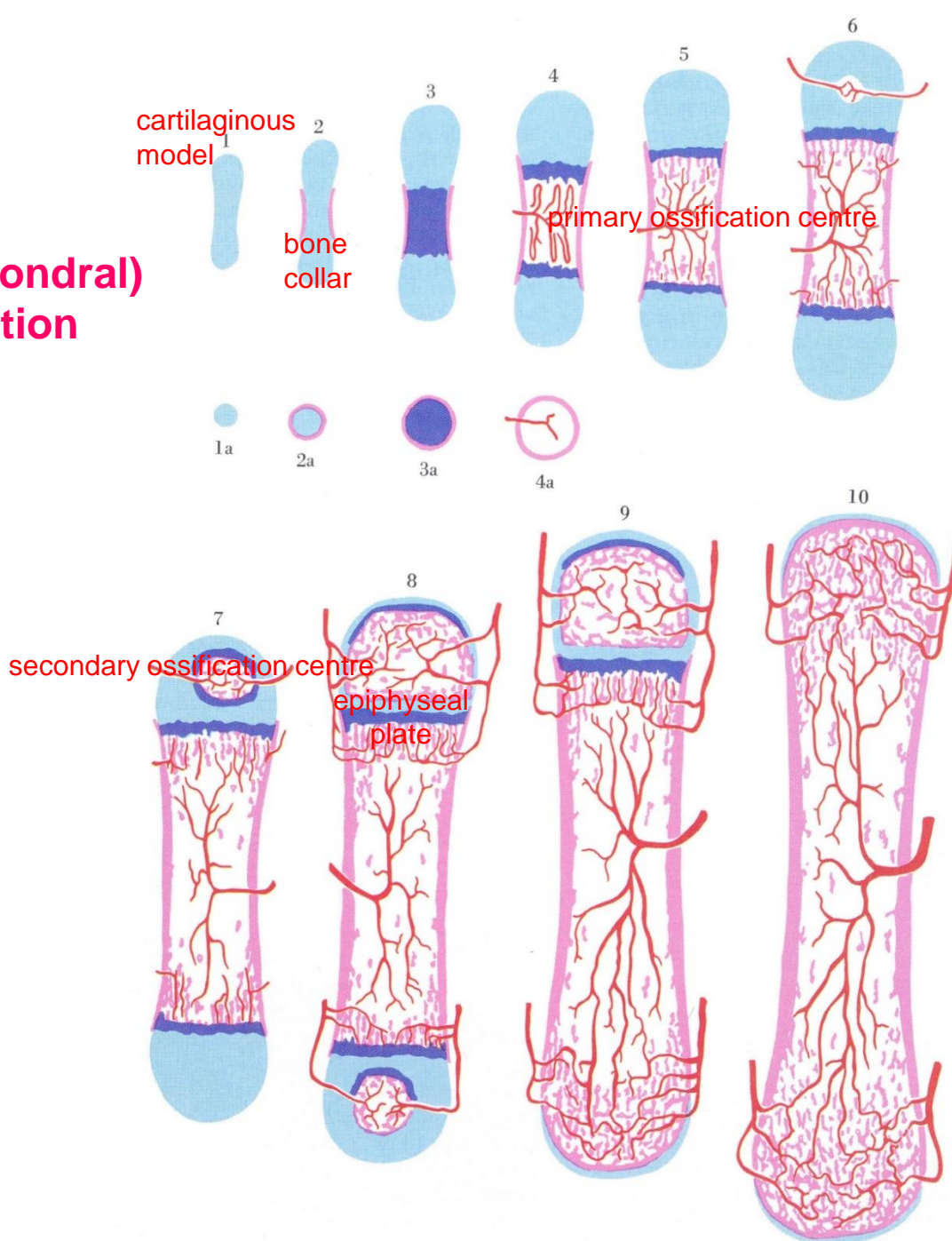
Bone blastema

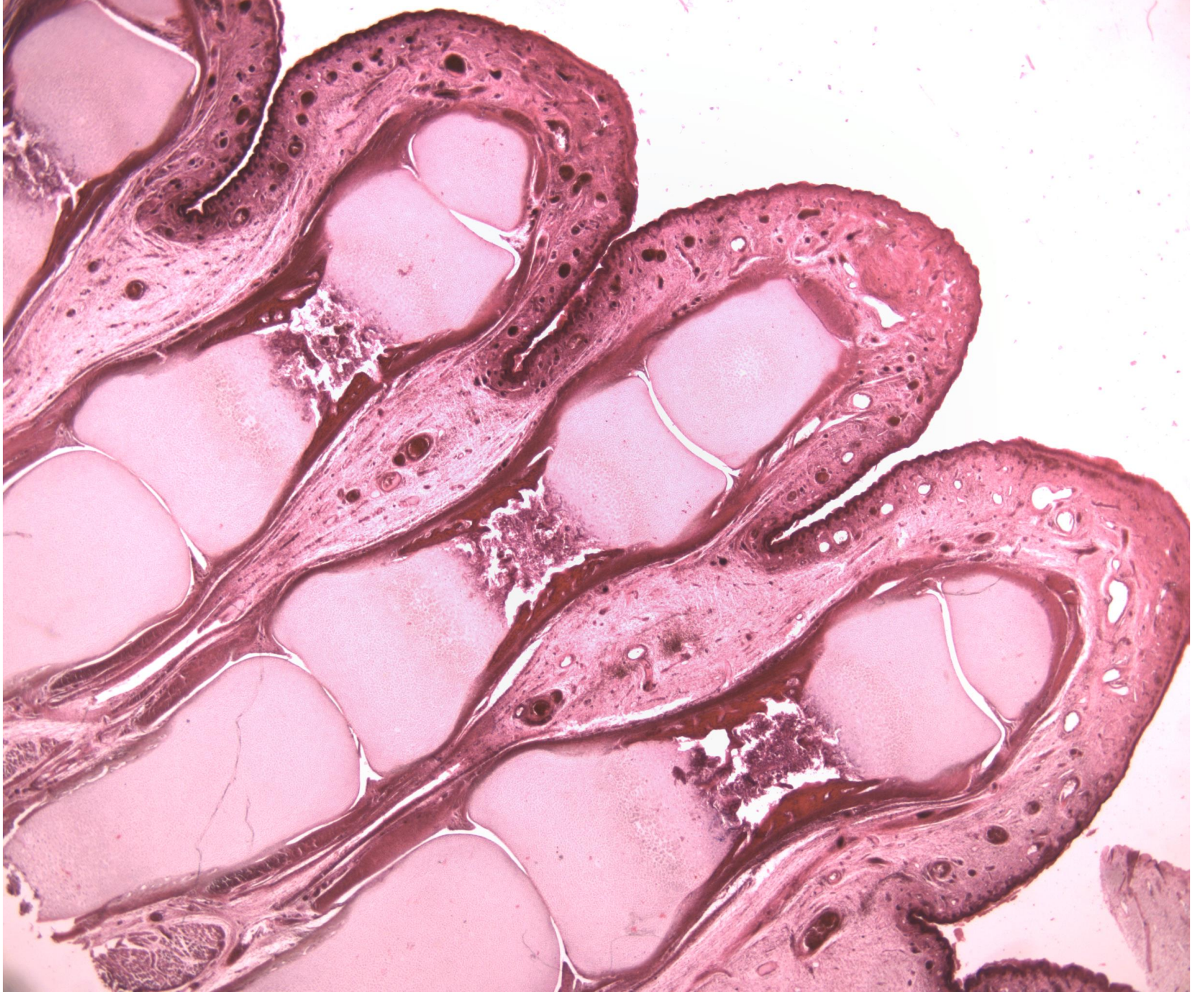
Osteoblasts

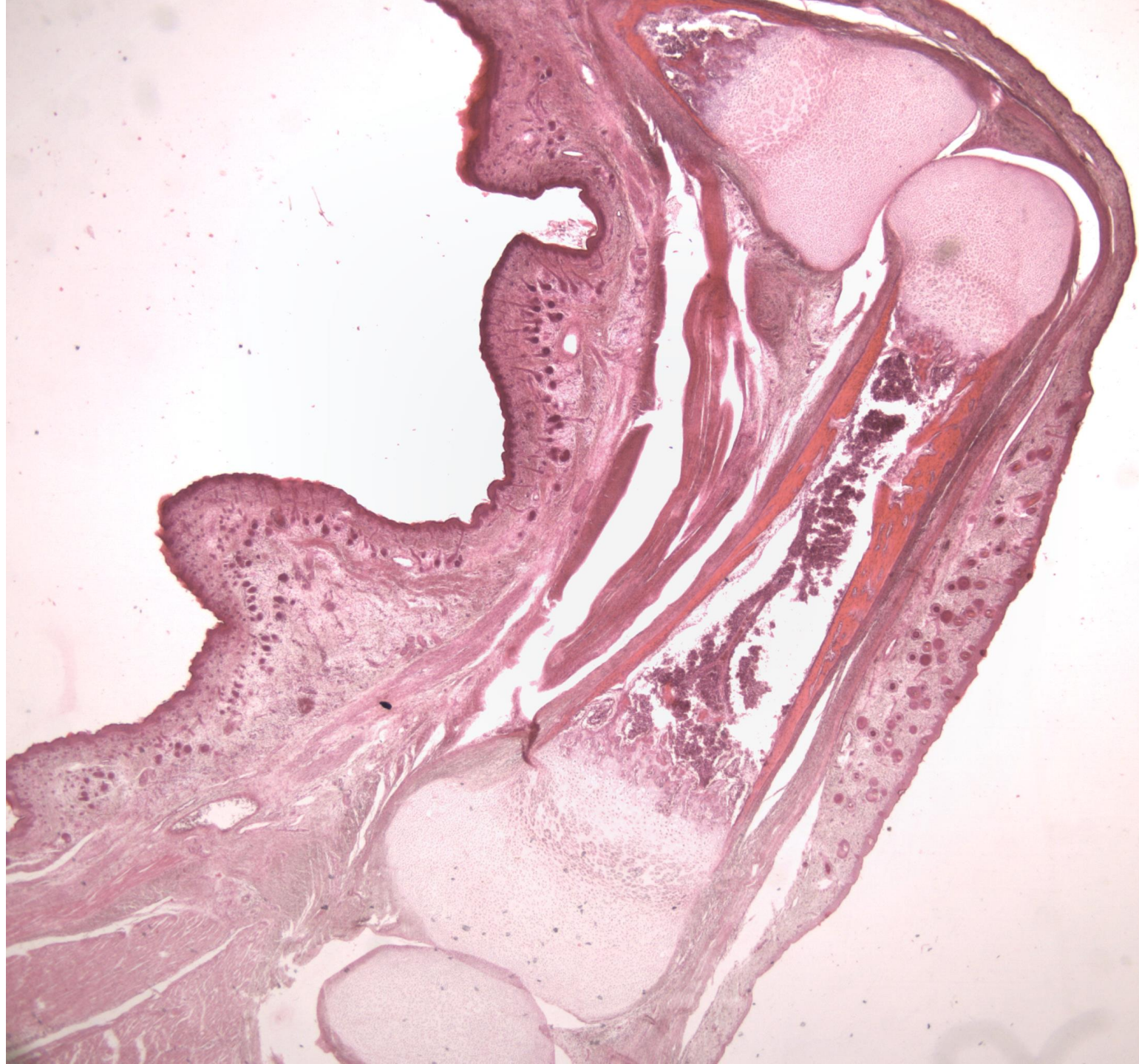
Primary bone tissue



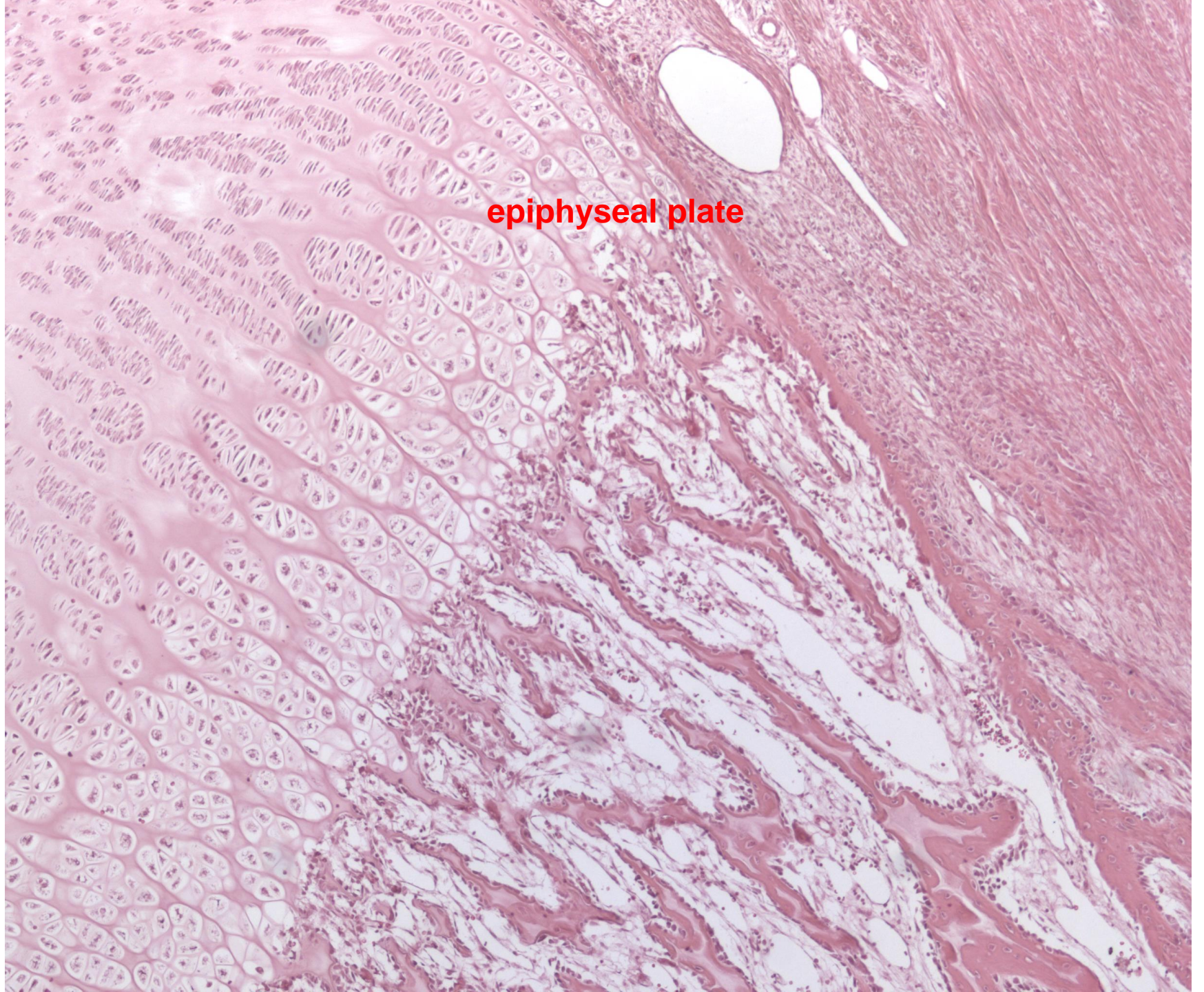
Endochondral ossification







epiphyseal plate





resting zone

This histological image shows a section of cartilage with three distinct zones. The resting zone is the uppermost layer, characterized by small, scattered chondrocytes. The proliferative zone is the middle layer, showing a higher density of chondrocytes arranged in parallel rows. The hypertrophic cartilage zone is the lowermost layer, featuring significantly larger chondrocytes and a more organized, columnar arrangement. The overall structure is composed of a dense network of collagen fibers and proteoglycan aggregates, stained in shades of pink and purple.

proliferative zone

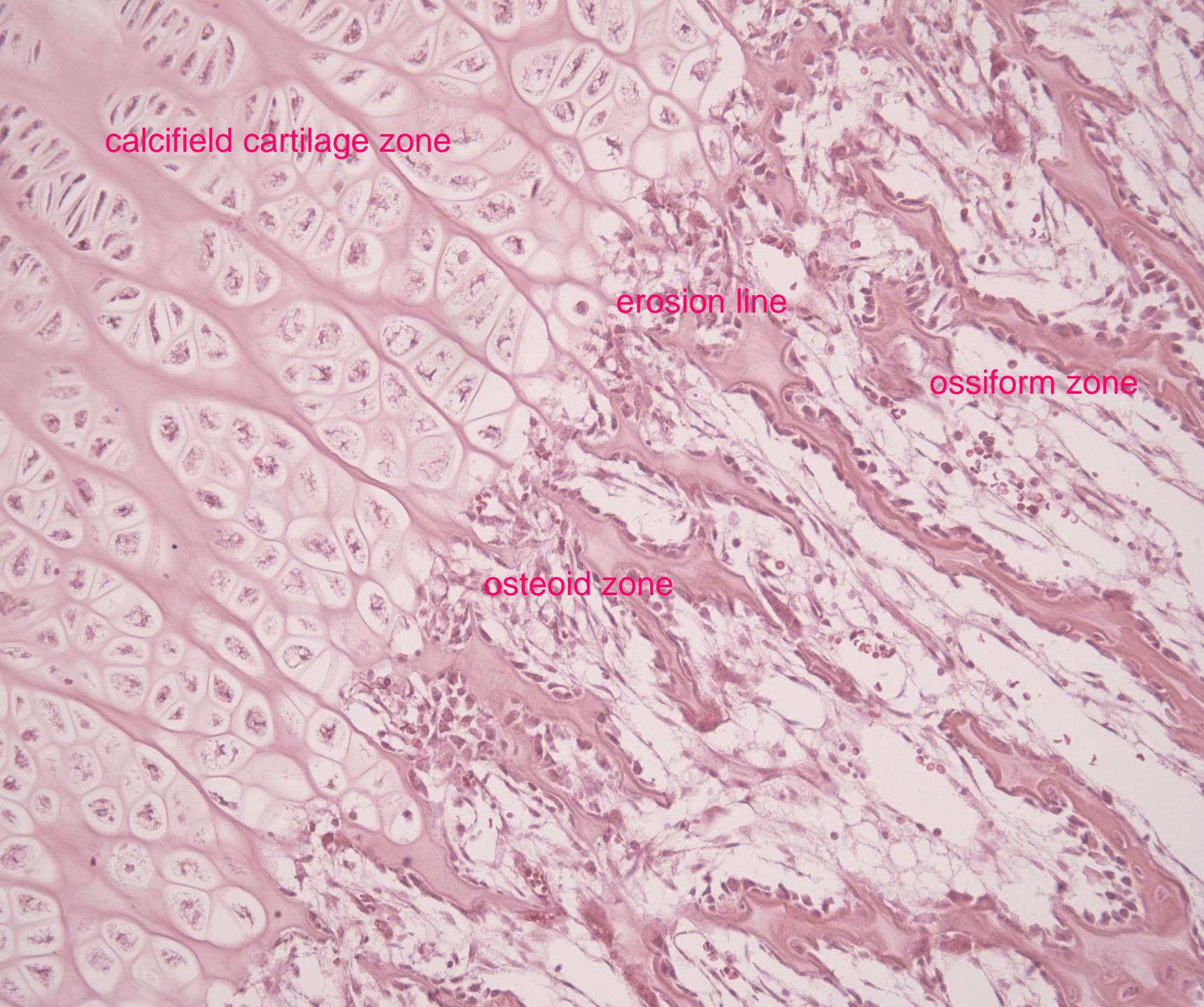
hypertrophic cartilage zone

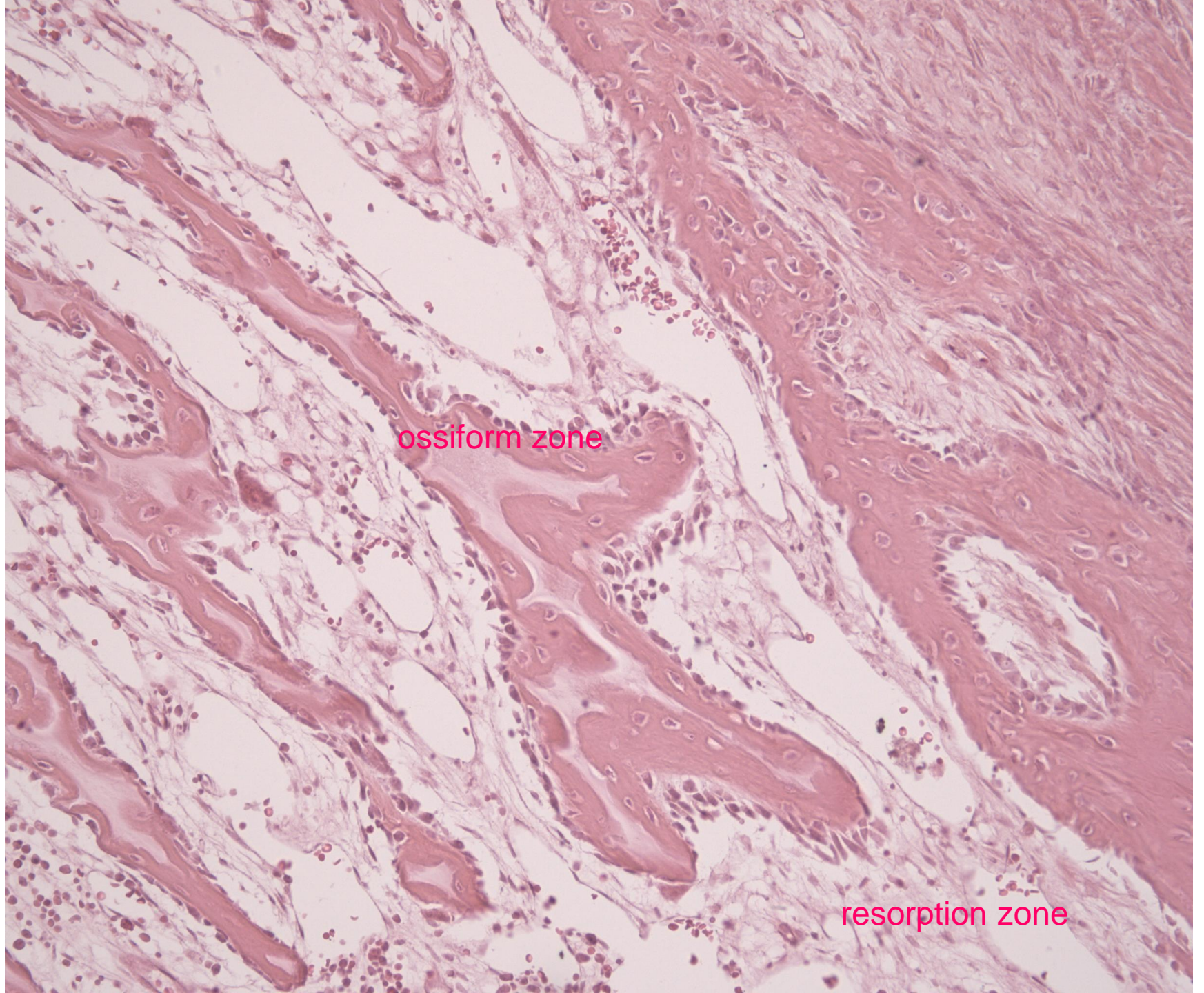
calcified cartilage zone

erosion line

ossiform zone

osteoid zone



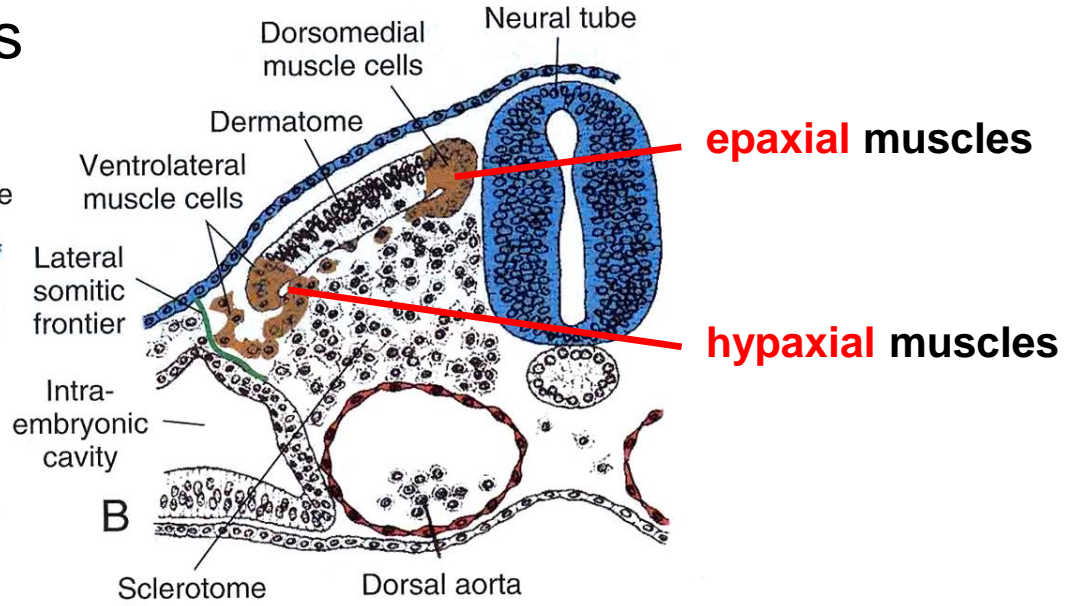
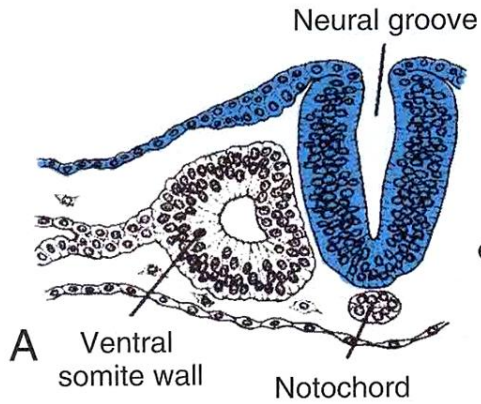


ossiform zone

resorption zone

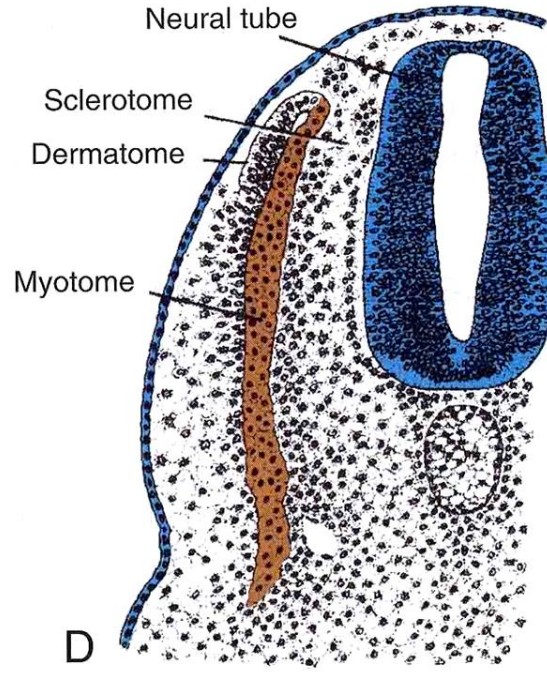
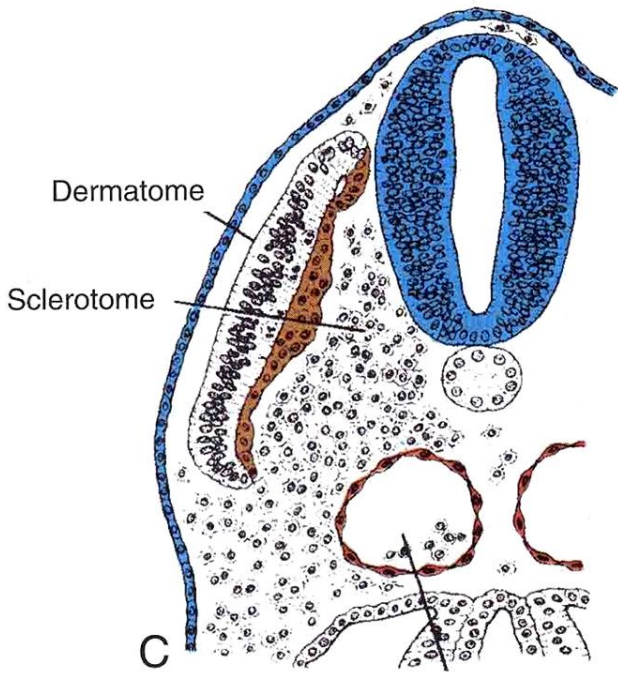
DEVELOPMENT OF THE MUSCLE SYSTEM

postcranial muscles



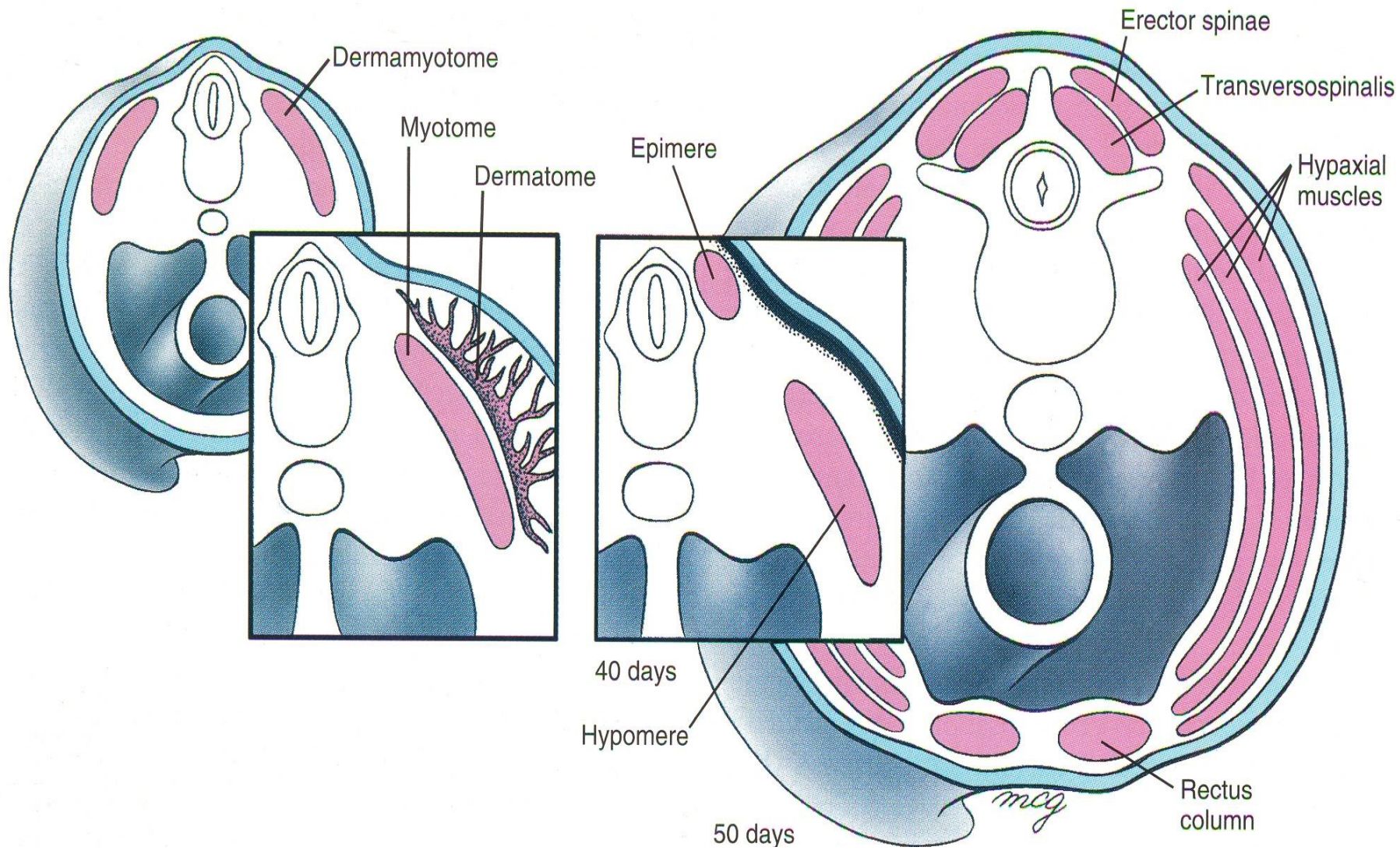
epaxial muscles

hypaxial muscles

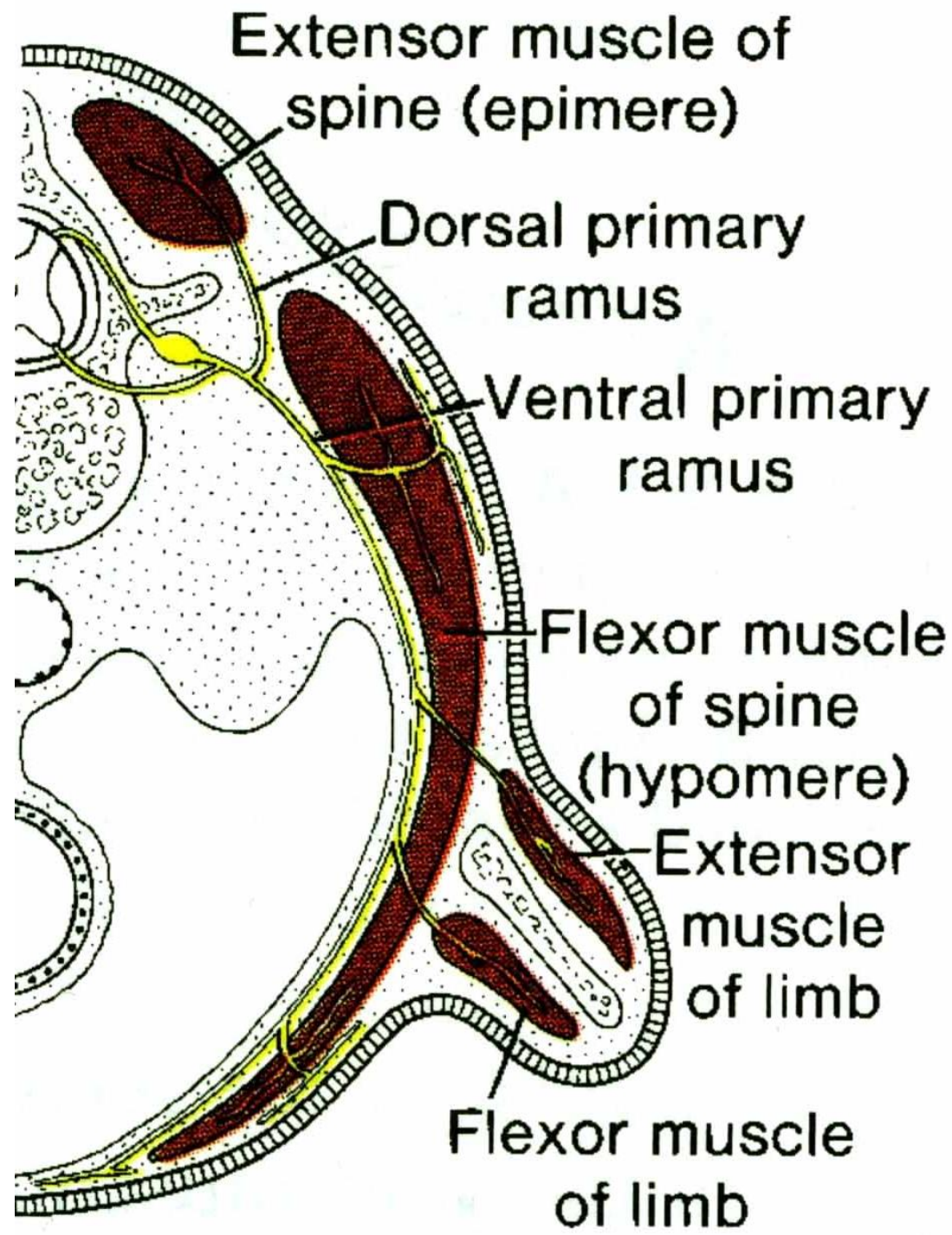


primaxial muscles
arise and develop
with somitic mesenchyme

abaxial muscles
arise within somitic mesenchyme
but develop within mesenchyme
of somatopleuric mesoderm

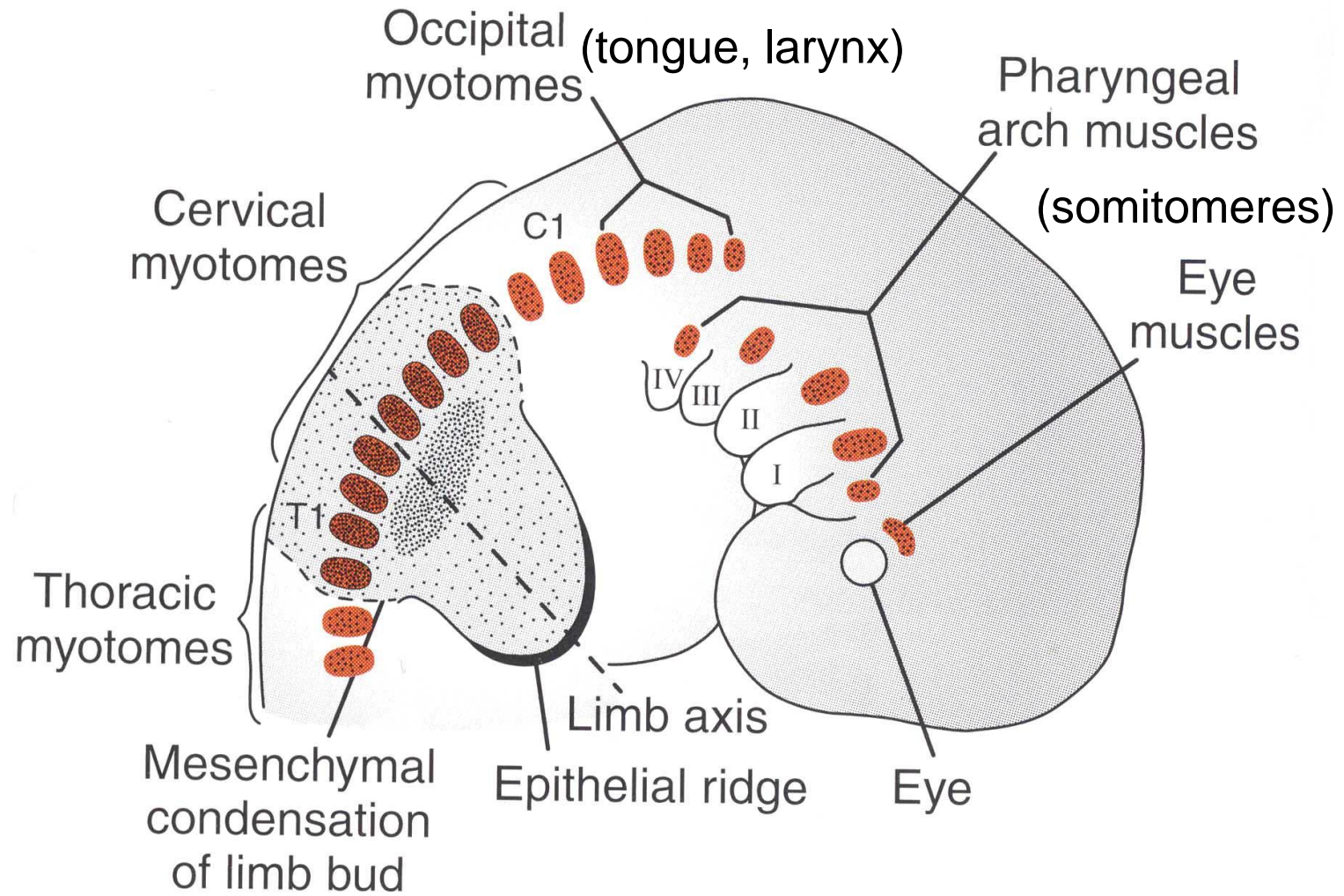


muscles of limbs



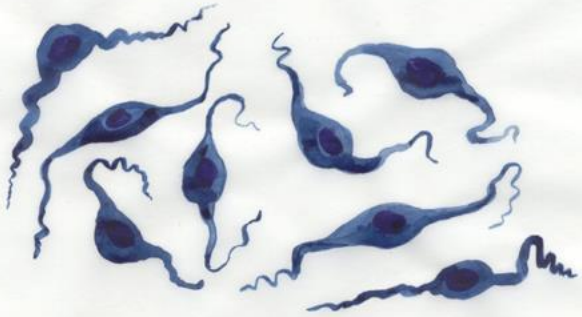
7th week

cranial muscles



7th week

New myoblasts



Myoblasts fusing



Myoblasts in line



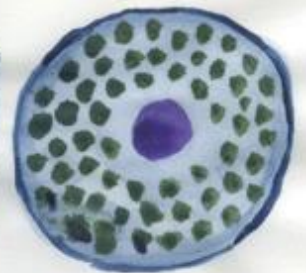
Side views



Cross sections

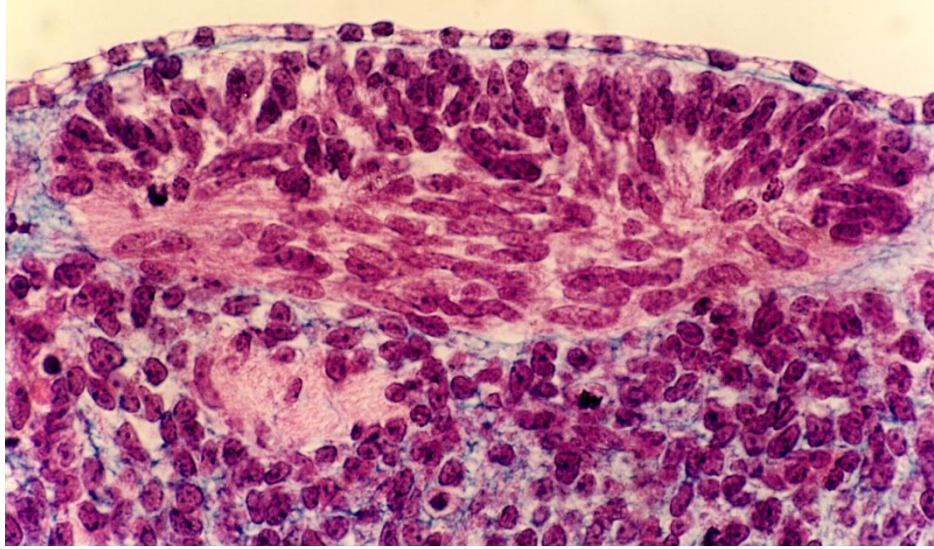


Myoblasts develop myofibrils

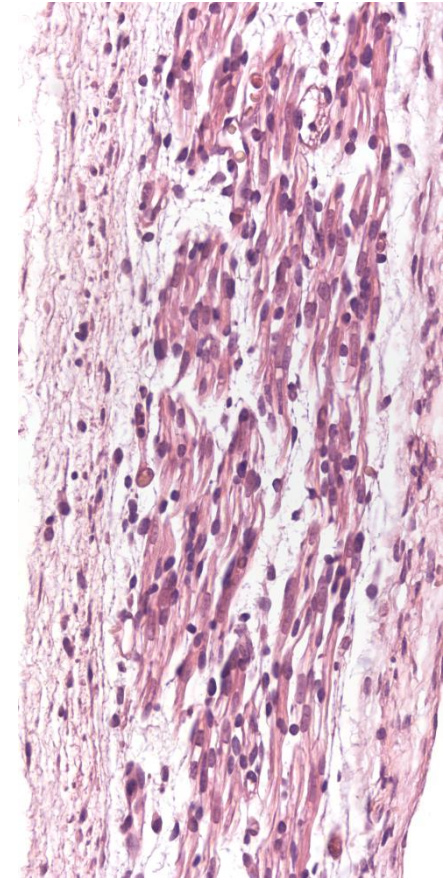
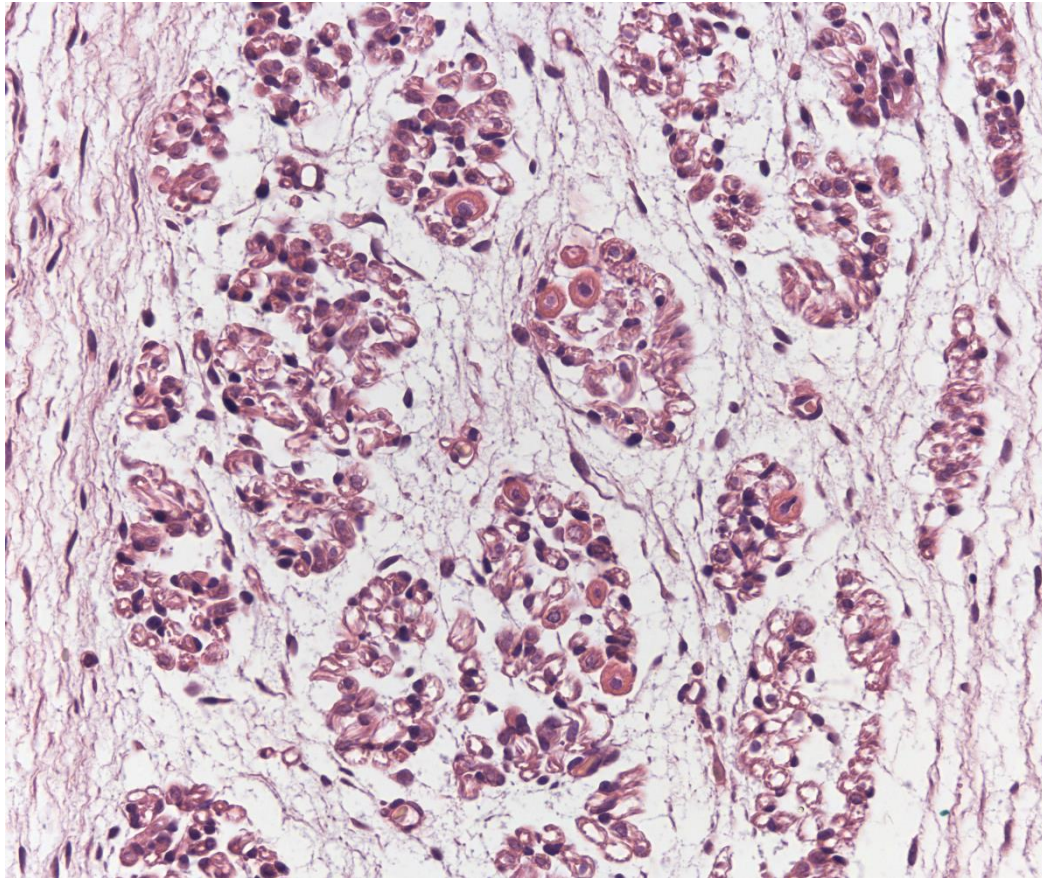


Myotube

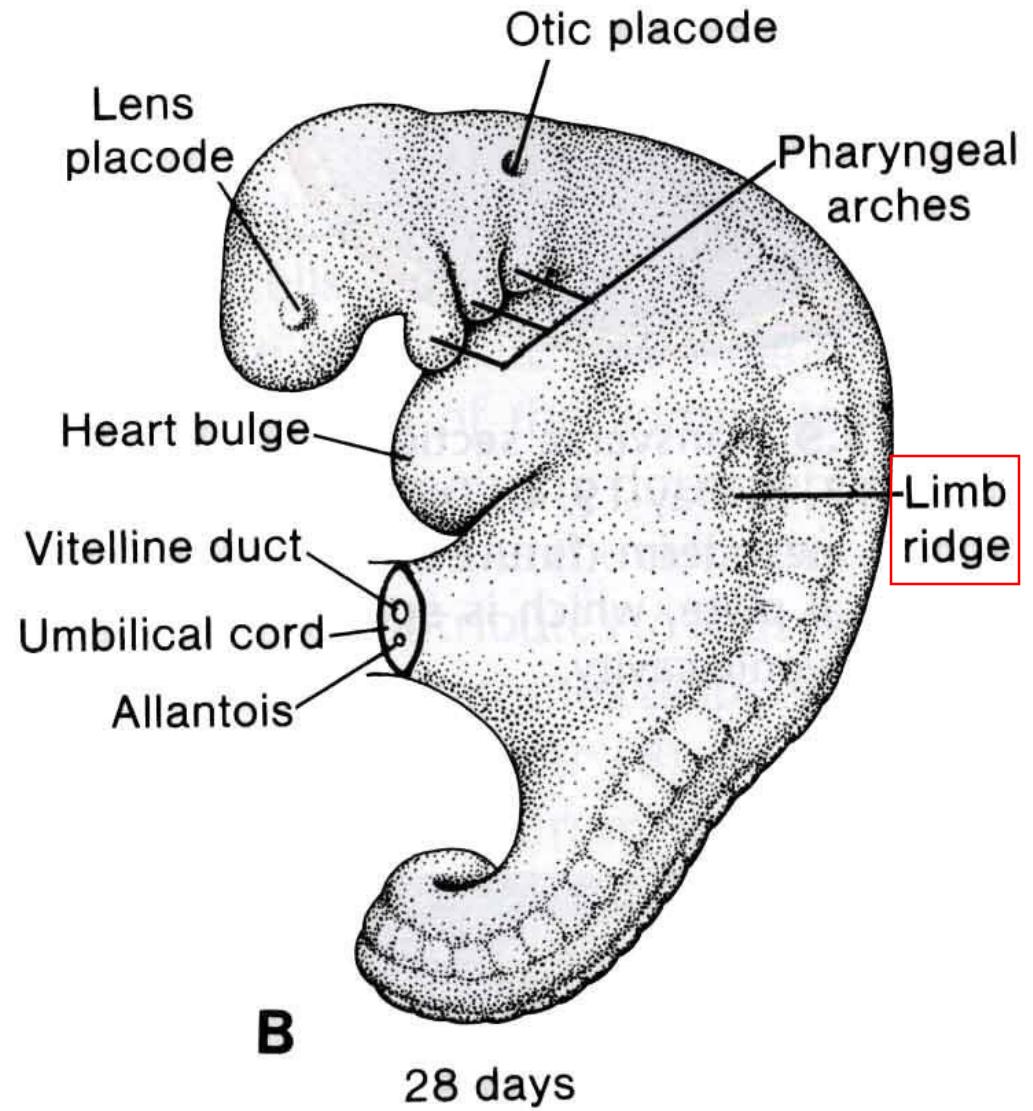
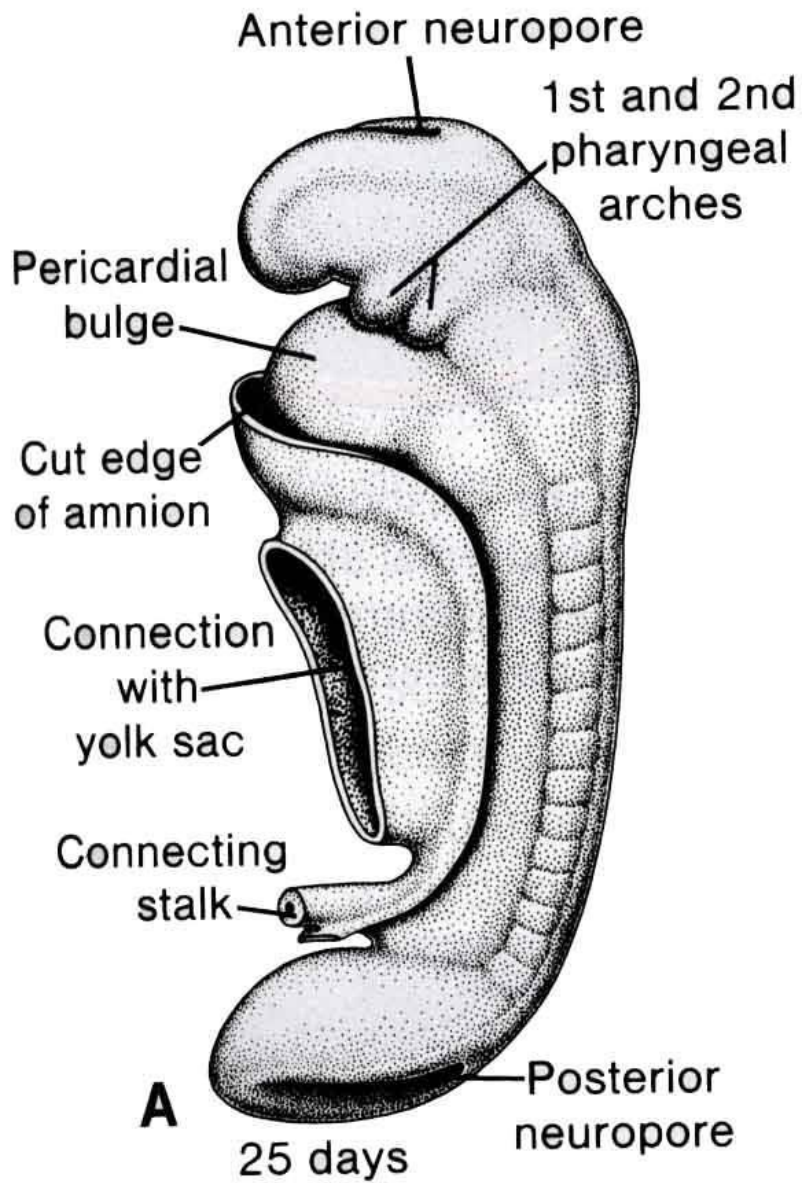
myoblasts



myotubes

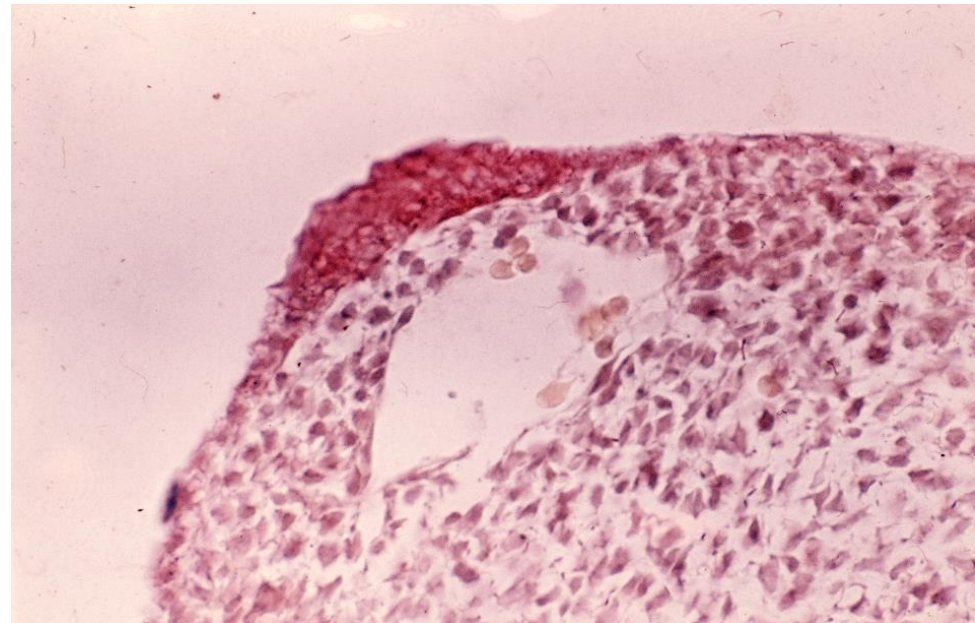
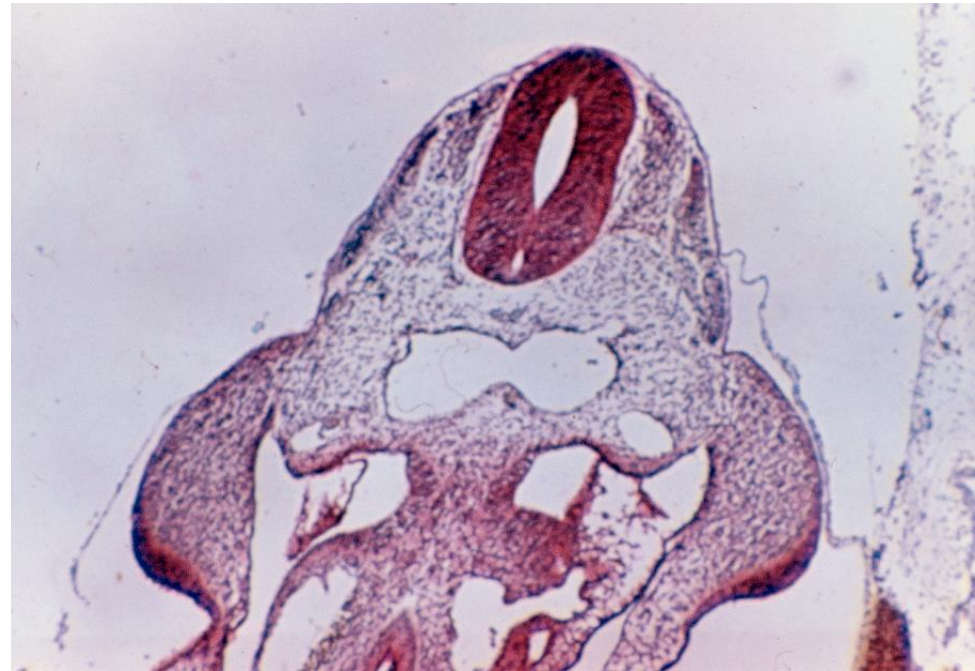


DEVELOPMENT OF LIMBS



Limb buds

5th week

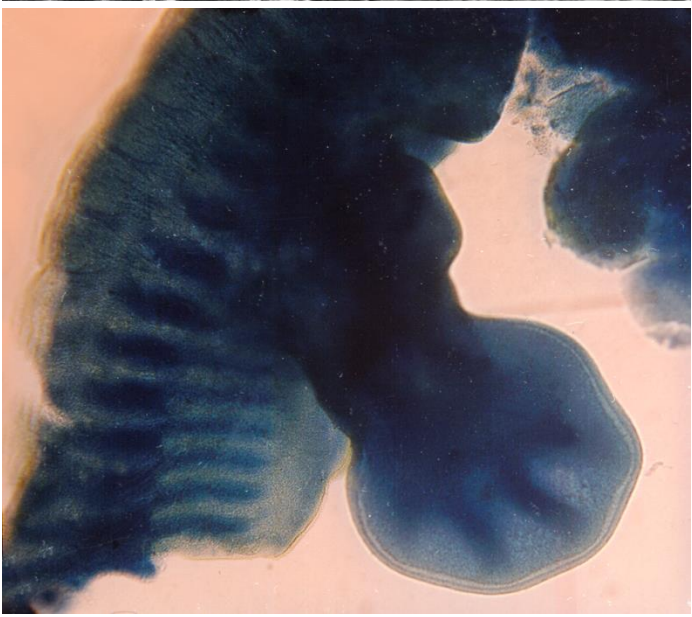
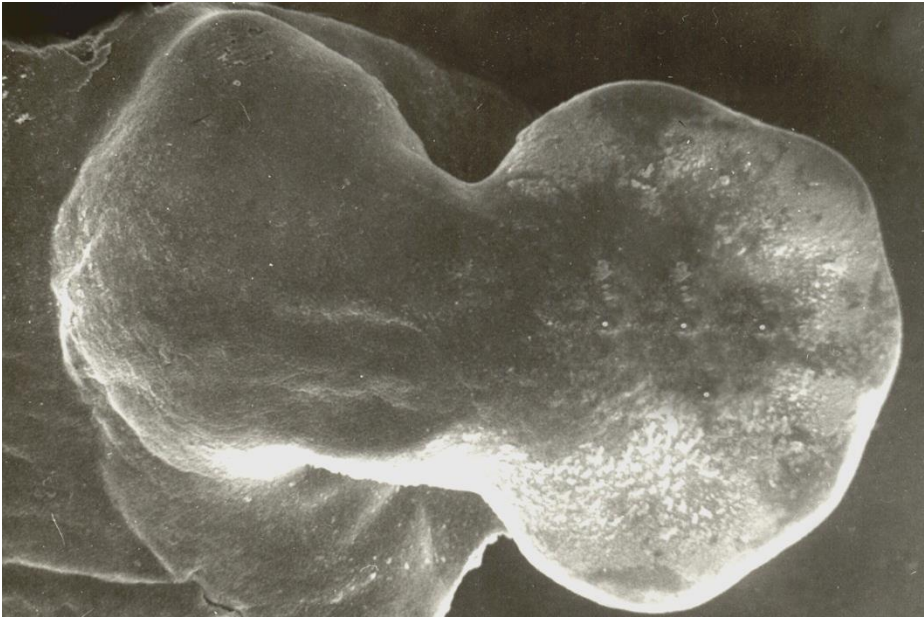
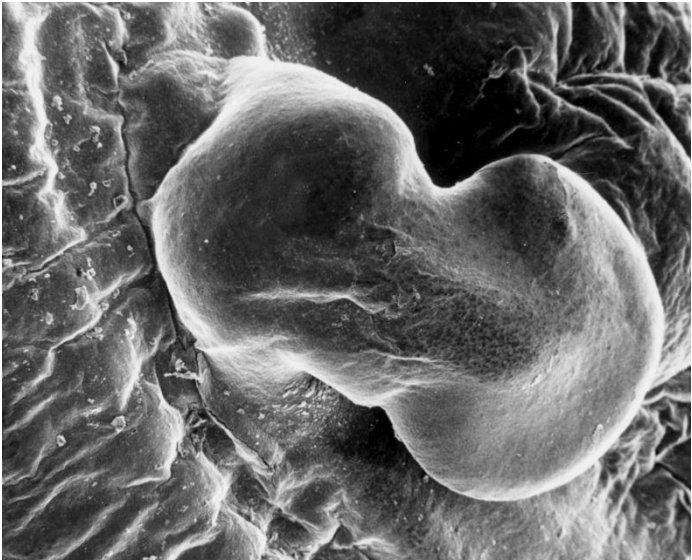




6th week

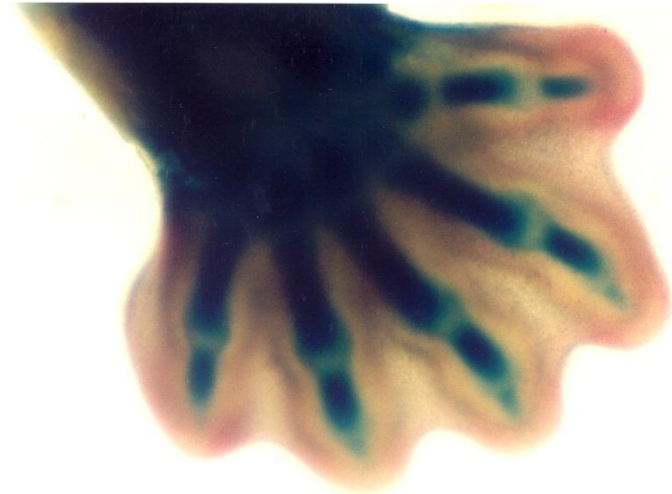
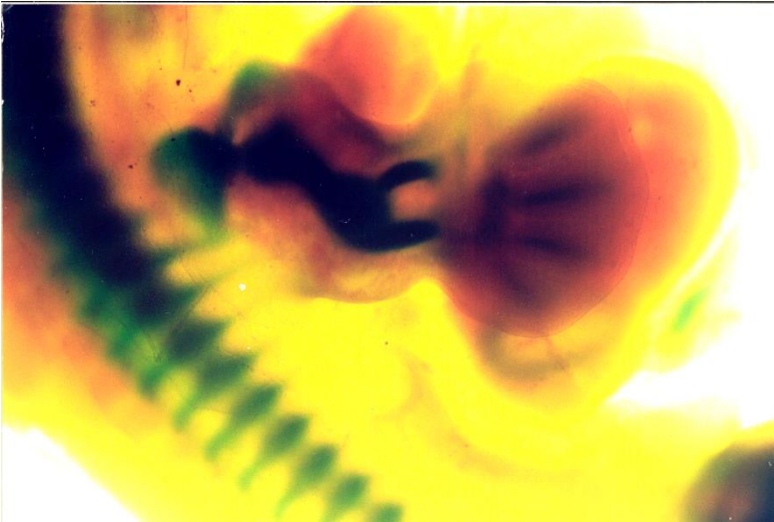
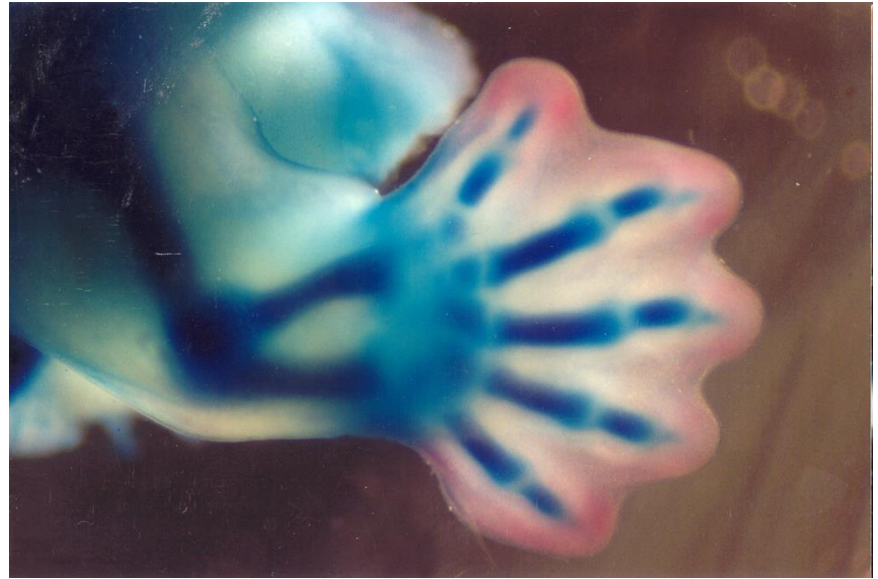
Two-segment limb; palmar plate and plantar plate, respectively

6th week

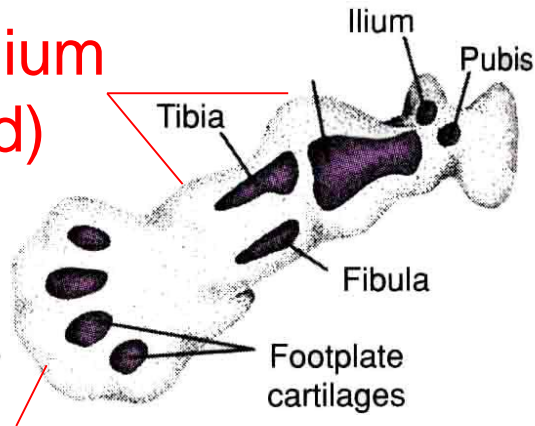


Three-segment limb; digital rays and tubercles

7th week

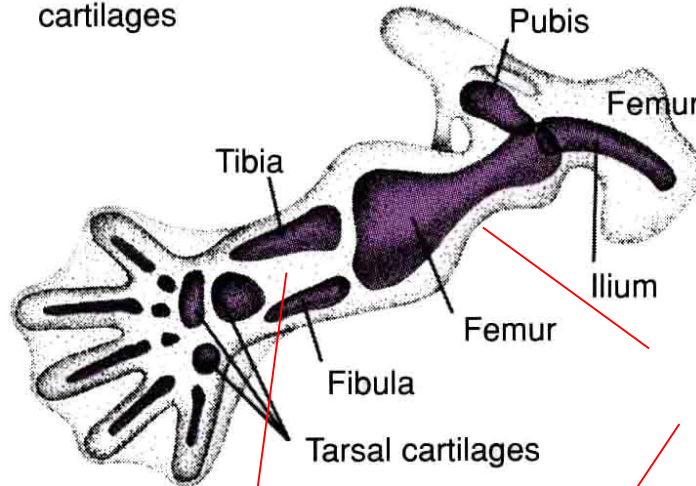


axopodium
(axopod)



two-segment limb

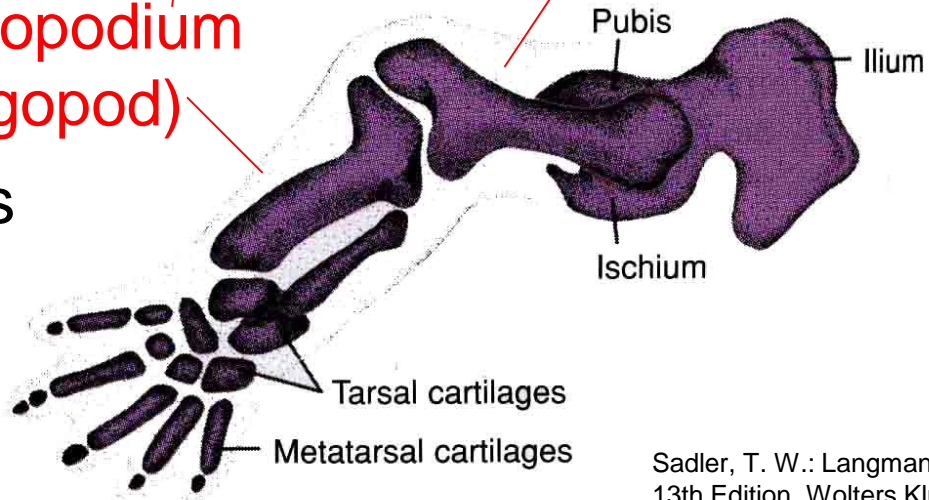
autopodium
(autopod)



stylopodium
(stylopod)

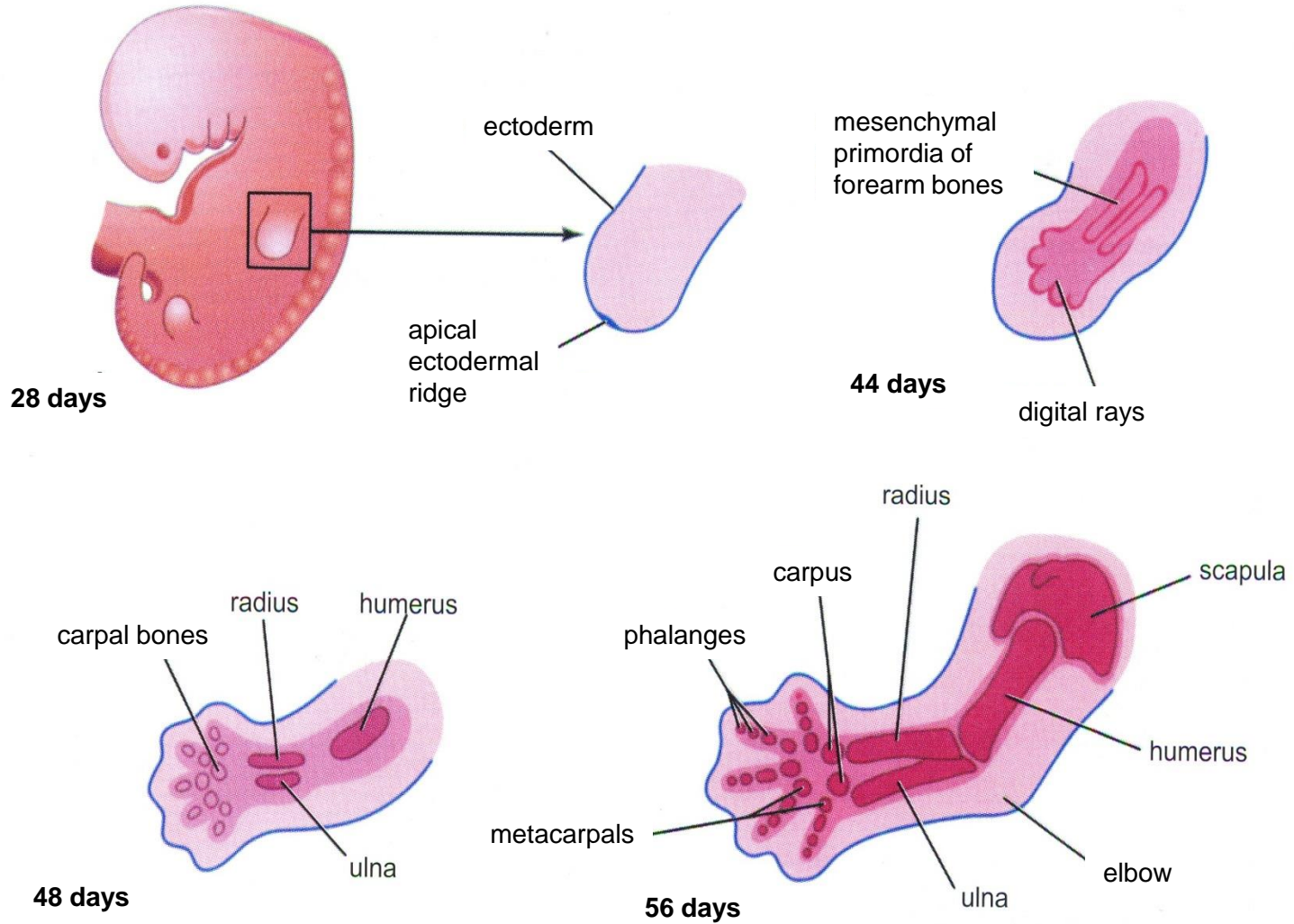
zeugopodium
(zeugopod)

three-segment limbs

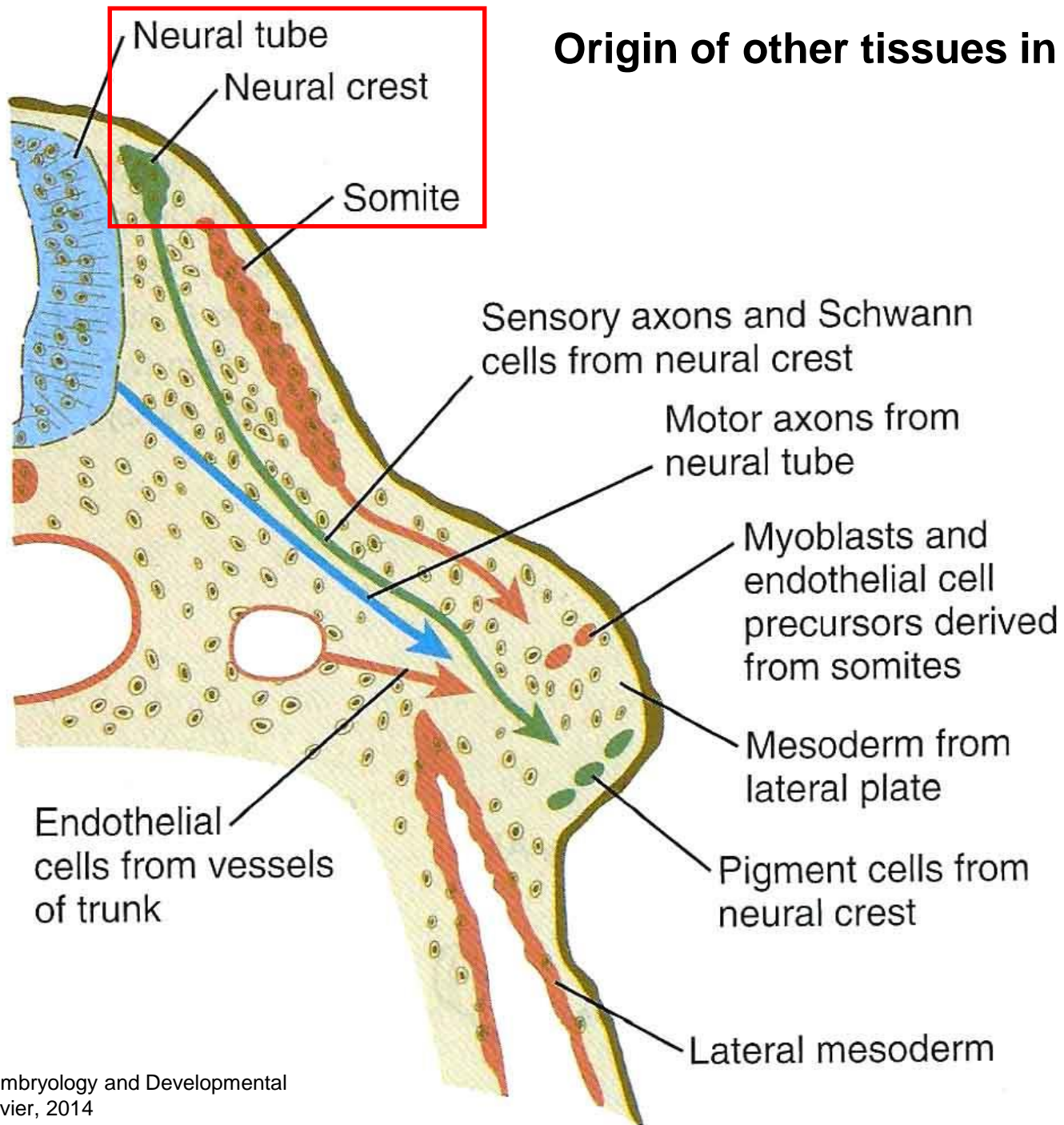


Limb skeleton – somatopleura

□ loose mesenchyme □ condensed mesenchyme □ cartilage



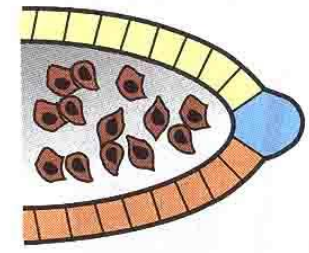
Origin of other tissues in limbs



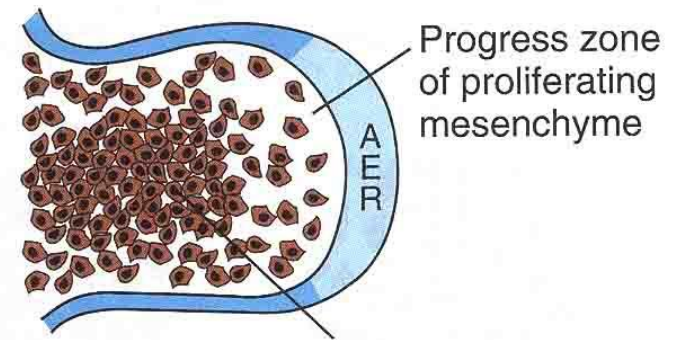
Proximodistal



FGF-10

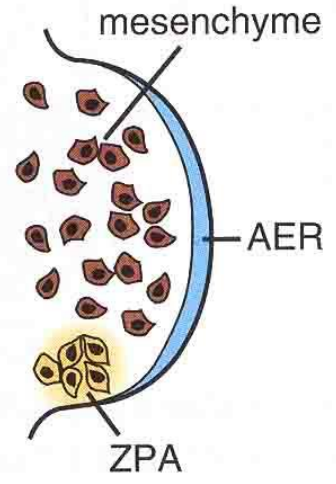


- Radical fringe
- Engrailed-1
- Ser-2



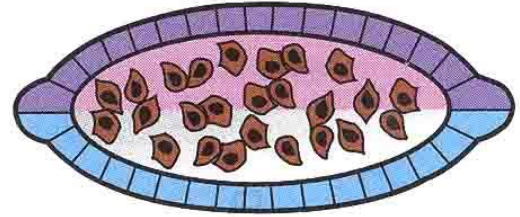
- FGF-4 and FGF-8

Craniocaudal



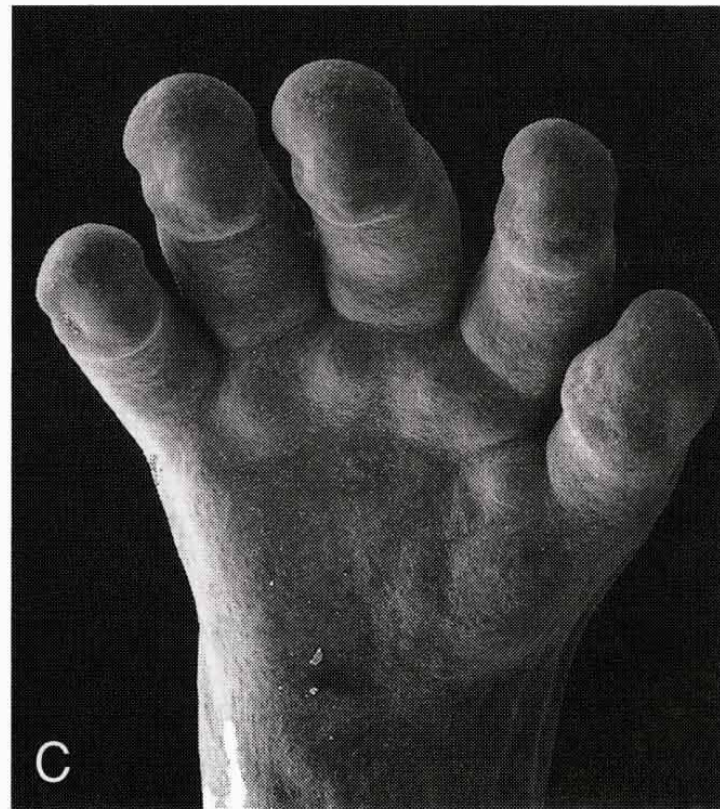
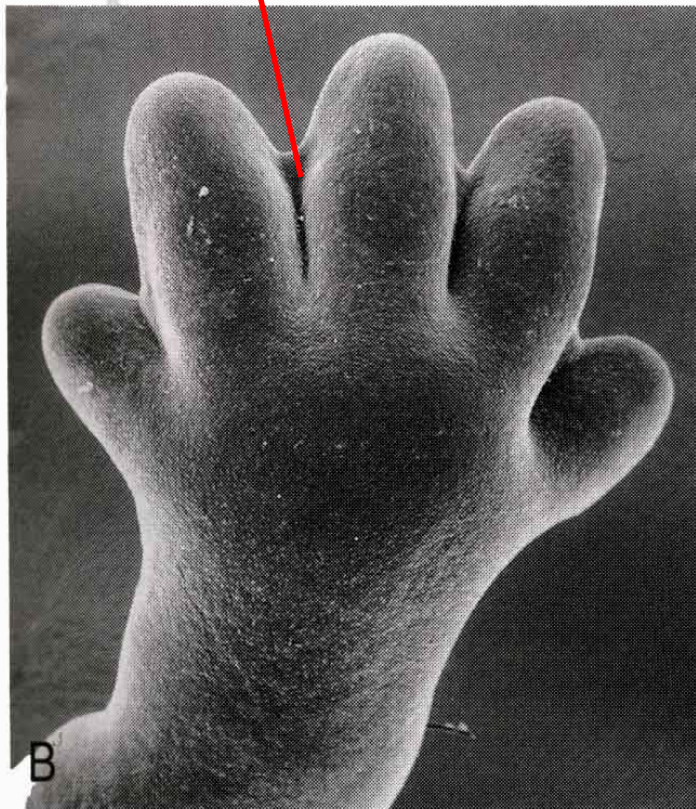
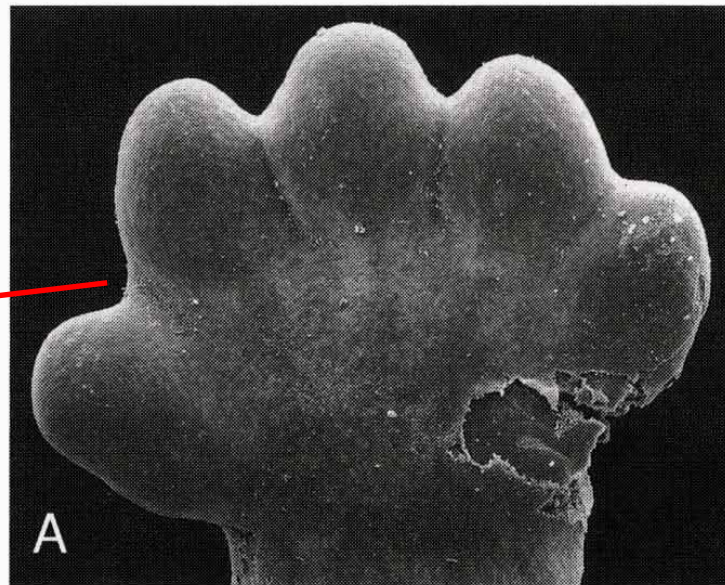
- Retinoic Acid
sonic hedgehog

Dorsoventral



- Wnt-7
- Engrailed-1
- Lmx1

areas of apoptosis





Limb rotation
(10th week)