Embryology I

Steven McLoon
Department of Neuroscience
University of Minnesota

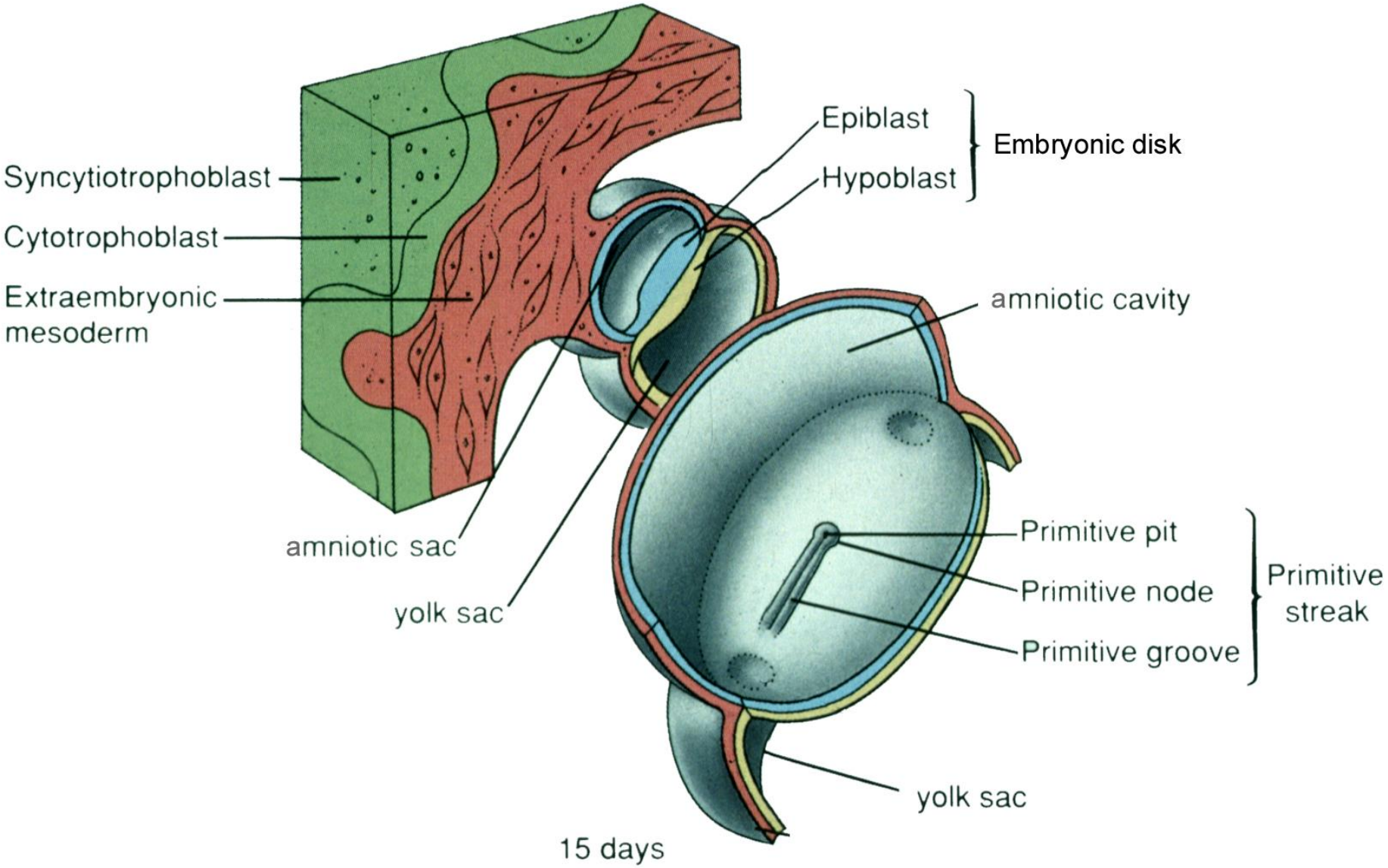
Coffee Hour

Friday (Sept 14) 8:30-9:30am

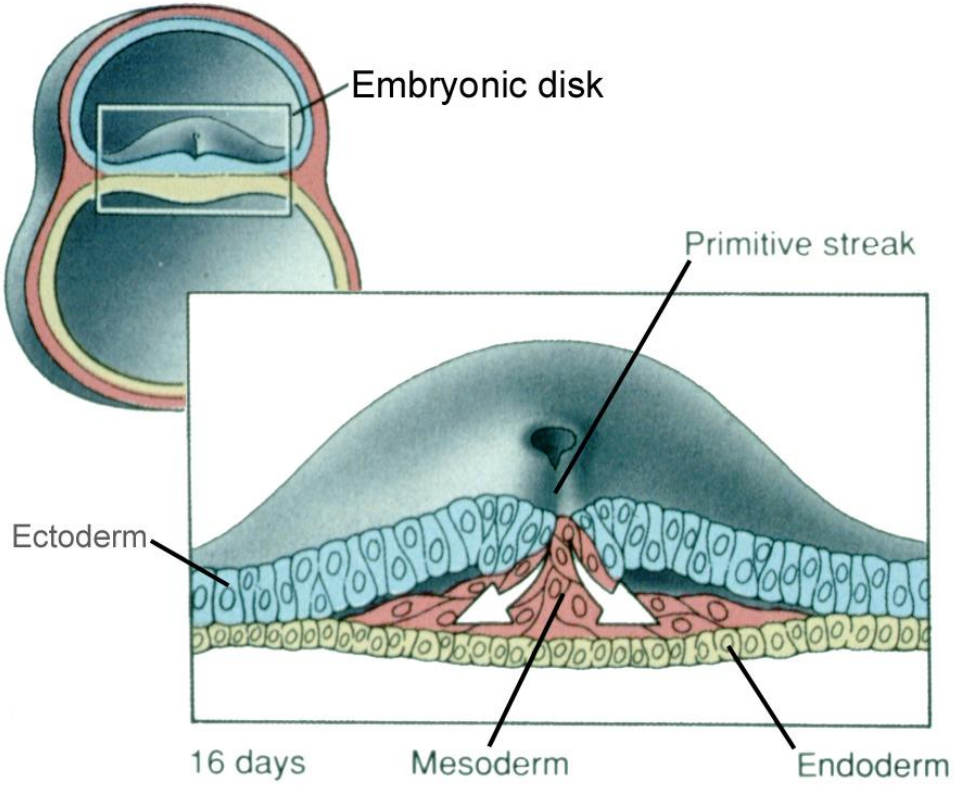
Surdyk’s Café in Northrop Auditorium

Stop by for a minute or an hour!

In the blastula stage embryo, the embryonic disk has two layers.



During gastrulation, epiblast cells migrate through the primitive streak to form a three layered embryo.



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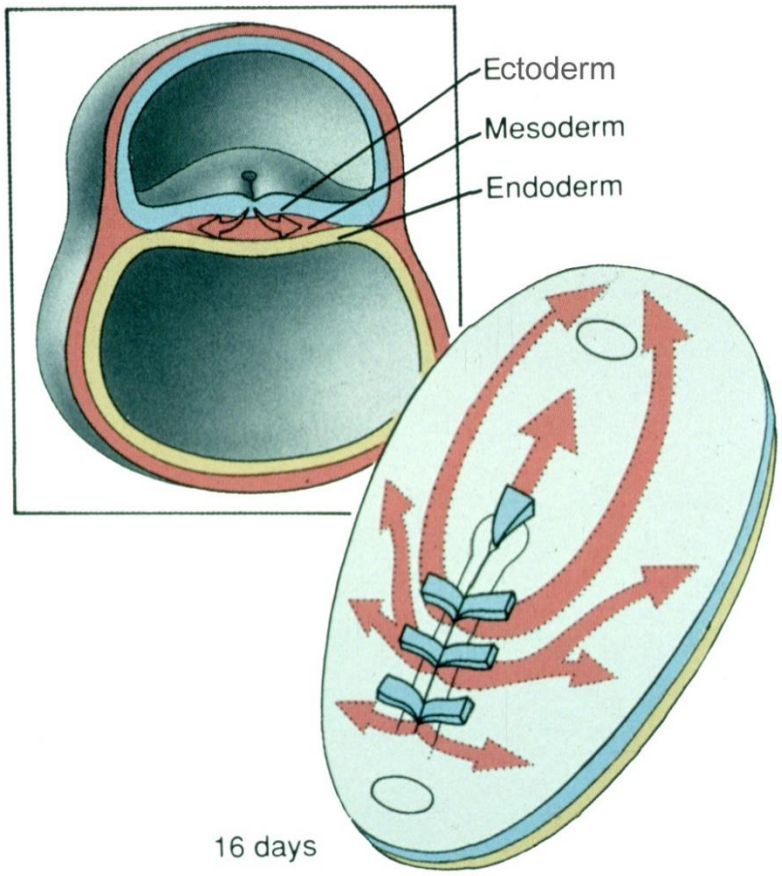
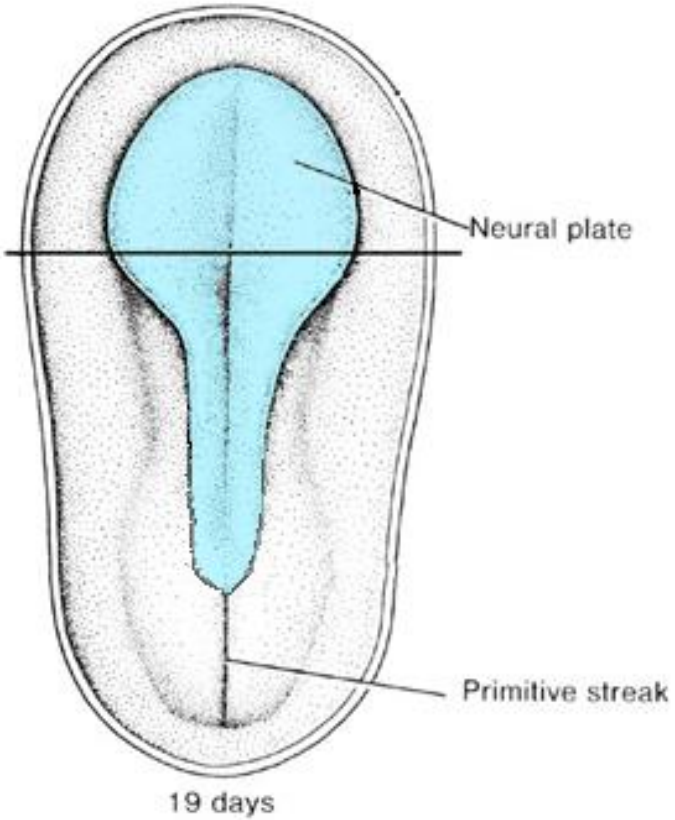
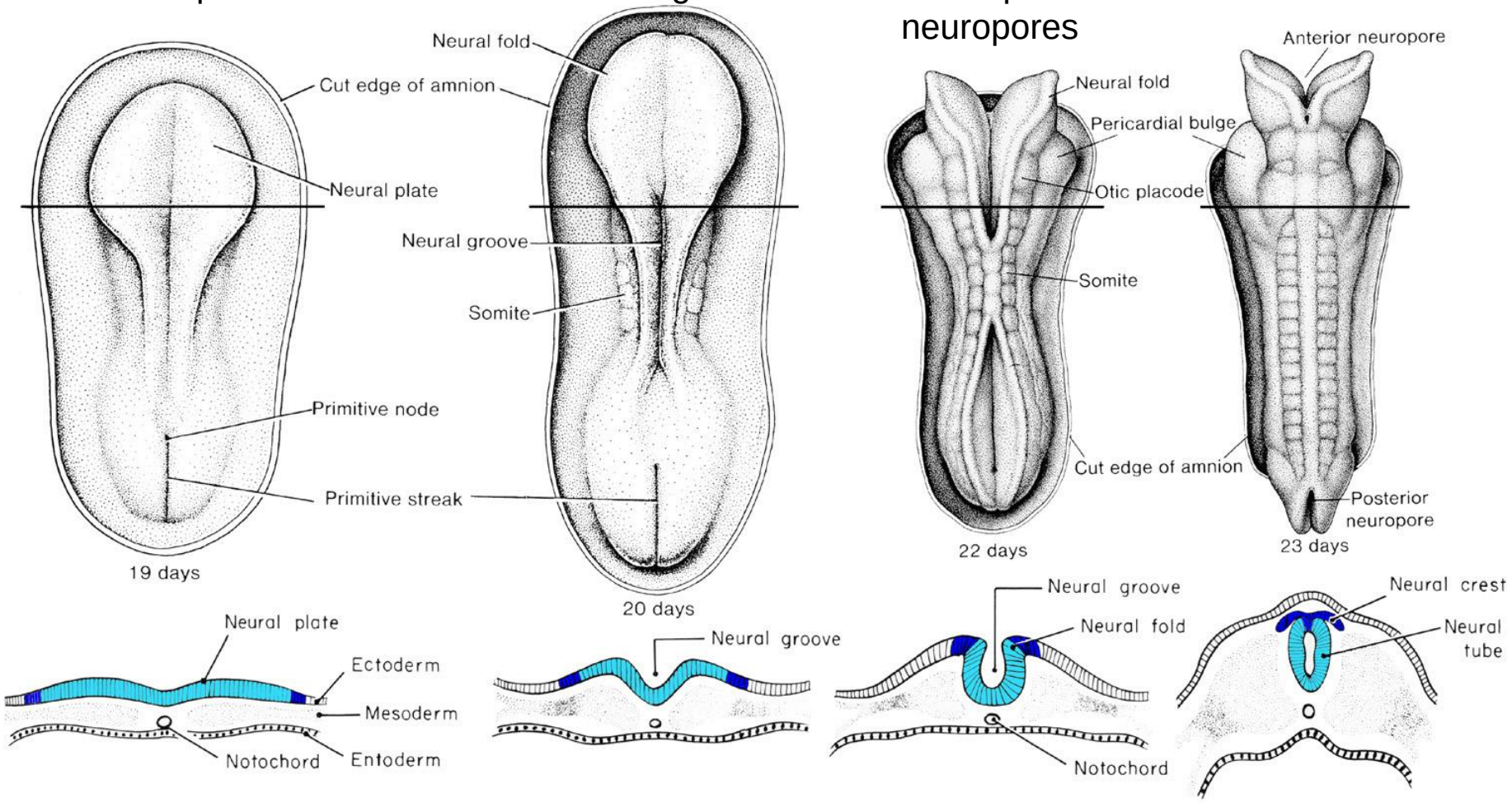


Factors from the midline mesoderm induce nervous system in the overlying ectoderm, and the neural plate forms from ectoderm.



During neurulation, the neural tube develops from the neural plate.

neural plate | neural groove | anterior & posterior neuropores | neural tube



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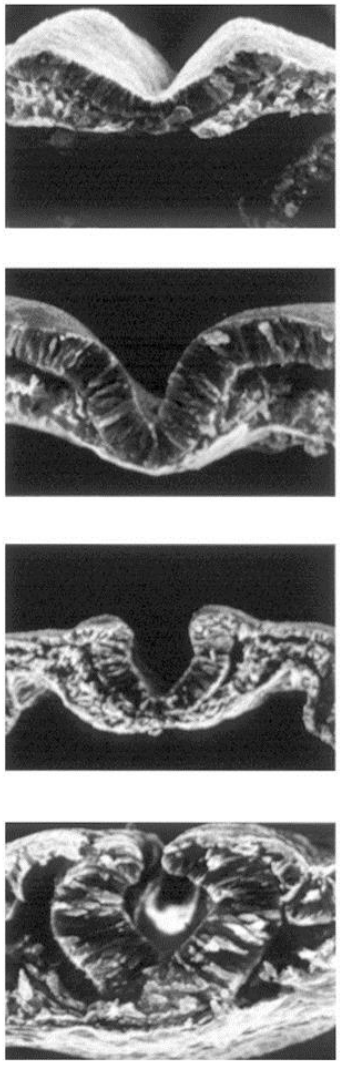
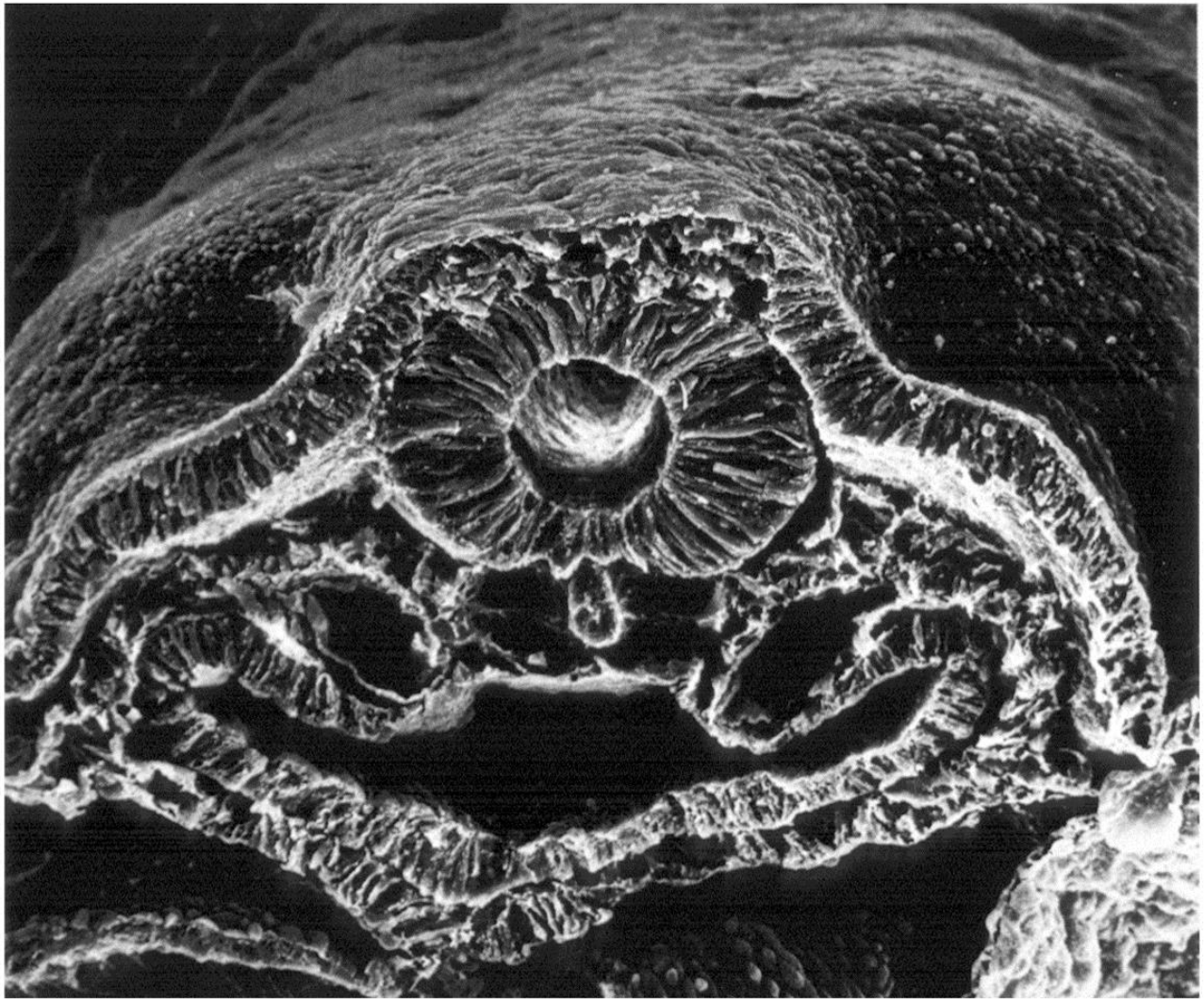
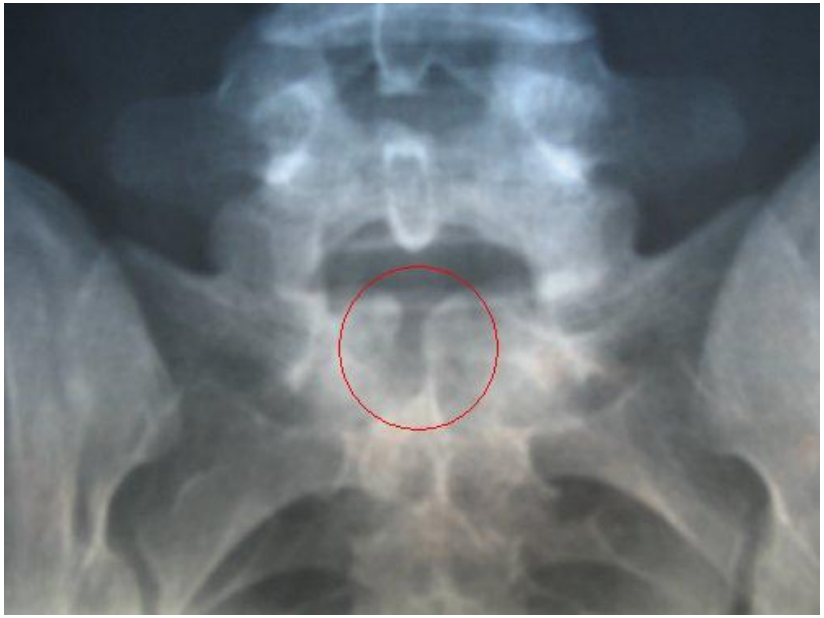
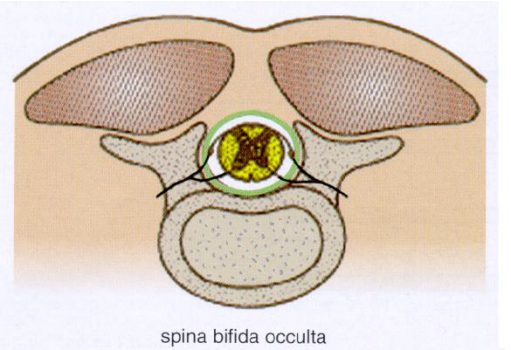


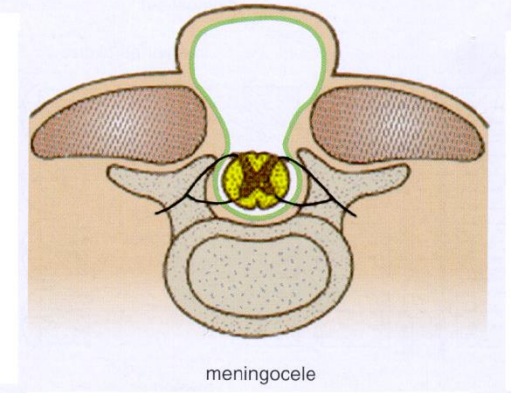


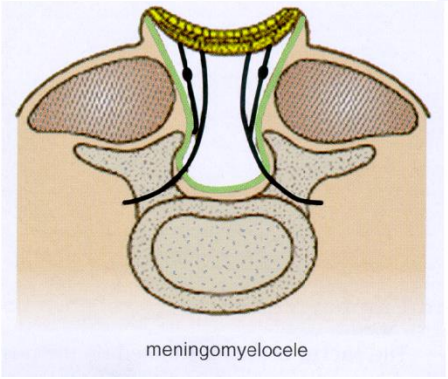
Incomplete closure of the neural tube is a common birth defect.

- Spina bifida:
- Incomplete closure of the spinal neural tube and/or the spine.
- The severity of the defect is variable and most often is of no consequence.
- ~1 in 50 live births exhibit spina bifida occulta, making this one of the most common birth defects.





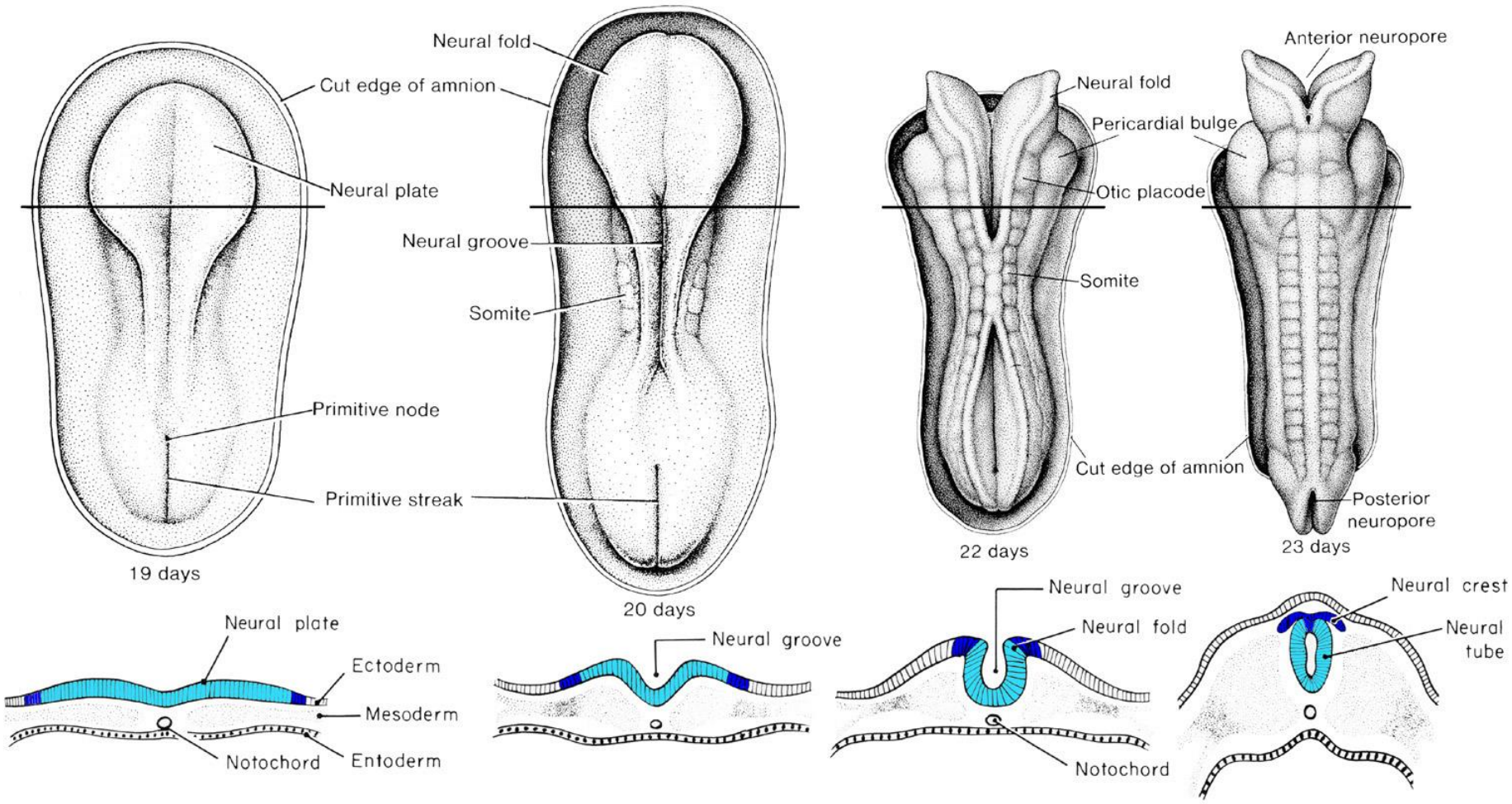




Incomplete closure of the neural tube is a common birth defect.

- Anencephaly = incomplete closure of the brain end of the neural tube
- Rare and lethal.

Three swellings at the rostral end of the early neural tube are the primary brain vesicles.



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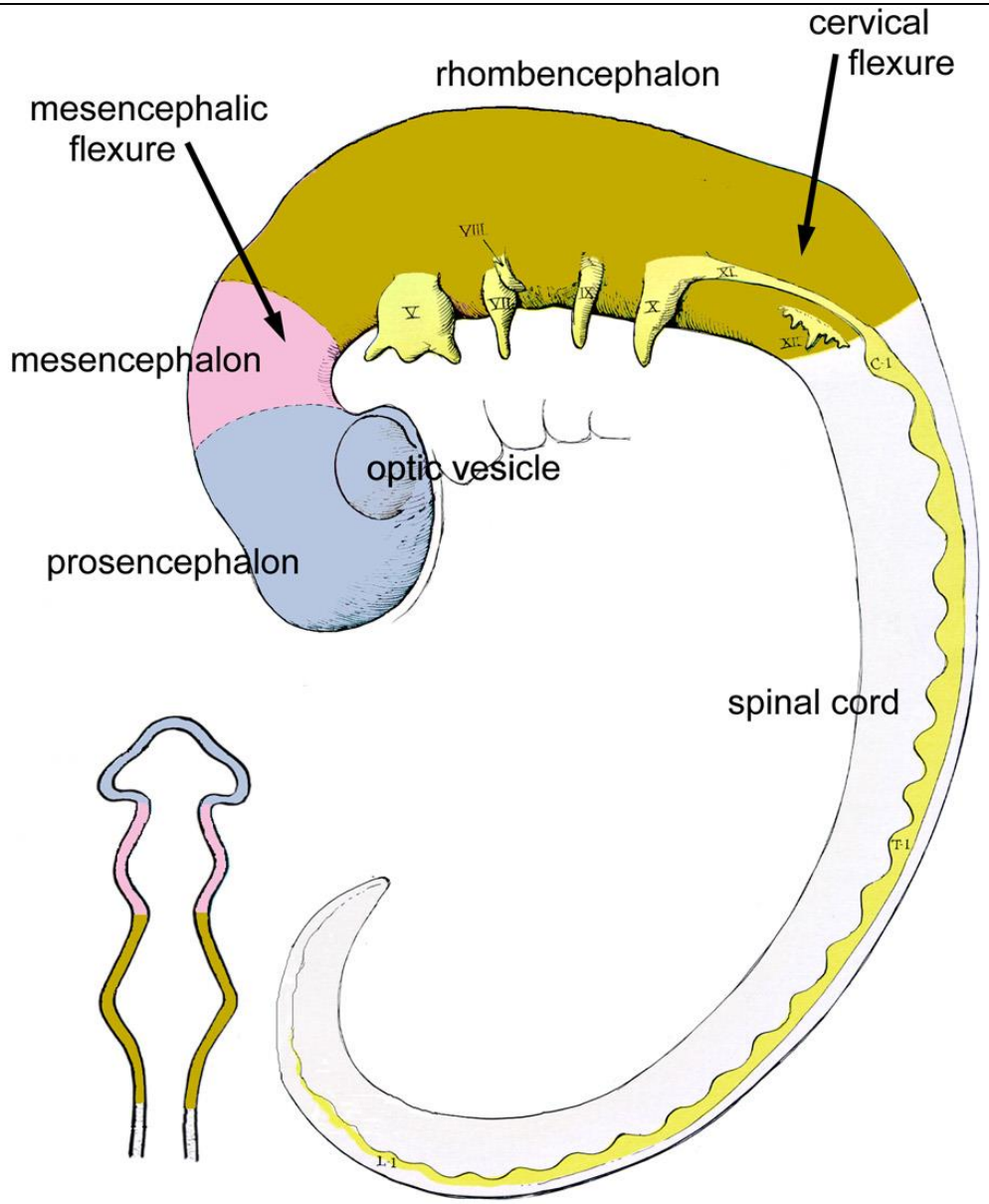
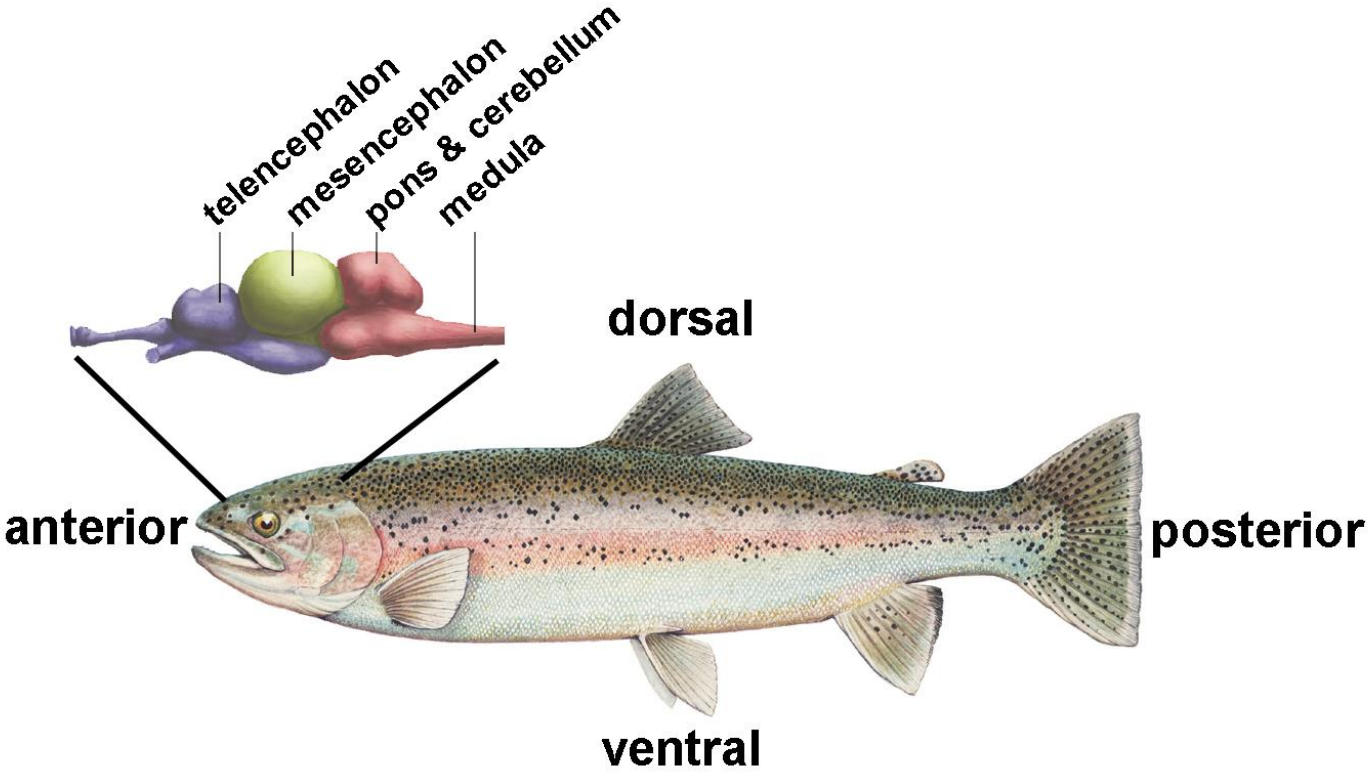


Flexures allow us to stand upright.



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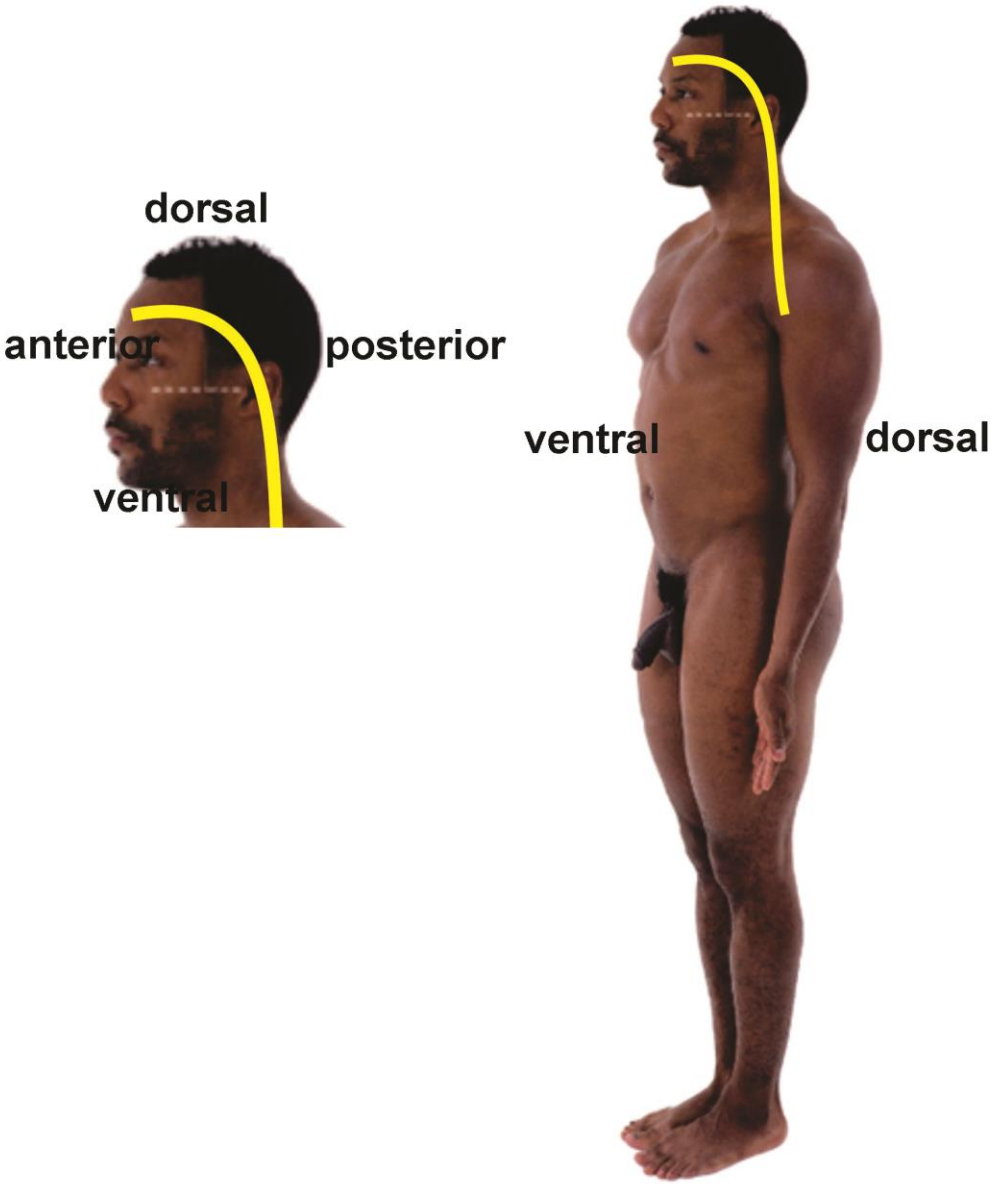
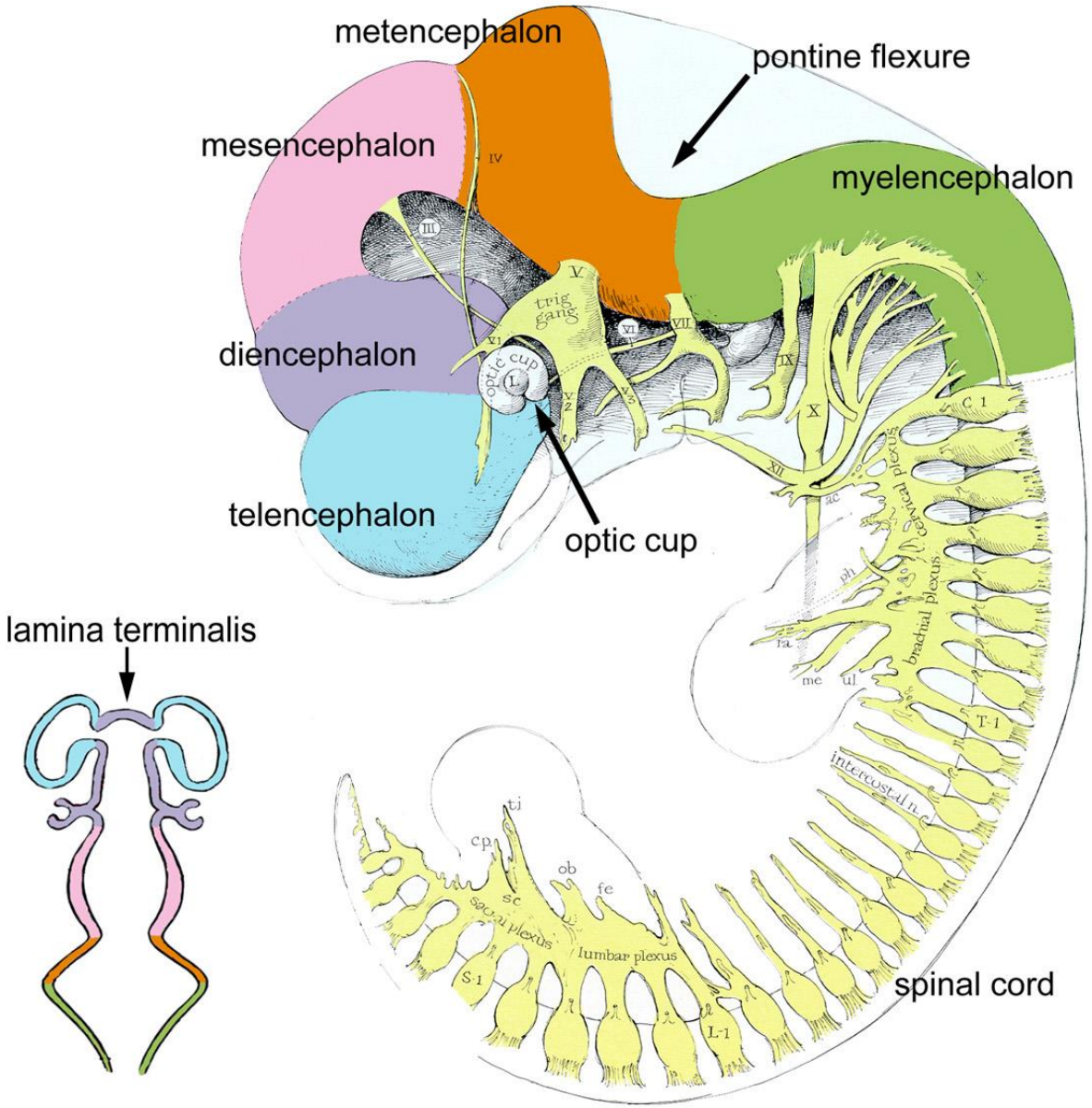
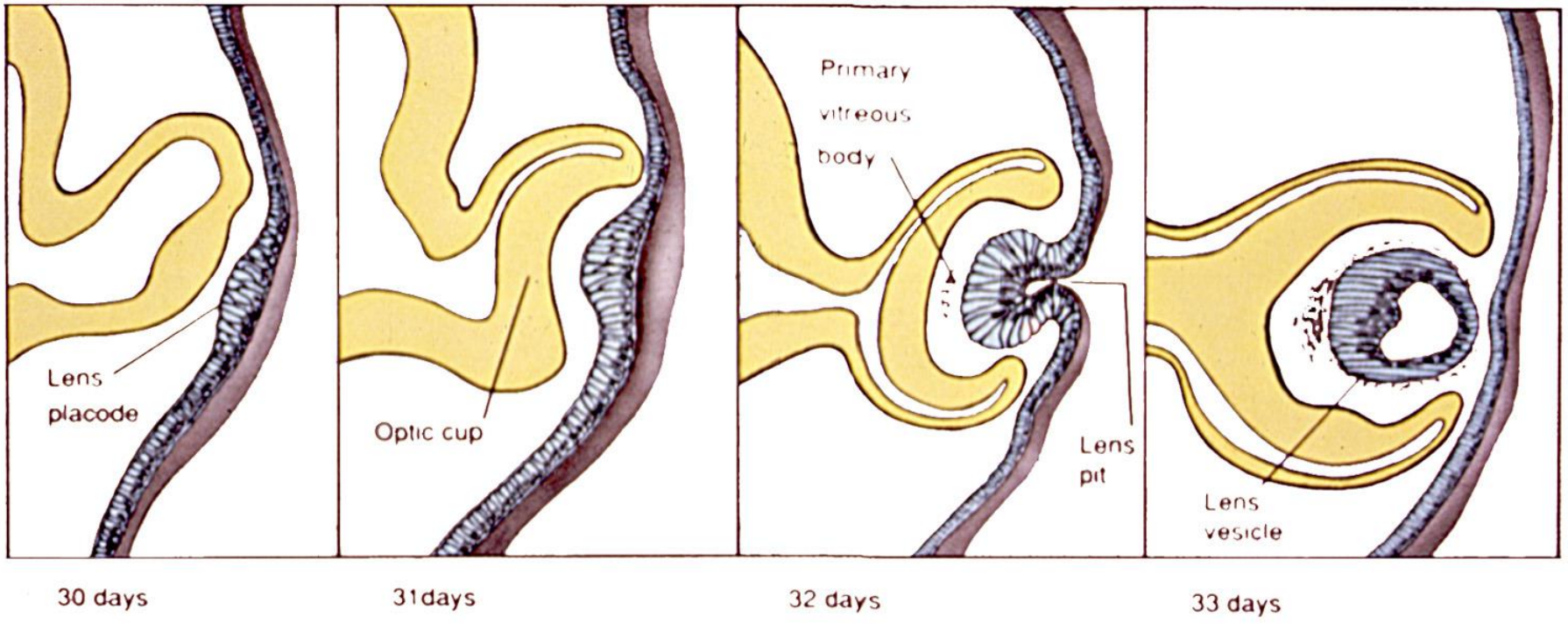


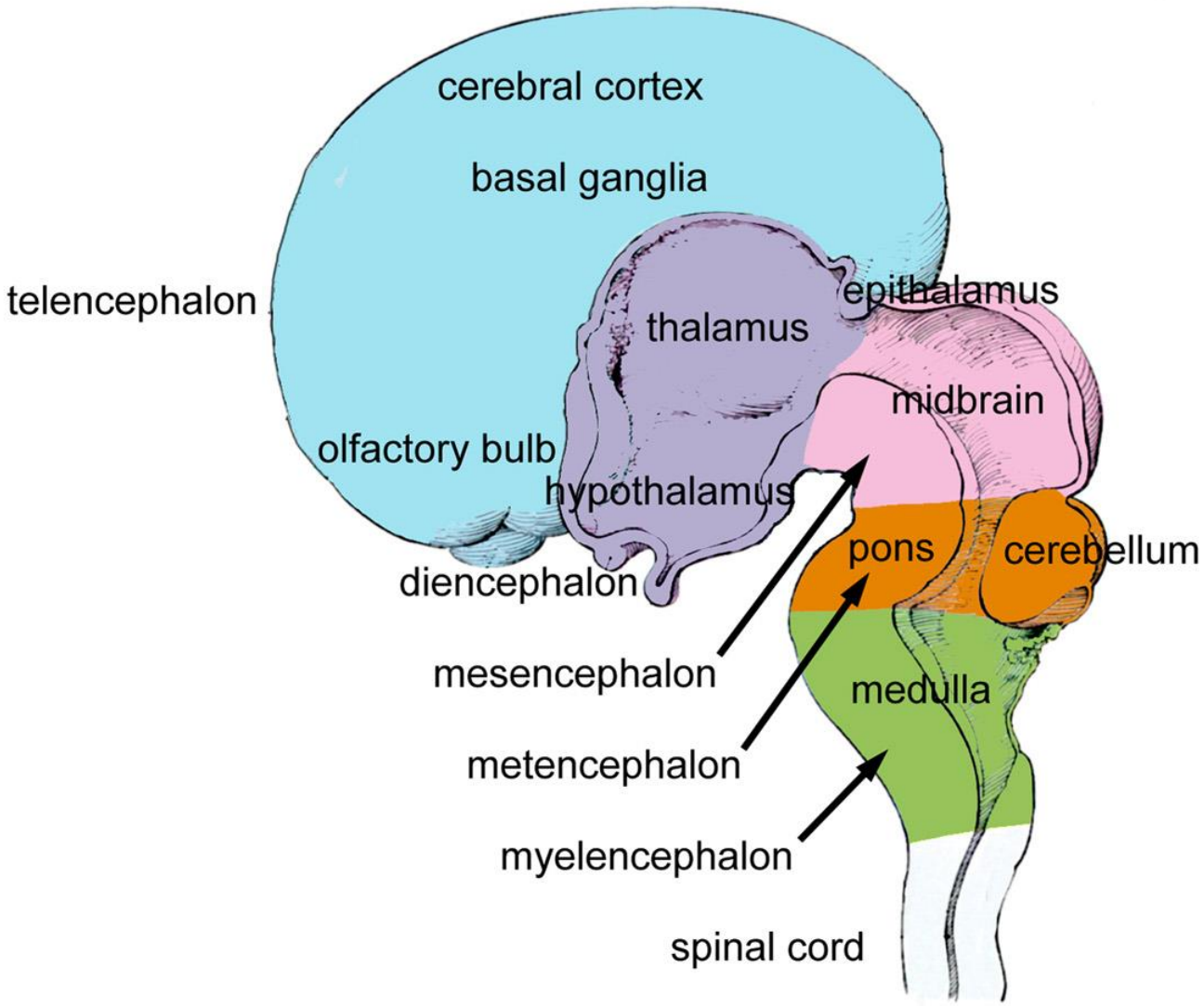
Additional changes form the secondary brain vesicles and optic vesicles.

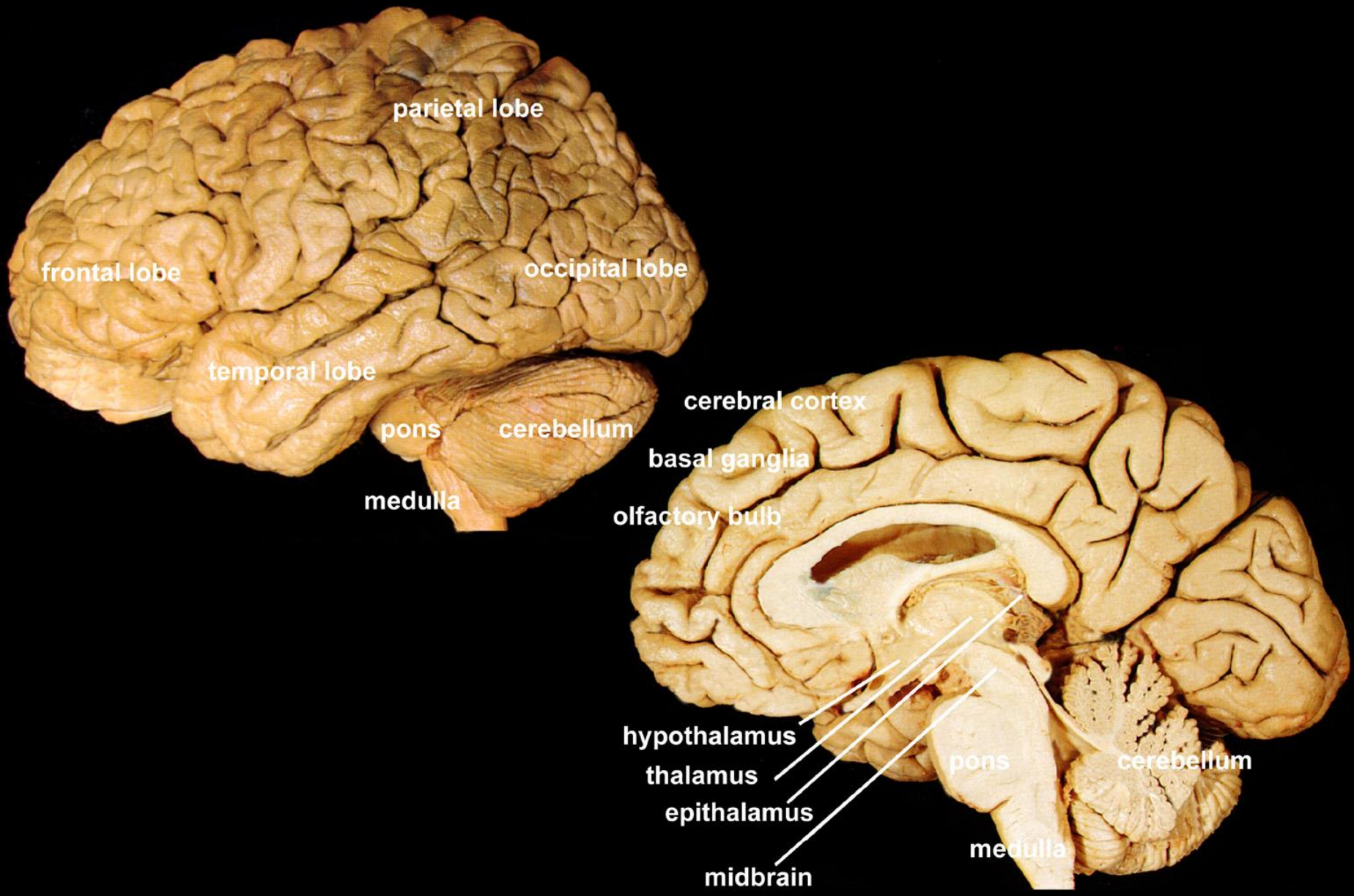


Optic vesicles give rise to neural retina & pigment epithelium.

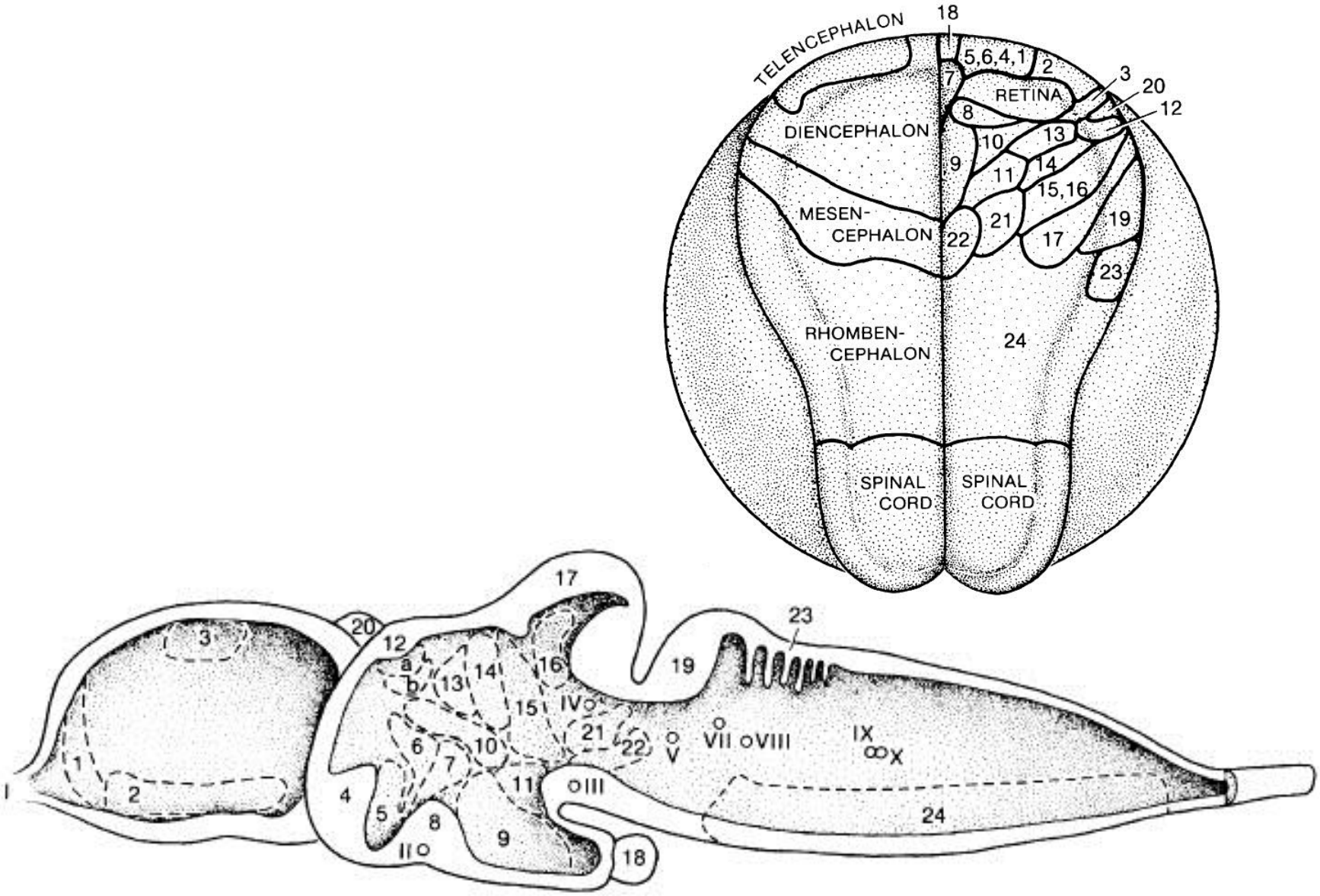


Each major adult brain region develops from one of the secondary brain vesicles.



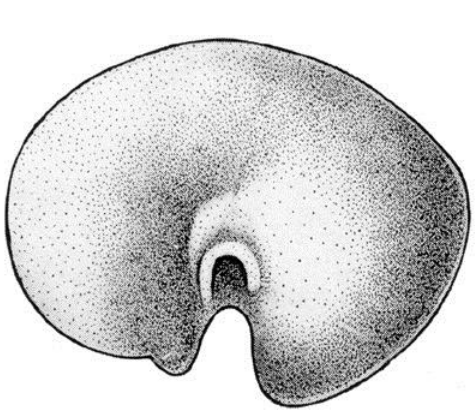

parietal lobe
frontal lobe
occipital lobe
temporal lobe
pons
cerebellum
medulla
cerebral cortex
basal ganglia
olfactory bulb
hypothalamus
thalamus
epithalamus
midbrain
pons
cerebellum
medulla

The entire nervous system develops from the neural plate.

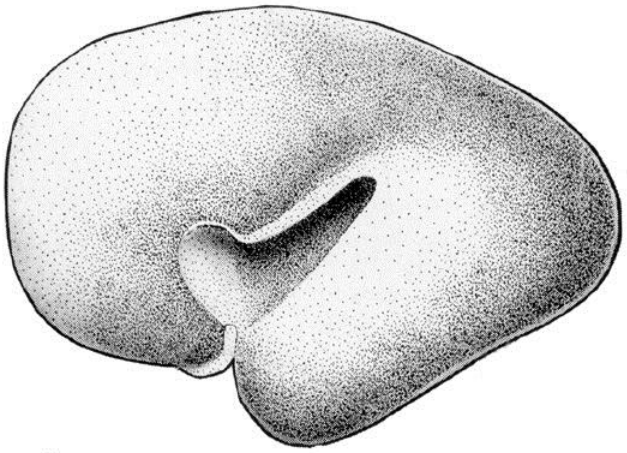


The telencephalon grows posterior then anterior.

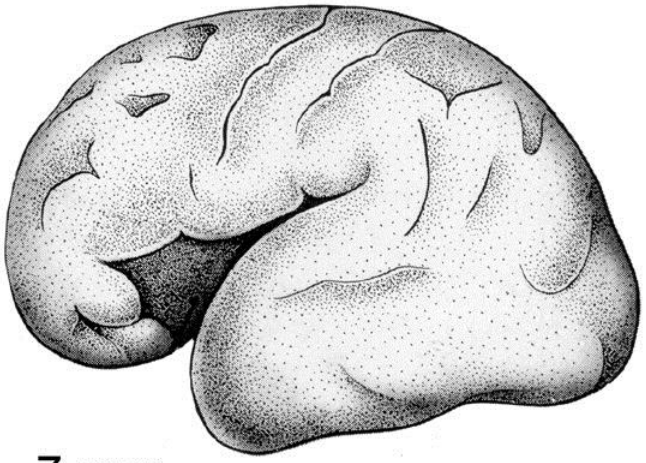
- The “ram’s horn” pattern of growth of the telencephalic vesicle creates the temporal lobe.



3 mos.



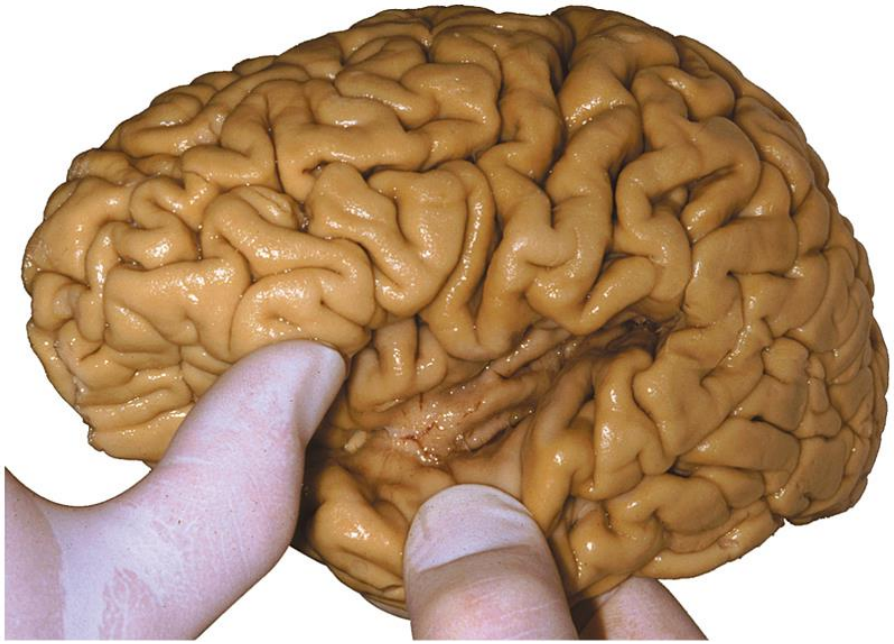
5 mos.



7 mos.

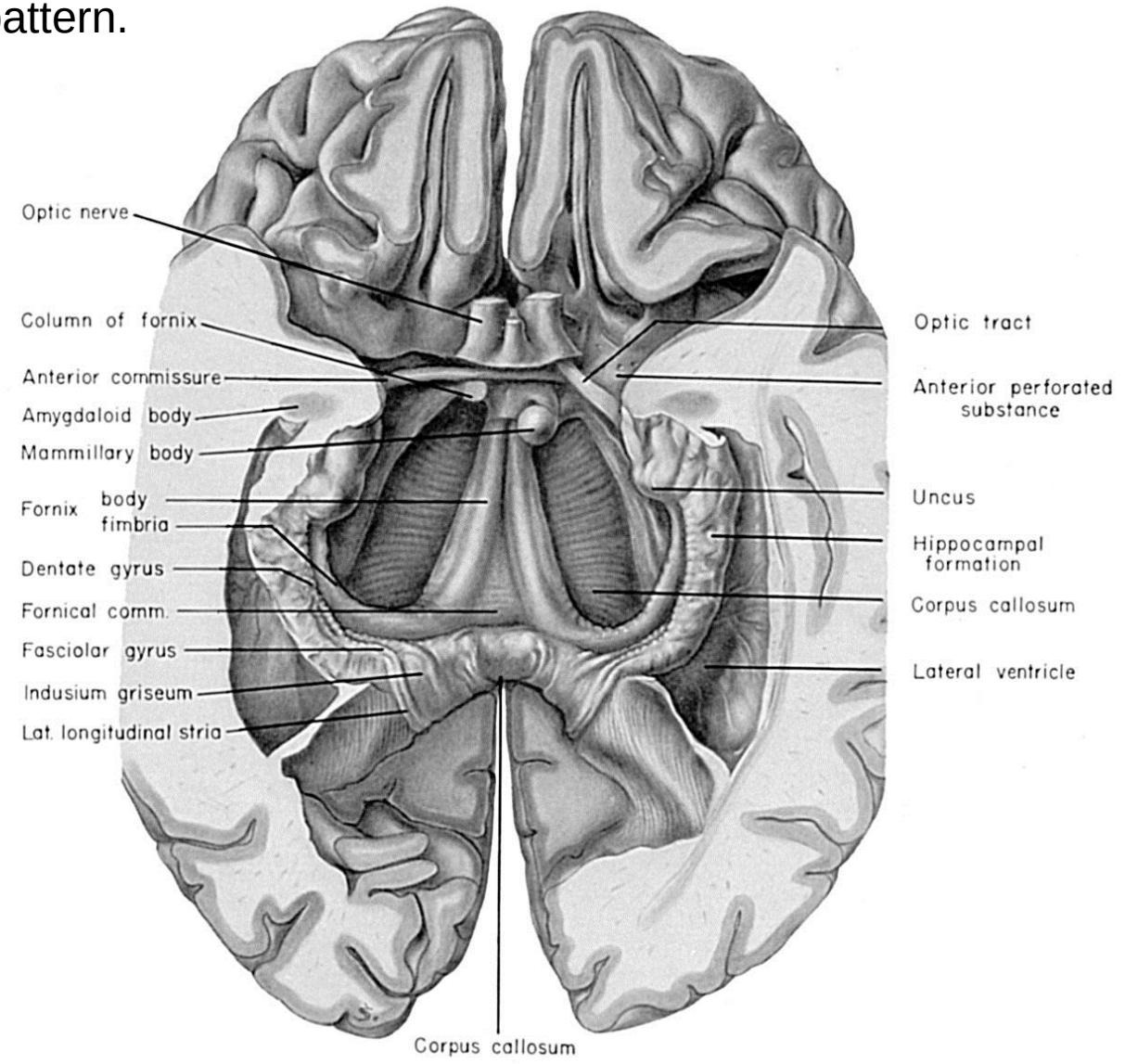
The telencephalon grows posterior then anterior.

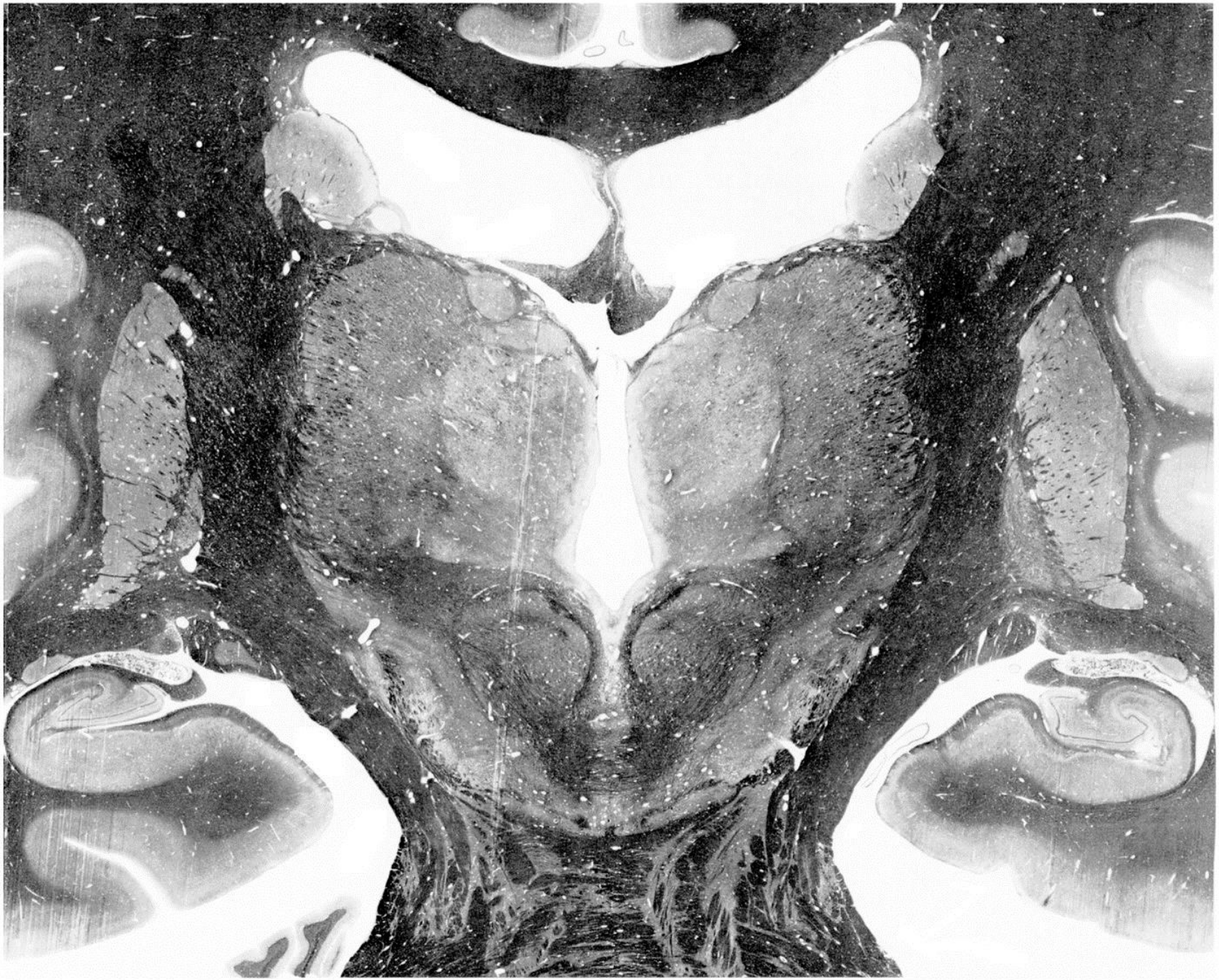
- The temporal lobe covers the insula.



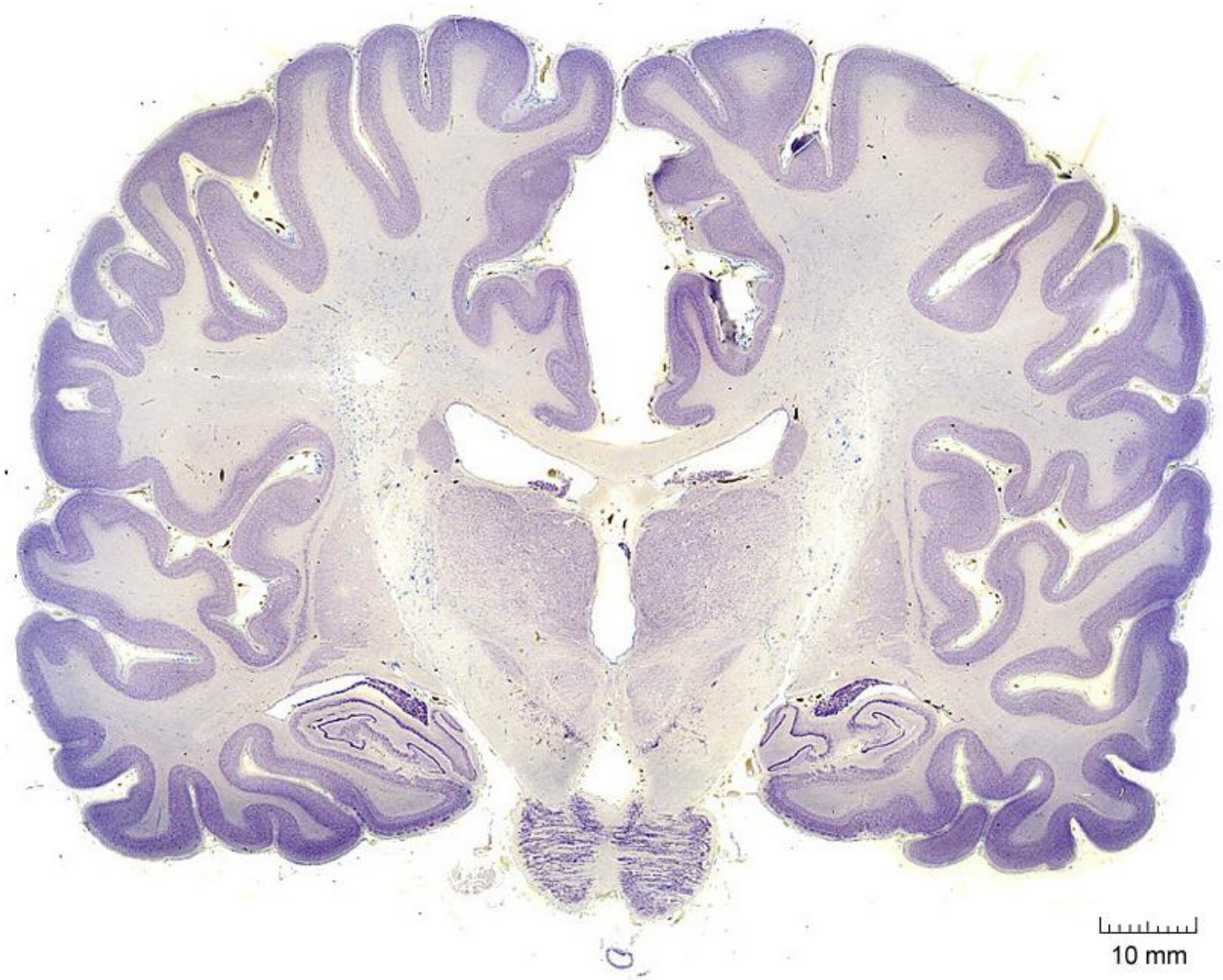
The telencephalon grows posterior then anterior.

- Other adult brain structures exhibit the “ram’s horn” pattern.





The lumen of the neural tube persists as the ventricular system of the adult brain.



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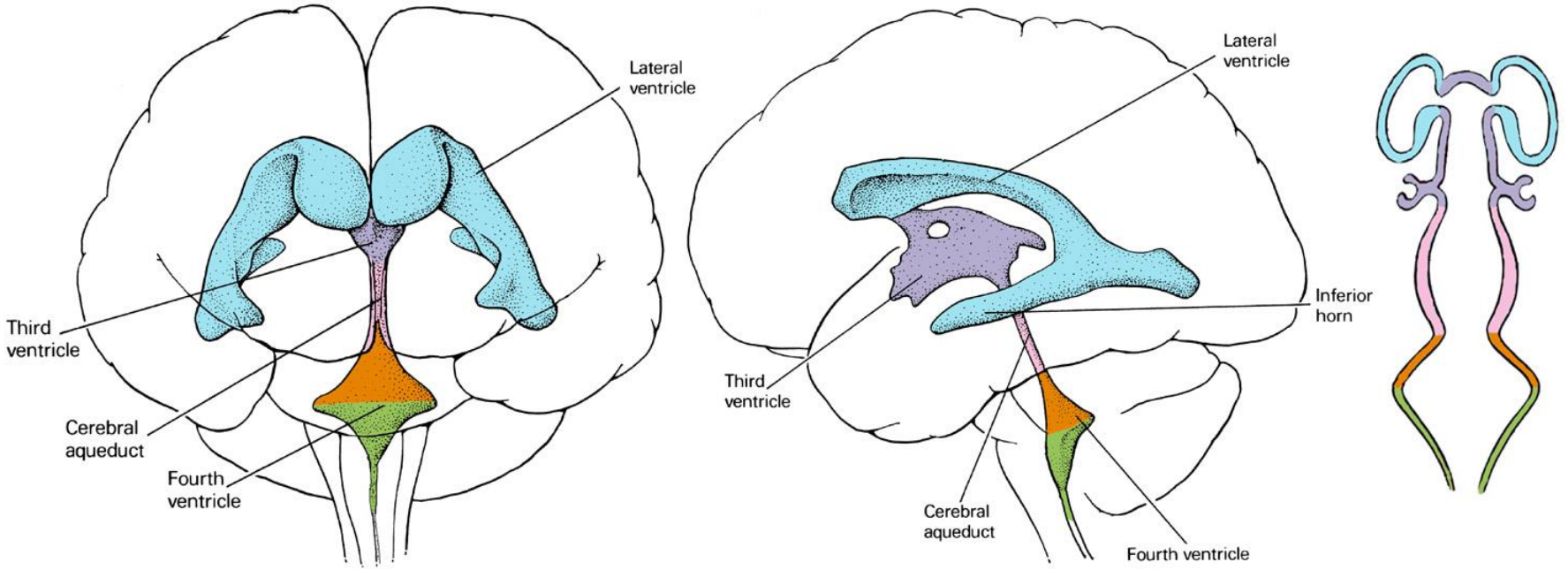
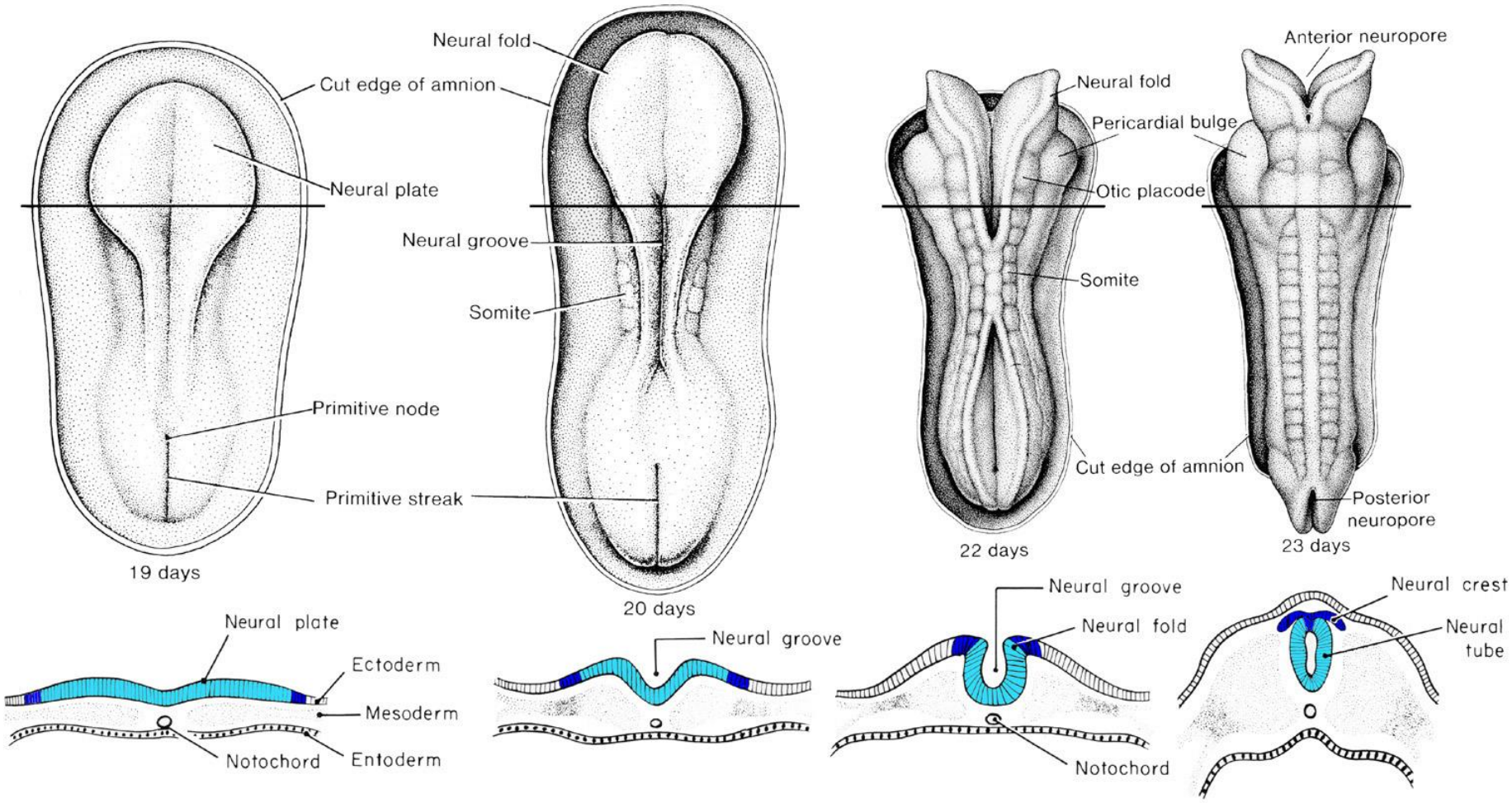


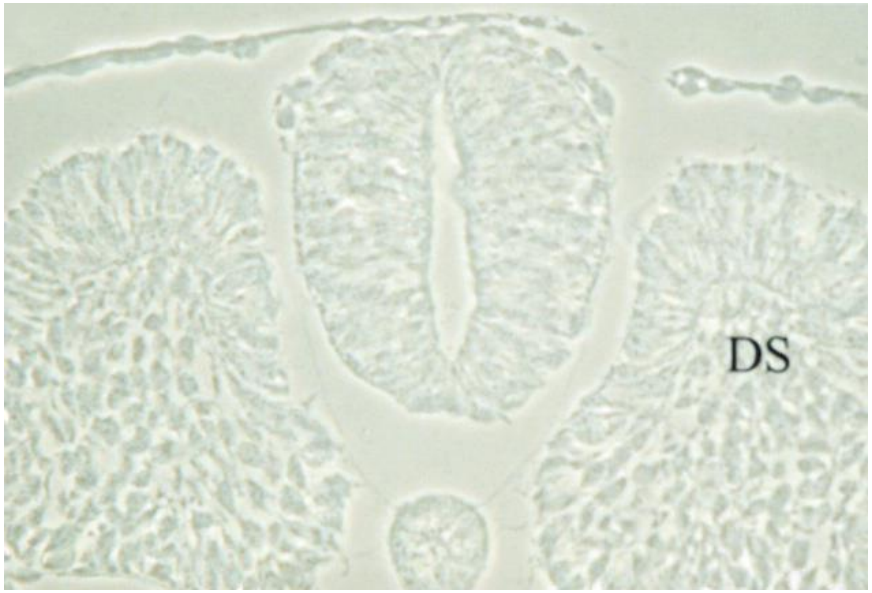
Neural Crest

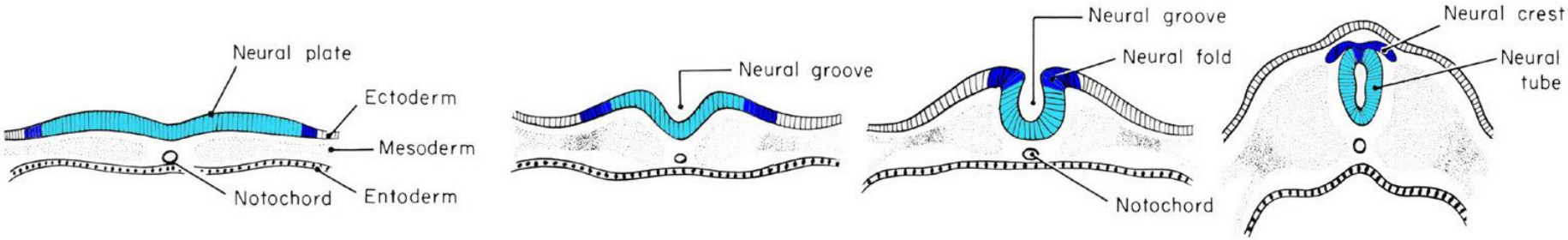
- The neural crest develops from cells at the margin of the neural plate.



Neural Crest

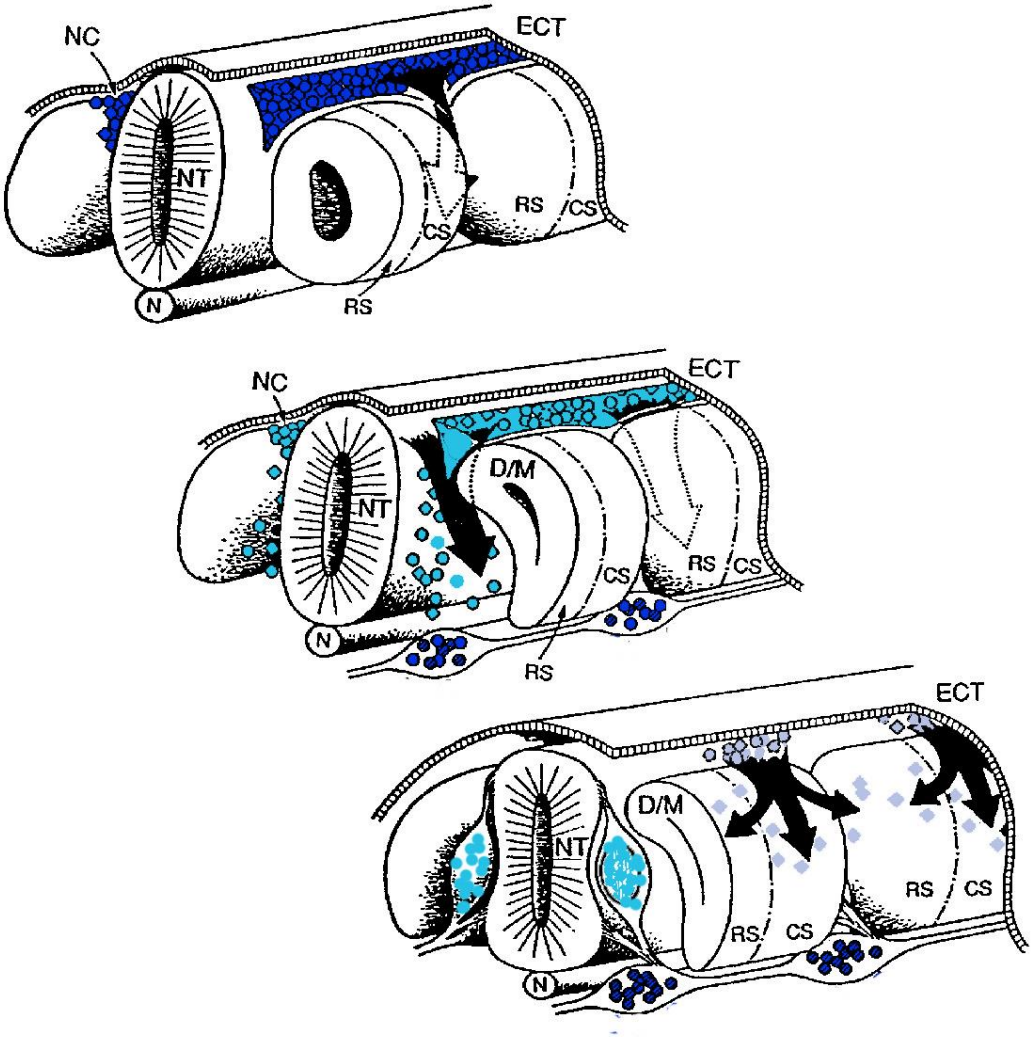
- Cells delaminate from the dorsal neural tube to form the neural crests.





Neural Crest

• Neural crest cells migrate throughout the body and develop into most of the cells of the peripheral nervous system, as well as other cell types.



Neural Crest

- Crest derivatives:

neurons
- most cranial nerve sensory ganglia
- dorsal root ganglia
- sympathetic ganglia
- parasympathetic ganglia
- enteric neurons

glia
- schwann cells of nerves
- satellite cells of ganglia

neurosecretory cells
- thyroid calcitonin (C) cells
- adrenal medulla cells

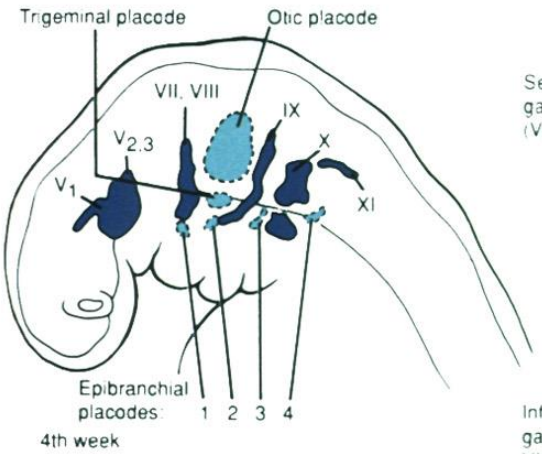
melanocytes

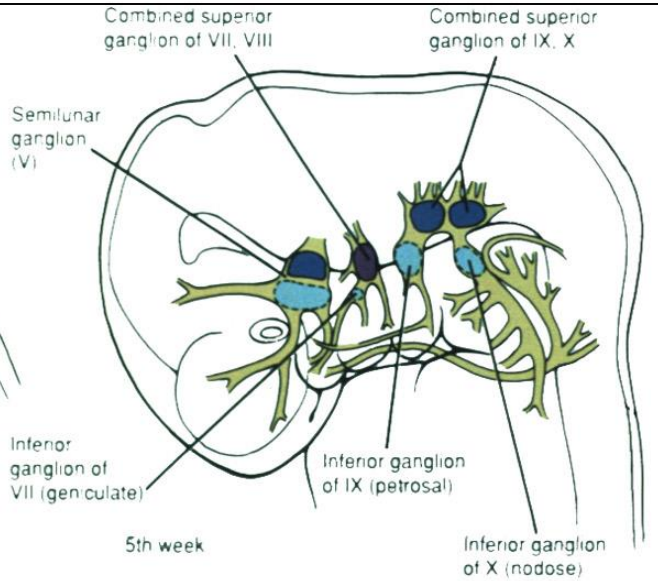
some skeletal and connective tissue of head and face

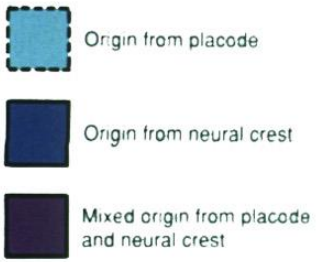
muscles
- ciliary muscle of eye
- muscle of cranial blood vessels and dermis

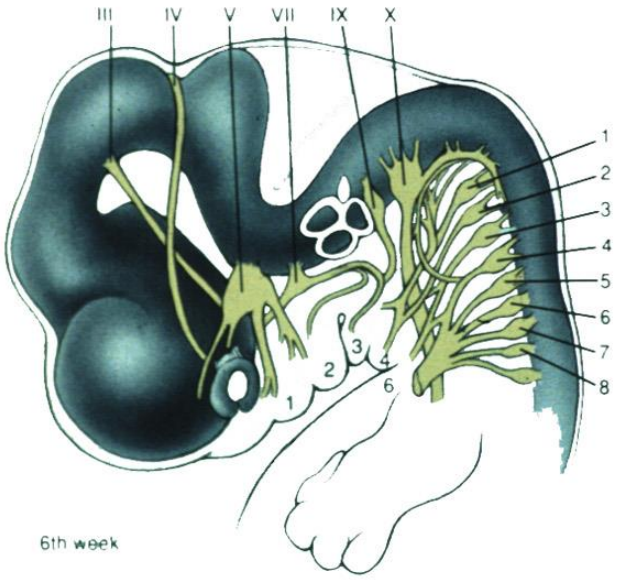
mesenchyme of thyroid, parathyroid & salivary glands

Neural placodes give rise to some neurons of cranial nerve sensory ganglia.









Origin of the Nervous System