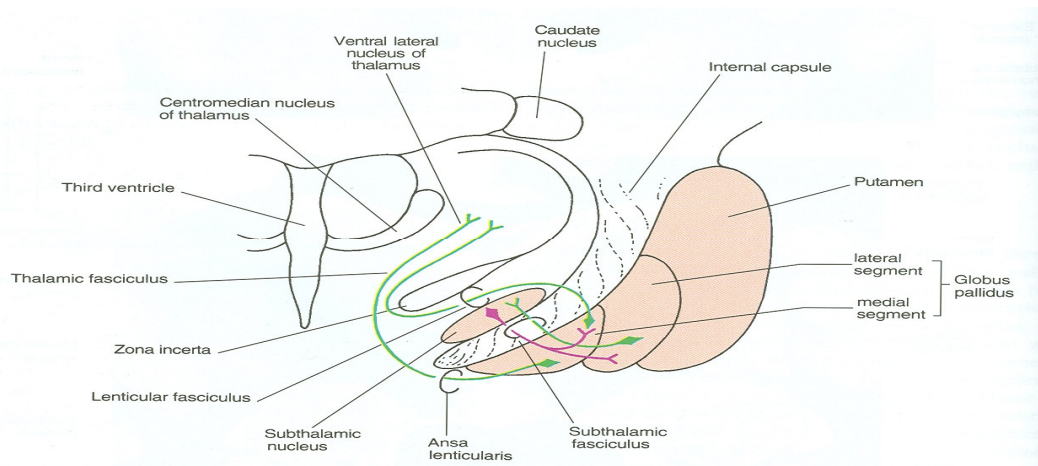


DIENCEPHALON II

SUBTHALAMUS :

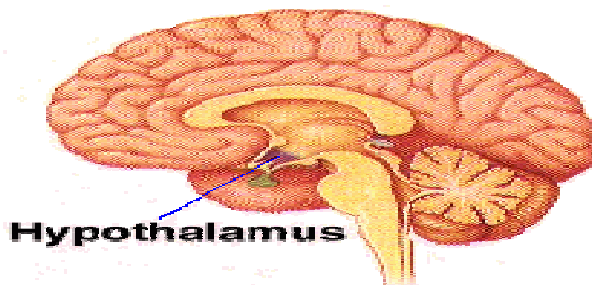
- **Site** : lies beneath the thalamus and dorsolateral to the hypothalamus, with its ventrolateral aspect against the internal capsule.
- **Components** : It contains two notable cell groups :
 1. **Subthalamic nucleus** :
 - It is located in the ventrolateral part of the subthalamus, immediately medial to the internal capsule.
 - It has the shape of a biconvex lens in coronal section.
 - It has prominent connections with the globus pallidus and the substantia nigra.
 - It is important in the control of movement.
 2. **Zona incerta** (between thalamus & subthalamic nucleus) : rostral extension of brain stem reticular formation.



- Several important fibre systems traverse the subthalamus en route to the thalamus.
- These include ascending sensory projections (medial lemniscus, spinothalamic tracts, trigeminothalamic tracts), cerebellothalamic fibres from the dentate nucleus and pallidothalamic fibres from the medial segment of the globus pallidus.
- The last envelop the zona incerta as the lenticular fasciculus and thalamic fasciculus.

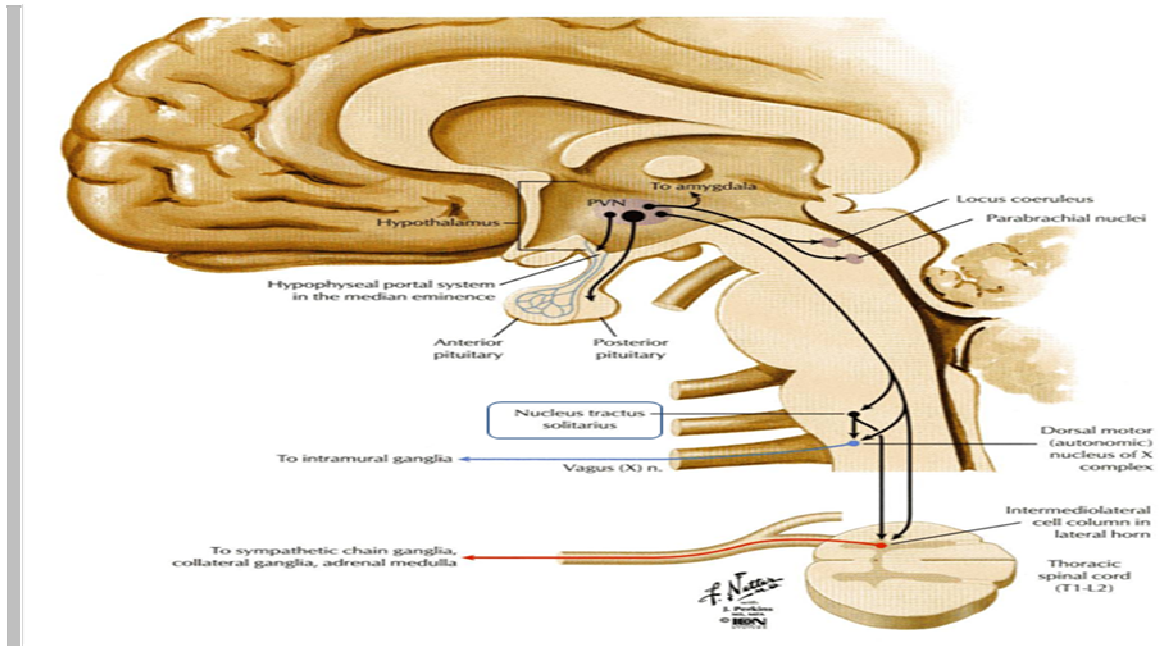
HYPOTHALAMUS :

- The **hypothalamus** is able to :
 - *integrate interoceptive signals* from internal organs and fluid-filled cavities, and
 - *make appropriate adjustments to the internal environment* by virtue of its input and output systems.

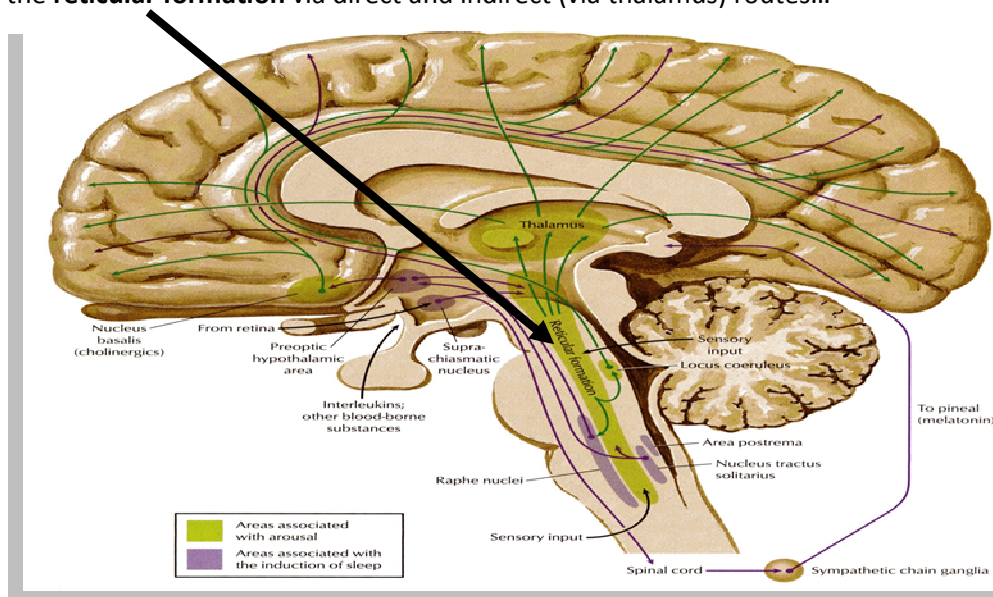


- The **hypothalamic input** is *circulatory* and *neural* in origin.
- The **circulating blood** provides :
 - *physical* (temperature, osmolality),
 - *chemical* (blood glucose, acid-base state), and
 - *hormonal signals* of the state of the body, its growth and development and its readiness for action (sex, suckling, defence).

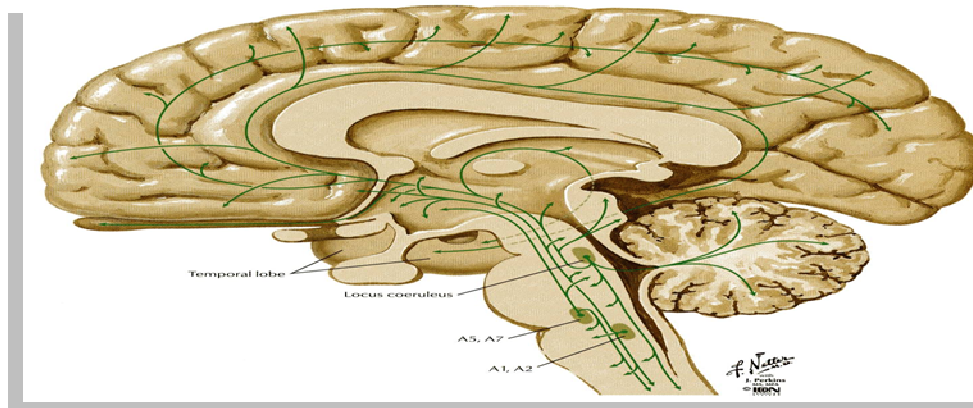
- **Neural signals** come to the hypothalamus from two sources.
- Firstly, the **nucleus solitarius of the medulla** projects to the hypothalamus and conveys *information collected by the autonomic nervous system concerning*
 - the **pressure** within the smooth-muscle walls of organs (*baroreceptors*), and
 - the **chemical constituents** of the fluid-filled cavities (*chemoreceptors*).



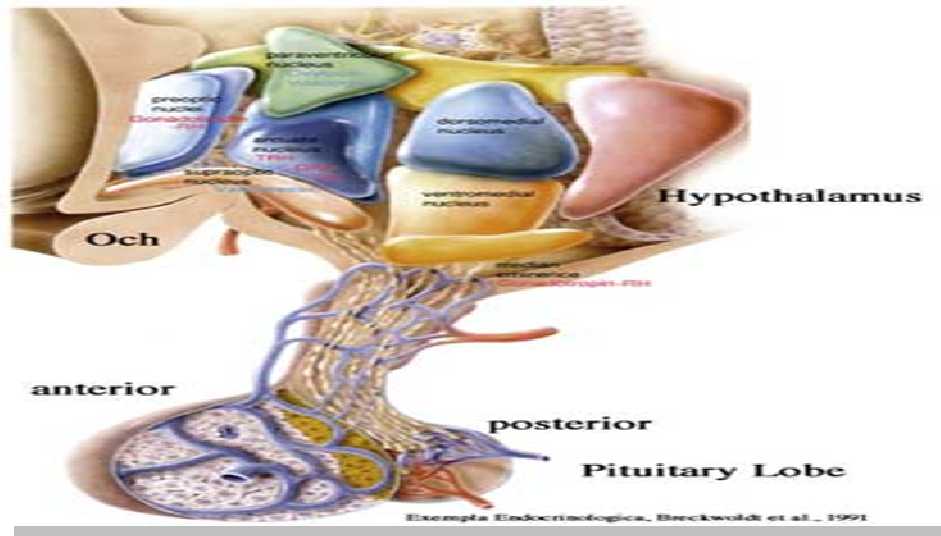
- Secondly, *the state of neural arousal* is communicated by two structures in the midbrain :
 - the **reticular formation** via direct and indirect (via thalamus) routes...



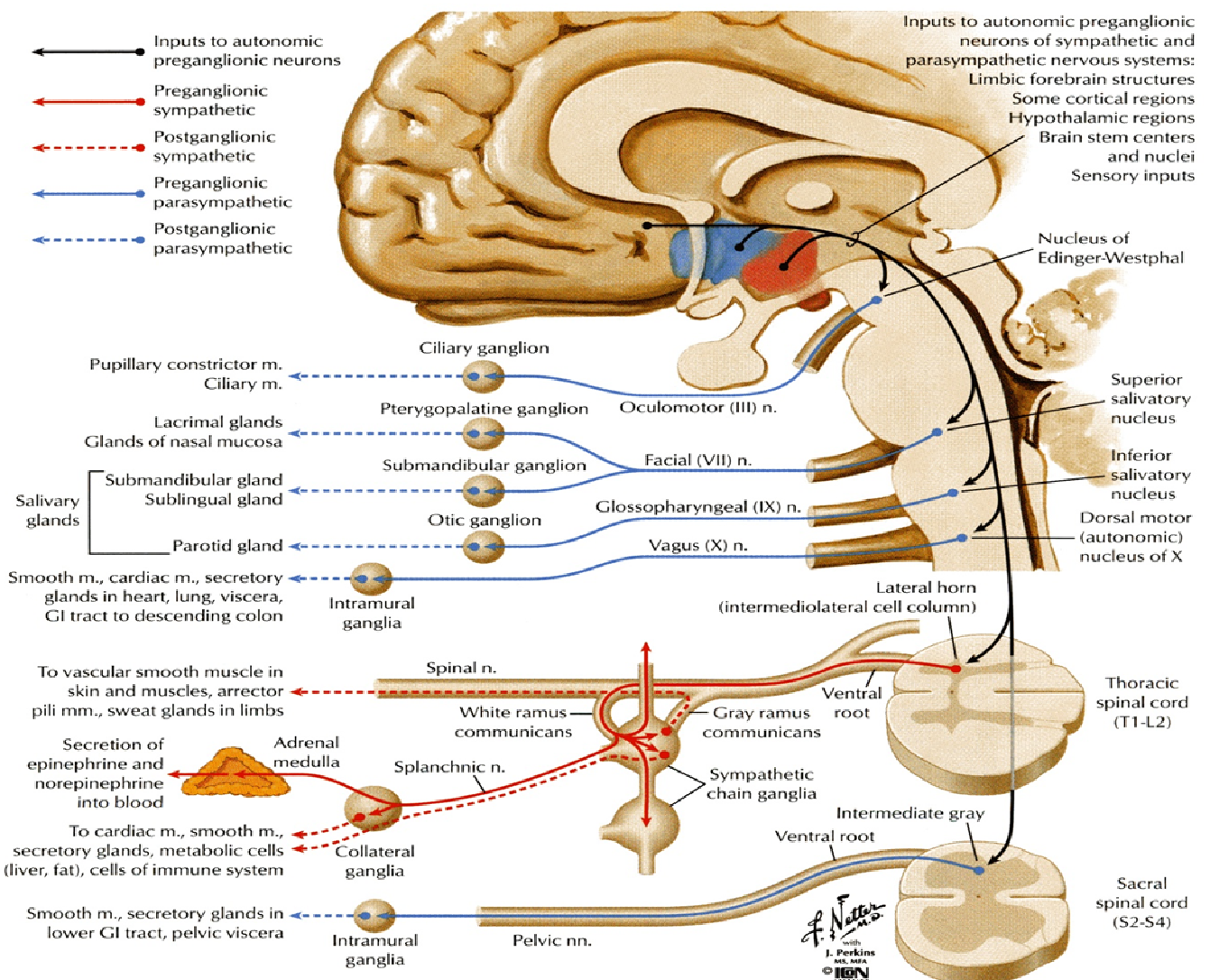
... and the **monoaminergic nuclei** via the medial forebrain bundle.



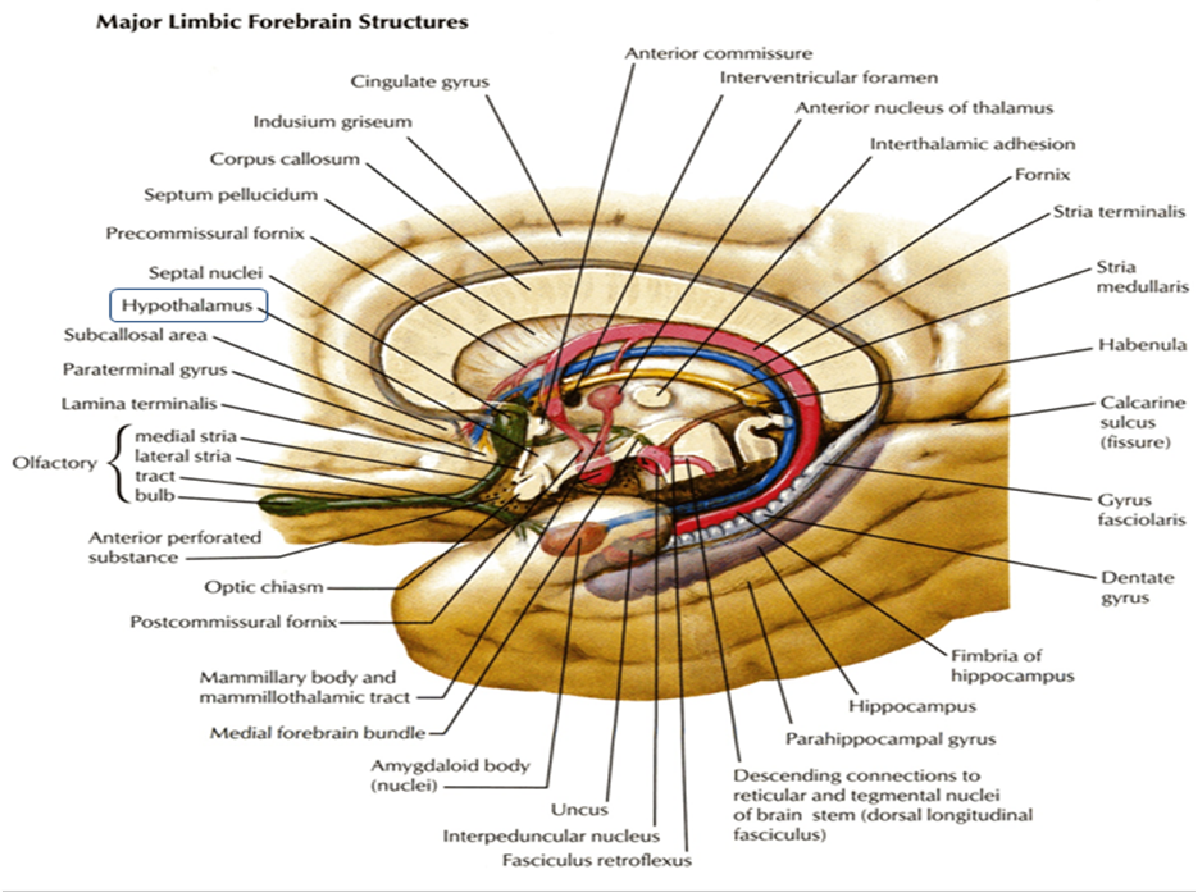
- The hypothalamus is capable of **generating responses** to these stimuli by *circulatory* and *neural means*.
- An intimate relationship with the pituitary gland and privileged access to its circulation (portal system) confers the *role of 'orchestrator of the endocrine system'* on the hypothalamus, as it directs hormonal synthesis and release.



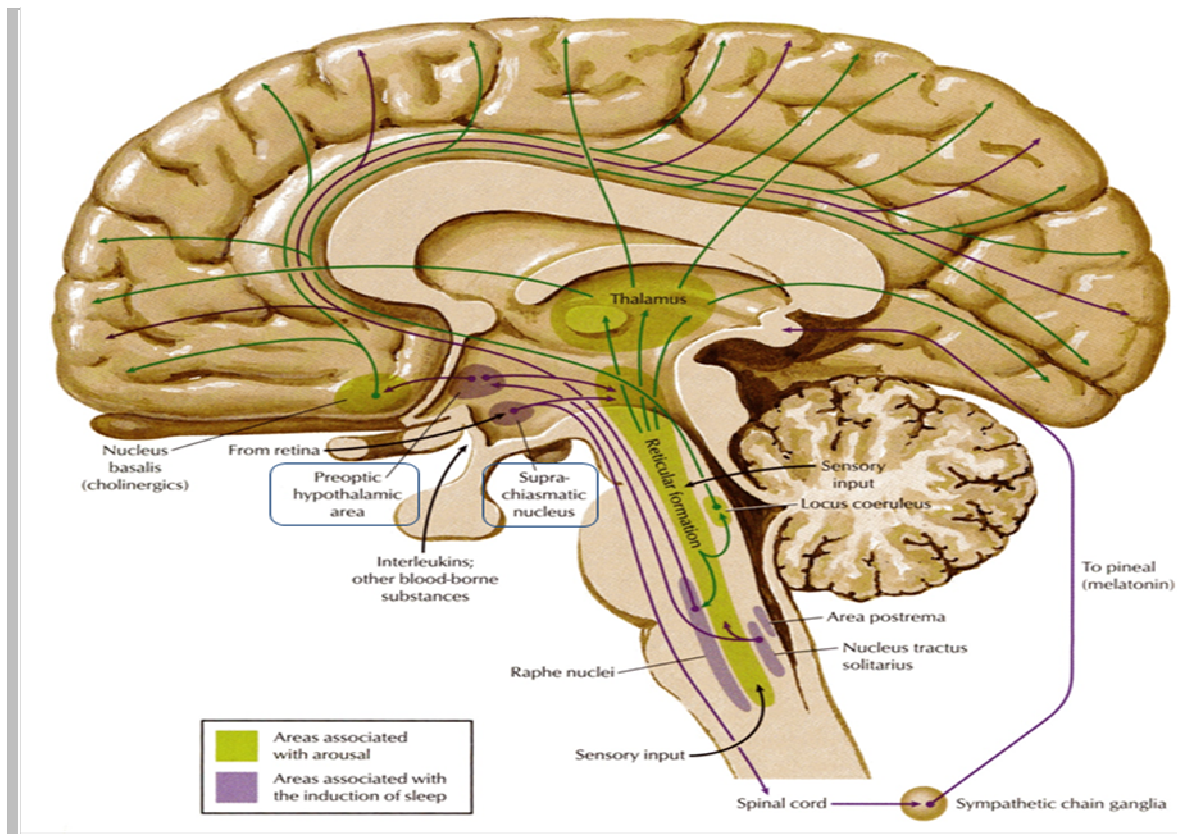
- The **neural output** of the hypothalamus is *twofold*.
- Firstly, the **autonomic nervous system** projects to and controls internal organs, outside conscious control (and, hence, autonomous).



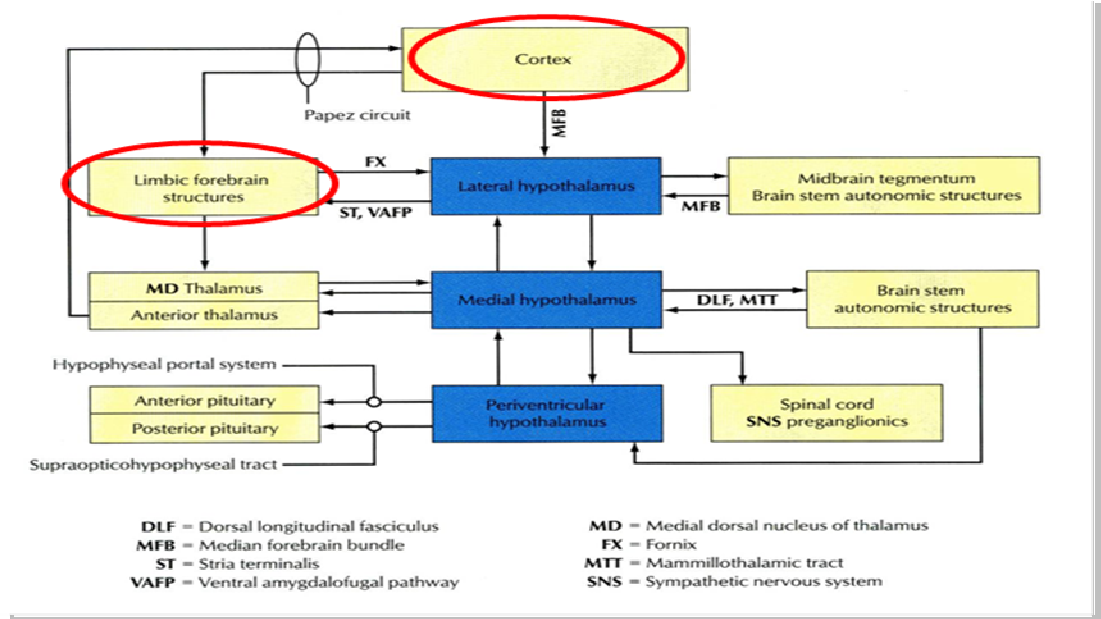
- Secondly, the **hypothalamus is capable of initiating** appropriate motor **behavioural repertoires of an instinctive kind** *through its connections with the limbic system* and limbic part of the corpus striatum (the nucleus accumbens).



- Through its *interconnections with the reticular formation*, the **hypothalamus is also capable of influencing the state of wake-fulness and sleep.**

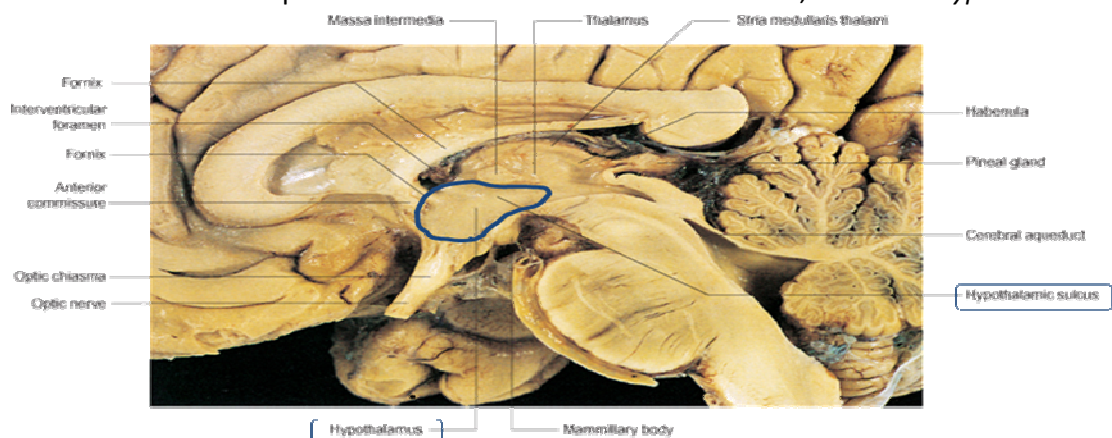


- The **hypothalamus** has the capability of influencing or overriding more complex adaptive behaviour because of its close links with two important structures: *the limbic system* and *the association cortex* of the frontal lobe (orbital part).

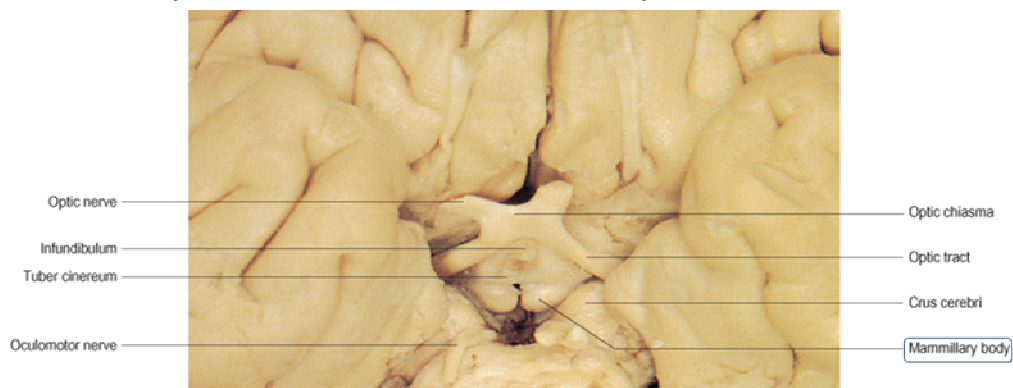


TOPOGRAPHICAL ANATOMY OF THE HYPOTHALAMUS :

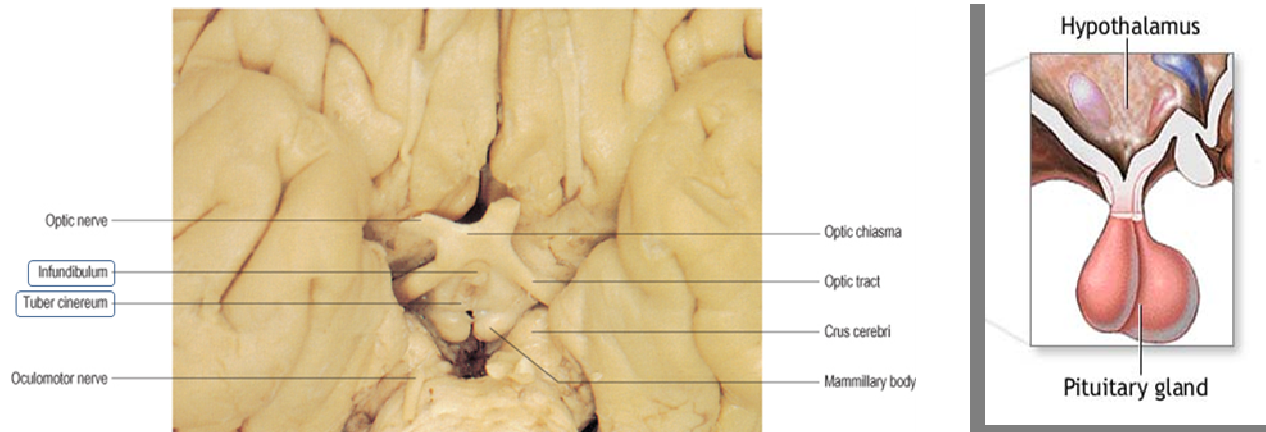
- The **hypothalamus** is the most ventral part of the diencephalon, lying beneath the thalamus and ventromedial to the subthalamus.
- It forms the floor and the lower part of the lateral wall of the third ventricle, *below the hypothalamic sulcus*.



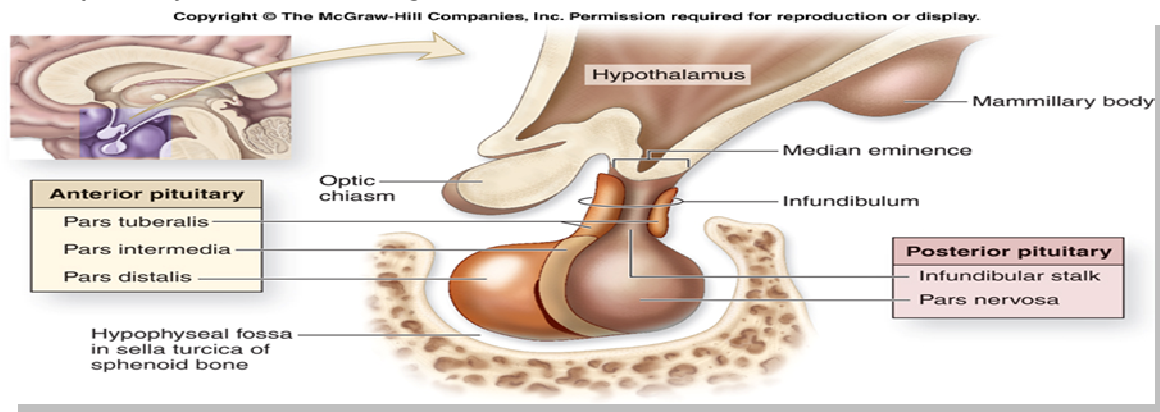
- On the base of the brain, parts of the hypothalamus can be seen occupying the small area circumscribed by the crura cerebri, optic chiasma and optic tracts.
- Between the rostral limits of the two crura cerebri, on either side of the midline, lie two distinct, rounded eminences, the **mammillary bodies**, which contain the **mammillary nuclei**.



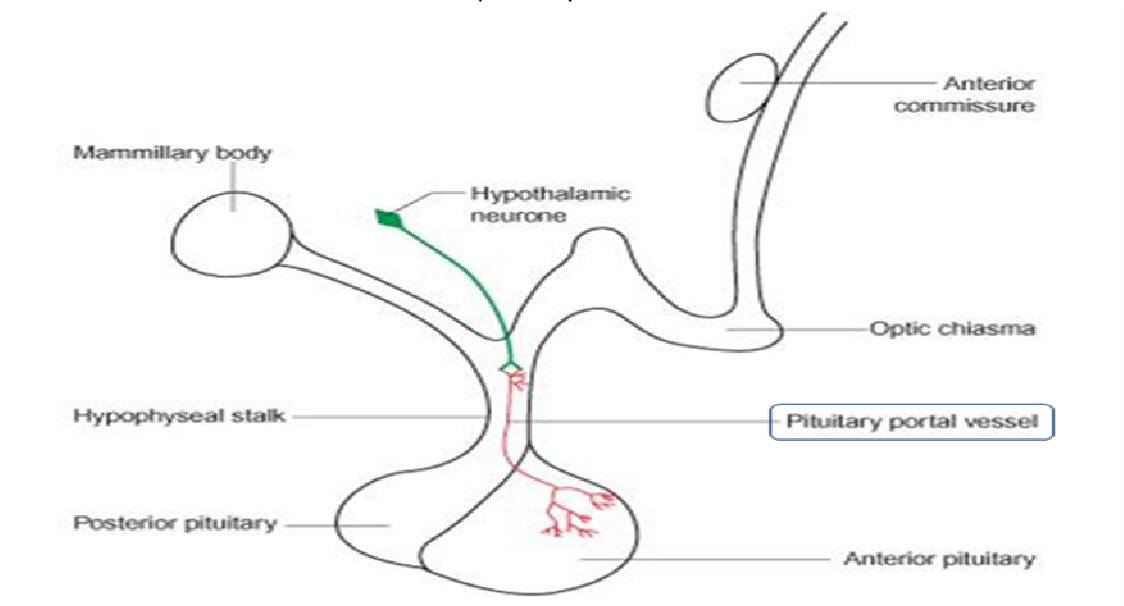
- In the midline, immediately caudal to the optic chiasma, lies a small elevated area known as the **tuber cinereum**, from the apex of which extends the thin **infundibulum** (infundibular process), or **pituitary stalk**.
- This is attached to the **pituitary gland (hypophysis)**, a pea-sized structure which lies within the sella turcica of the sphenoid bone.



- The pituitary gland consists of two major, cytologically distinct, parts : the posterior pituitary or **neurohypophysis** and the anterior pituitary or **adenohypophysis**.
- The **posterior pituitary** is a *neuronal structure*, being an expansion of the distal part of the infundibulum.
- The **anterior pituitary** is *not neural* in origin.

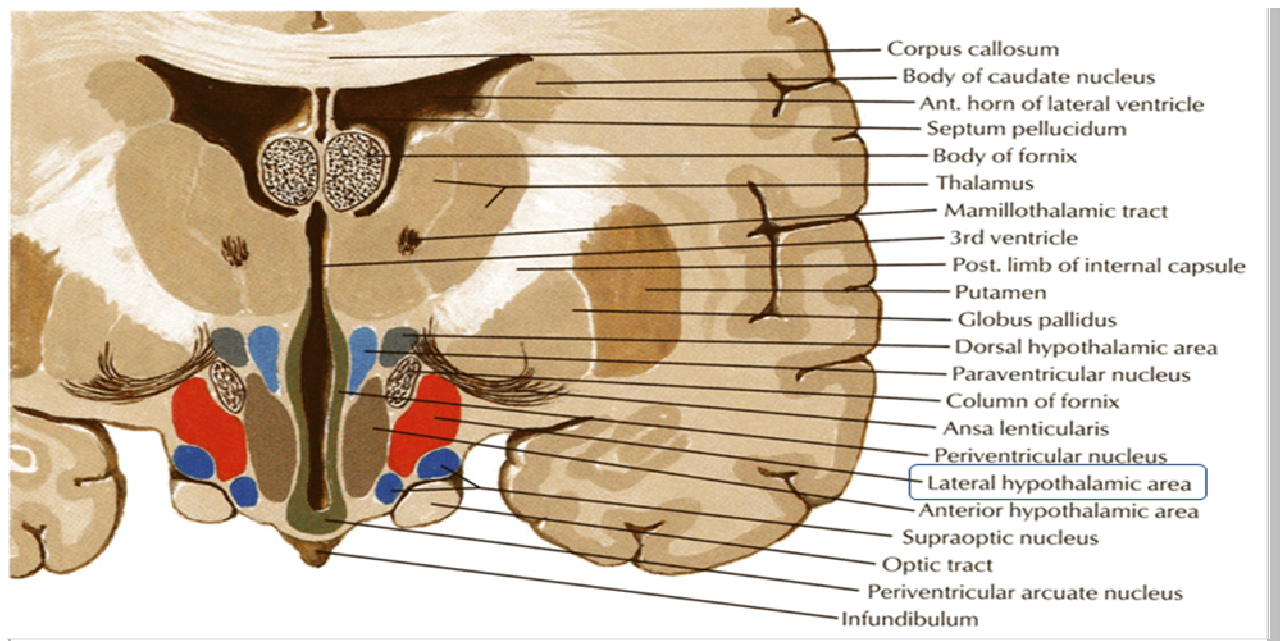


- The two parts of the pituitary are, however, closely linked by the **pituitary (hypophyseal) portal system** of vessels, which are derived from the superior hypophyseal artery.
- **Releasing factors**, which are synthesised in the hypothalamus, pass to the adenohypophysis through these vessels to control the release of anterior pituitary hormones.

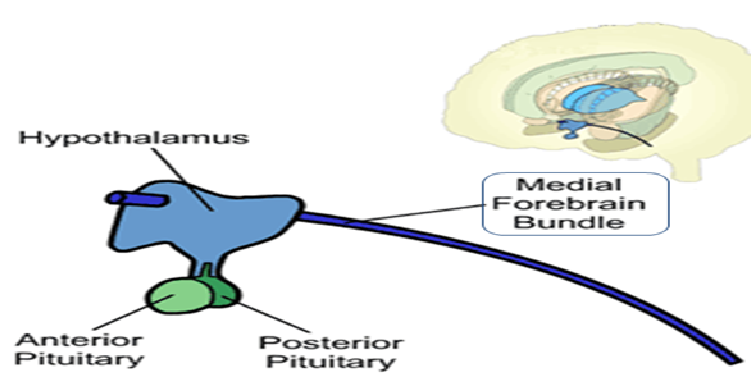


HYPOTHALAMIC NUCLEI :

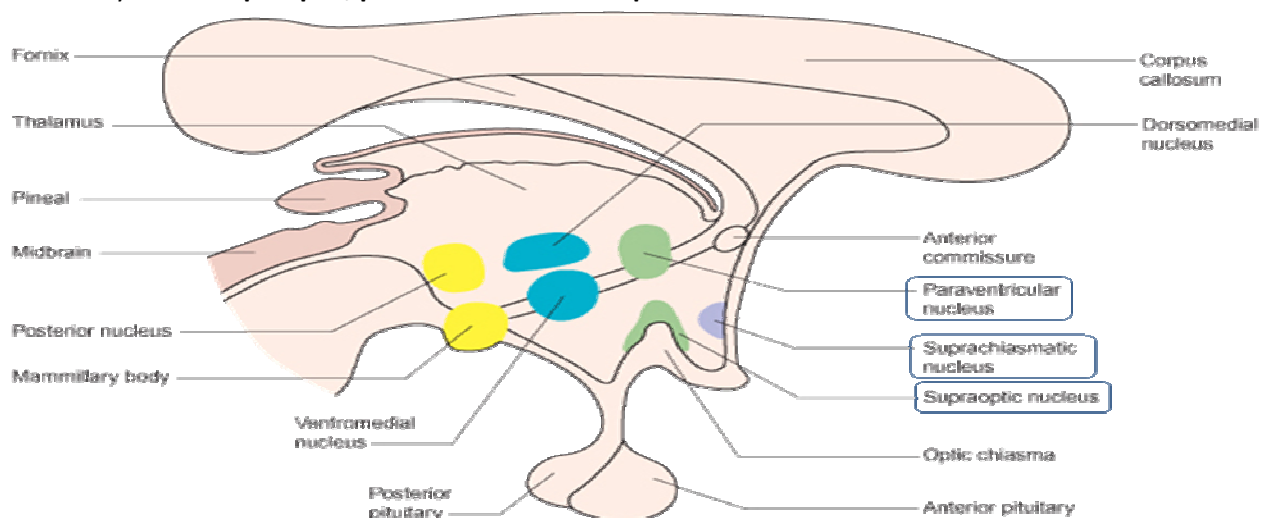
- The hypothalamus consists of many nuclear divisions.
- The region lying medial and ventral to the structures of the subthalamus is known as the **lateral hypothalamus**.



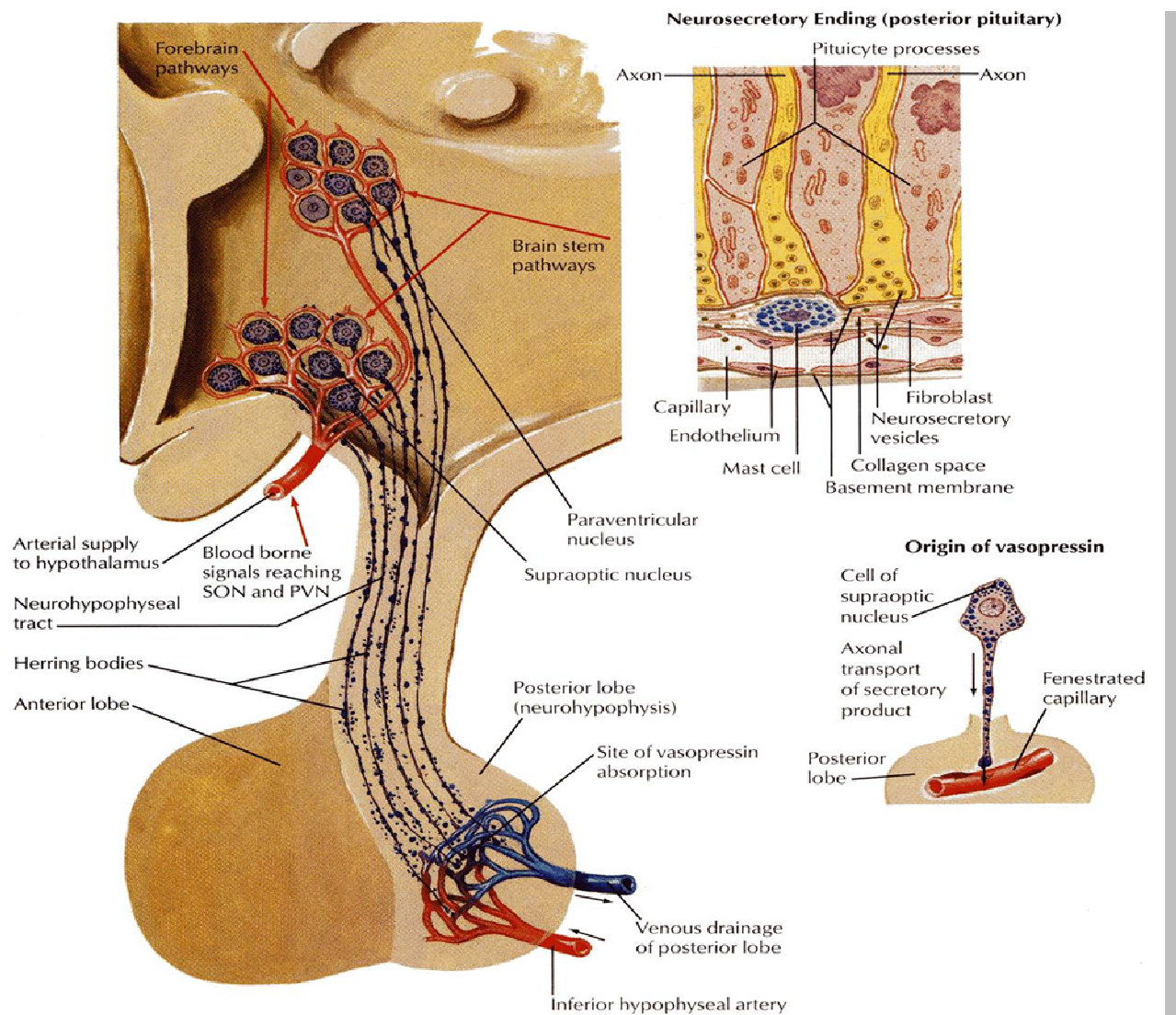
- The lateral hypothalamus is traversed longitudinally by many fibres, including the **medial forebrain bundle**.
- The lateral hypothalamic area is important in the *control of food and water intake* and is, in part, equivalent to the physiologically defined feeding centre.
- *Lateral hypothalamic lesions cause aphagia and adipsia.*



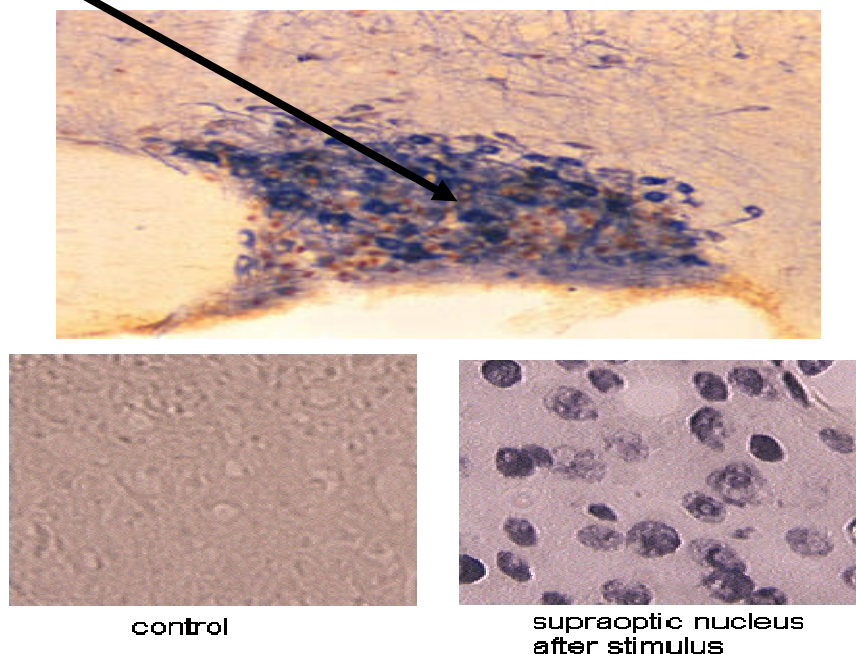
- The **medial region** of the hypothalamus contains various nuclei, only some of which have well-defined functions.
- Anteriorly lie the **supraoptic, paraventricular and suprachiasmatic nuclei**.



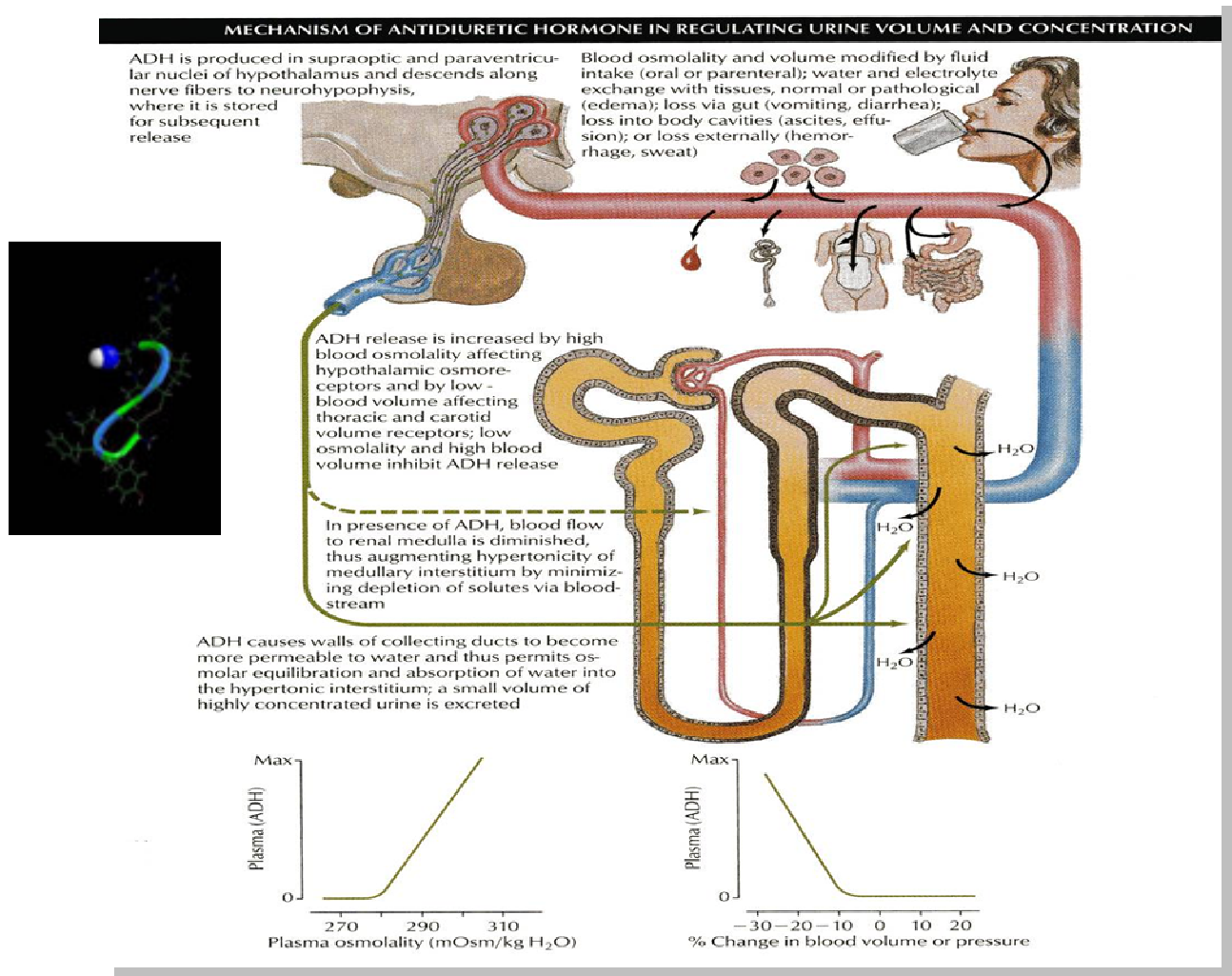
- The **supraoptic** and **paraventricular nuclei** both *produce* systemically acting *hormones*, which are released from the posterior pituitary into the general circulation.



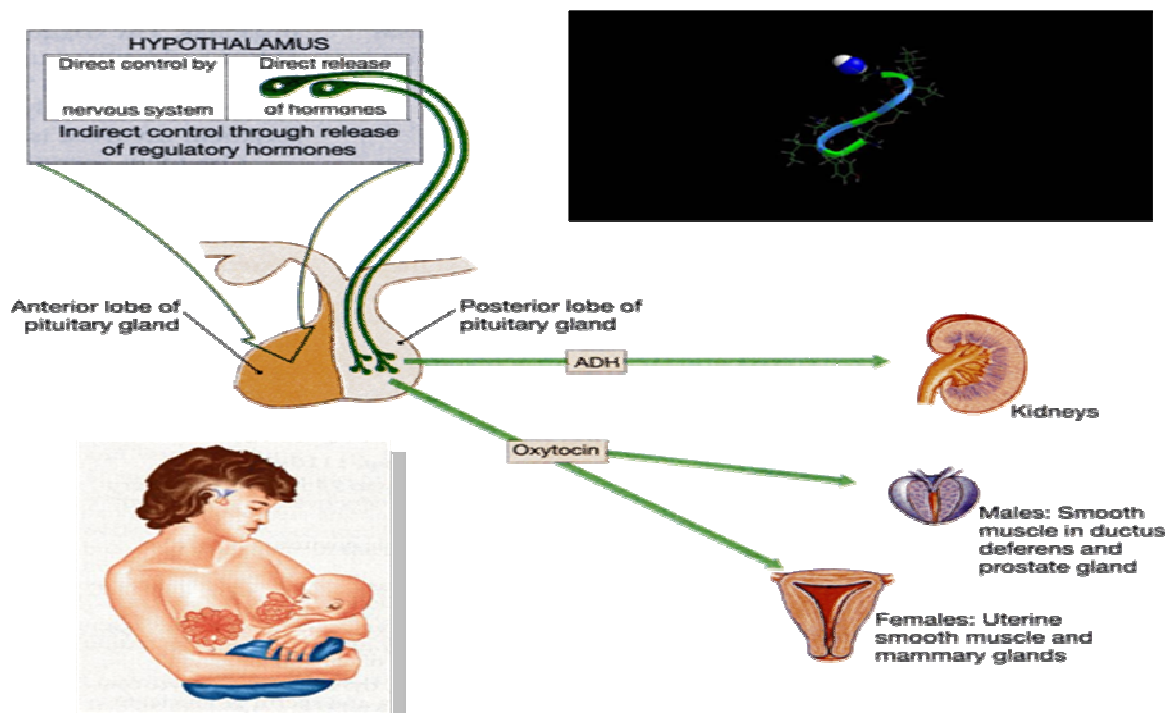
- The **supraoptic nucleus** contains *osmosensitive neurones* that are activated by changes in the osmolality of circulating blood.



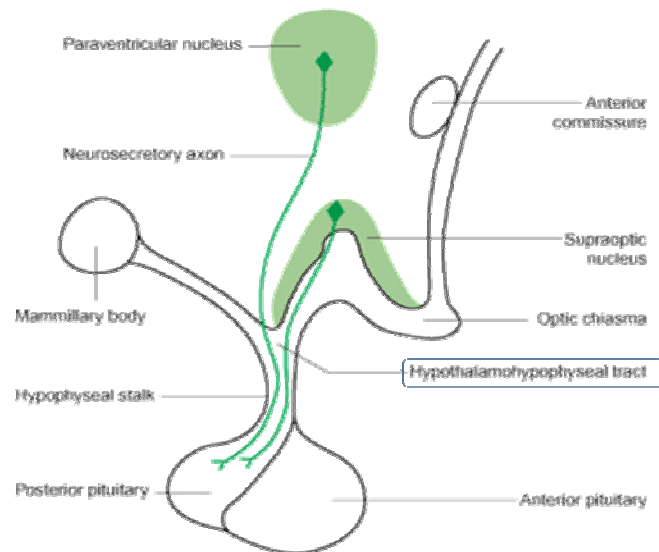
- An increase in osmolality causes release of vasopressin.
- Vasopressin acts upon the kidney tubules to increase water reabsorption, thus maintaining water homeostasis.



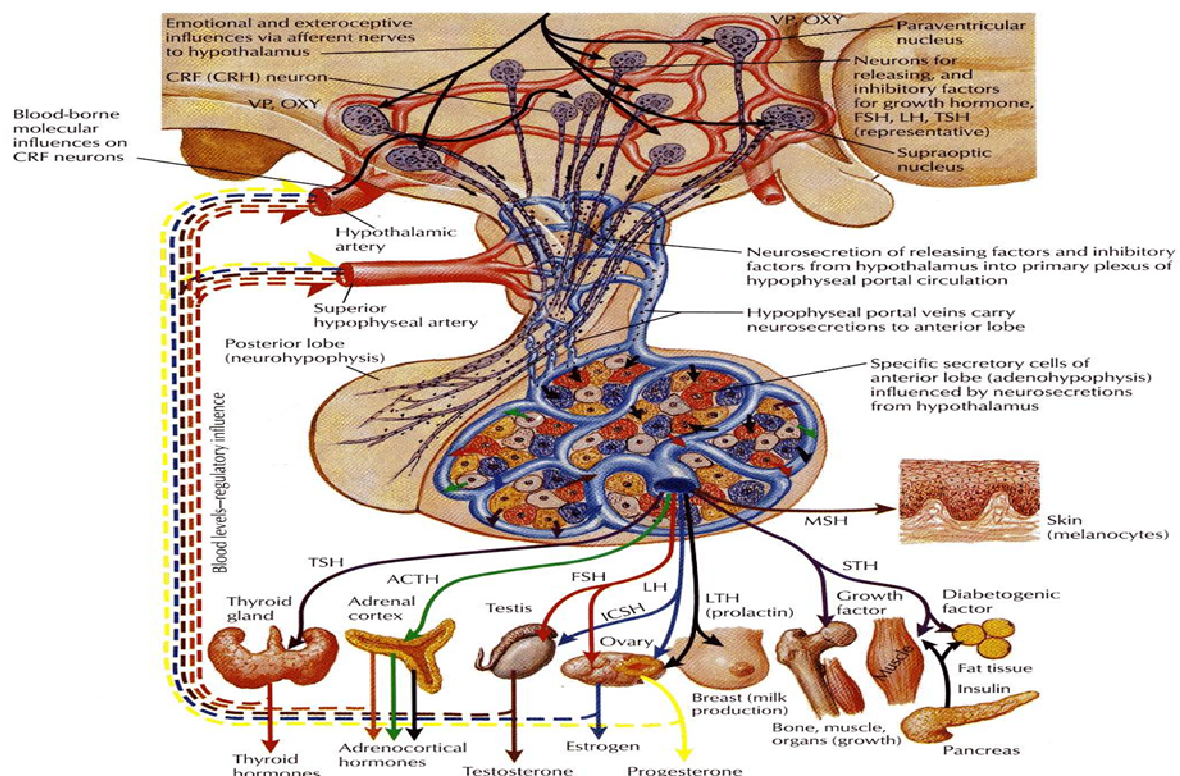
- The **paraventricular nucleus** synthesises *oxytocin*.
- In the female, activation of the paraventricular nucleus, and *release of hormone, is induced by suckling*.
- This stimulates milk production by the mammary gland and causes *contraction of uterine muscle*.



- The axons of cells in the supraoptic and paraventricular nuclei pass to the neurohypophysis in the **hypothalamohypophyseal tract**.
- The neuroendocrine products are transported in this tract to the neurohypophysis, where they are released into the capillary bed and, thus, reach the general circulation.

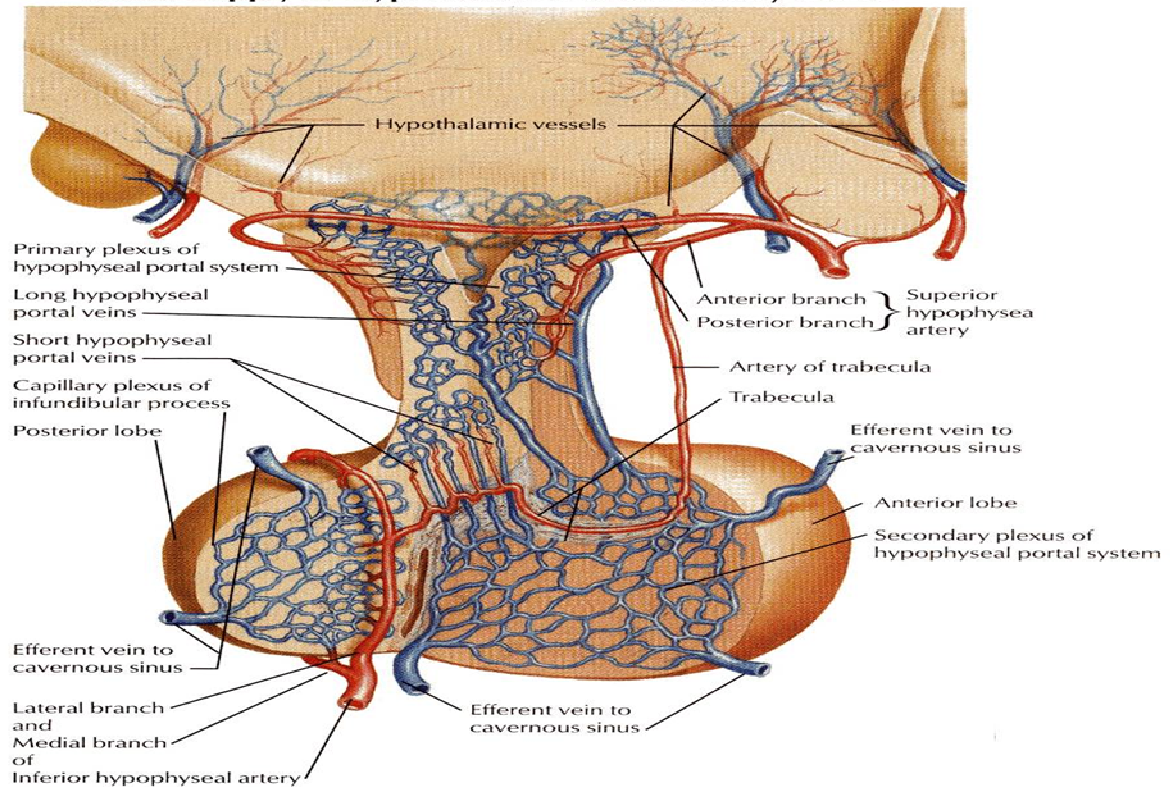


- The hypothalamus also **synthesises releasing factors and release-inhibiting factors, which control the release** of hormones by the adenohypophysis.
- The adenohypophysis produces *adrenocortico-trophic hormone (ACTH)*, *luteinising hormone (LH)*, *follicle-stimulating hormone (FSH)*, *thyroid-stimulating hormone (TSH)*, *growth hormone* and *prolactin*, which are released into the general circulation.

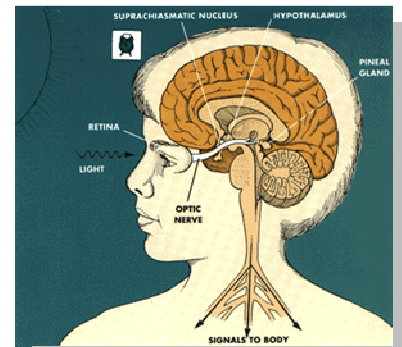
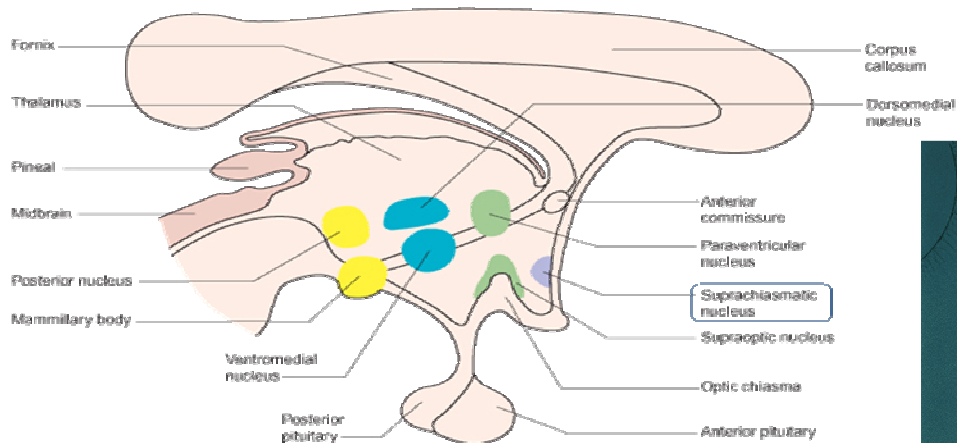


- The factors that control the hormonal secretion of the adenohypophysis are released from the terminals of hypothalamic neurones into the capillary bed of the **pituitary portal system**.
- These vessels, which are intrinsic to the hypophyseal stalk, convey the released agents to the adenohypophysis, where they act upon the hormone-secreting cells.
- The synthesis of hypothalamic releasing factors is under feedback regulation by hormones produced by target organs.

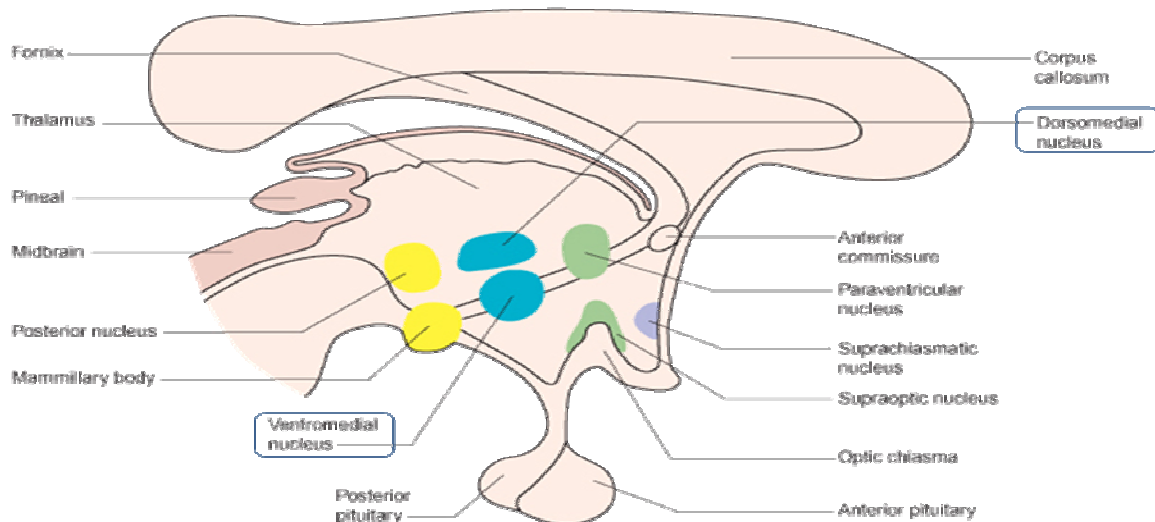
Blood Supply of Hypothalamus and Pituitary Gland



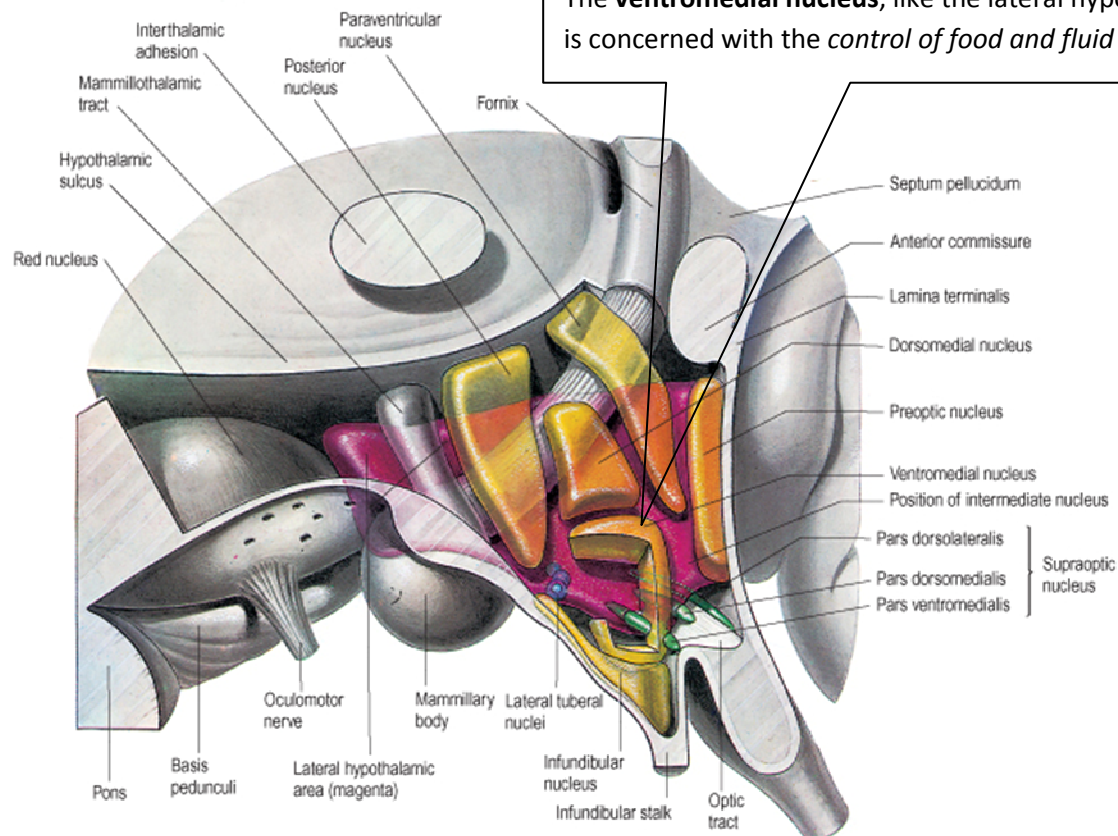
- The **suprachiasmatic nucleus** is concerned with the *control of diurnal rhythms* and the sleep/waking cycle.
- It receives some afferent fibres directly from the retina.



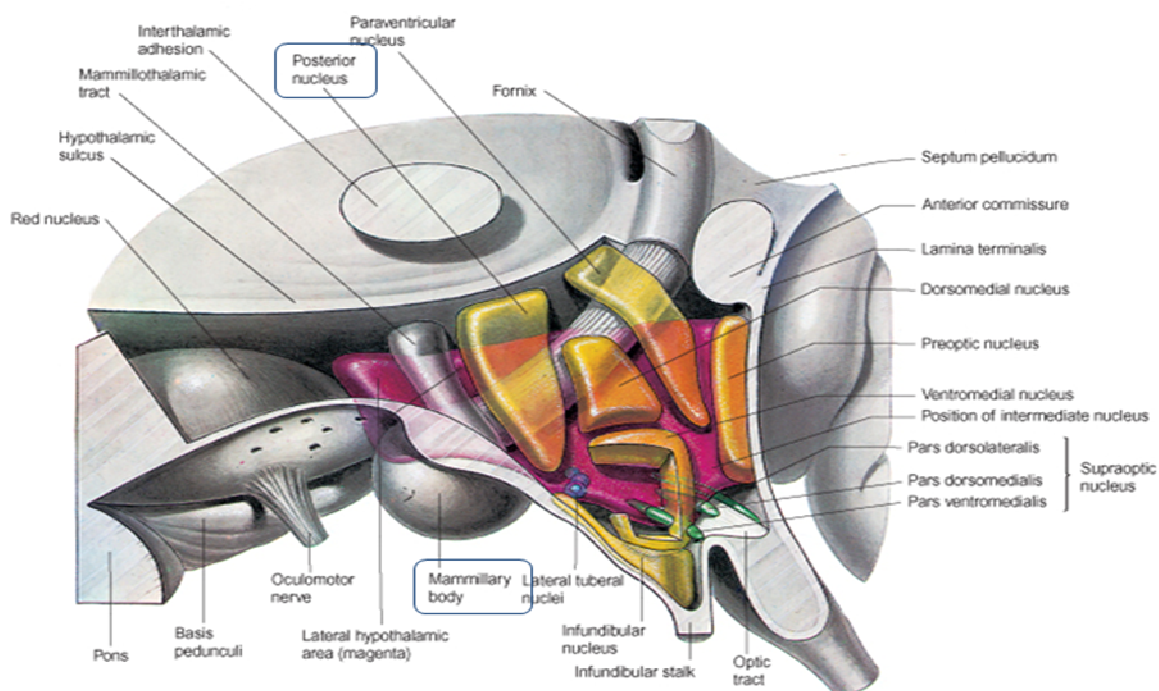
- More caudally, **dorsomedial** and **ventromedial nuclei** lie deep to the lateral wall of the third ventricle.



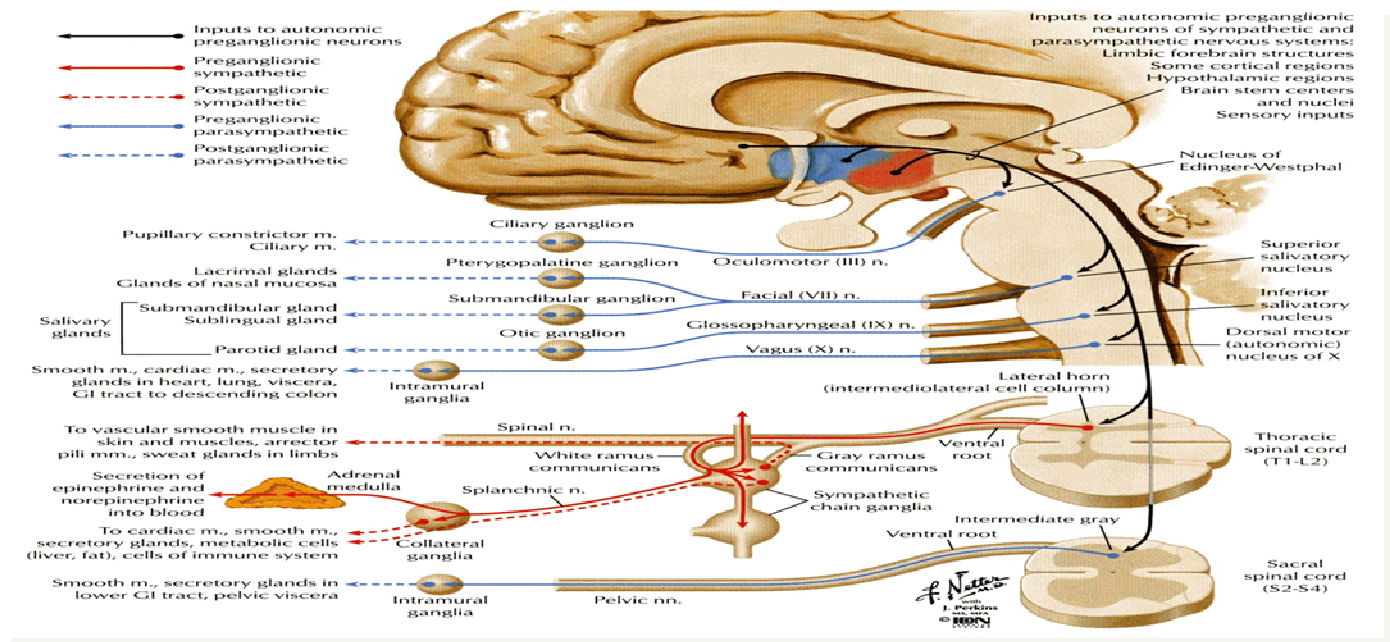
- The ventromedial nucleus is equated with the physiologically defined **satiety centre** and lesions of this region cause abnormally increased food intake.



- In the most caudal part of the hypothalamus lie the **posterior nucleus** and the **medial mammillary nucleus**, the latter being located within the mammillary body.
- The **mammillary body** is part of the *limbic system*, receiving afferents from the hippocampus and projecting to the anterior nuclei of the thalamus and the brain stem.

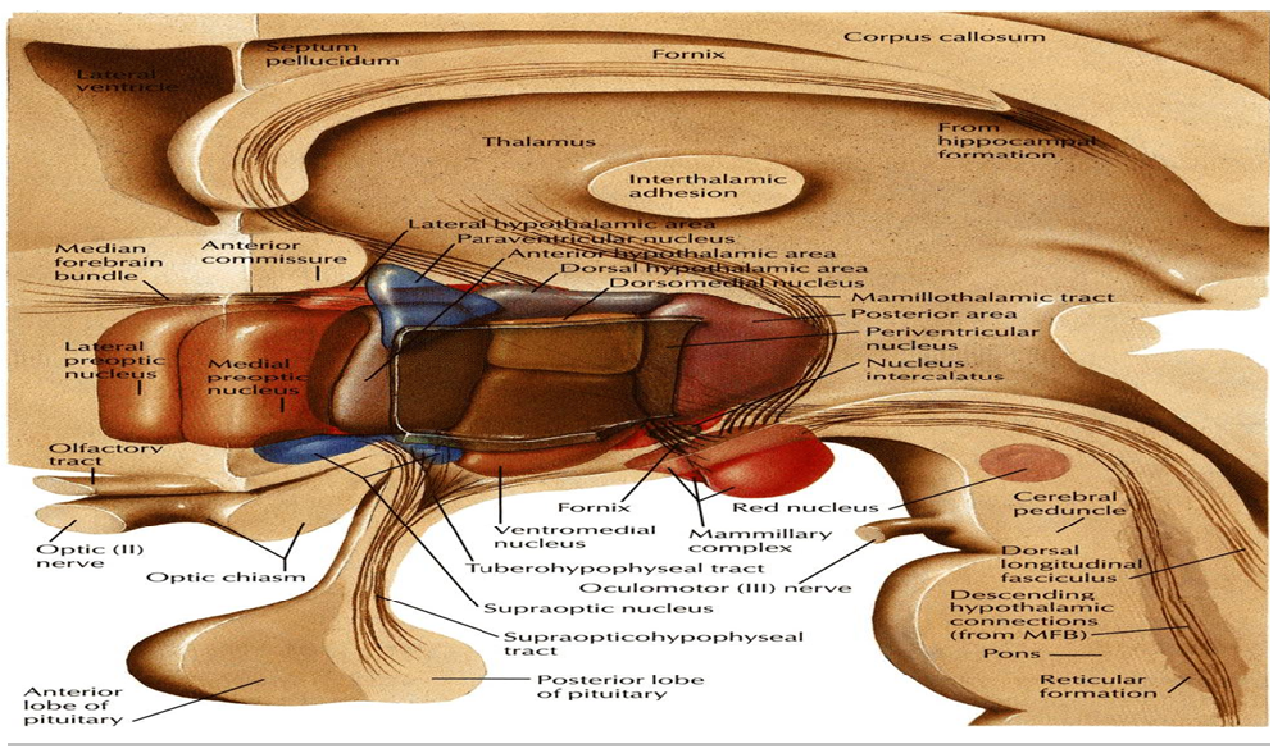


- The *hypothalamus* is the brain centre for regulation of the *autonomic nervous system*.
- Generally, activation of the **posterior hypothalamic domain** is associated with *sympathetic responses*, whereas activation of the **anterior hypothalamus** is associated with *parasympathetic activity*.



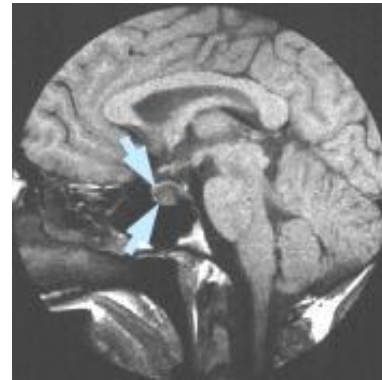
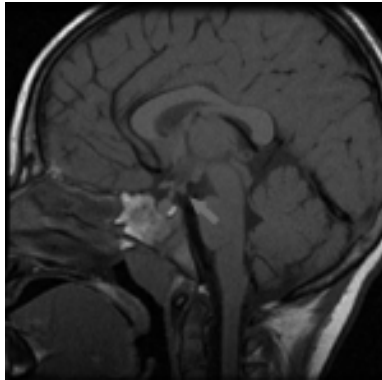
HYPOTHALAMUS – IN BRIEF :

- The hypothalamus is part of the diencephalon; it is connected to the pituitary gland via the infundibulum.
- The hypothalamus has autonomic, neuroendocrine and limbic functions and is involved in the coordination of homeostatic mechanisms.
- The hypothalamus produces hormones that are released from the posterior pituitary and also releasing factors that control the release of hormones from the anterior pituitary.
- The supraoptic and paraventricular nuclei of the hypothalamus produce vasopressin and oxytocin, respectively.
- Vasopressin and oxytocin are transported to the posterior pituitary in the hypothalamohypophyseal tract.
- The anterior pituitary produces: adrenocorticotrophic hormone, luteinising hormone, follicle-stimulating hormone, thyroid-stimulating hormone, growth hormone and prolactin. Factors that control their secretion are released into the pituitary portal system of the pituitary stalk and carried to the anterior pituitary.
- The lateral hypothalamus and the ventromedial nucleus regulate eating and drinking.

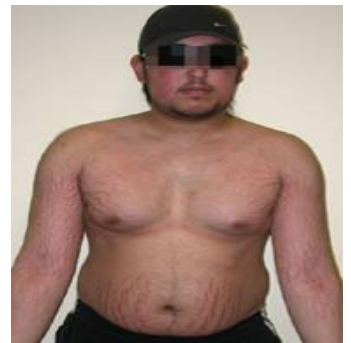


TUMOURS OF THE HYPOTHALAMUS AND PITUITARY GLAND :

- Tumours and other diseases of the hypothalamus and associated pituitary gland lead to under- or overproduction of circulating hormones.



- These hormonal disturbances, in turn, produce :
 - **Disorders of growth** (*dwarfism, gigantism and acromegaly*),
 - **Sexual function** (*precocious puberty, hypogonadism*),
 - **Body water control** (*diabetes insipidus and pathological drinking*),
 - **Eating** (*obesity and bulimia*), and
 - **Adrenal cortical control** (*Cushing's disease and adrenal insufficiency*).

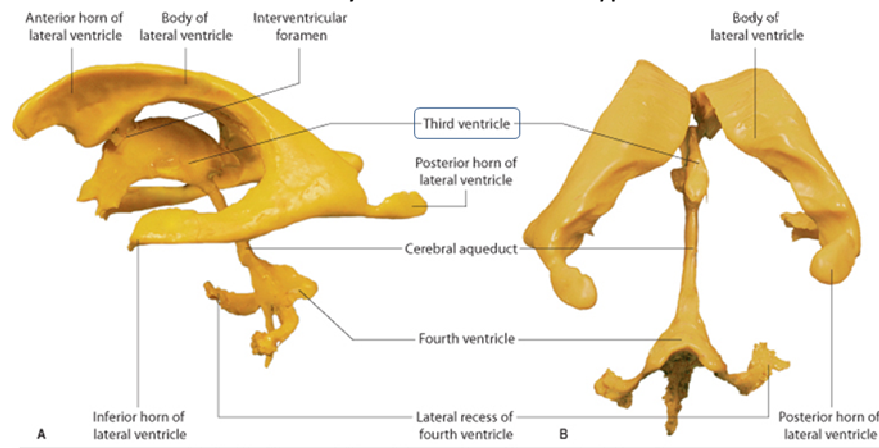


- Since the pituitary gland is closely adjacent to the optic chiasma, tumors of the gland (**pituitary adenomas**) may lead to *bitemporal visual field loss*.

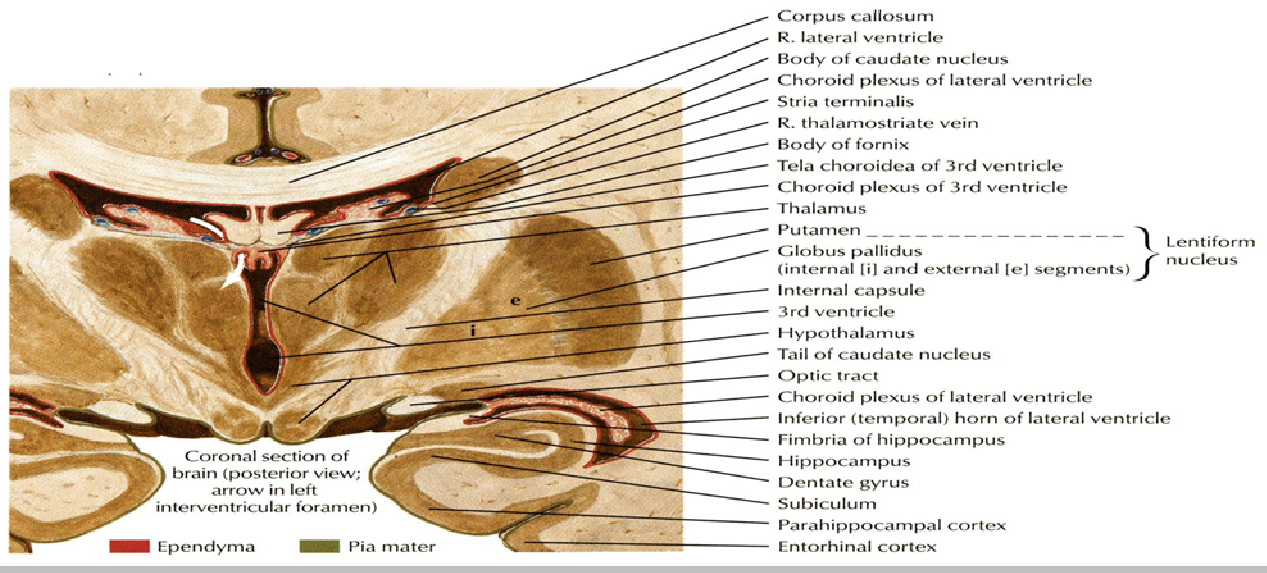


3RD VENTRICLE :

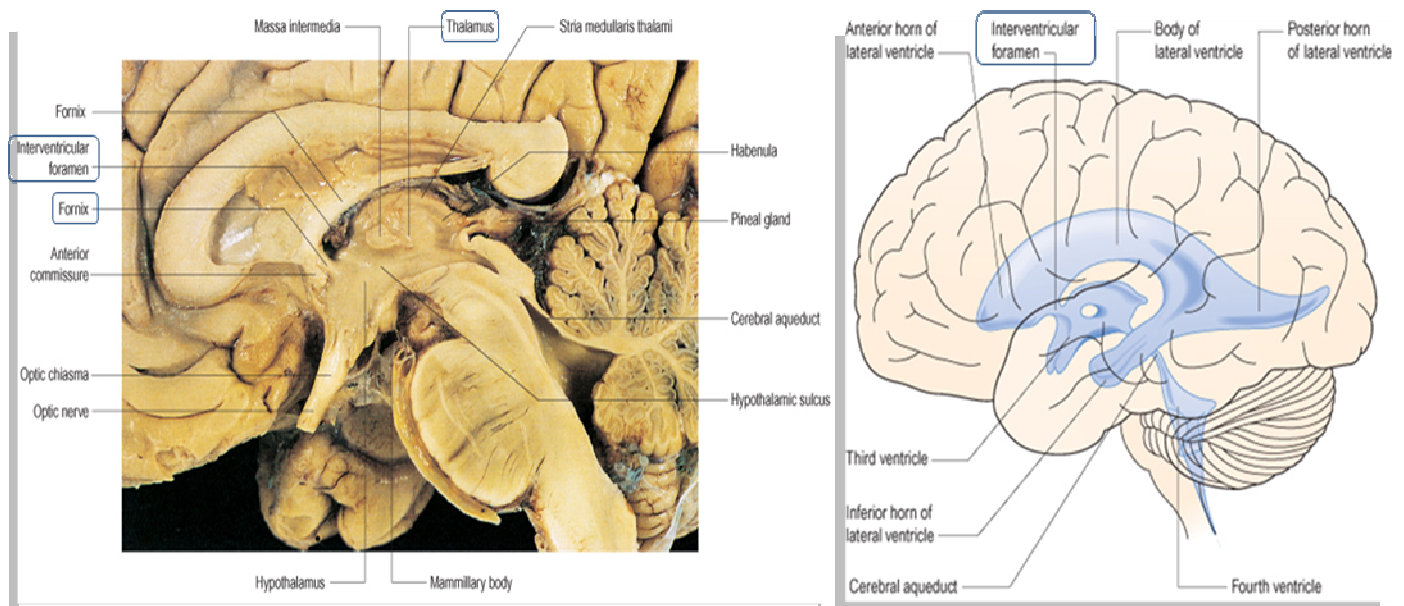
- At the rostral margin of the midbrain, the cerebral aqueduct opens into the **third ventricle**, which is a narrow slit-like cavity whose lateral walls are formed by the thalamus and hypothalamus on either side.



- The roof of the ventricle** is formed by pia-ependyma, which spans between the two striae medullaris thalami, situated along the dorsomedial border of the thalamus.

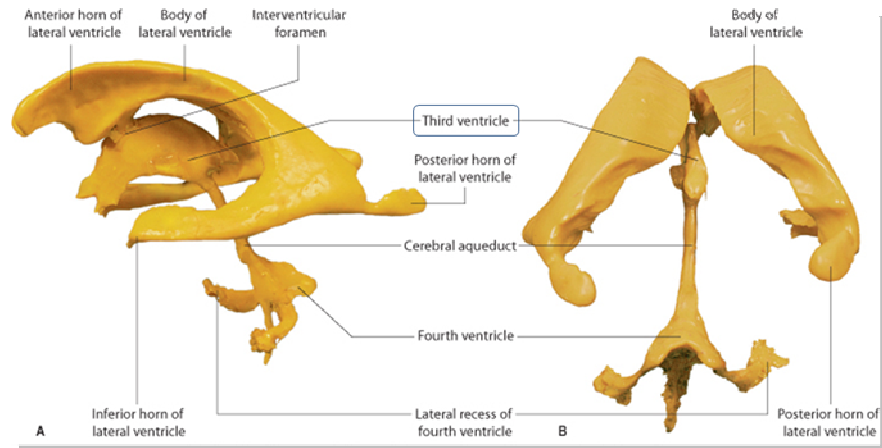


- In the rostral part of the third ventricle lies an aperture, the **interventricular foramen** or **foramen of Monro**, which is located *between the column of the fornix and the anterior pole of the thalamus*.

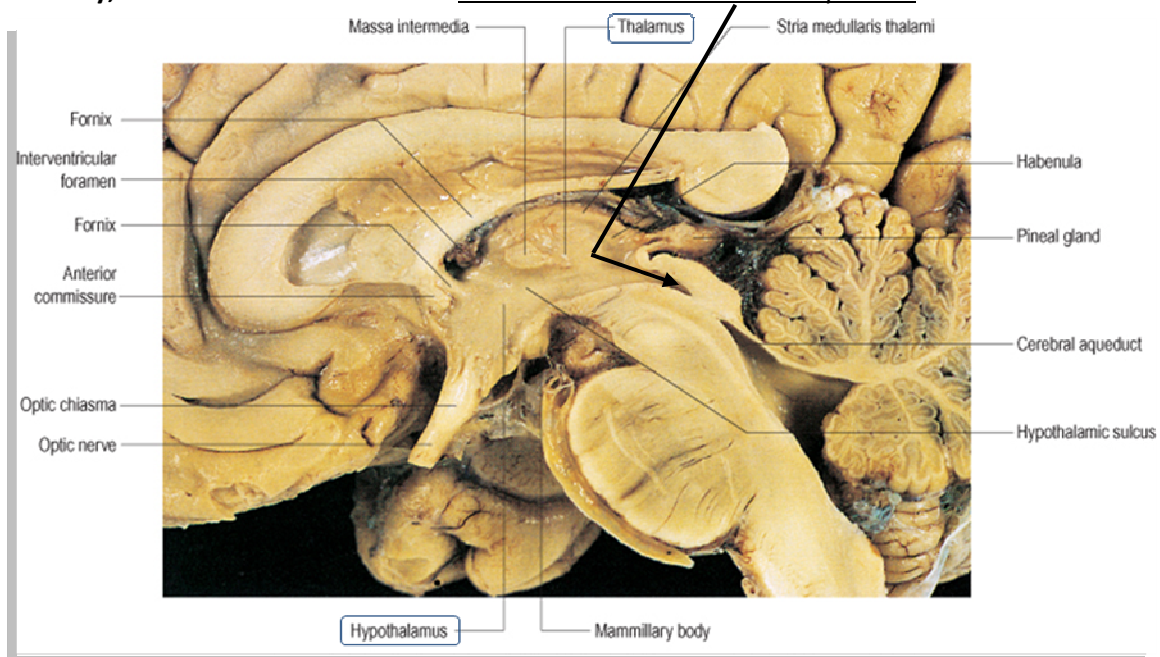


TOPOGRAPHICAL ANATOMY :

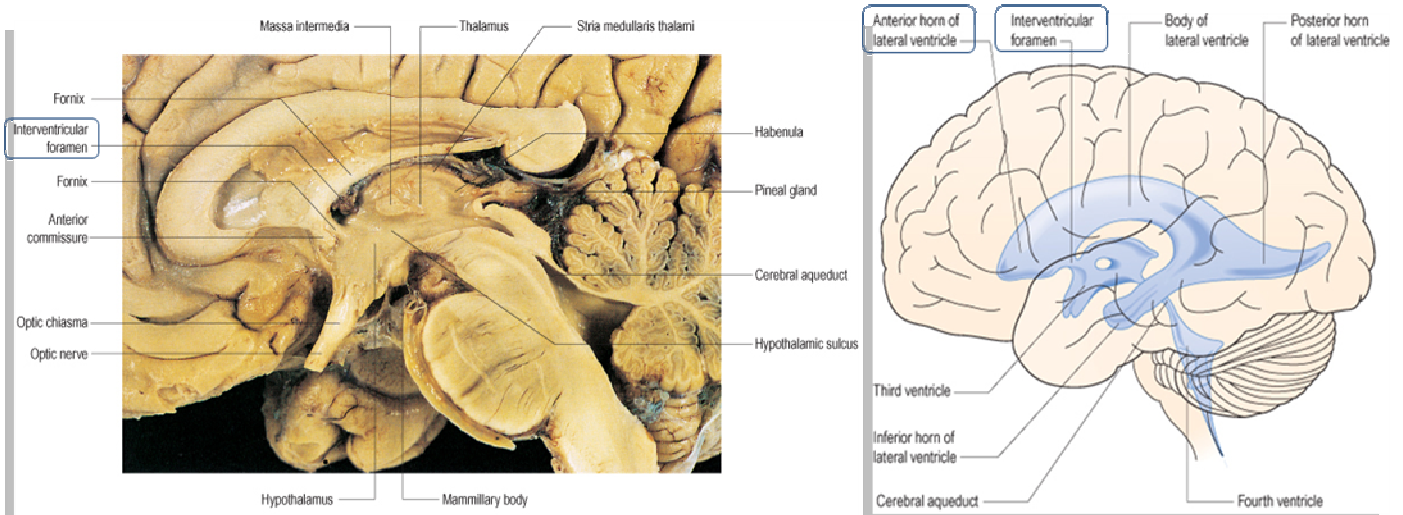
- The third ventricle is a midline, slit-like cavity.



- The **lateral walls** of the 3rd ventricle consist of the *thalamus and hypothalamus*.
- Caudally**, the third ventricle becomes continuous with the cerebral aqueduct.



- The **interventricular foramen** provides communication, on either side, with the extensive lateral ventricle located within the cerebral hemisphere.



SELF QUIZ

1- Which of the following sentences are not true about subthalamus :

- a. It has a role in the control of movement.
- b. It lies beneath the thalamus.
- c. Its dorsolateral aspect against the internal capsule.
- d. It has two nucleus.
- e. The subthalamic nucleus is connected to globus pallidus.

2- Which of the following sentences are not true about hypothalamus :

- a. The anterior commissure is located anterior to it.
- b. The paraventricular and supraoptic nuclei of the hypothalamus produce vasopressin and oxytocin, respectively.
- c. The hypothalamus is part of the diencephalon; it is connected to the pituitary gland via the infundibulum.
- d. The lateral hypothalamus and the ventromedial nucleus regulate eating and drinking.
- e. Tumors of the pituitary gland (pituitary adenomas) may lead to bi-temporal visual field loss.

3- Which of the following sentences are not true about 3rd ventricles :

- a. The lower part of the lateral wall are bonded by the thalamus.
- b. The roof of the ventricle is formed by pia-ependyma.
- c. The interventricular foramen provides communication, on either side, with the extensive lateral ventricle.
- d. The cerebral aqueduct opens into the third ventricle.
- e. None of the above.

1. c	2. b	3. a
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THE END

LoveTomy Team 426

Team leader : Dr. hams

Dr. S Dr. noop Omar H

ابتنسم !! همي بروحي

M.A.M Abo Slo7 Cute Killer