

Developmental biology hypophysis

iii M.Sc zoology

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HYPOPHYSIS

Pituitary gland

- In most species the pituitary gland is divided into three lobes: the anterior lobe, the intermediate lobe, and the posterior lobe

- In humans the intermediate lobe does not exist as a distinct anatomic structure but rather remains only as cells dispersed within the anterior lobe..

- Nonetheless, the anterior and posterior lobes of the pituitary are functionally, anatomically, and embryologically distinct.

- The hypophysis cerebri is a pea sized bulb-like half gram structure that extends from hypothalamus to rest in the hypophyseal fossa of the sella turcica in the superior part of the sphenoid bone.

- While it is not considered as being a part of the brain, the gland maintains connection to the brain by way of its **infundibulum** (pituitary stalk) that passes through an encasing fold of dura mater known as the **diaphragma sellae**.

- Anteriorly, a somatoectodermal protrusion from the rostral part of the stomodeum – also known as the hypophyseal pouch of Rathke – forms the glandular component of the pituitary gland.
- This segment, known as the adenohypophysis, is comprised of:

- Pars distalis (anterior) – the larger, distal, highly vascular part of the gland; also known as the anterior pituitary gland,
- Pars intermedia – small intermediate portion between the anterior and posterior portions of the pituitary gland; remnant of the hypophyseal pouch of Rathke,

- Pars tuberalis – superior circumferential extension of the pars distalis that encircles the infundibular stalk of the posterior pituitary gland.

- Simultaneously, as the adenohypophysis projects superiorly, a neuroectodermal outgrowth projects inferiorly from the floor of the third ventricle. The resulting structure is the neurohypophysis.

- The bony borders of the pituitary gland are:
- Anteriorly: tuberculum sellae, jugum sphenoidale, and the prechiasmatic groove
- Posteriorly: dorsum sellae and the posterior clinoid processes (posterolaterally).
- Inferiorly: hypophyseal fossa of the sella turcica and the sphenoid air sinus
- There are other important structures surrounding hypophysis cerebri that should be noted.

- Immediately superior to the gland (outside the diaphragma sellae) the anterior and posterior intercavernous sinuses form an anastomosis at the base of the infundibulum.
- Anteriorly, the left and right [optic nerves](#) branch from the optic chiasm in the prechiasmatic groove and pass through the optic canal with the [ophthalmic artery](#). Anterolaterally, the cavernous parts of the [internal carotid artery](#) passes by in the [cavernous sinus](#). Also located in the cavernous sinus (arranged in a craniocaudal manner) are the [oculomotor](#) (CNIII), [trochlear](#) (CNIV), [abducent](#) (CNVI), [ophthalmic](#) (CNV1) and [maxillary](#) (CNV2) nerves.
- As a result of its post developmental location, visualization of the pituitary gland of an intact specimen is best done from an inferior angle. At this angle, the hypophysis cerebri will be located posterior to optic nerves (CNII) and their chiasm, and anterior to the tuber cinereum and mammillary bodies. The cerebral peduncle and the [pons](#) of the brain stem can also be observed further posterior to the gland. Posterolaterally, on either side, uncus of the parahippocampal gyri can be appreciated.

- The cavernous and supraclinoid parts of the internal carotid artery provide a solitary inferior hypophyseal artery and several superior hypophyseal arteries, respectively. The former provides oxygenated blood to the pars nervosa and the lower aspect of the infundibulum. On the other hand, the latter vessels supply the upper region of the infundibulum and the median eminence. They indirectly provide blood supply to the pars distalis by way of primary and secondary capillary beds. This vascular connection of the adenohypophysis, neurohypophysis and the hypothalamus is known as the hypophyseal portal system.
- Venous drainage of the neurohypophysis is achieved by the short and long portal veins that join the pars distalis capillary bed. Additionally, the inferior hypophyseal vein drains the neurohypophysis directly to the cavernous sinus.

- Neuroendocrine pathway
- The infundibular stalk provides a direct pathway for neuronal communication between the hypothalamus and the pars nervosa. There are no hormone secreting cells in the neurohypophysis. Therefore, the hormones found in the pars nervosa are supraoptically and paraventricularly derived from the nuclei of the hypothalamus. They are then transported to the pars nervosa via the hypothalamo-hypophyseal tract (infundibular stalk). Subsequent to processing and storage, the hormones are released directly on the pars nervosa capillary beds and enter the lumen of the vessels via their fenestra when needed.

- Conversely, there are no direct neuronal communications between the brain and the pars distalis. Since the pars distalis is of somatoectodermal origin, it has a vast vascular network that allows direct hormonal regulation of its actions by the hypothalamus. The numerous fenestrated superior hypophyseal arteries receive hormones from terminal hypothalamic neurons and, by way of primary and secondary capillary plexuses, deliver these hormones to the pars distalis.

- Clinical notes
- Pathophysiology of the pituitary gland may present as an overactive (hyperpituitarism) or an inactive (hypopituitarism) gland.
- Hyperpituitarism may arise from neoplastic insults to the anterior part of the gland. Consequently, there is an overproduction of the trophic hormones that elaborates the respective systems the induced hormones affects. For example, if the pituitary adenoma produces prolactin, the cells are called lactotrophs and the adenoma is classified as a lactotroph adenoma; which causes amenorrhea (in women), galactorrhea, and infertility.
- In cases of hypopituitarism, iatrogenic or ischaemic insults can initiate a destructive cascade that reduces the functionality of the pituitary gland. A persistent Rathke's pouch can develop into a cyst between the adenohypophysis and the neurohypophysis. The pouch may become oedematous after collecting protein-rich fluids, and subsequently obstruct the function of the gland.
- It should also be noted that since the gland is limited inferiorly by the sella turcica of the sphenoid bone, it is most likely that neoplasias of the pituitary gland will grow rostrally. Consequently, the mass may compress the optic chiasm, resulting in visual impairment.