HYPOPITUITARISM

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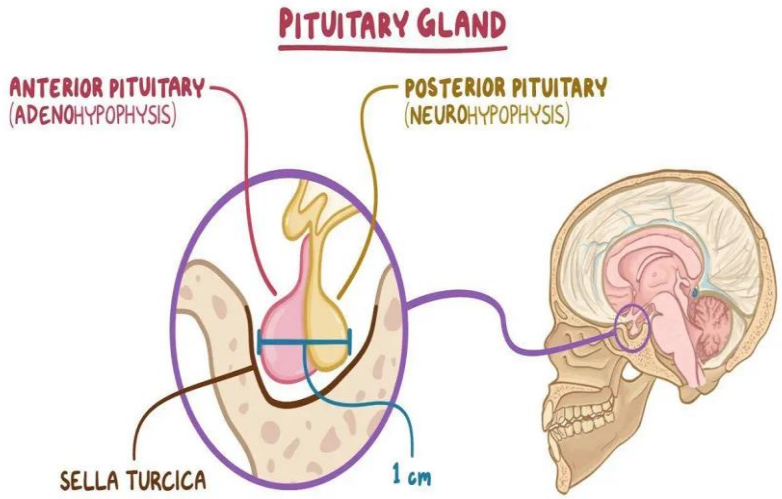
The **pituitary gland** is located at the base of the brain, in a small depression of the sphenoid bone.

Purpose: control the activity of many other endocrine glands.

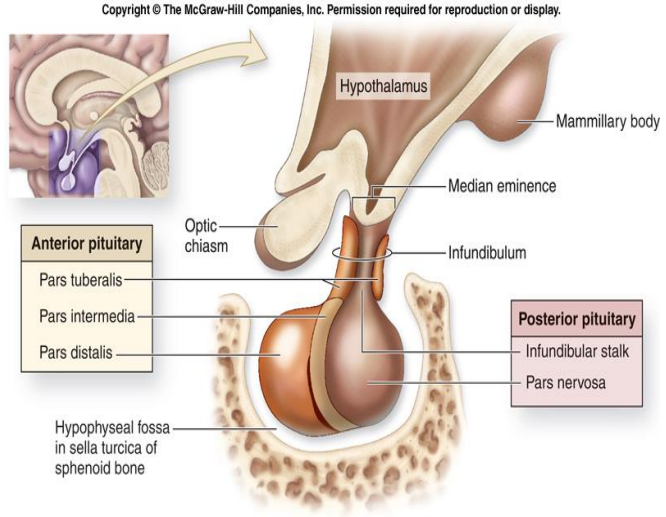
“ Master gland”



The pituitary gland is divided into 2 lobes:

-The anterior lobe, which constitutes 80% of the pituitary and release **6 hormones.**

-The posterior lobe which is store and release **2 hormones**



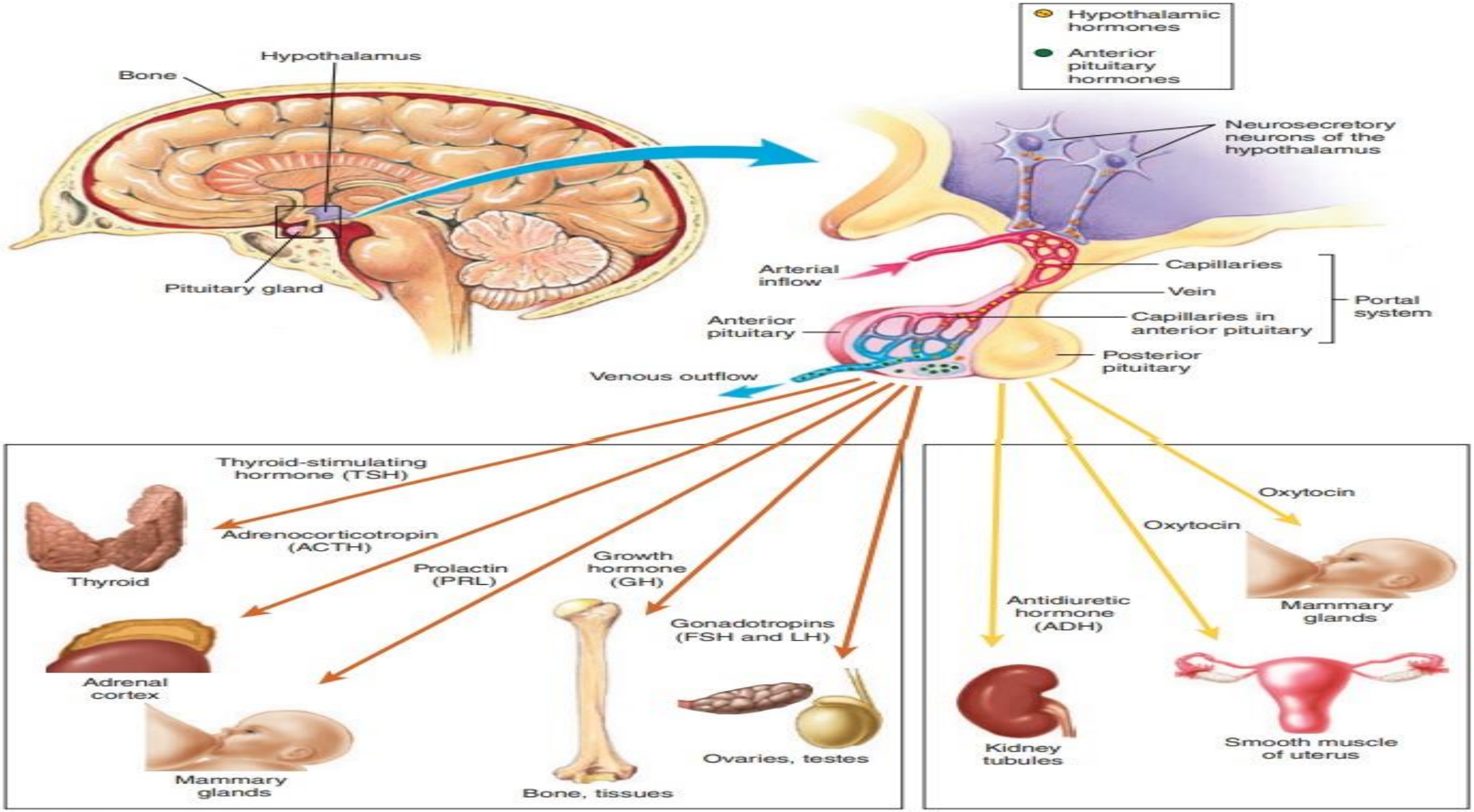


FIGURE 16-6 The pituitary gland.

Anterior Lobe Hormone:

Growth Hormone (GH):

- Effects growth of skeletal muscles and long bones.(linear growth)
- Helps to maintain blood sugar homeostasis.

Prolactin (PRL):

- Stimulates and maintains milk production by the mother's breasts after childbirth.

Adrenocorticotropic Hormone (ACTH):

Stimulates growth of adrenal cortex and secretion of its hormones

Thyroid Stimulating Hormone (TSH):

Stimulates growth of thyroid and secretion of T3 and T4 via cAMP

Gonadotropic Hormones:

- Regulate the hormonal activity of the gonads (ovaries and testes).

Follicle Stimulating Hormone (FSH):

- Stimulates follicle development in ovaries in women. As they mature, they produce estrogen.
- Stimulates sperm development by the testes in men.

Luteinizing Hormone (LH):

- Triggers ovulation of an egg from the ovary in women.
- Stimulates testosterone production by the interstitial cells of testes in men.

POSTERIOR Lobe Hormone:

Oxytocin :

Causes uterine contraction

Breast milk secretion

Vasopressin(ADH) :

Acts at renal collecting ducts on V2 receptors to cause insertion of aquaporin channels and increases water reabsorption thereby **concentrating urine**

DEFINITION

Hypopituitarism refers to the inadequate production of one or more anterior pituitary hormones as a result of damage the pituitary gland and/or hypothalamus.

They are affected in this order: growth hormone (GH), gonadotropins: follicle-stimulating hormone (FSH) and luteinizing hormone (LH), thyroid-stimulating hormone (TSH), and adrenocorticotrophic hormone (ACTH), prolactin (PRL).

Panhypopituitarism is deficiency of all hormones, usually caused by irradiation, surgery, or pituitary tumour

ETIOLOGY

1-Large pituitary tumors, or cysts, as well as **hypothalamic tumors** (craniopharyngiomas, meningiomas, gliomas) can lead to hypopituitarism.The mass can grow in size → compress the functional cells in the pituitary → Hypopituitarism

2-Pituitary apoplexy ▪ Infarction of the pituitary gland as a result of ischemia and/or hemorrhage. Most commonly occurs in patients with a preexisting pituitary adenoma.

Clinical features: severe headache, nausea or vomiting, and altered level of consciousness.

3-Inflammatory diseases can lead to hypopituitarism: sarcoidosis, tuberculosis [TB], syphilis.

4-Trauma, radiation, surgery, infections, and hypoxia may also damage both the pituitary and hypothalamus

Sheehan syndrome:

-postpartum necrosis of the pituitary gland.(pituitary infarction due to excessive post-partum blood loss and hypovolemic shock),

-initial sign being the inability to lactate.

infiltrative diseases including hemochromatosis and amyloidosis may induce this state as well.

Empty Sella Syndrome : is the condition when the pituitary gland shrinks or becomes flattened, filling the sella turcica with cerebrospinal fluid (CSF) instead of the normal pituitary Rarely can compress pituitary → hypopituitarism

CLINICAL FEATURES

• **GH** deficiency in children results in growth failure and short stature. And in adult **gives** an asymptomatic increase in lipid levels and a decrease in muscle mass.

• **Gonadotropic deficiency** (LH and FSH) can occur in women and lead to amenorrhea, infertility, and loss of axillary and pubic hair, loss of libido.

• In men, decreased LH and FSH results in impotence, testicular atrophy, infertility, and loss of axillary and pubic hair and gynecomastia loss of libido.

• **TSH deficiency** results in hypothyroidism with weight gain, fatigue, weakness, cold intolerance, and dry skin.

- **Adrenocorticotropic** (ACTH) deficiency occurs last and results in secondary adrenal insufficiency >>> decreased cortisol, which results in fatigue, decreased appetite, weight loss , gastrointestinal disturbances , hypoglycaemia , hypotension, and hyponatremia.

- **Prolactin:** failure to lactate

- **ADH**: symptoms of diabetes insipidus (extreme thirst, polydipsia, hypernatremia)

- **Oxytocin**: usually asymptomatic – only needed during labour and breastfeeding

DIAGNOSIS

- **clinical examination** including visual field charting is essential
- Each hormone deficiency must be tested individually because the pattern of hormone deficiency may vary.
- If a hormone deficiency is identified, cranial imaging (preferably MRI) is indicated to identify the cause (e.g., pituitary adenoma).
- In an emergency setting (e.g., adrenal crisis, myxedema coma), treatment is indicated prior to biochemical testing

LABORATORY STUDIES

ACTH deficiency (central/secondary adrenal insufficiency)

- First line: morning cortisol level:

o < 3 mcg/dL: diagnosis of AI supported; serum ACTH values required to differentiate between primary and central AI:

  - High ACTH: supports primary AI.
  - Low to normal ACTH: supports central AI.

o 3–15 mcg/dL: Perform ACTH stimulation test.

o >15 mcg/dL: likely excludes AI.

LABORATORY STUDIES

TSH deficiency (secondary hypothyroidism)

- First line: thyroid function tests (both TSH and free T4 are required).
- Supportive findings: ↓ or normal TSH with ↓ serum free T4 and ↓ serum free T3.

A normal TSH does not rule out secondary hypothyroidism; always send for serum free T4 levels.

LABORATORY STUDIES

LH/FSH deficiency (secondary hypogonadism):

- **Men:** o Testosterone: ↓
    - o LH and FSH: ↓
    - o DHEA (if sent): ↓
- **Women:**

o Patients with regular menstrual cycles: confirms normal gonadotropin function; no further diagnostic testing required.

o Routine testing in oligomenorrhea, amenorrhea, or postmenopause if secondary hypogonadism is suspected:

- Estradiol: ↓
- LH and FSH: ↓

LABORATORY STUDIES

Growth hormone deficiency:

- Testing is required if treatment is planned and optional if treatment is not planned and hormonal deficiencies exist **in ≥ 3** pituitary axes.
- IGF-1 level: typically ↓; may be normal .
- Confirmatory testing: GH stimulation test.

o Procedure:
  - Record baseline serum GH level.
  - Administer stimulating agent (e.g., macimorelin).
  - Repeat serum GH levels at set intervals.

o Interpretation: ↓ GH level supports a GH deficiency.

Prolactin deficiency:

- Routine testing is not performed in the investigation of hypopituitarism

LABORATORY STUDIES

Posterior pituitary hormones:

ADH deficiency (central diabetes insipidus)

- **Initial testing**:

o 24-hour urine collection: ↑ urine volume, ↓ urine osmolality.

o Plasma osmolality: ↑ or normal.

o Serum sodium: ↑ or normal.

- **Water deprivation test**:

o Initial deprivation: no change to urine osmolality.

o Following exogenous desmopressin administration: increased urine osmolality

IMAGING:

Imaging of the pituitary is indicated in all patients to determine the underlying cause.

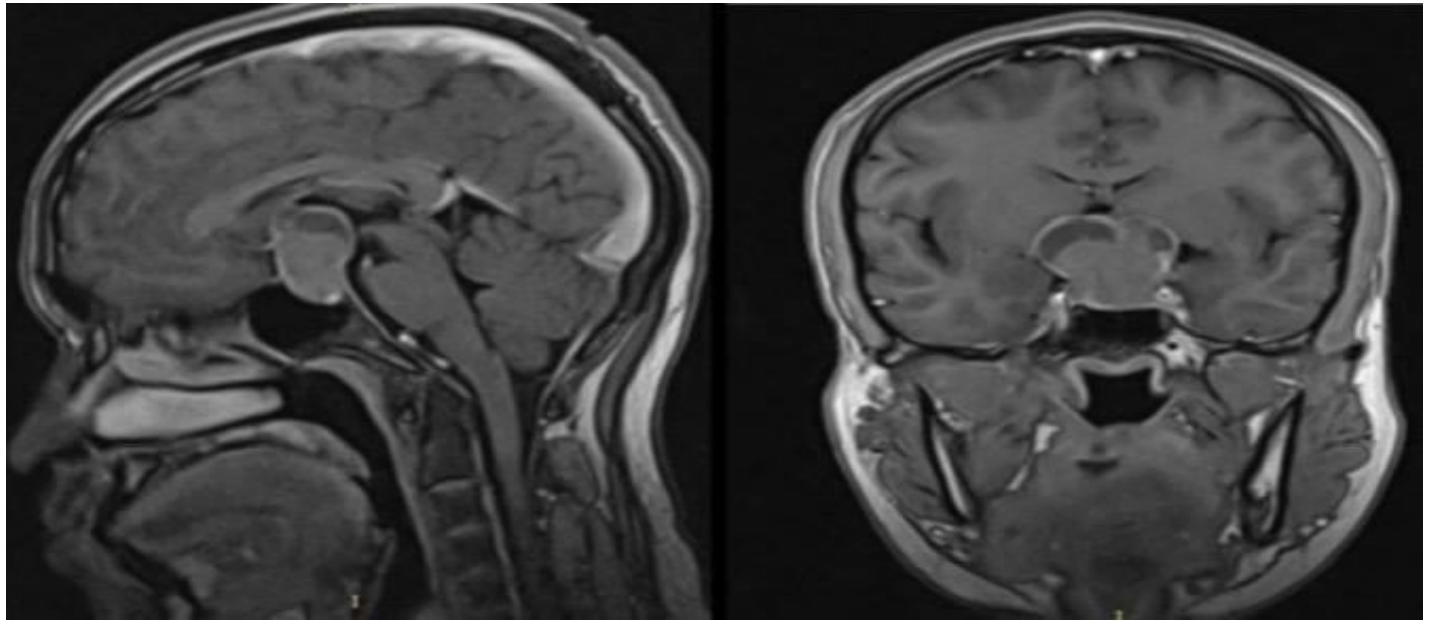
 MRI brain o Preferred imaging modality.

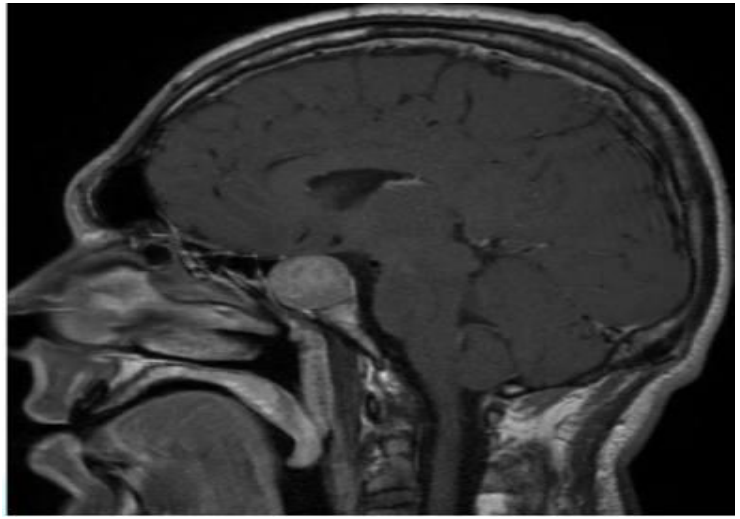
o Findings depend on the underlying etiology and include pituitary adenomas (most common cause in adults), congenital malformations, and trauma.

 CT Head (without IV contrast):

o Used if there are contraindications to MRI or in patients requiring rapid evaluation, e.g., after suspected TBI or SAH.

Sellar mass with suprasellar extension





Pituitary gland tumor

TREATMENT

Approach

- **Assess patients for signs of clinical instability** and, if present, initiate emergency management.
- **All patients require pituitary hormone replacement to treat the conditions that result from hypopituitarism.**
  - Treat all patients for secondary adrenal insufficiency, secondary hypothyroidism, hypogonadism, and diabetes insipidus.
  - Treat growth hormone deficiency in all children and consider treatment in adults.
  - No treatment is indicated for deficiencies of prolactin, oxytocin, or MSH.
- **Identify and treat the underlying cause** (e.g., transsphenoidal resection in some cases of pituitary macroadenomas).

TREATMENT

Emergency management

Acute loss of pituitary function, e.g., via pituitary apoplexy (including Sheehan syndrome), iatrogenic (hypophysectomy), or traumatic brain injury, can lead to life-threatening complications.

- **Adrenal crisis**: Give **immediate IV hydrocortisone** without waiting for diagnostic confirmation.
- **Myxedema coma**
  - ☐ Give **IV hydrocortisone** because of the risk of levothyroxine precipitating an adrenal crisis through enhanced clearance of cortisol.
  - ☐ **Replace thyroid hormones** via IV levothyroxine and liothyronine.
- **Hypernatremia**
  - ☐ Start **desmopressin**.
  - ☐ Replace free water deficit.
- **Once stabilized**, patients should be started on **maintenance** pituitary hormone replacement.

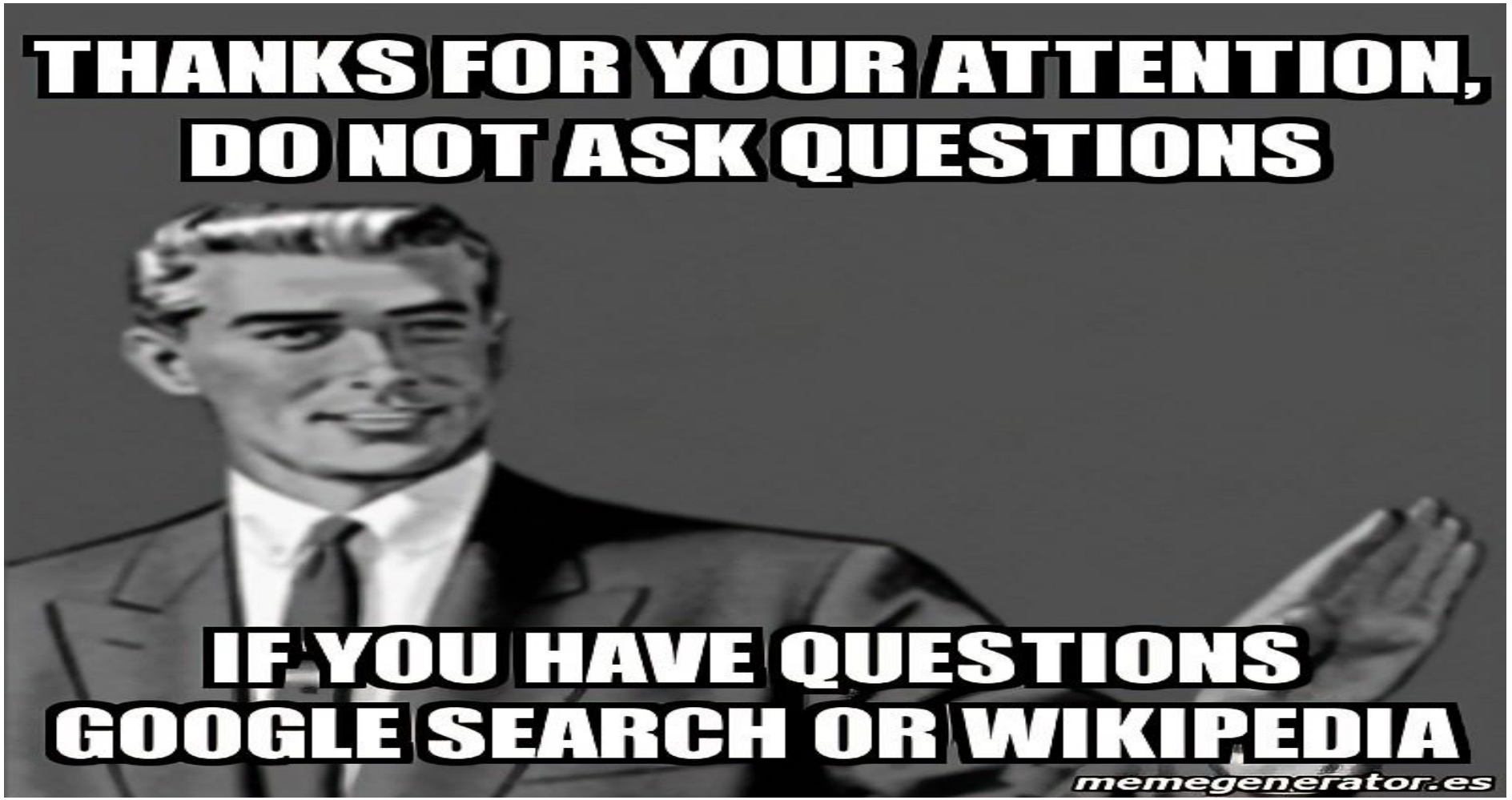
Maintenance therapy for pituitary hormone deficiencies

Hormone replacement in hypopituitarism	
Secondary adrenal insufficiency	▪ Routine management: **glucocorticoids** with dose increases during periods of stress.
Secondary hypothyroidism	▪ New diagnosis: Rule out ACTH deficiency before starting treatment, as levothyroxine increases the clearance of cortisol and may precipitate an adrenal crisis. ▪ Routine management: **levothyroxine.**
Secondary hypogonadism	▪ Men ○ **Testosterone** replacement. ○ If fertility is desired, exogenous gonadotropins (e.g., hCG) ▪ Females: **estrogen** replacement with **progesterone**.
Growth hormone deficiency	▪ Children: **growth hormone** replacement. ▪ Adults: GH replacement may be offered but is not usually required.
Central diabetes insipidus	▪ Routine management: **desmopressin.**

In addition to pituitary hormone replacement, **the underlying cause of hypopituitarism should be treated.**

Hypopituitarism patients with TSH deficiency should not be treated with levothyroxine until ACTH deficiency has been ruled out and/or treated because levothyroxine increases the clearance of cortisol and may precipitate an adrenal crisis

THANK YOU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