See 74, 80, 152

DIENCEPHALON

CN: Use light colors for A and B, and a very bright color for C. (1) Color each structure wherever it appears before going on to the next title. (2) Although not colored, the neighboring relations of the diencephalic structures are important and have been identified by name. These should be given special attention.

DIENCEPHALON
- THALAMUS A
- HYPOTHALAMUS B
- EPITHALAMUS (PINEAL GLAND) C
- THIRD VENTRICLE D

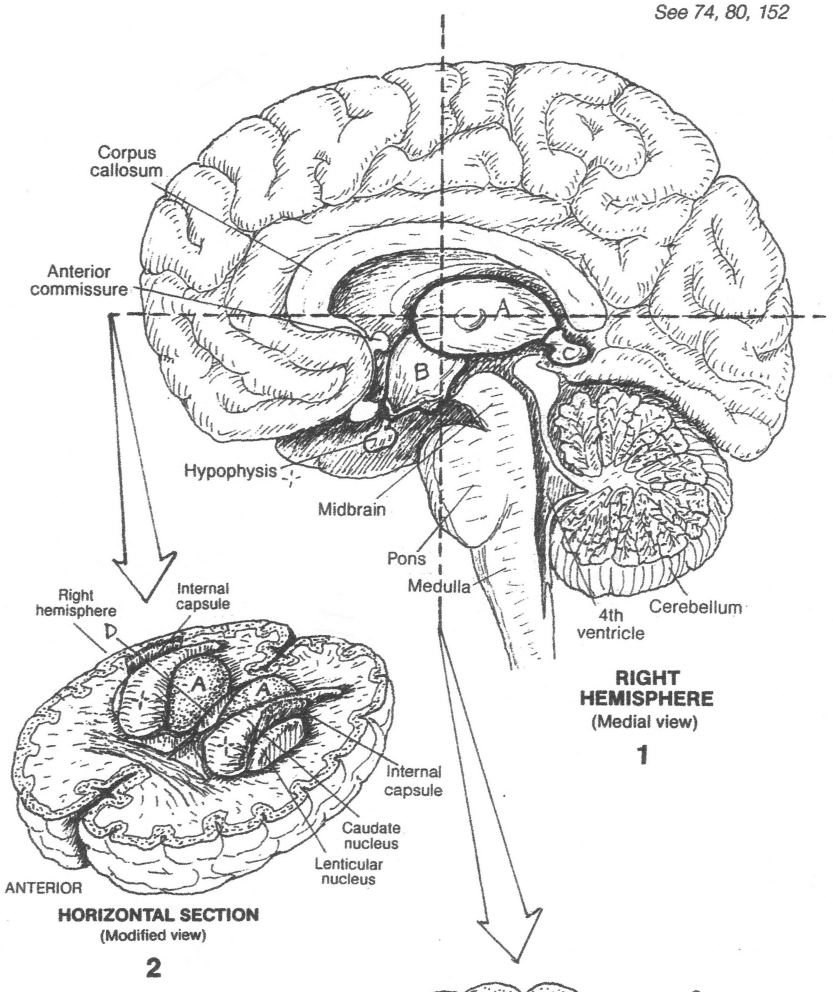
The **diencephalon**, the smaller of two derivatives of the early forebrain, fits between but is not part of the surrounding cerebral hemispheres (see drawings 2 and 3). It consists largely of paired masses of nuclei and related tracts of white matter arranged around the thin, purse-like third (III) ventricle (2 and 3). The nature of this cavity can be seen in Plate 80.

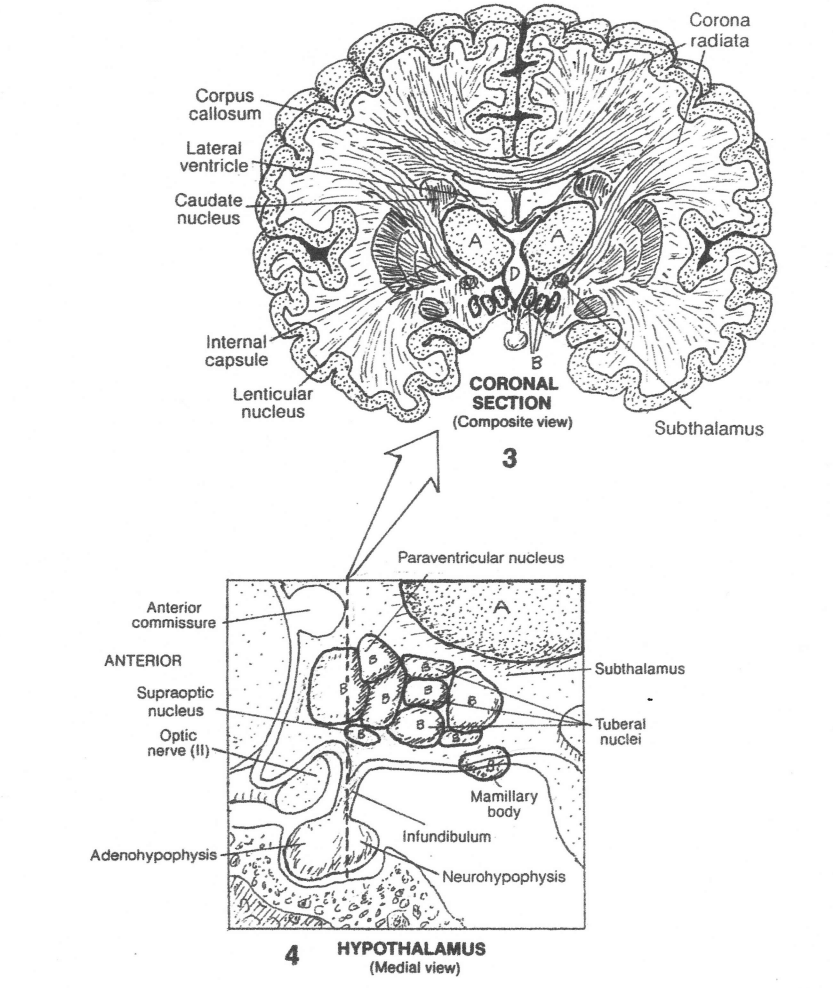
On each side of the third ventricle, note the *thalamus*, *subthalamus*, and *hypothalamus* (2 and 3). The *epithalamus* or *pineal gland* is a midline structure seeming to hang off the posterior thalamus. The relationship of these nuclei to the basal nuclei and internal capsule should be carefully studied while coloring to ensure orientation (recall Plate 74).

The thalamus (1–4) consists of several groups of cell bodies and processes that, in part, process all incoming impulses from sensory pathways (except olfactory). It has broad connections with the motor, general sensory, visual, auditory, and association cortices. Not surprisingly, the corticothalamic (cortex to thalamus) fibers contribute significantly to the *corona radiata*. Still other thalamic nuclei connect to the *hypothalamus* and other brainstem nuclei. Thalamic activity (1) integrates sensory experiences resulting in appropriate motor responses, (2) integrates specific sensory input with emotional (motor) responses (e.g., a baby crying in response to hunger), and (3) regulates and maintains the conscious state (awareness), subject to facilitating/inhibiting influences from the cortex. *Subthalamic nuclei* (3) are concerned with motor activity and have connections with the basal ganglia.

The hypothalamus (1, 3, and 4) consists of nuclear masses and associated tracts on either side of the lower third ventricle. The hypothalamus maintains neuronal connections with the frontal and temporal cortices, thalamus, neurohypophysis, and brainstem. Its neurosecretions (hormones) are also directed to the *adenohypophysis* via the hypophyseal portal system. In addition, the hypothalamus is concerned with emotional behavior, regulation of the autonomic (visceral) nervous system and related integration of visceral (autonomic) reflexes with emotional reactions, and activation of the drive to eat (hunger) and the subsequent feeling of satisfaction (satiety) following fulfillment of that drive. Finally, it mediates descending impulses related to both reflexive and skilled movement—all of this in an area the size of four peas!

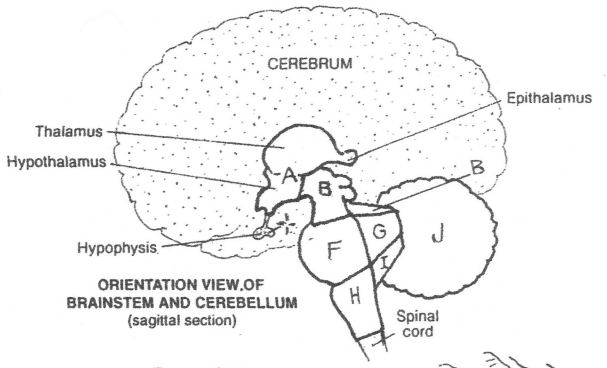
The epithalamus (pineal gland) (1) consists primarily of the pineal body and related nuclei and tracts that have connections with the thalamus, hypothalamus, basal nuclei, and the medial temporal cortex. It produces melatonin (a pigment-enhancing hormone), the synthesis of which is related to diurnal cycles or rhythms (body activity in day or sunlight as opposed to dark or nocturnal periods). It may influence the onset of puberty through inhibition of testicular/ovarian function. Remarkably, the pineal is the only unpaired structure in the brain.





BRAIN STEM / CEREBELLUM

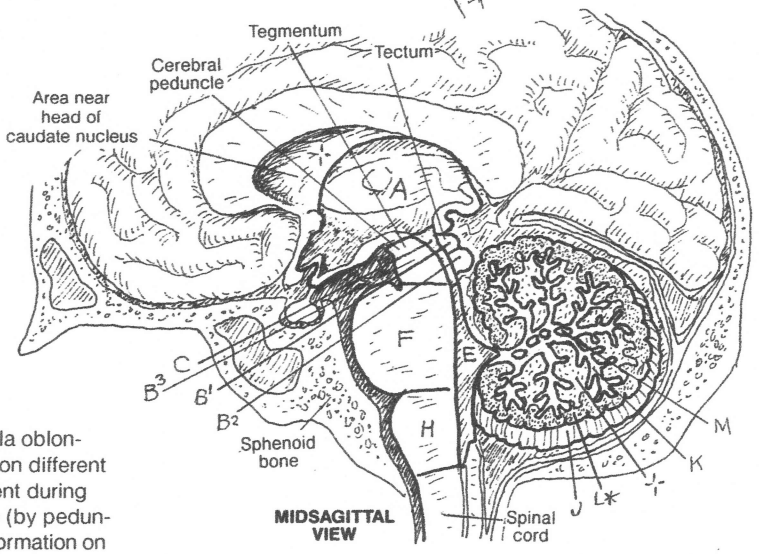
CN: Use darker colors for C, E, and M and the lightest for K. (1) As you color each structure in as many views as it is shown, take particular note of the orientation of the view. (2) Note that the fourth ventricle is located in both parts of the hindbrain and receives the same color in both parts. The diencephalon has been presented on the previous plate and is shown here only for orientation.



ORIENTATION VIEW OF BRAINSTEM AND CEREBELLUM (sagittal section)

BRAIN STEM -/-

- DIENCEPHALON A
- MIDBRAIN B
  - CEREBRAL AQUEDUCT C
  - SUPERIOR COLLICULUS B'
  - INFERIOR COLLICULUS B²
  - CEREBRAL PEDUNCLE F
  - SUP. CEREBELLAR PEDUNCLE D
- HINDBRAIN -/-
  - 4TH VENTRICLE E
  - PONS F
    - MID. CEREBELL. PED. G
  - MEDULLA OBLONGATA H
    - INF. CEREBELL. PED. I



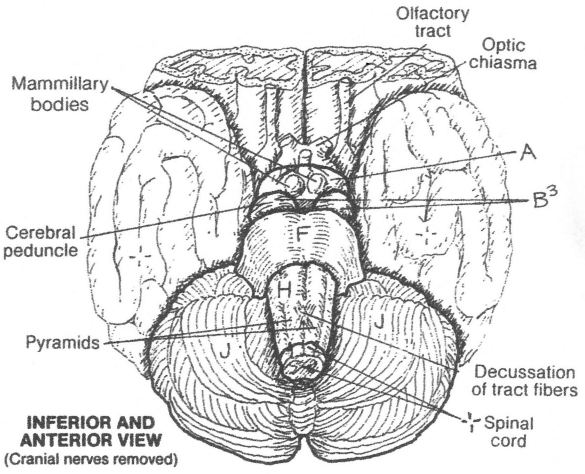
MIDSAGITTAL VIEW

The brain stem includes the diencephalon, midbrain, pons, and medulla oblongata. Throughout the brain stem, the brain cavity (Plates 80, 82) takes on different shapes, a reflection of the kind of differential growth the brain underwent during development (Plate 169). The cerebellum is attached to the brain stem (by peduncles) but is not considered a part of the brain stem. See Plate 75 for information on the diencephalon.

In the midbrain, the *cerebral peduncles* are composed of long descending tracts that originate in the cerebral cortex, descend through the internal capsule (recall Plate 74), and continue caudally to the pons and medulla (for cranial nerves) and the spinal cord (for spinal nerves). Immediately posterior to these tracts in the midbrain is the tegmentum, an area of neurons associated with the reticular formation and cranial nerves III and IV, and multiple tracts. The superior cerebellar peduncles transmit fibers to the *cerebellum* from the spinal cord, and fibers to the thalamus and medulla from the cerebellum. The superior colliculi are centers for visual reflexes; the inferior colliculi make possible auditory reflexes (e.g., rapid, involuntary movements in response to visual and auditory stimuli).

The pons is characterized by its massive anterior bulge consisting of stalks of white matter that bridge the 4th ventricle (pons = bridge) to reach the cerebellum as the middle cerebellar peduncles. These fibers largely arise from neurons in the pons—neurons that convey impulses from both motor and sensory areas of the cerebral cortex. Cranial nerve nuclei V, VI, VII, and VIII are located here. Both ascending and descending tracts pass through here, including the neurons of the reticular formation.

The medulla contains life-sustaining control centers of respiration, heart rate, and vasomotor function. Nuclei for cranial nerves VIII, IX, X, XI, and XII exist here. The inferior cerebellar peduncles carry fibers to the cerebellum from the spinal cord and brain stem vestibular and reticular systems, as well as fibers from the cerebellum to the vestibular system.

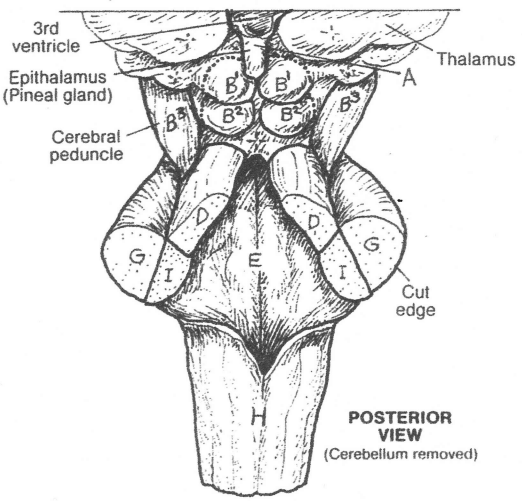


INFERIOR AND ANTERIOR VIEW (Cranial nerves removed)

CEREBELLUM J

- ARBOR VITAE K
- CEREBELLAR CORTEX L*
- DEEP CEREB. NUCLEUS M

The cerebellum consists of two hemispheres, with a cortex of gray matter on its surface (*cerebellar cortex*), central masses of motor-related (*deep cerebellar*) *nuclei*, and bands of white matter forming a treelike appearance (*arbor vitae* = tree of life) when the cerebellum is cut in section. The cerebellum is attached to the brain stem by the three cerebellar peduncles. The cerebellum is concerned with equilibrium and position sense, fine movement, control of muscle tone, and overall coordination of muscular activity in response to proprioceptive input and descending traffic from higher centers.



POSTERIOR VIEW (Cerebellum removed)