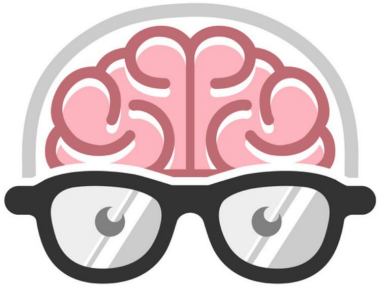


Development of cerebrum & cerebellum

Neuroanatomy block-Embryology-Lecture 2

Editing file

Anatomy team
med 438

MED438
KING SAUD UNIVERSITY

Reviewed by: Razan AlRabah & Ibrahim AlDakhil

Objectives

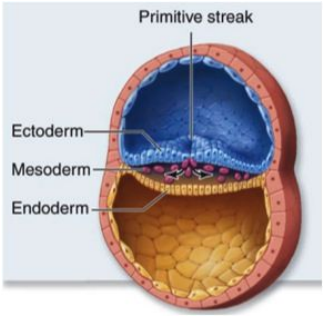
At the end of the lecture, students should be able to:

- **Describe the formation of the neural tube.**
- **List the 3 brain vesicles and their derivatives.**
- **Describe the brain flexures.**
- **Describe briefly the development of the cerebrum.**
- **Describe briefly the development of the cerebellum.**

Introduction

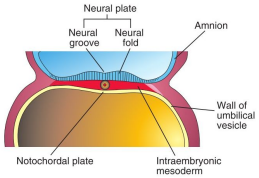
By the beginning of the **3rd week** of development, three germ cell layers become established.

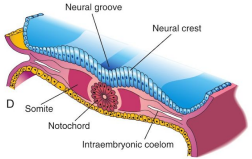
Ectoderm — Mesoderm — Endoderm

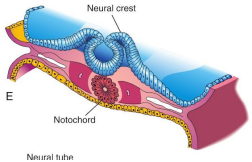


Early development

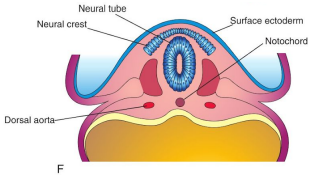
During the middle of the 3rd week(16-17 days) the dorsal midline ectoderm undergoes thickening to form the neural plate (neuroectoderm).







- The 2 margins of the plate elevate, forming neural folds
- A longitudinal, midline depression, called the neural groove is formed.



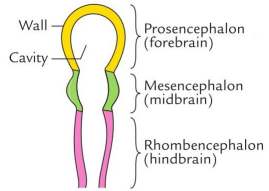
- The 2 neural folds approximate then fuse together, thus sealing the neural groove and creating the neural tube. (complete close).
- Formation of neural tube is completed by the middle of 4th week

Neural Tube Development

end of 4th week

Three- primary brain vesicles stage , Neural tube upper end dilates and shows 3 vesicles:

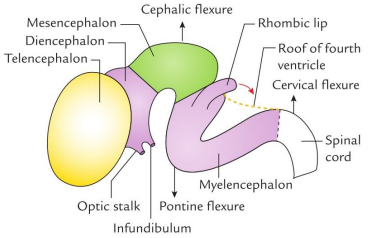
- Prosencephalon (Forebrain)
- Mesencephalon (Midbrain)
- Rhombencephalon (Hindbrain)



by 4th week

The neural tube grows rapidly and faster than the cranial cavity. So it bends twice ventrally, producing two flexures. later on it bend once dorsally producing 3rd flexures :

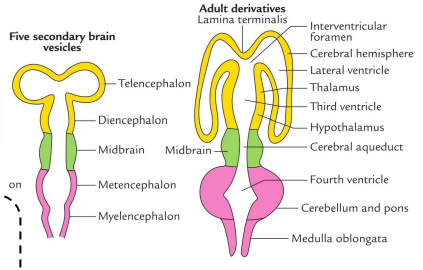
- *Midbrain flexure*: (cephalic) between the prosencephalon & the mesencephalon (midbrain)
- *Cervical flexure*: between the Rhombencephalon (hindbrain) & the spinal cord
- Later *Pontine flexure*: appears in the hindbrain, in the **opposite direction**, resulting in thinning of the roof of the hindbrain.



5th week

five secondary brain vesicles stage

- **Prosen**cephalon divides into:
  - 2 lateral **Telen**cephalon (cerebral hemisphere)
  - 1 medial **Dien**cephalon (Thalamus family)
- **Mes**encephalon (Midbrain)
- **Rhomben**cephalon divides into:
  - **Meten**cephalon (Pons - Cerebellum)
  - **Myelen**cephalon (Medulla oblongata)



Differentiation of Forebrain Vesicle:

-The lumen gives the 2 lateral ventricles and the (median)3rd ventricle Both cavities communicating with each other through a wide interventricular foramen.

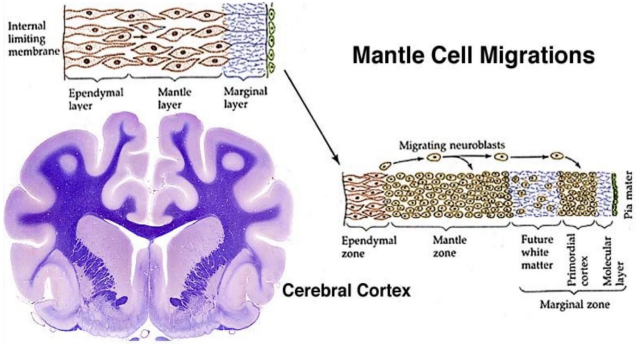
-The cerebral hemispheres expand in all directions .

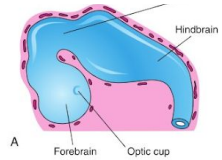
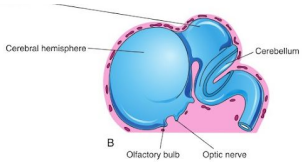
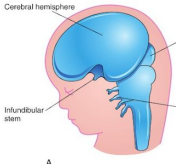
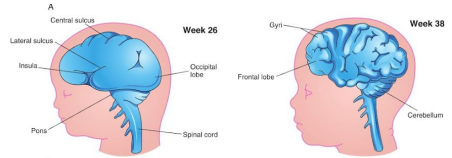
- Its medial wall becomes thin, flat and it is the site of choroid plexus of the lateral ventricle.

Development of the cerebrum

- The cerebrum develops from the Telencephalon.

The wall of the telencephalon is formed of 3 layers from inwards to outwards they are :		
Ependymal	**Mantel**	**Marginal**
lining the cavity of the lateral ventricle.	nerve cells forming the grey matter	nerve fibers forming the white matter
As development proceeds the following changes occur: Most of the nerve cells in mantle layer migrate to the marginal layer forming the cerebral cortex. Some cells do not migrate and remains to form the basal ganglia		

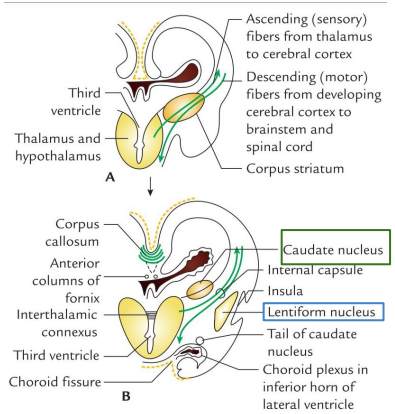


Day 32	Week 16	End of 3rd month	4th month
the cerebral hemisphere first appear as a pair of bubble-like outgrowth of the telencephalon	the rapidly growing hemispheres are oval and have expanded back to cover the diencephalon.	the surfaces of the cerebral hemispheres are smooth.	the grey matter grows faster than the white matter, so, the cortex becomes folded into gyri separated by sulci. The gyri and sulci effectively increase the surface area of the brain. The detailed pattern of gyri & sulci varies to some extend from individual to individual.
			

Development of the cerebrum (cont.)

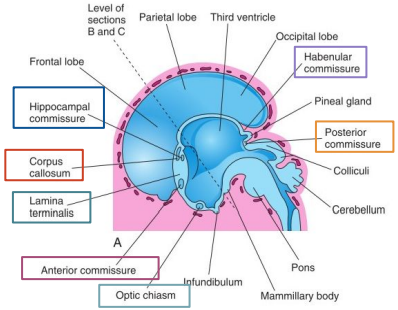
Development of Corpus striatum :

- It appears in 6th week in the floor of each cerebral hemisphere. As the cerebral cortex differentiates and the fibers passing to and from it, pass through the corpus striatum.
- The corpus striatum now divides into : caudate nucleus. lentiform nucleus
- This fiber pathway forms the internal capsule
- Further expansion of cerebral hemisphere gives C- shape appearance to the hemisphere itself as well as its cavity (lateral ventricle).
- Also the caudate nucleus elongates and assumes the shape of the lateral ventricle and remains related to it



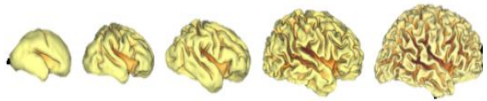
Development of cerebral commissures

- As the cerebral cortex develops, group of fibers, (commissures), connect the corresponding regions of the cortex. These are:
  - 1- Lamina terminalis.
  - 2-Optic chiasma.
  - 3- Anterior commissure
  - 4-Posterior commissure
  - 5-Hippocampal commissure.
  - 6-Habenular commissure.
  - 7-Corpus callosum.(is a major commissural fibres that connect the two cerebral hemispheres)



Development of insula

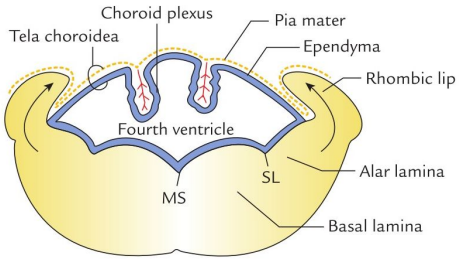
The cortex covering the surface of the **corpus striatum** grows relatively slower than the other cortices, so it is overgrown by the rest of the hemisphere and lies in the depth of the lateral sulcus. So, the insular lobe is a portion of cerebral cortex that has been hidden to lie deep within the lateral sulcus.



Development Of Cerebellum

It develops from the dorsal part of the Metencephalon
The metencephalon develops into the pons (anteriorly) and overlying Cerebellum (posteriorly)
Pontine flexure results in:

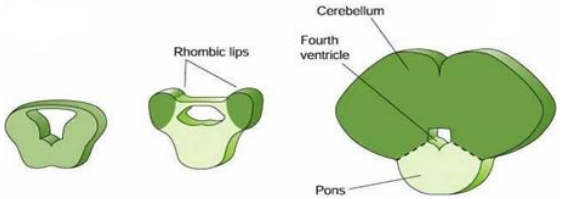
1- Moving the 2 alar plates laterally then pending medially
2- Stretching and thinning of the roof plate.
3- Widening of the cavity to form the 4th ventricle.



Metencephalon : Changes In Alar Plates

The dorsal parts thicken to form Rhombic lips, that will give rise to the cerebellum.
Some neuroblasts migrate from the mantle layer to the marginal layer and form the cerebellar cortex

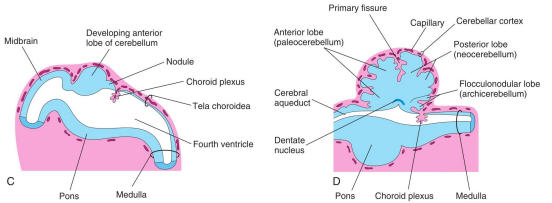
Others remains in the mantle layer and give rise to the cerebellar nuclei
The cerebellar peduncles develop later as the axons of the neurons of the cerebellar nuclei grow out to reach the brain stem.



The Surface Of The Cerebellum

As the cerebellar hemispheres develops they undergo a complicated process of transverse folding to form closely packed, leaf-like transverse gyri called folia.

These processes of fissure formation and foliation continue throughout embryonic, fetal, and postnatal life, and they vastly (extremely) increase the surface area of the cerebellar cortex.

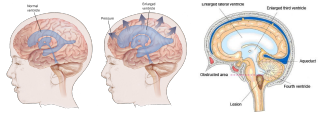


Congenital Anomalies of The Brain

The most Common Congenital Anomalies of The Brain

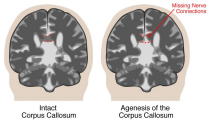
Hydrocephalus

The most common cause is a flow obstruction, by hindering the free passage of CSF through the ventricular system and subarachnoid space, like: **Aqueductal stenosis and brain tumours.**



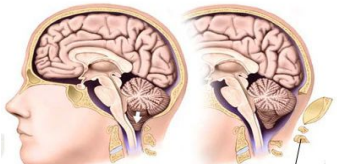
Cranium bifidum with or without meningocele & meningoencephalocele.

Agenesis of corpus callosum



Microcephaly (abnormal small head associated with incomplete brain development).

Arnold-Chiari malformation: (herniated part of cerebellum through the foramen magnum leading to CSF obstruction. ,so hydrocephalus results),



Most of the Anomalies Manifested by

- Seizures (changes in electrical activity).
- Mental retardation.
- Cerebral palsy

Anencephaly: the brain and skull are minute and the infant does not survive. It is due to failure of closure of the cranial neuropore of the neural tube. The frequency of this case 1:1000.

Practice

Q1: The distinguish of five secondary brain vesicles from the primary vesicles is in:

A. 3rd month

B. 5th month

C. 3rd week

D. 5th week

Q2: Surfaces of the cerebral hemispheres are smooth in the:

A. Beginning of 3rd month

B. End of 4th month

C. 6th week

D. beginning of 4th month

Q3: Metencephalon develops into:

A. Medulla

B. Pons and cerebellum.

C. Midbrain

D. A&C

Q4: Telencephalon develops into:

A. Thalamus

B. Midbrain

C. Cerebral hemisphere

D. Medulla.

Q5: Corpus striatum appears in the floor of each cerebral hemisphere in the:

A. 5th week

B. 4th week

C. 3rd week

D. 6th week

Q6: Processes of fissure formation and foliation:

A. stop at 3rd month

B. stop at 4th month

C. Continue through postnatal life

D. stop in 6th week.

Q7: nerve cells forming the grey matter called:

A. Marginal

B. Mantle

C. Ependymal

D. Lol

Q8 : is a major commissural fibers that connect the two cerebral hemisphere:

A. Anterior commissure

B. Posterior commissure

C. Corpus callosum

D. Hippocampal

Answers: Q1(D) Q2(A) Q3(B) Q4(C) Q5(D) Q6(C) Q7(B) Q8(C)

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med 438

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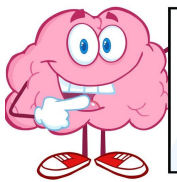

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Hmmm I wonder who reviewed this lecture, must be a great person

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most probably you don't need this