Unit IV – Problem 6 – Physiology: Hypothalamic-Pituitary Hormones

- **Hypothalamic-pituitary hormones:**

Hormone	Function	Notes
CRH	↑ACTH + MSH + β-endorphin	• ↓ in chronic exogenous steroid use • CRH is produced from hypothalamus and stimulates adenohypophysis to secrete ACTH
Dopamine	↓prolactin (inhibiting it)	• Dopamine antagonists (e.g. antipsychotics) can cause galactorrhea. • Galactorrhea: excessive production of milk due to ↑prolactin level (prolactinemia)
GnRH	↑FSH and LH	• GnRH is inhibited by prolactin. • Tonic GnRH suppresses hypothalamic-pituitary axis (no secretion of FSH and LH) • Pulsatile GnRH results in puberty and fertility
Prolactin	↓GnRH (inhibiting it)	• Pituitary prolactinoma results in: ✓ Females: galactorrhea, infertility and amenorrhea. ✓ Males: gynecomastia, infertility and impotence
Somatostatin	↓GH and TSH	• Analogs of somatostatin (such as octreotide) are used to treat acromegaly (which results from excessive GH production).
TRH	↑TSH and prolactin	

- **Prolactin:**
  - **It is secreted from anterior pituitary gland (adenohypophysis).**
  - **Functions:**
    - ✓ Stimulating milk production in breasts.
    - ✓ Inhibiting ovulation in females and spermatogenesis in males by inhibiting GnRH synthesis and release.
      Note: excessive amounts of prolactin associated with ↓libido (decreased sexual interest).
  - **Regulation of prolactin secretion:**
    - ✓ Prolactin secretion is inhibited by dopamine. Notice that:
      - ❖ *Dopamine agonists (such as bromocriptine) inhibit prolactin secretion* and can be used in treatment of prolactinoma (a pituitary adenoma which is secreting excessive amounts of the hormone prolactin).
      - ❖ *Dopamine antagonists (such as antipsychotic: drugs used in treating schizophrenia) stimulate prolactin secretion.*
    - ✓ TRH (Thyrotropin-Releasing Hormone): enhances the secretion of prolactin and TSH.
- **Growth hormone (somatotropin):**
  - **It is secreted from anterior pituitary gland (adenohypophysis).**
  - **Function:**
    - ✓ Stimulating linear growth and muscle mass through IGF-1 (Insulin-like Growth Factor) secretion. Linear growth is the growth by the same amount in each time step.
  - **Regulation of growth hormone secretion:**
    - ✓ It is released in pulses in response to Growth-Hormone Releasing Hormone (GHRH):
      - ❖ *Secretion is increased during exercise and sleep.*
      - ❖ *Secretion is inhibited by glucose and somatostatin.*
    - ✓ Notice that excessive secretion of growth hormone (e.g. pituitary adenoma) may cause acromegaly (in adults) or gigantism (in children).

- **Antidiuretic Hormone:**
  - **It is secreted from supraoptic nucleus in the hypothalamus. Then, it will be stored in posterior pituitary gland (neurohypophysis) to be released when needed.**
  - **Functions:**
    - ✓ Regulating serum osmolarity (through V_2-receptors).
    - ✓ Regulating blood pressure (through V_1-receptors).
  - **Diabetes insipidus (مرض السكري الكاذب) can be:**
    - ✓ Central: when there is lack in the production of ADH. This condition is treated by ADH analogs such as desmopressin.
    - ✓ Nephrogenic: ADH is produced but there is a mutation in V_2-receptors.
  - **Regulation of ADH secretion:**
    - ✓ Primary: through osmoreceptors in hypothalamus.
    - ✓ Secondary: through hypovolemia.
- **Adrenal steroids and congenital adrenal hyperplasias: this topic was discussed in biochemistry note in problem 5.**
- **Cortisol (will be discussed here because it is important):**
  - **It is secreted from zona fasciculata of adrenal cortex and it will be bound to corticosteroid-binding globulin.**
  - **Functions: remember the mnemonic (BIG FIB)**
    - ✓ ↑ **B**lood pressure (through up-regulation of α_1-receptors on arterioles).
    - ✓ ↑ **I**nsulin resistance (diabetogenic).
    - ✓ ↑ **G**luconeogenesis, lipolysis and proteolysis.
    - ✓ ↓ **F**ibroblast activity (causes striae).
    - ✓ ↓ **I**nflammatory and **I**mmune responses.
    - ✓ ↓ **B**one formation (↓ osteoblast activity).
  - **Regulation of Cortisol secretion:**
    - ✓ CRH (produced from hypothalamus) stimulated adenohypophysis to secrete ACTH which results in cortisol production in zona fasciculate of adrenal cortex.