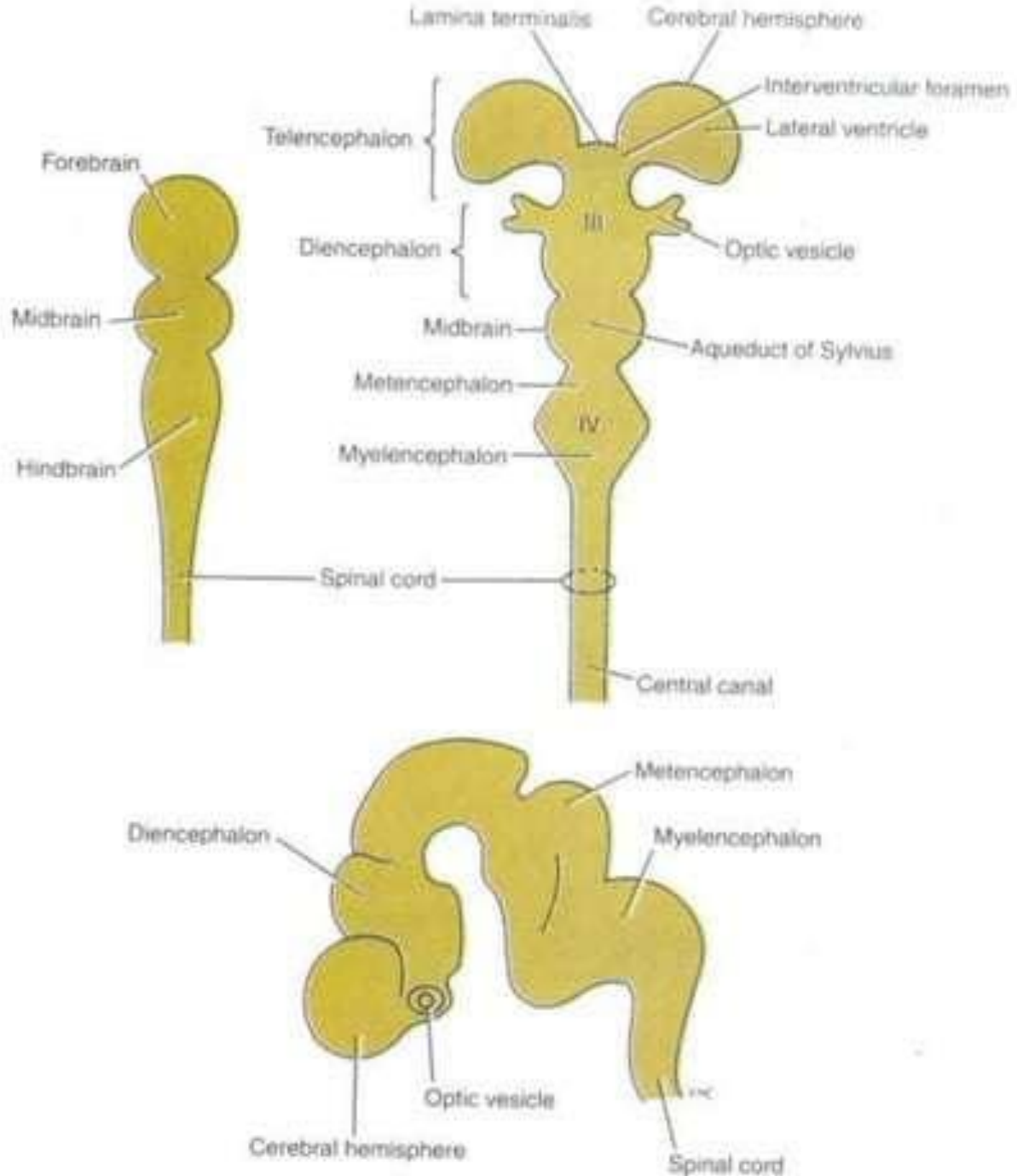
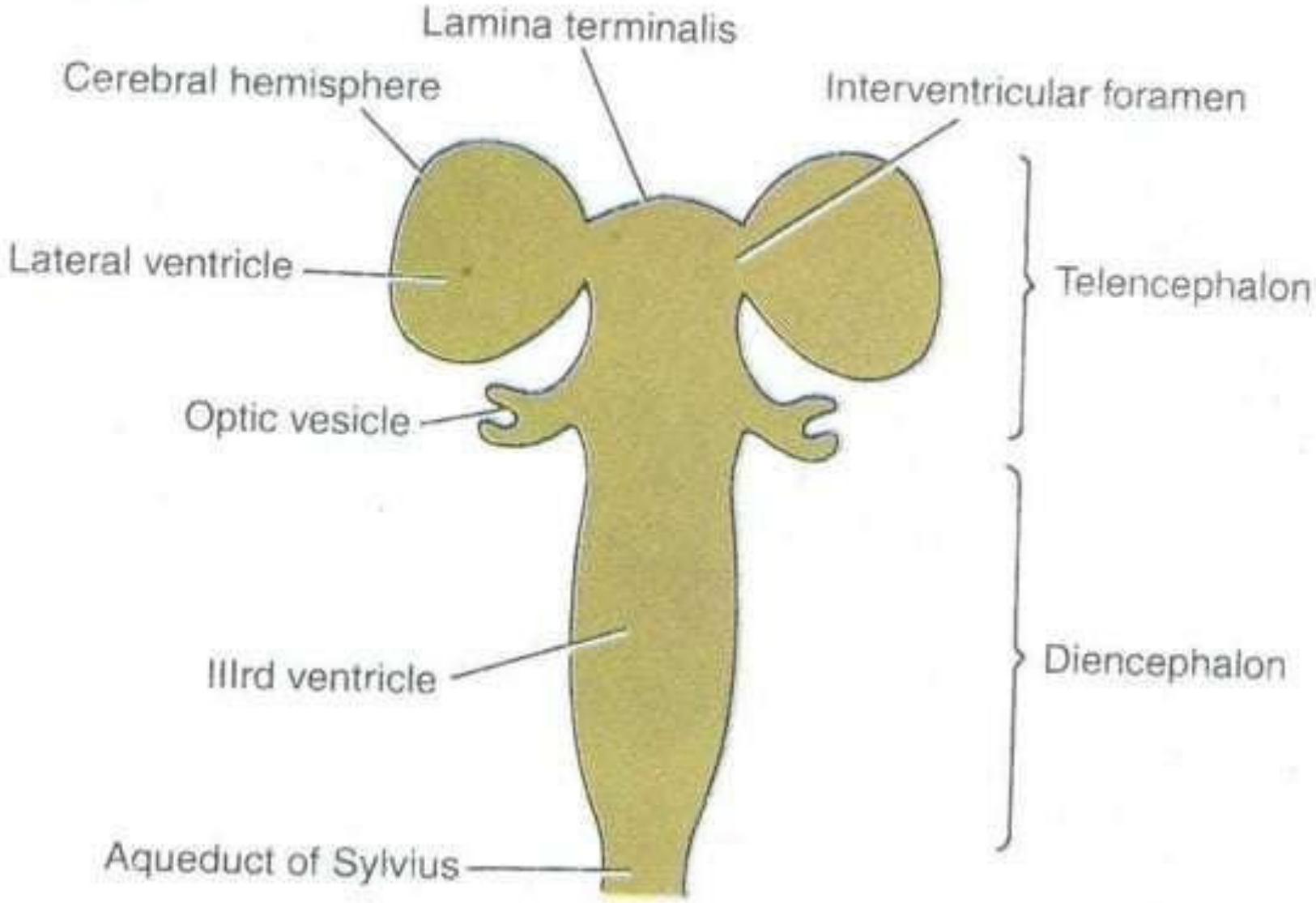
CEREBRAL HEMISPHERES

DEVELOPMENT

DEVELOPMENT OF CEREBRAL HEMISPHERES

- DEVELOPS FROM TELENCEPHALON
- TELENCEPHALON CONSISTS OF---
- A MEDIAN PART AND
- TWO LATERAL DIVERTICULA
- **DIVERTICULA** [**CEREBRAL VESICLES**] ARE THE PRIMORDIA OF THE HEMISPHERES
- CAVITY OF THE MEDIAN PORTION OF THE TELENCEPHALON FORMS THE EXTREME ANT PORTION OF THE 3rd VENTRICLE


Lamina terminalis
Cerebral hemisphere
Interventricular foramen
Telencephalon
Lateral ventricle
Forebrain
III
Diencephalon
Optic vesicle
Midbrain
Midbrain
Aqueduct of Sylvius
Metencephalon
IV
Myelencephalon
Hindbrain
Spinal cord
Central canal
Metencephalon
Diencephalon
Myelencephalon
Optic vesicle
Cerebral hemisphere
Spinal cord


Lamina terminalis
Cerebral hemisphere
Interventricular foramen
Lateral ventricle
Telencephalon
Optic vesicle
IIIrd ventricle
Diencephalon
Aqueduct of Sylvius

DEVELOPMENT OF CEREBRAL HEMISPHERES

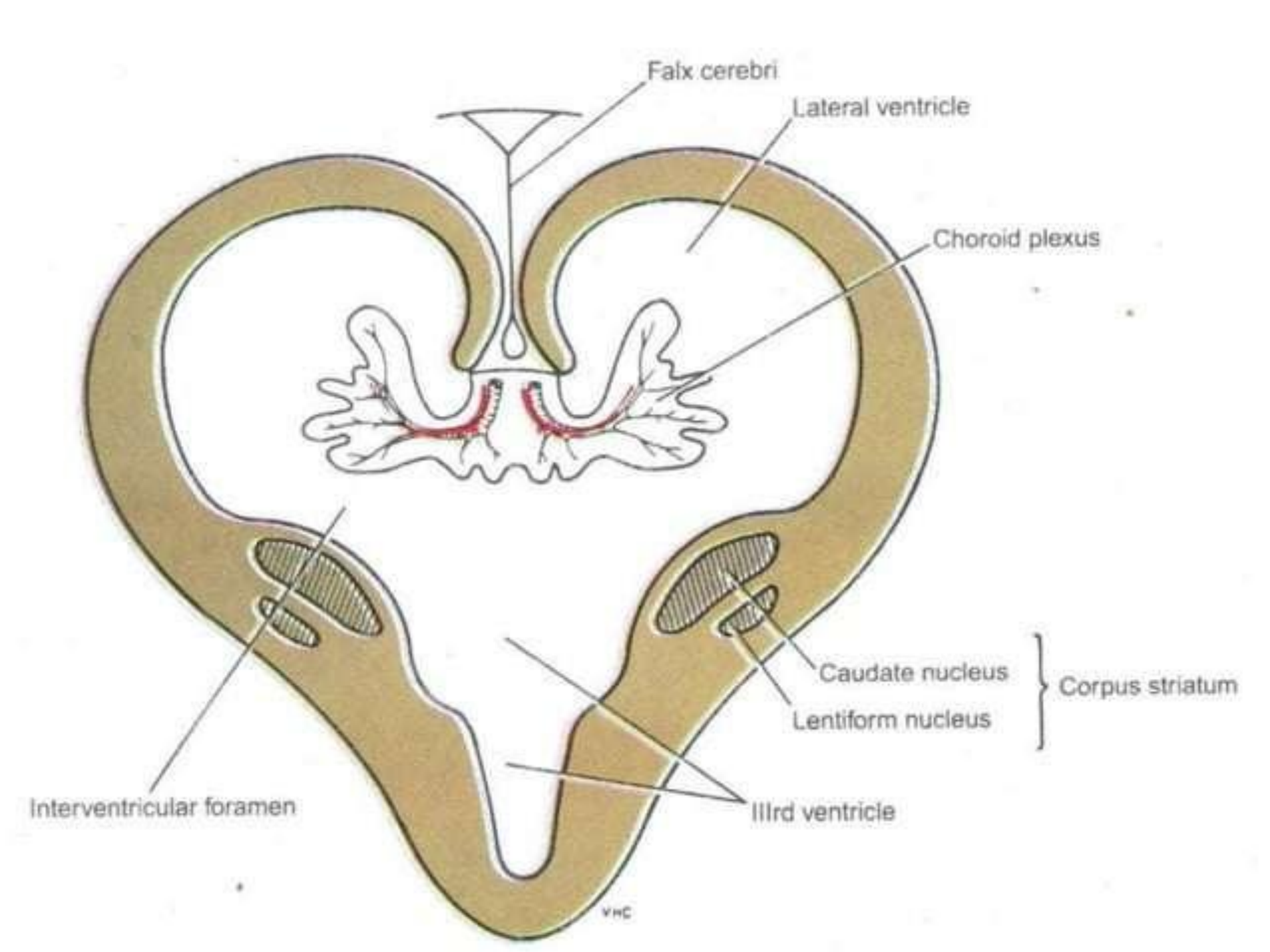
- ARISE AT THE BEGINNING OF 5th WEEK

- INITIALLY THE CEREB VESICLES ARE IN WIDE COMMUNICATION WITH THE CAVITY OF 3rd VENTRICLE THROUGH **INTERVENTRICULAR FORAMEN** ALONG A LINE KNOWN AS **CHOROID FISSURE**

DEVELOPMENT OF CEREBRAL HEMISPHERES

- PART OF MEDIAL WALL OF CEREB HEMISPH BECOMES VERY THIN
- THIN PORTION IS CONTINUOUS WITH THE ROOF OF 3rd VENTRICLE

- CHOROID PLEXUS OF LATERAL VENTRICLE FORMS AT THIS SITE


Falx cerebri
Lateral ventricle
Choroid plexus
Caudate nucleus
Lentiform nucleus
Corpus striatum
Interventricular foramen
IIIrd ventricle

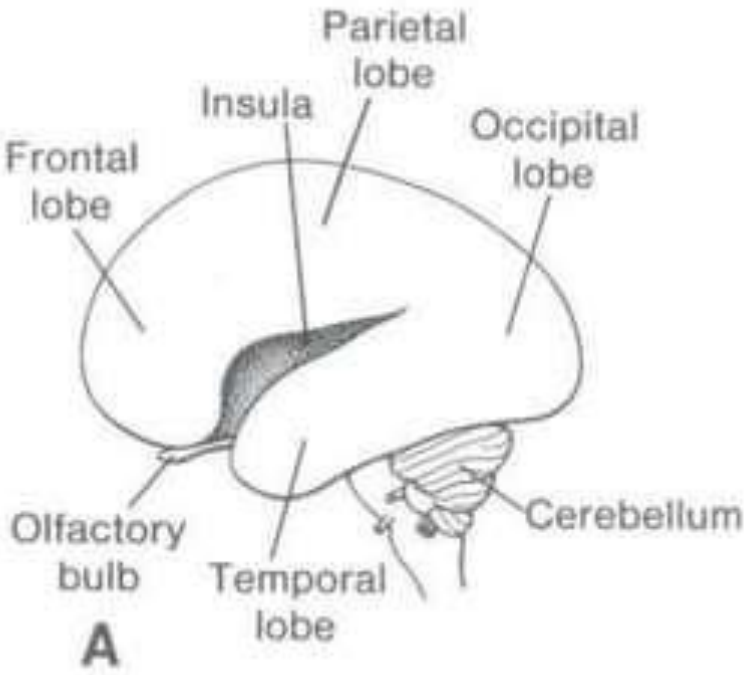
DEVELOPMENT OF CEREBRAL HEMISPHERES

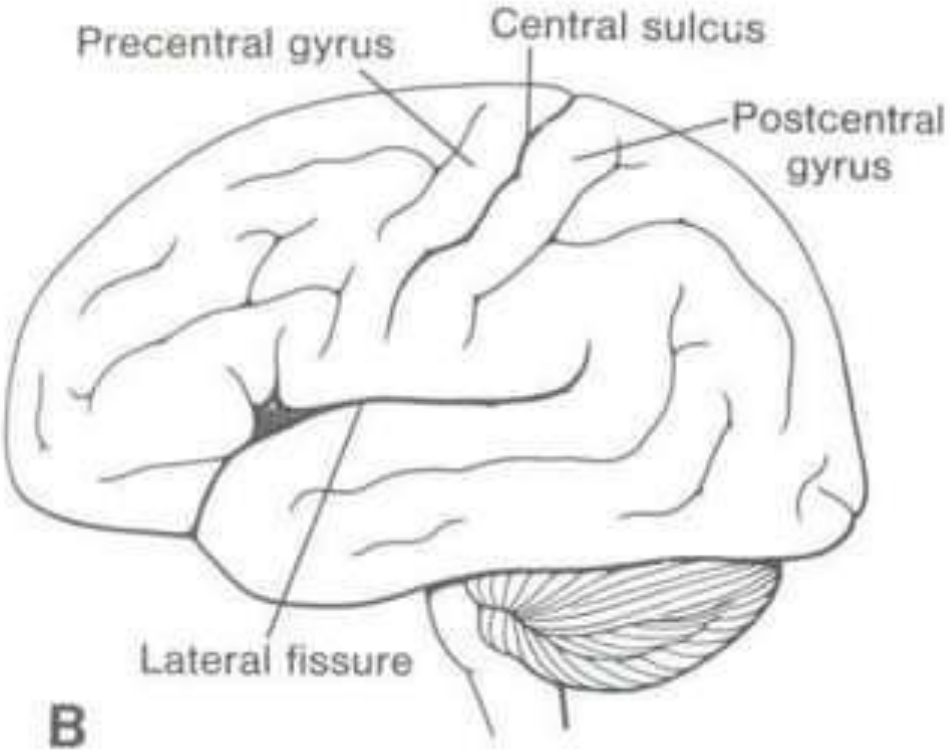
- AS THE CEREB HEMISPH EXPANDS SUPERIORLY ITS WALLS THICKEN
- INTERVENTRICULAR FORAMEN BEOMES REDUCED IN SIZE

- MESENCHYME B/W EACH HEMISPHERE CONDENCES TO FORM THE **FALX CEREBRI**

DEVELOPMENT OF CEREBRAL HEMISPHERES

- HEMISPHERES GROW AND EXPAND RAPIDLY
- ANTERIORLY----TO FORM **FRONTAL LOBE**
- SUPERIORLY----TO FORM **PARIETAL LOBE**
- POSTERIORLY---- TO FORM **OCCIPITAL LOBE**
- INFERIORLY ----TO FORM **TEMPORAL LOBE**


Parietal lobe
Insula
Occipital lobe
Frontal lobe
Olfactory bulb
Temporal lobe
Cerebellum
A

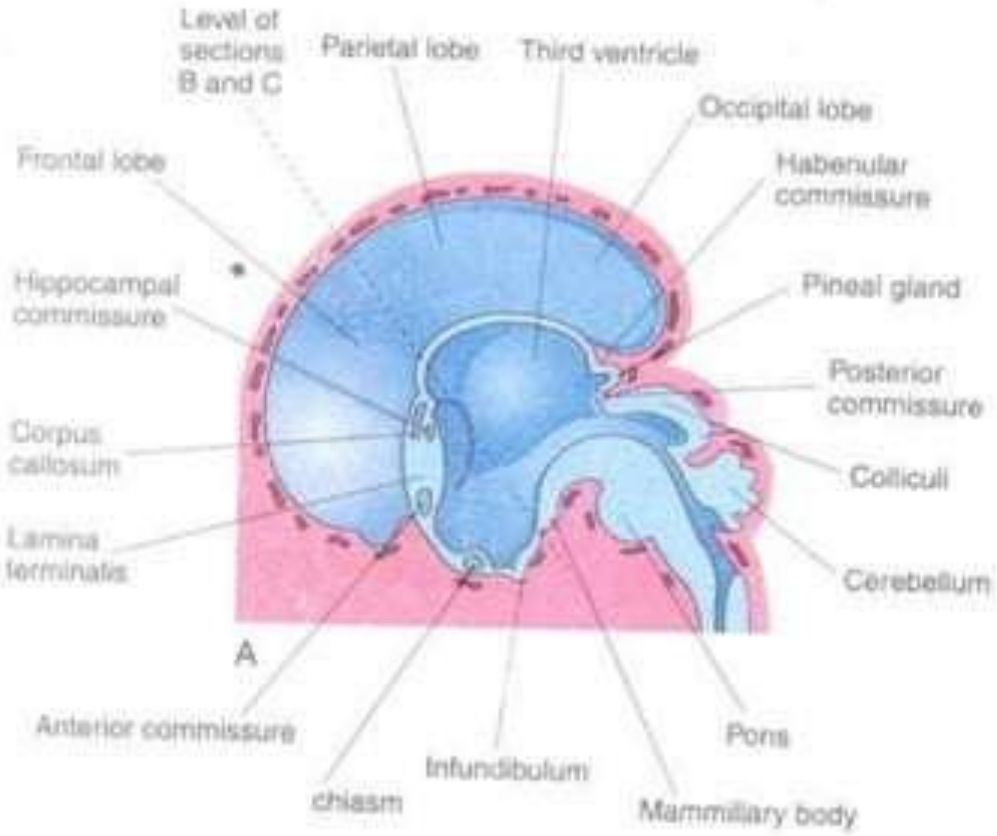

Precentral gyrus
Central sulcus
Postcentral gyrus
Lateral fissure
B

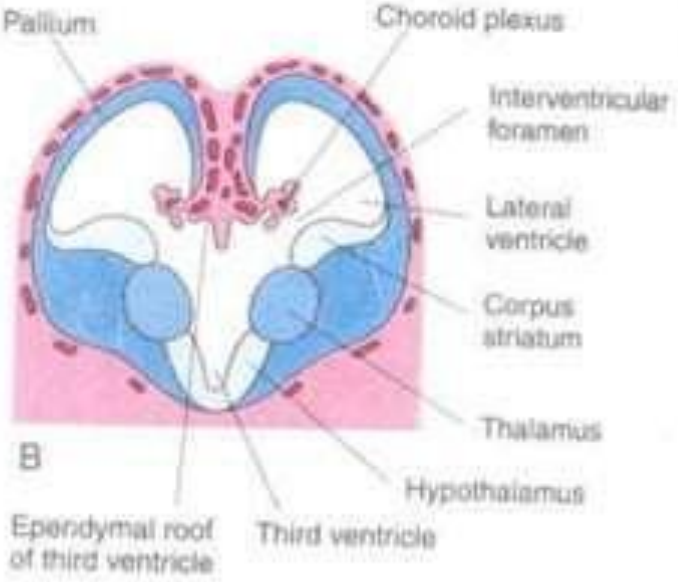
DEVELOPMENT OF CEREBRAL HEMISPHERES

- DUE TO GREAT EXPANSION THE HEMISPHERES SUCCESSIVELY COVER THE ---
- DIENCEPHALON
- MIDBRAIN AND
- HINDBRAIN
- THE TWO HEMISPHERES MEET IN THE MIDLINE ,FLATTENING THEIR MEDIAL SURFACES

DEVELOPOMENT OF CEREBRAL HEMISPHERES

- DURING THE 6th WEEK APROMINENT SWELLING APPEARS IN THE FLOOR OF EACH HEMISPHERE
- IT BULGES INTO THE LAT VENTRICLE AND INTO THE FLOOR OF THE FORAMEN OF MONRO
- IN TS THE RAPIDLY GROWING SWELLING HAS A STRIATED APPEARANCE ---**THE CORPUS STRIATUM**

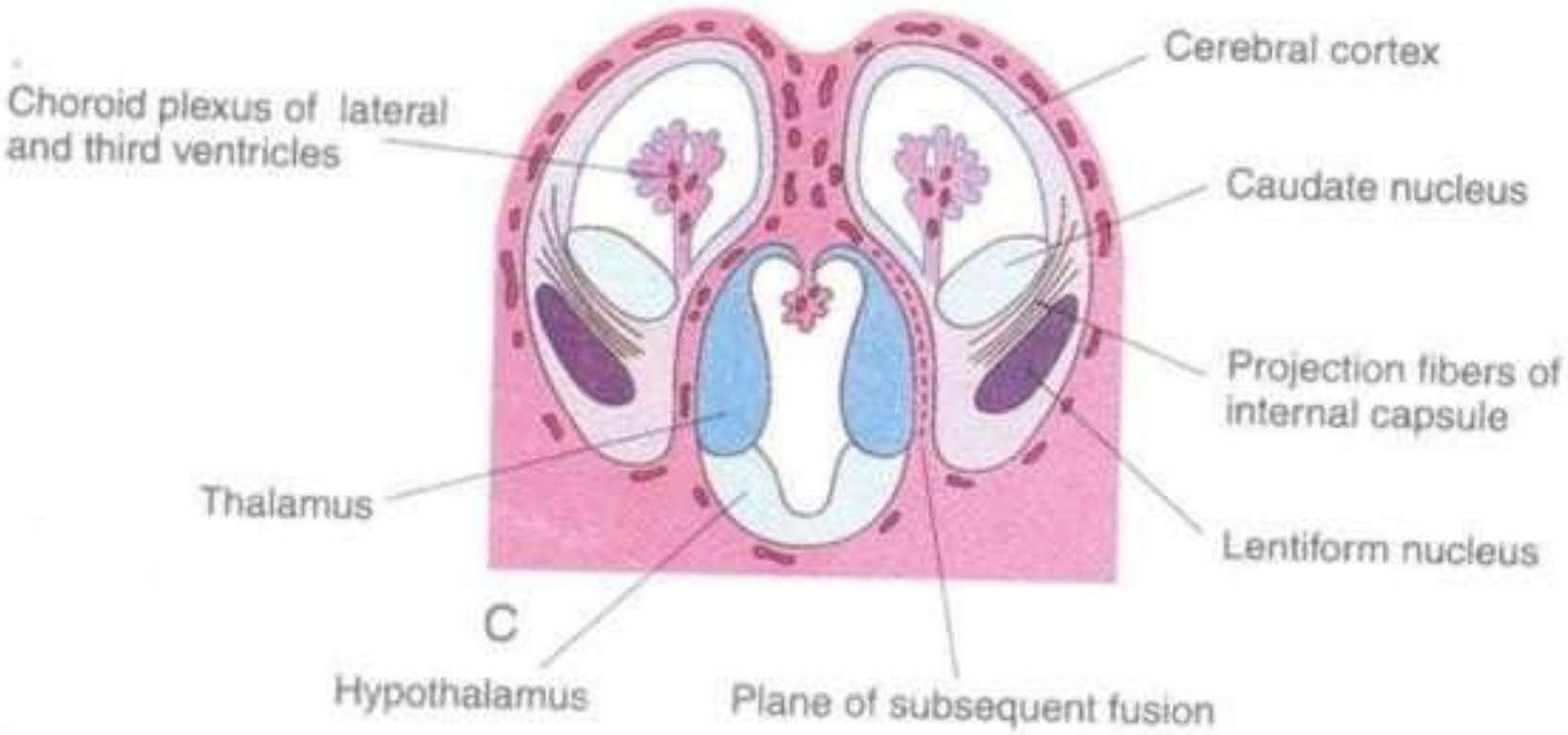

Level of sections B and C
Parietal lobe
Third ventricle
Occipital lobe
Frontal lobe
Habenular commissure
Hippocampal commissure
Pineal gland
Posterior commissure
Corpus callosum
Colliculi
Lamina terminalis
Cerebellum
A
Anterior commissure
Pons
Infundibulum
chiasm
Mammillary body

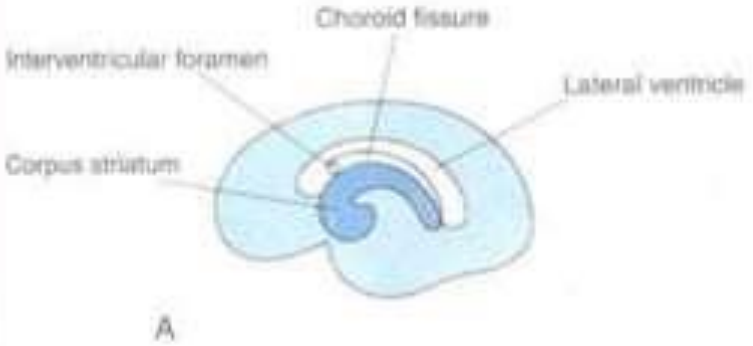

Pallium
Choroid plexus
Interventricular foramen
Lateral ventricle
Corpus striatum
Thalamus
B
Hypothalamus
Ependymal roof of third ventricle
Third ventricle

DEVELOPMENT OF CEREBRAL HEMISPHERES

- CORPUS STRIATUM DIFFERENTIATES INTO TWO PARTS
- 1—DORSOMEDIAL---CAUDATE NUCLEUS
- 2—VENTROLATERAL---LENTIFORM NUCLEUS

- LENTIFORM NUCLEUS DIVIDES INTO---
- 1 LATERAL---PUTAMEN
- 2 MEDIAL---GLOBUS PALLIDUS


Choroid plexus of lateral and third ventricles
Cerebral cortex
Caudate nucleus
Projection fibers of internal capsule
Thalamus
Lentiform nucleus
C
Hypothalamus
Plane of subsequent fusion



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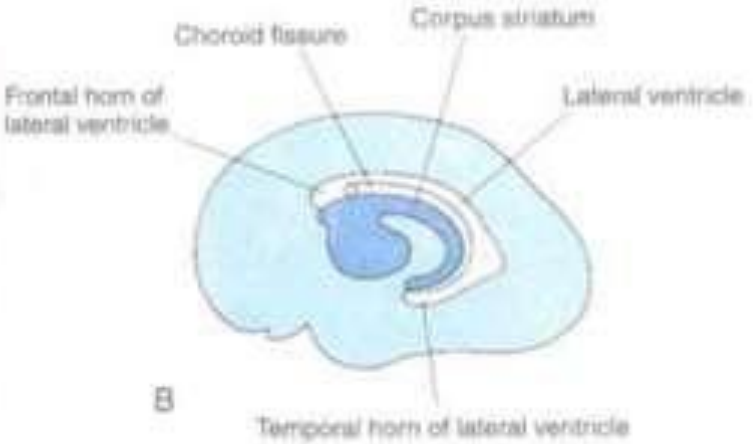
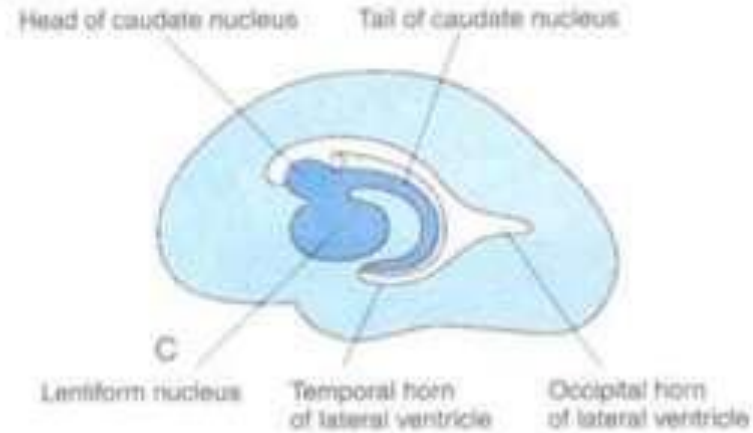


B

Temporal horn of lateral ventricle



C

Lentiform nucleus

Temporal horn of lateral ventricle

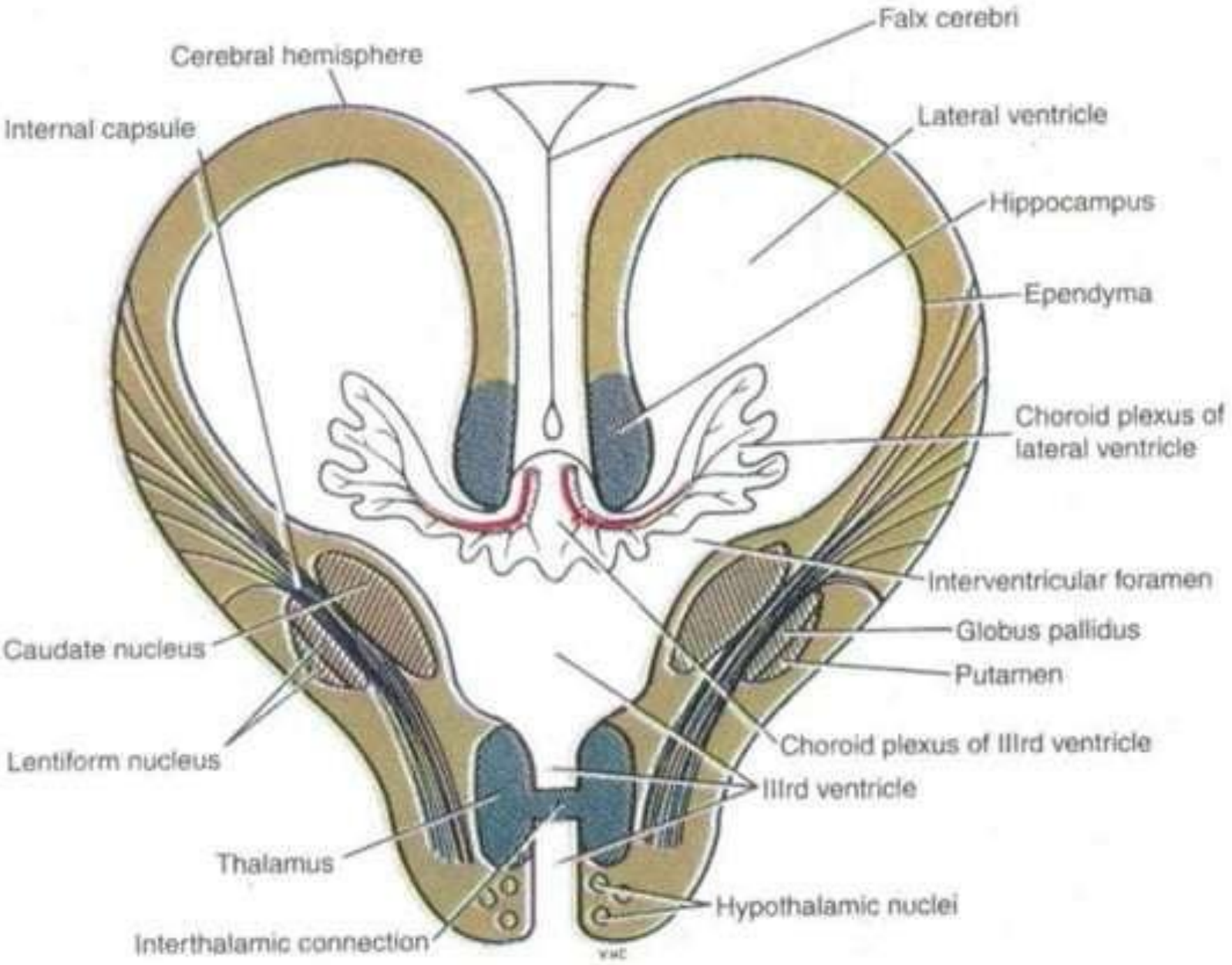
Occipital horn of lateral ventricle

DEVELOPMENT OF CEREBRAL HEMISPHERES

- CAUDATE NUCLEUS BECOMES ELONGATED AND C SHAPED
- ITS PEAR SHAPED HEAD ELONGATED BODY LIE IN THE FLOOR OF ANT HORN OF LAT VENT
- ITS TAIL MAKES U SHAPED TURN TO GAIN THE ROOF OF TEMPORAL HORN
- MEDIAL SURFACE OF EACH HEMISPHERE APPROACHES THE LAT SURFACE OF THE DIENCEPHALON SO THAT THE CAUDATE NUCLEUS AND THE THALAMUS COME IN CLOSE CONTACT

DEVELOPMENT OF CEREBRAL HEMISPHERE

- **HIPPOCAMPUS**
- A LONGITUDINAL THICKENING OCCURS IN THE WALL OF FOREBRAIN VESICLE
- PROTRUDES INTO THE LAT VENTRICLE
- FORMS THE HIPPOCAMPUS
- PRIMARY FUCTION---**OLFACTION**


Falx cerebri
Cerebral hemisphere
Internal capsule
Lateral ventricle
Hippocampus
Ependyma
Choroid plexus of lateral ventricle
Interventricular foramen
Globus pallidus
Putamen
Caudate nucleus
Choroid plexus of IIIrd ventricle
Lentiform nucleus
IIIrd ventricle
Thalamus
Hypothalamic nuclei
Interthalamic connection

DEVELOPMENT OF CEREBRAL HEMISPHERES

- **INTERNAL CAPSULE**
- MATURING NEURONS IN DIFFERENT PARTS OF THE NERVOUS SYST SEND **AXONS** ------EITHER TO OR FROM THE DIFFERENTIATING CORTEX
- AXONS FORM THE ASCENDING OR DESCENDING TRACT
- THE COMPACT BUNDLE OF ASCENDING AND DESCENDING TRACTS IS **INTERNAL CAPSULE**

DEVELOPMENT OF CEREBRAL HEMISPHERES

- **INTERNAL CAPSULE** [CONTD]
- PRESENT B/W THE----
- THALAMUS & CAUDATE NUCLEUS—MEDIALLY
- LENTIFORM NUCLEUS ---LATERALLY

- BECOMES C SHAPED AS THE HEMISPHERE ASSUMES THIS SHAPE

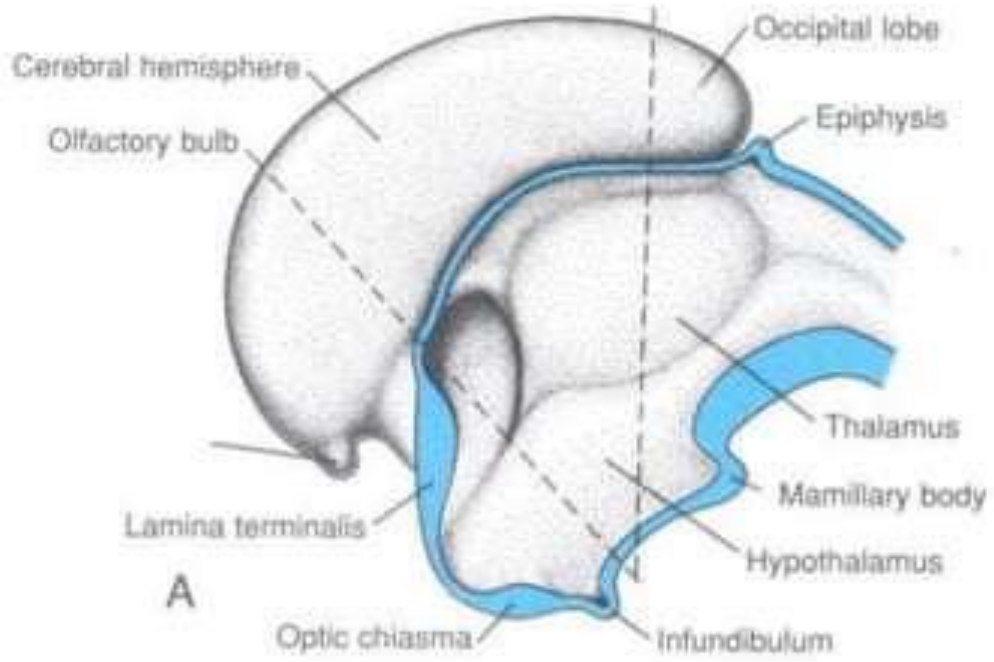
DEVELOPMENT OF CEREBRAL HEMISPHERES

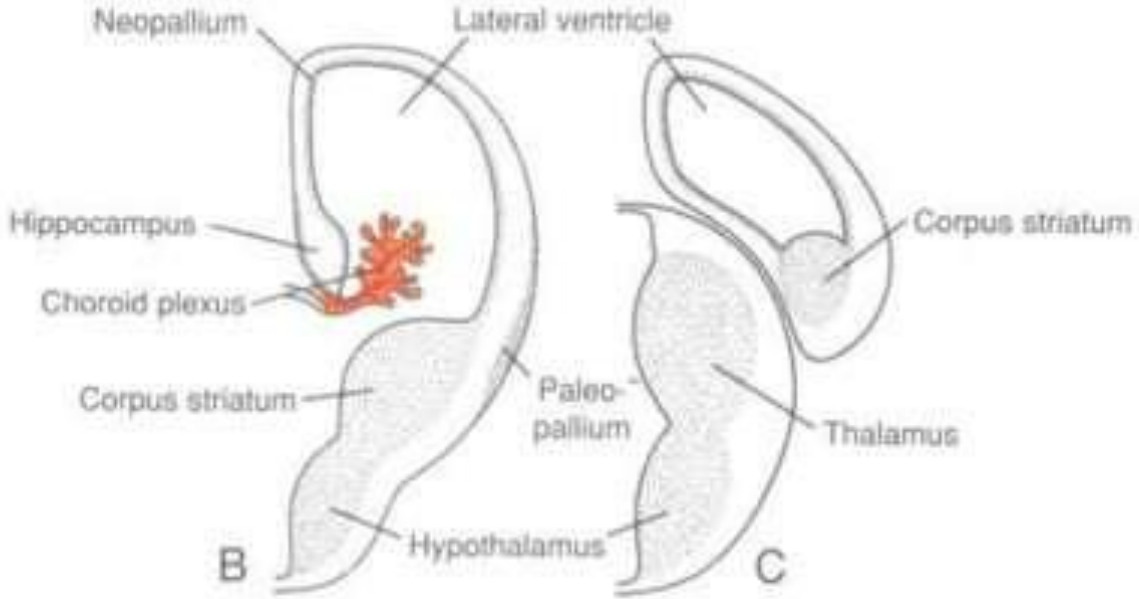
- **EXTERNAL CAPSULE**

- CONSIST OF A FEW PROJECTION FIBRES THAT PASS LATERAL TO THE LENTIFORM NUCLEUS

DEVELOPMENT OF CEREBRAL HEMISPHERES

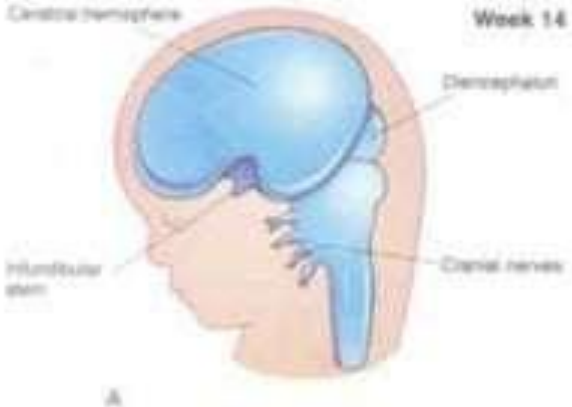
- **CEREBRAL CORTEX**
- DEVELOPS FROM THE PALLIUM
- PALLIUM HAS TWO REGIONS---
- **1 PALEOPALLIUM** OR **ARCHIPALLIUM-----** LATERAL TO CORPUS STRIATUM
- **2 NEOPALLIUM -------**BETWEEN THE HIPPOCAMPUS AND PALLEOPALLIUM

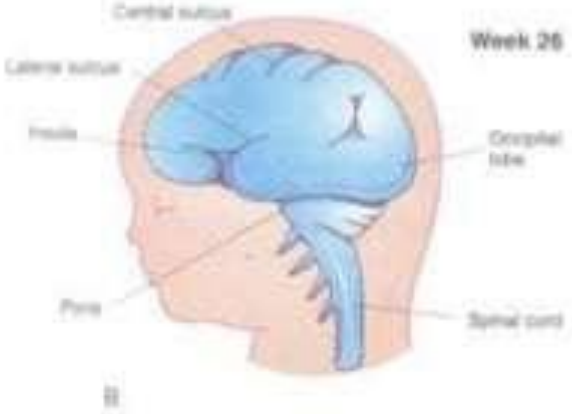

Occipital lobe
Cerebral hemisphere
Epiphysis
Olfactory bulb
Thalamus
Mamillary body
Lamina terminalis
Hypothalamus
A
Optic chiasma
Infundibulum

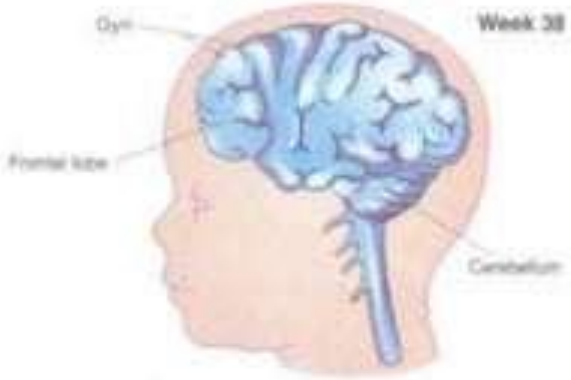

Neopallium
Lateral ventricle
Hippocampus
Corpus striatum
Choroid plexus
Corpus striatum
Paleo-
pallium
Thalamus
Hypothalamus
B
C

DEVELOPMENT OF CEREBRAL HEMISPHERES

- **CEREBRAL CORTEX** [CONTD]
- INITIALLY THE SURFACE IS SMOOTH
- DURING THE FINAL PART OF FOETAL LIFE THE SURFACE GROWS SO RAPIDLY THAT MANY CONVOLUTIONS [**GYRI**] APPEAR ON THE SURFACE
- GYRI SEPARATED BY **FISSURES AND SULCI**
- SULCI AND GYRI INCREASE THE SURFACE AREA OF THE CORTEX WITHOUT REQUIRING AN EXTENSIVE INCREASE IN CRANIAL SIZE







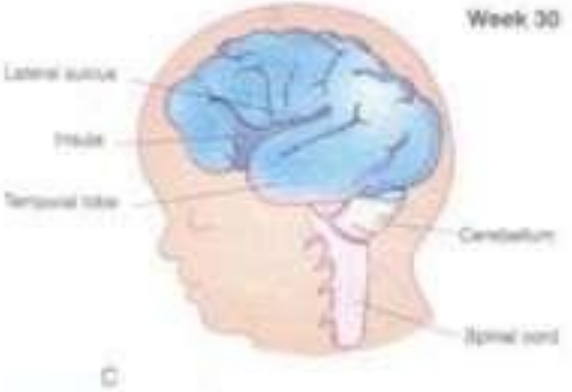
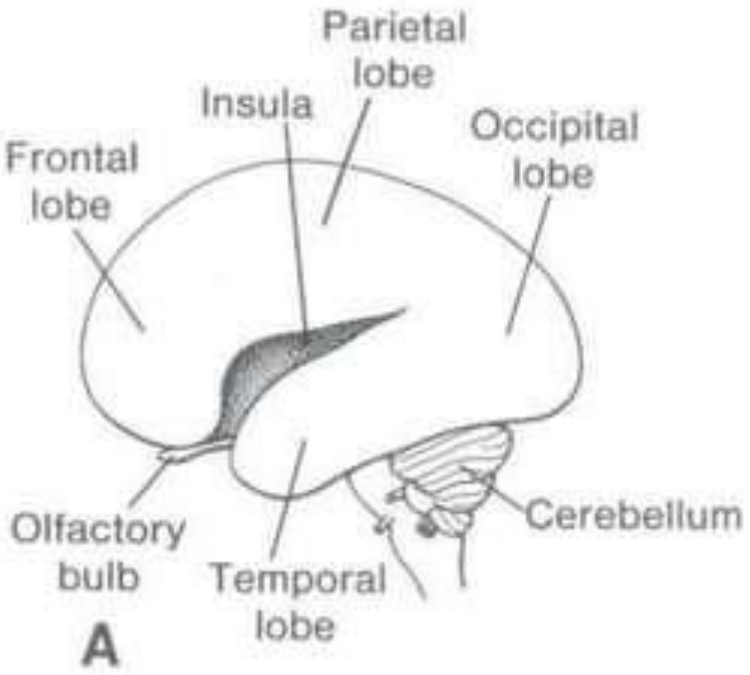
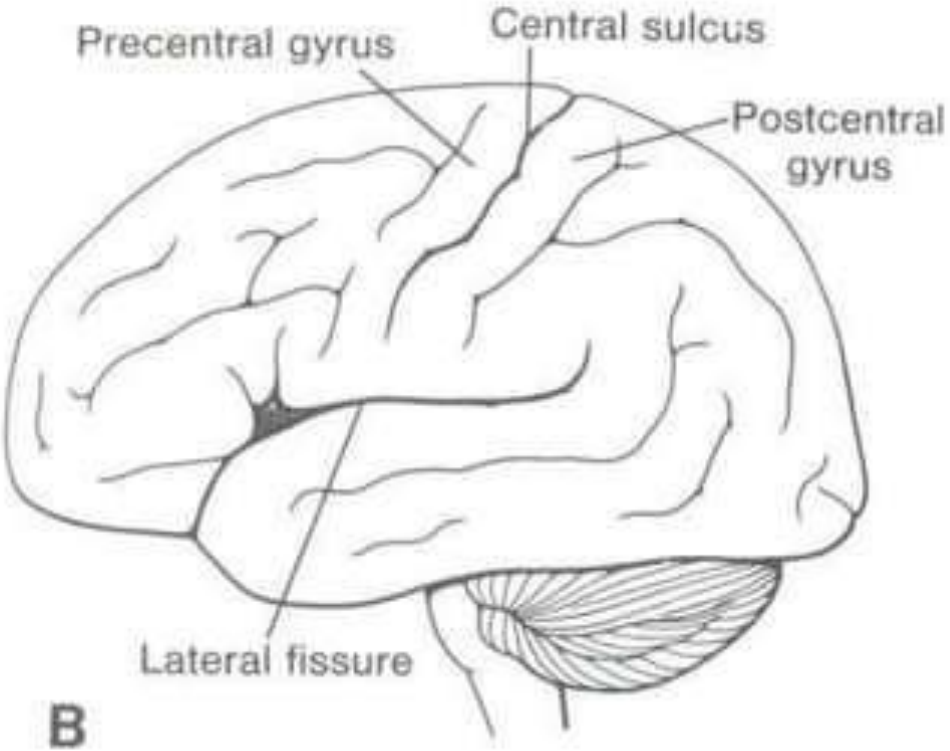


FIGURE 17-31. Sketches of lateral views of the left cerebral hemisphere, diencephalon, and brainstem showing successive stages in the development of the sulci and gyri in the cerebral cortex. Note the gradual narrowing of the lateral sulcus and burying of the insula (Latin, island), an area of cerebral cortex that is concealed from surface view. Note that the surface of the cerebral hemispheres grows rapidly during the fetal period, forming many gyri (convolutions), which

DEVELOPMENT OF CEREBRAL HEMISPHERES

- **INSULA**
- AS EACH HEMISPHERE GROWS,GROWTH IN THE CORTEX OVERLYING CORPUS STRIATUM SLOWS
- THE AREA B/W FRONTAL AND TEMPORAL LOBES BECOMES DEPRESSED
- THIS AREA IS THE **INSULA**
- LATER OVERGROWN BY THE ADJACENT LOBES
- AT BIRTH ALMOST COMPLETELY HIDDEN IN THE DEPTHS OF LATERAL SULCUS


Parietal lobe
Insula
Occipital lobe
Frontal lobe
Olfactory bulb
Temporal lobe
Cerebellum
A


Precentral gyrus
Central sulcus
Postcentral gyrus
Lateral fissure
B

DEVELOPMENT OF CEREBRAL HEMISPHERES

- WALLS OF DEVELOPING HEMISPHERES SHOW THREE TYPICAL ZONES OF NEURAL TUBE
- 1 VENTRICULAR ZONE
- 2 INTERMEDIATE ZONE
- 3 MARGINAL ZONE
- CELLS OF THE INTERMEDIATE ZONE MIGRATE INTO THE MARGINAL ZONE AND GIVE RISE TO THE **CORTICAL LAYERS**

DEVELOPMENT OF CEREBRAL HEMISPHERES

- **CORTICAL LAYERS**
- IN THE NEOPALLIUM,WAVES OF NEUROBLASTS MIGRATE TO A SUBPIAL POSITION AND THEN DIEERENTIATE INTO FULLY MATURE NEURONS
- THE NEXT WAVE OF NEUROBLASTS ARRIVES AND THE CELLS MIGRATE THROUGH THE EARLIER FORMED LAYERS OF CELLS UNTIL THEY REACH THE SUBPIAL POSITION

DEVELOPMENT OF CEREBRAL HEMISPHERES

- **CORTICAL LAYERS** [CONTD]
- THE EARLY FORMED NEUROBLASTS OCCUPY A DEEP POSITION IN THE CORTEX
- THOSE FORMED LATER OBTAIN A MORE SUPERFICIAL POSITION
- AT BIRTH THE CORTEX HAS A STRATIFIED APPEARANCE DUE TO
- 1 DIFFERENTIATION OF CELLS IN LAYERS
- 2 PRESENCE OF INCOMING AND OUTGOING FIBRES

DEVELOPMENT OF CEREBRAL HEMISPHERES

- DIFFERENT AREAS OF CORTEX SHOW SHOW SPECIAL CELL TYPES
- **MOTOR CORTEX**---LARGE NUMBER OF PYRAMIDAL CELLS
- **SENSORY CORTEX**---MAINLY GRANULAR CELLS
- IN CEREBRUM GRAY MATER LOCATED PERIPHERALLY
- AXONS FROM CELL BODIES FORM LARGE VOLUME OF WHITE MATER---MEDULLA

DEVELOPMENT OF CERBRAL HEMISPHERES

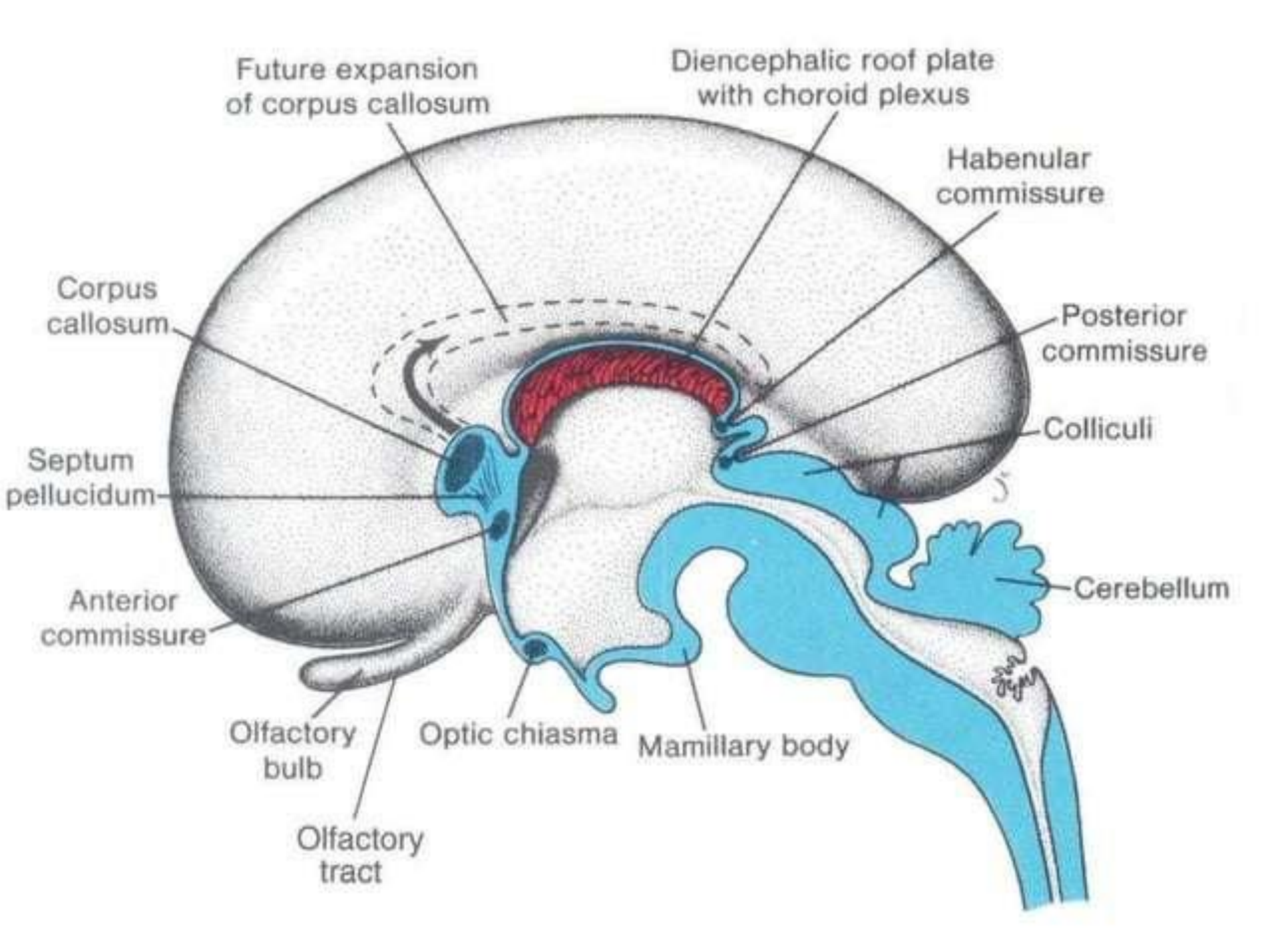
- **COMMISSURES**
- FIBRE BUNDLES CROSS THE MIDLINE AND CONNECT THE CORRESPONDING AREAS OF THE TWO HEMISPHERES
- **LAMINA TERMINALIS**
- CEPHALIC END OF THE N TUBE
- FORMS A BRIDGE B/W THE TWO HEMISPHERES
- ENABLES NERVE FIBRES TO PASS FROM ONE CEREBRAL HEMISPHERE TO THE OTHER

DEVELOPMENT OF CEREBRAL HEMISPHERES

- **ANTERIOR COMMISSURE**
- FIRST COMMISSURE TO DEVELOP
- RUNS IN LAMINA TERMINALIS
- CONNECTS THE OLFACTORY TEMPORAL LOBES OF THE TWO SIDES
- **HIPPOCAMPAL COMMISSURE/FORNIX COMMISSURE**
- SECOND COMMISSURE TO DEVELOP
- FIBRES ARISE IN THE HIPPOCAMPUS
- CONVERGE ON LAMINA TERMINALIS

DEVELOPMENT OF CEREBRAL HEMISPHERES

- **CORPUS CALLOSUM**
- THIRD COMMISSURE TO DEVELOP
- LAREST AND MOST IMPORTANT
- APPEARS BY THE 10th WEEK
- CONNECTS THE NON OLFACTORY AREAS OF RT & LT CORTEX
- AS A RESULT OF CONTINUOUS EXPANSION OF NEOPALLIUM IT EXTENDS ANTERIORLY AND THEN POSTERIORLY ARCHING OVER THE ROOF OF 3rd VEVTRICLE


Future expansion of corpus callosum
Diencephalic roof plate with choroid plexus
Habenular commissure
Corpus callosum
Posterior commissure
Colliculi
Septum pellucidum
Cerebellum
Anterior commissure
Olfactory bulb
Optic chiasma
Mamillary body
Olfactory tract

DEVELOPMENT OF CEREBRAL HEMISPHERES

- THE REMAINS OF LAMINA TERMINALIS WHICH LIE B/W THE CORP CALLOSUM AND THE FORNIX BECOME STRETCHED OUT TO FORM A THIN SEPTUM---THE **SEPTUM PELLUCIDUM**
- **OPTIC CHIASMA**
- FORMED IN THE INFERIOR PART OF THE LAM TERMINALIS
- CONTAINS FIBRES FROM THE MEDIAL HALVES OF THE RETINAE
- FIBRES CROSS THE MIDLINE TO JOIN THE OPTIC TRACT OF OPPOSITE SIDE

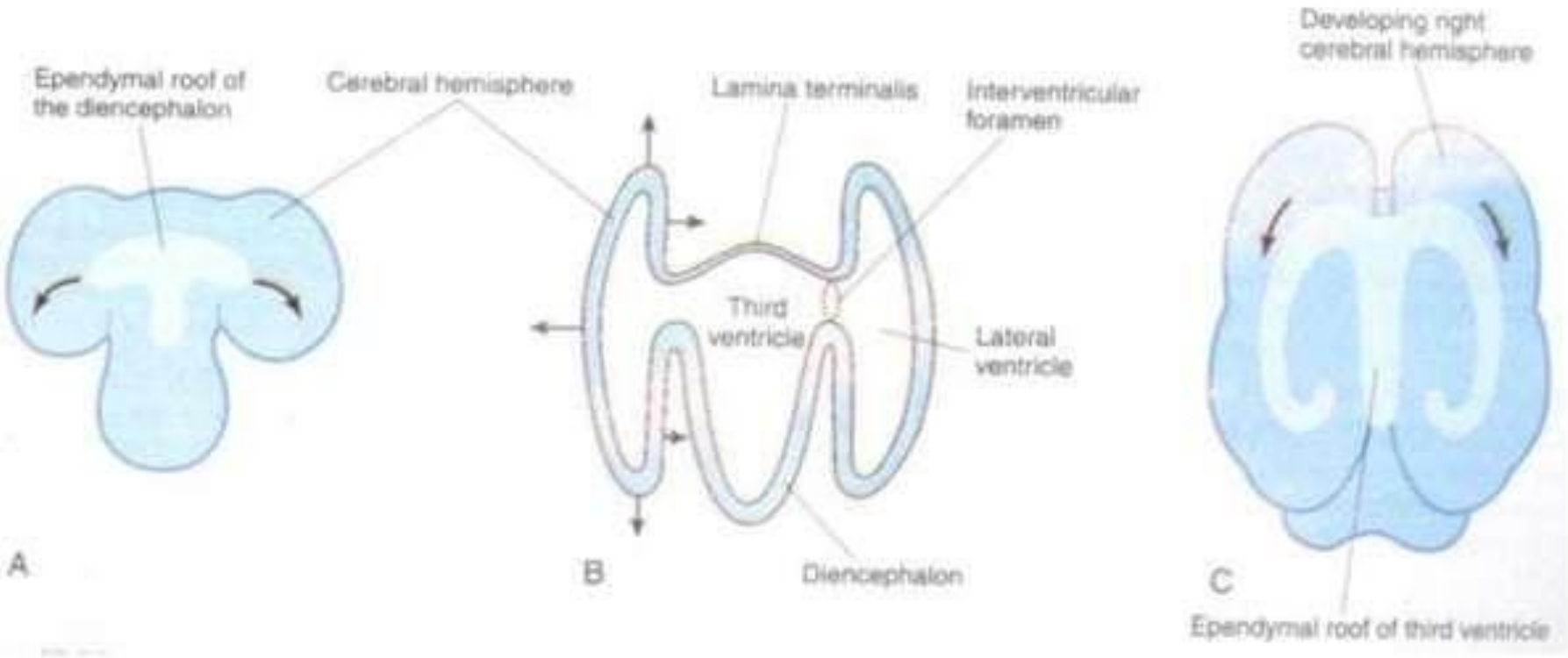
DEVELOPMENT OF CEREBRAL HEMISPHERES

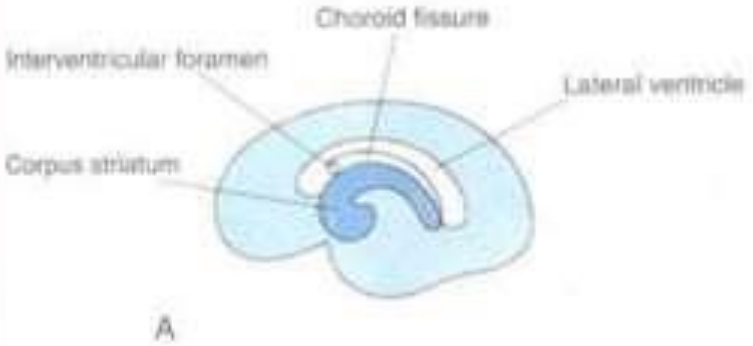
- **POSTERIOR COMMISSURE**
- **HABENULAR COMMISSURE**

- BOTH DEVELOP IN RELATION TO THE STALK OF THE PINEAL GLAND

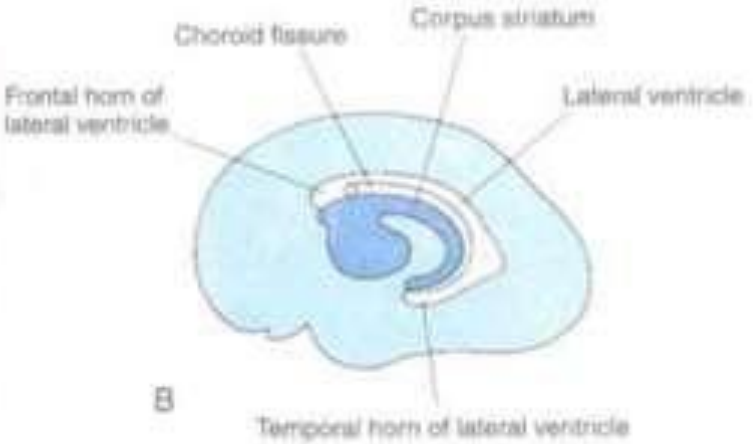
DEVELOPMENT OF LATERAL VENTRICLES

- TELENCEPHALON DEVELOPS A DIVERTICULUM ON EACH SIDE
- ITS CAVITY FORMS THE LAT VENTRICLE
- GROTH AND CURVATURE OF THE HEMISPHERES AFFECT THE SHAPE OF THE LAT VENTRICLES
- ROUGHLY C SHAPED CAVITY
- CAUDAL END OF EACH HEMISPHERE TURNS VENTRALLY AND THEN ROSTRALLY FORMING THE TEMPORAL LOBE
- IT CARRIES THE VENTRICLE[FORMING THE INFERIOR HORN] AND THE CHOROID FISSURE WITH IT


Ependymal roof of the diencephalon
Cerebral hemisphere
Lamina terminalis
Interventricular foramen
Third ventricle
Lateral ventricle
Diencephalon
Developing right cerebral hemisphere
Ependymal roof of third ventricle
A
B
C

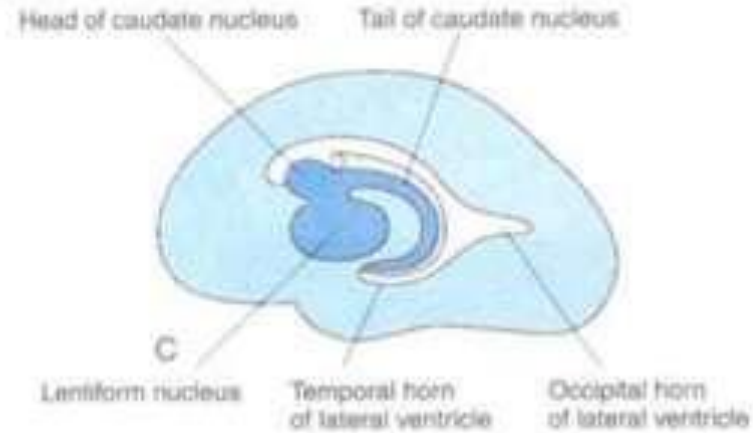


A



B

Temporal horn of lateral ventricle



C

Lentiform nucleus

Temporal horn of lateral ventricle

Occipital horn of lateral ventricle

DEVELOPMENT OF LATERAL VENTRICLES

- THE THIN MEDIAL WALL OF THE HEMISPHERE IS INVAGINATED ALONG THE CHOROID FISSURE BY VASCULAR PIA MATER TO FORM THE CHOROID PLEXUS OF LAT VENT
- INITIALLY THE CEREBRAL HEMISPHERES ARE IN WIDE COMMUNICATION WITH THE CAVITY OF THE 3rd VENTRICLE THROUGH INTRVENTRICULAR FORAMINA