ENDOCRINOLOGY

Dr. Hana Alzamil

PITUITARY GLANDS

- Hypothalamic control
- Anterior pituitary hormones
  - GH
    - Effects on body tissues
    - Regulation of GH secretion
    - Effect of hypo and hyper secretion
- Posterior pituitary hormones
  - ADH
  - Oxytocine

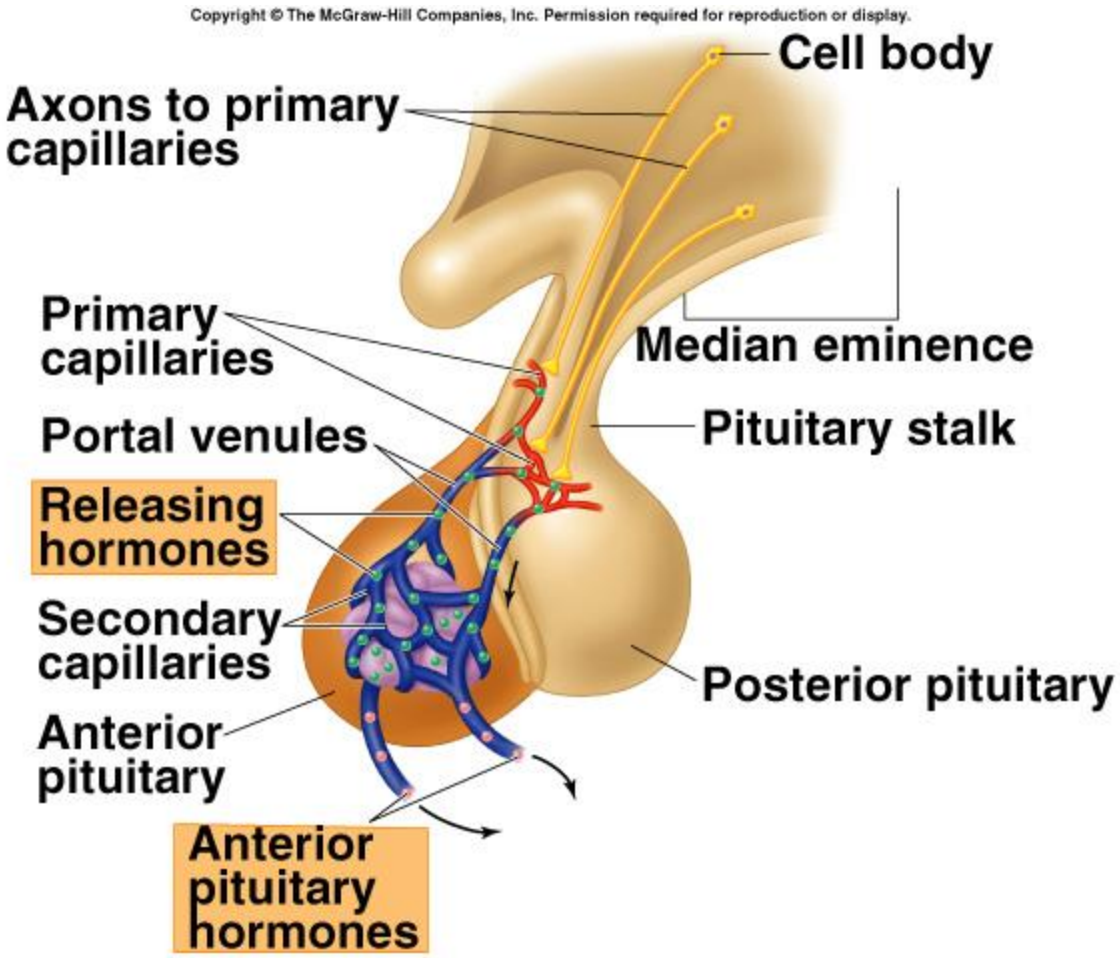
HYPOTHALAMIC CONTROL OF PITUITARY SECRETIONS

- Almost all secretions by the pituitary are controlled by either
  - hormonal secretion of hypothalamus
    (The anterior pituitary)
    or
  - nervous signals from hypothalamus
    (Posterior pituitary)

HYPOTHALAMIC CONTROL OF ANTERIOR PITUITARY GLAND (ADENOHYPOPHYSIS)

- Anterior pituitary gland is connected to hypothalamus by portal system: “hypothalamic-hypophysial portal vessels”.

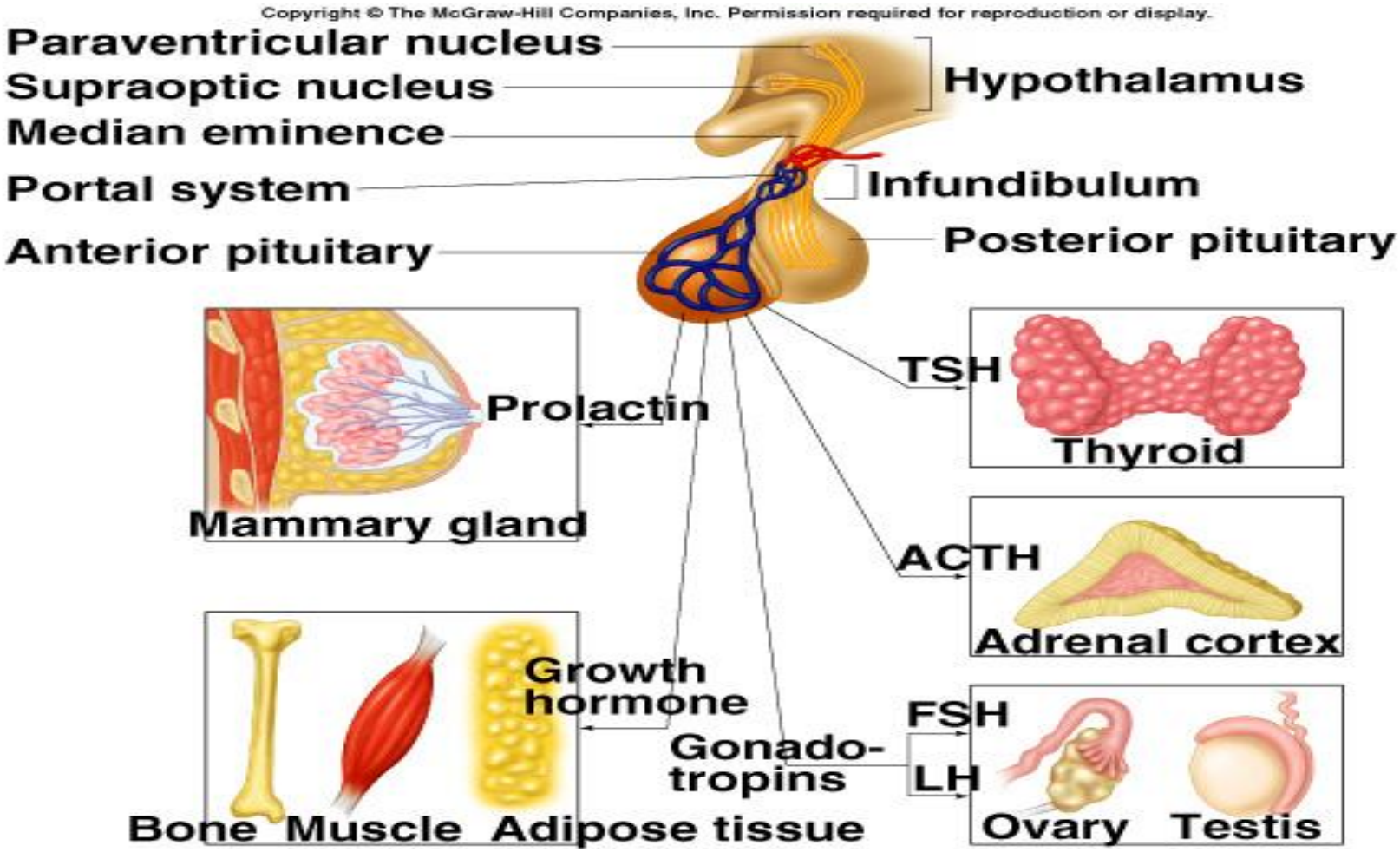
PITUITARY GLAND



Hypothalamic Hormones

Corticotropin-releasing hormone (CRH)	protein	release ACTH
Gonadotropin-releasing hormone (GnRH)	polypeptide	release LH and FSH
Prolactin-releasing factor (PRF)	Peptide	release prolactin
Prolactin-release inhibiting factor (PIF) dominant	Polypeptide	inhibit prolactin release
Growth hormone-releasing hormone (GHRH)	protein	stimulates GH secretion
Growth hormone-release inhibiting hormone, GHIH)	polypeptide	inhibits GH
Thyrotropin-releasing hormone (TRH)	Peptide	stimulates TSH

ANTERIOR PITUITARY HORMONES



FEEDBACK MECHANISM

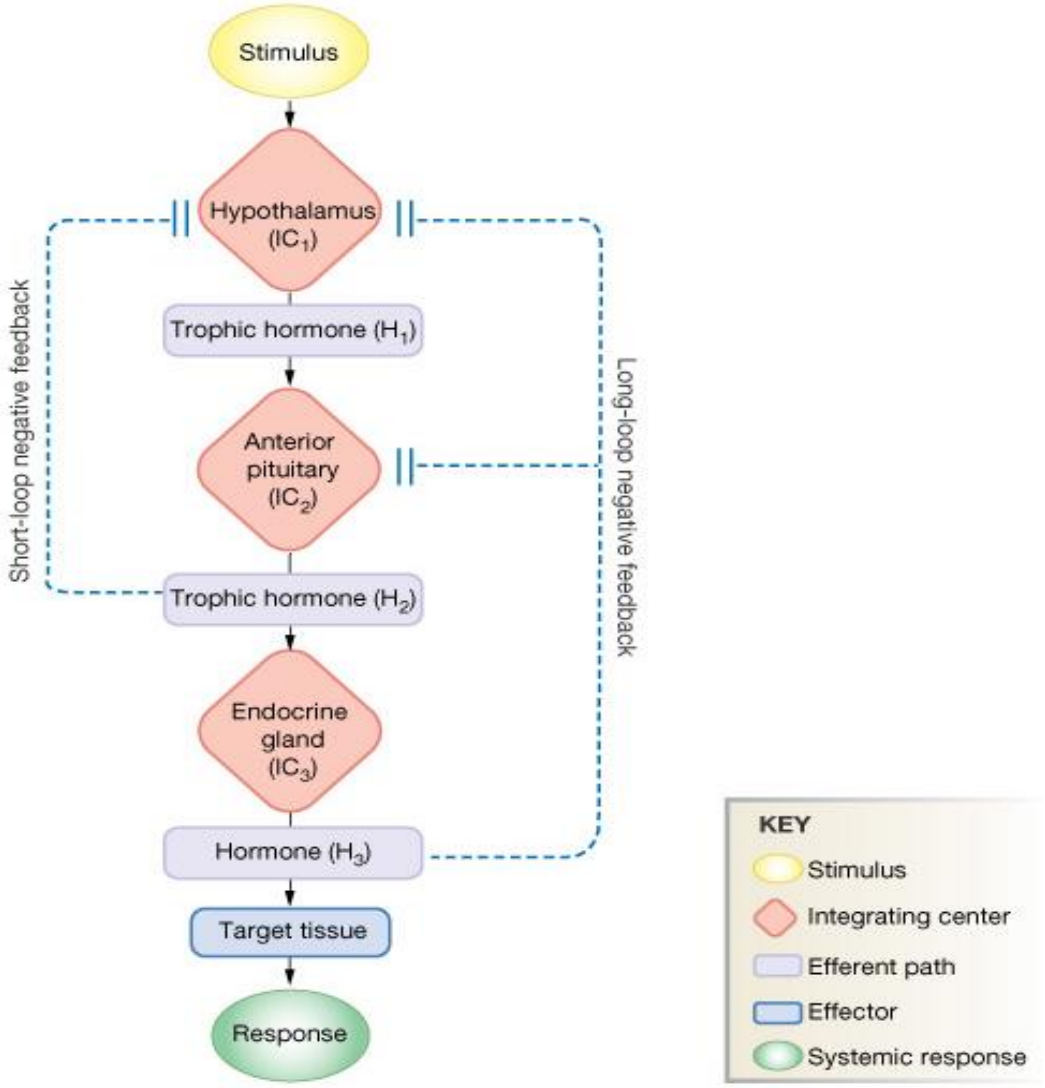
Positive feedback

- Release of hormone A stimulates the release of hormone B
- Hormone B stimulates further release of hormone A

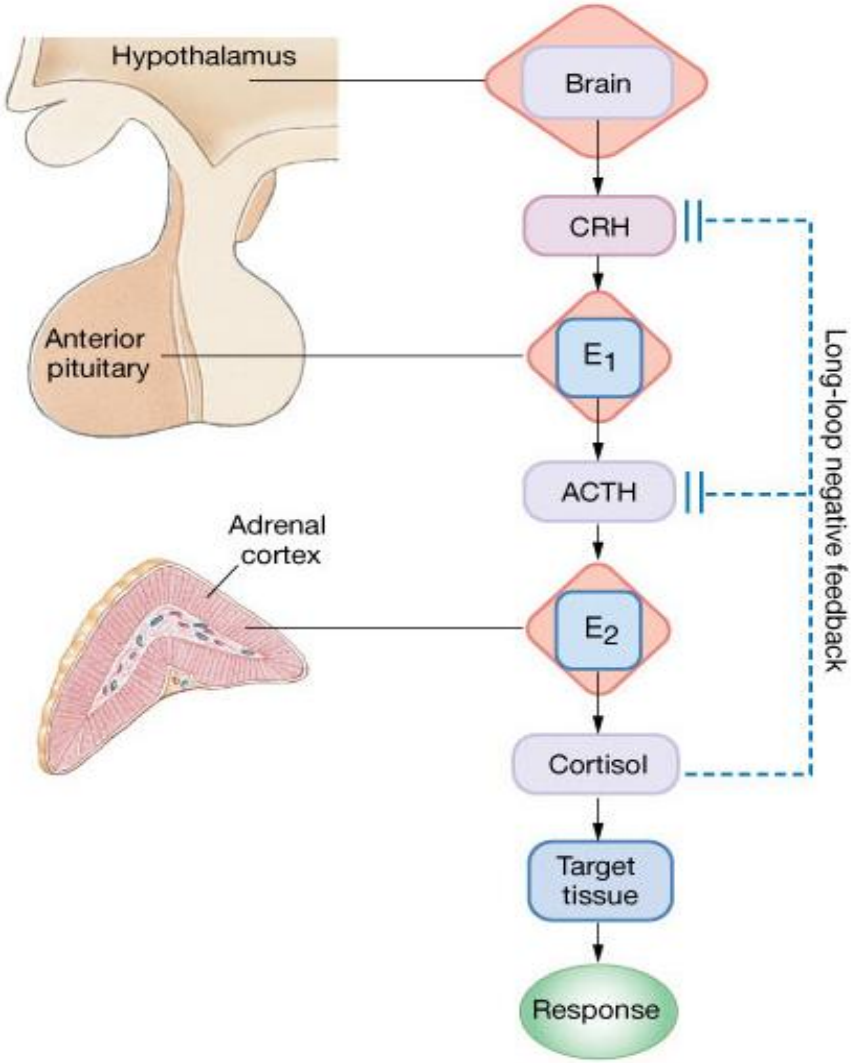
Negative feedback

- Release of hormone A stimulates the release of hormone B
- Hormone B inhibits the release of hormone A

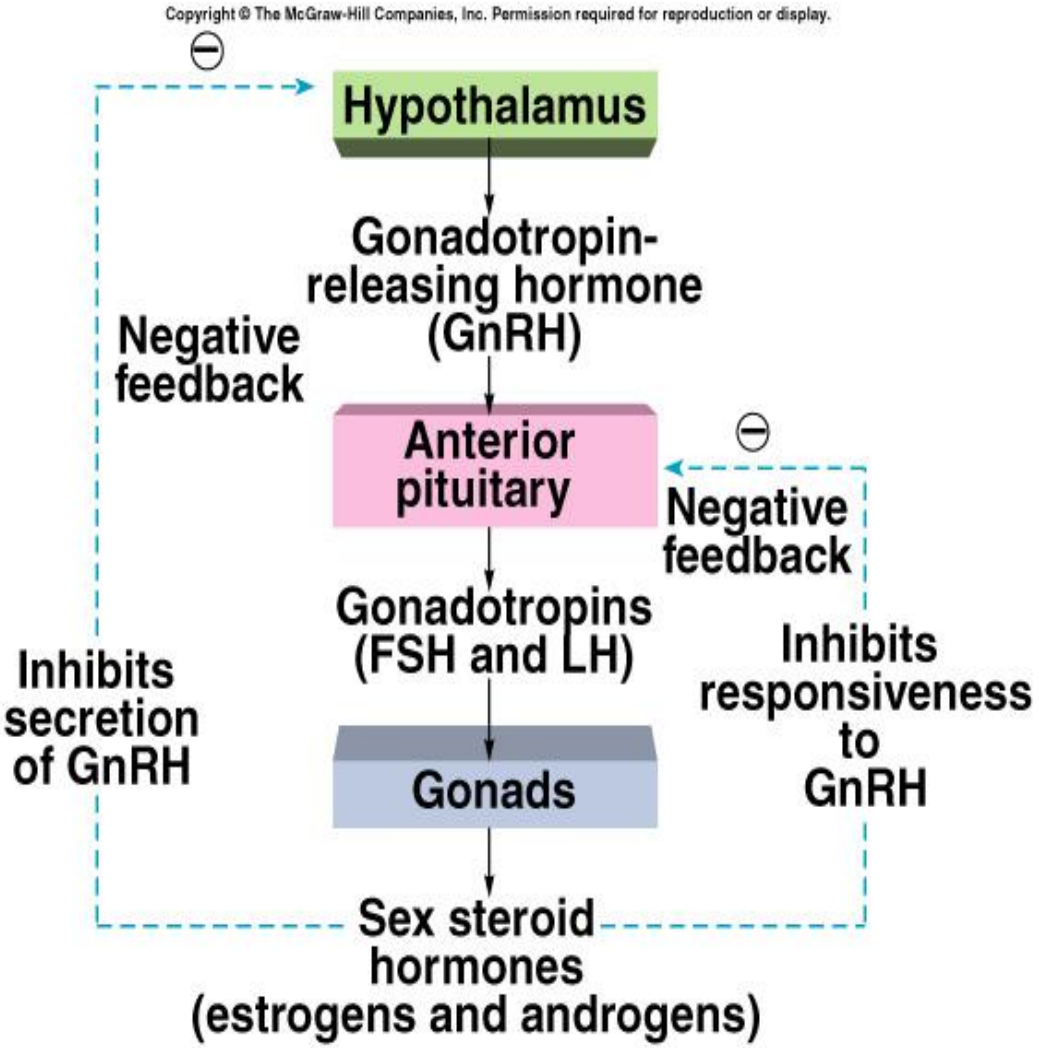
NEGATIVE FEEDBACK CONTROLS: LONG & SHORT LOOP REFLEXES



NEGATIVE FEEDBACK CONTROLS CORTISOL



NEGATIVE FEEDBACK CONTROLS SEX STEROIDS



GROWTH HORMONE

(Somatotropin)

FUNCTIONS OF GROWTH HORMONE:

A) **Long term effect**

Promotion of growth:

↑ cellular sizes & ↑ mitosis (no.).

↑ tissue growth & organ size.

Does not act directly on bone & cartilage.

Its action depends on somatomedin ('insulin- like growth factor (IGF-I' II)

[IGF-I& II] secreted by the liver, which is responsible for effect of GH on bone & cartilage growth and increase the synthesis of protein in skeletal muscles.

MECHANISMS OF BONE GROWTH

1. Linear growth of long bones:
   - Long bones grow in length at epiphyseal cartilages, causing deposition of **New Cartilage** (↑collagen synthesis) followed by its conversion into bone.
   - When bony fusion occurs between shaft & epiphysis at each end, no further lengthening of long bone occur.

2. Deposition of **New Bone** (↑ cell proliferation) on surfaces of older bone & in some bone cavities, ↑ thickness of bone.
   - Occurs in membranous bones, e.g. jaw, & skull bones.

FUNCTIONS OF GROWTH HORMONE:

B) Short- term metabolic effects:

1) **Protein metabolism:** Anabolic,
↑ rate of protein synthesis in all cells.

2) **Fat metabolism:** Catabolic,
↑ mobilization of FFAs from adipose tissue stores to provide energy

3) **CHO metabolism:** Hyperglycemic(diabetogenic)
↓ glucose uptake by cells.
↓ rate of glucose utilization throughout the body

CONTROL OF GH SECRETION:

1. **The hypothalamus:**
   a. GHRH → ↑ GH secretion.
   b. GHIH (somatostatin) → ↓ GH secretion
2. **Hypoglycemia** (fasting)→ ↑ GH secretion.
   (N.B. ↑glucose intake → ↓ GH secretion).
3. **Free fatty acids** → ↓ GH secretion
4. **Intake of protein or amino acids** → ↑ GH secretion (after meals).

CONTROL OF GH SECRETION:

5. **During sleep** → ↑ more in children.
6. **Stress conditions**,
   e.g. trauma or emotions → ↑ GH secretion.

7. **Glucagon**, & L-Dopa → ↑ GH secretion.
8. **Muscular exercise** → ↑ GH secretion

ABNORMALITIES OF GH SECRETION

↑ GH SECRETION:

- **Signs & symptoms 'in childhood':**

Gigantism,

- as all body tissues grow rapidly, including bones.
- ↑Height as it occurs before epiphyseal fusion of long bones with their shafts.

Hyperglycemia (diabetes).

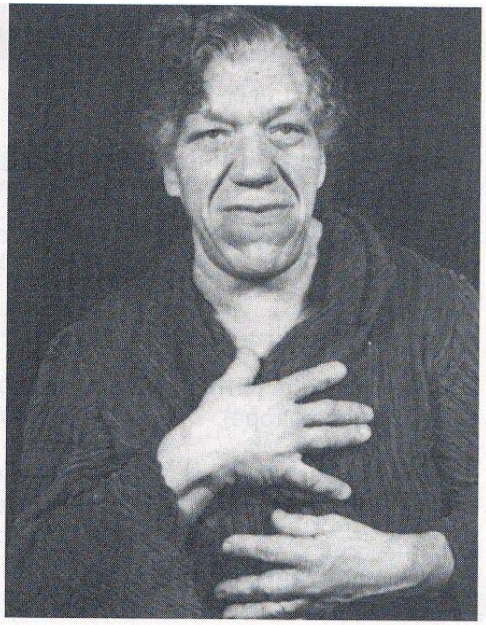
- **Signs & symptoms 'in adults':**

Acromegally,

- Soft tissue continue to grow in thickness (skin, tongue, liver, kidney, …)
- Enlargement of bones of hands & feet.
- Enlargement of membranous bones including cranium, nose, forehead bones, supraorbital ridges.
  - Protrusion of lower jaw.
  - Hunched back (kyphosis) (enlargement of vertebrae

↑GH AS JUVENILE

↑GH AS AN ADULT

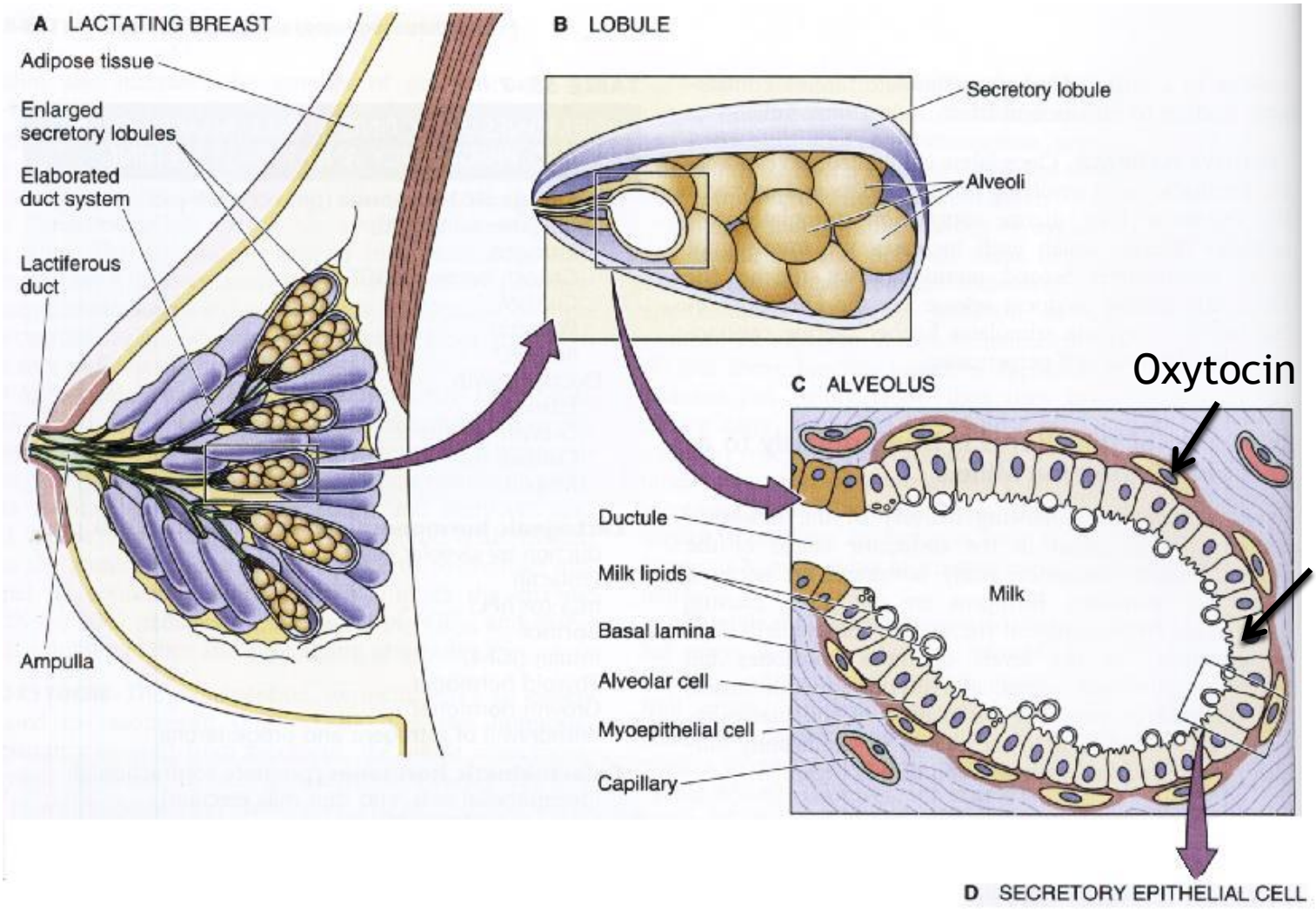


↓GH = PITUITARY DWARFISM

PROLACTIN

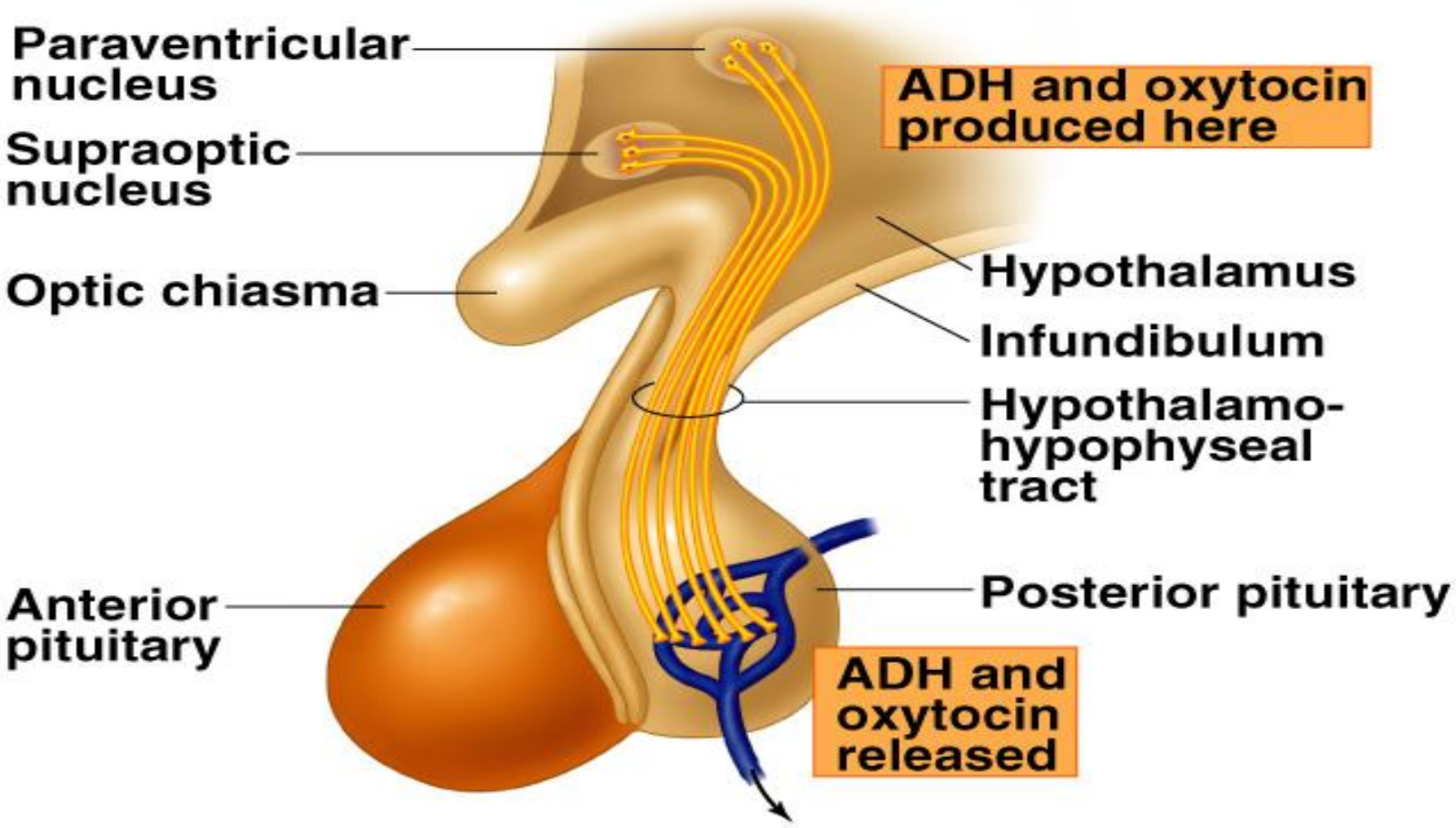
FUNCTIONS OF PROLACTIN

- The major function of prolactin is milk production
- Controlling mechanism
  - Controlled by hypothalamic hormones
    - release is inhibited by PIH (dopamine)
    - suckling response inhibits PIH release

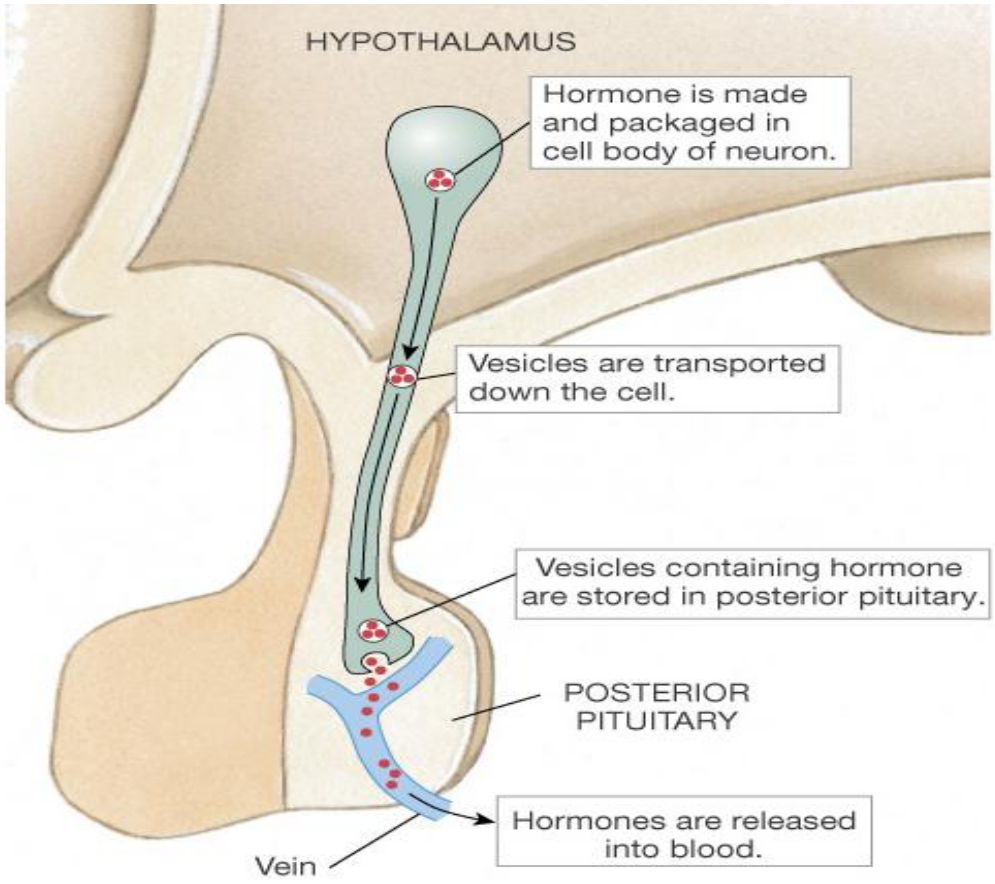

A LACTATING BREAST
Adipose tissue
Enlarged secretory lobules
Elaborated duct system
Lactiferous duct
Ampulla
B LOBULE
Secretory lobule
Alveoli
C ALVEOLUS
Ductule
Milk lipids
Basal lamina
Alveolar cell
Myoepithelial cell
Capillary
Milk
Oxytocin
Prolactin
D SECRETORY EPITHELIAL CELL

POSTERIOR PITUITARY GLAND

(neurohypophysis)



SECRETION OF POSTERIOR PITUITARY HORMONES



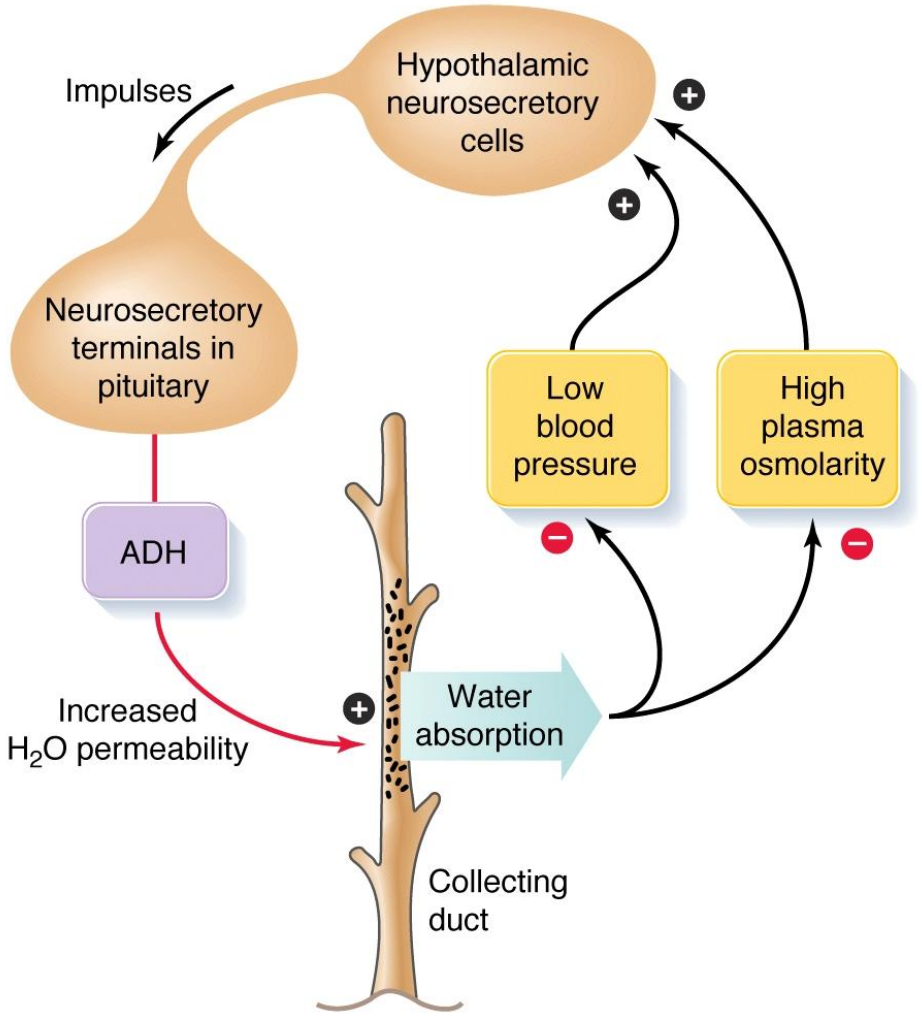
POSTERIOR PITUITARY HORMONES

Hormone	Target Tissue	Principal Action
ADH	Kidney	Water Retention
	Blood Vessels	Vasoconstriction
Oxytocin	Uterus in labor	Contraction of smooth muscle
	Mammary	Contraction of alveoli

ANTIDIURETIC HORMONE

(vasopressin)

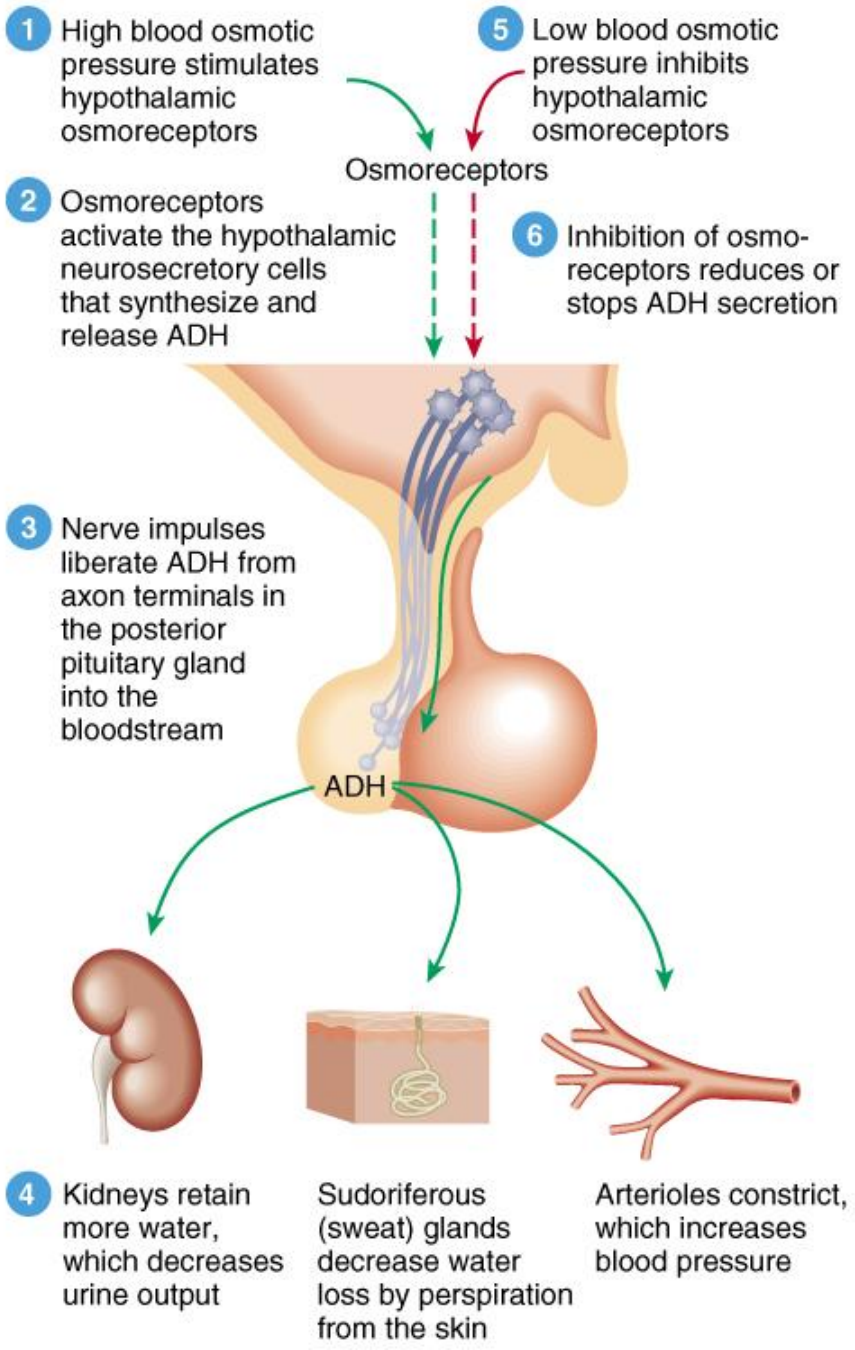
FUNCTION OF ADH (VASOPRESSIN)



CONTROL OF ADH RELEASE

- **Osmotic pressure**:
  - Osmoreceptor mediated
  - ↑osmolality → ↑ADH secretion
  - ↓osmolality → ↓ ADH secretion
- **Volume effects**
  - Baroreceptor mediated (vagus nerve)
  - ↑blood pressure → ↓ ADH secretion
  - ↓blood pressure → ↑ ADH secretion

Regulation of ADH secretion



OXYTOCIN

FUNCTION OF OXYTOCIN

- **Breast-feeding**
  - contracts the myoepithelial cells of the alveoli

  (classic neuroendocrine reflex)

- **Childbirth** (parturition)
  - in late pregnancy, uterine smooth muscle (myometrium) becomes sensitive to oxytocin

    (positive feedback)

SUCKLING REFLEX

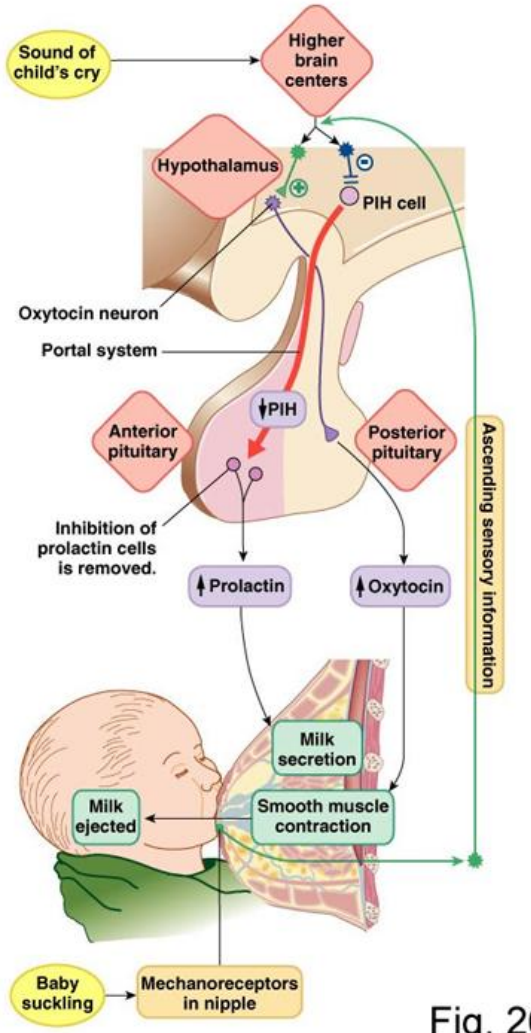
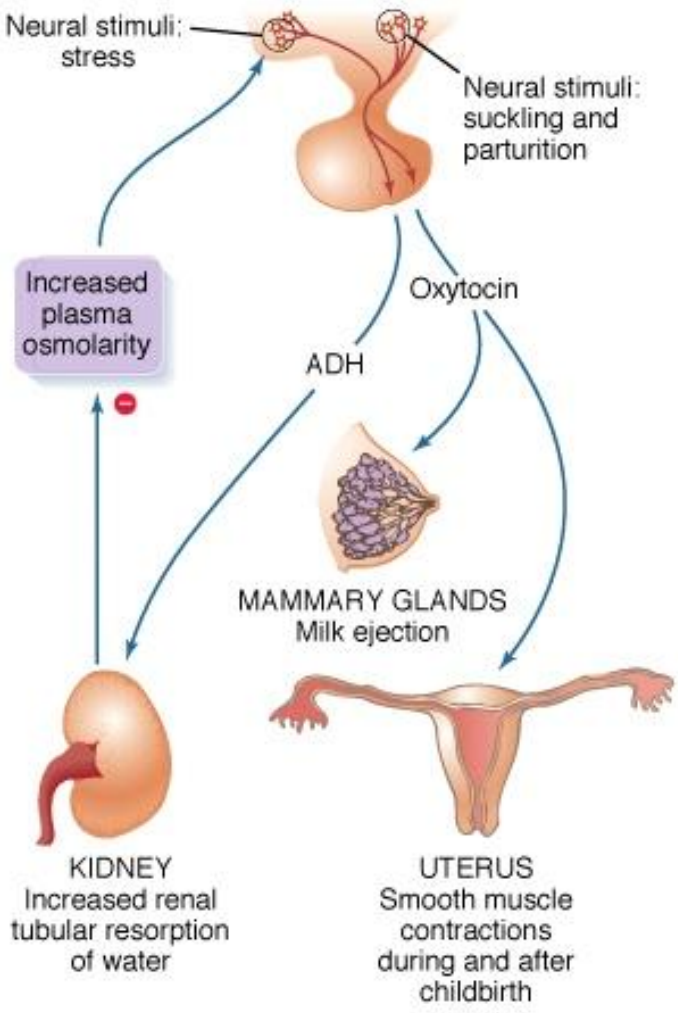
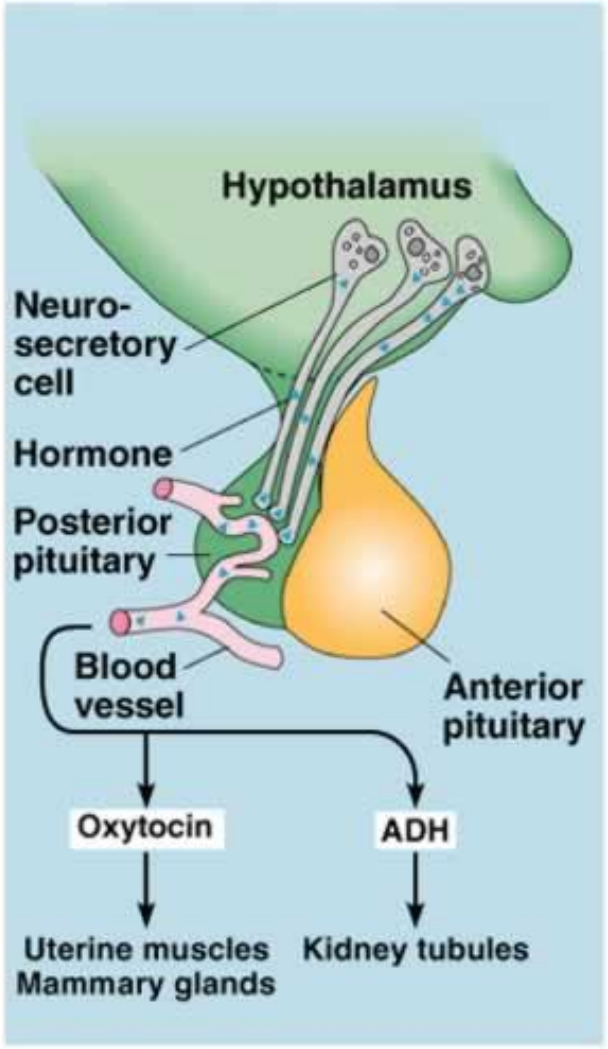
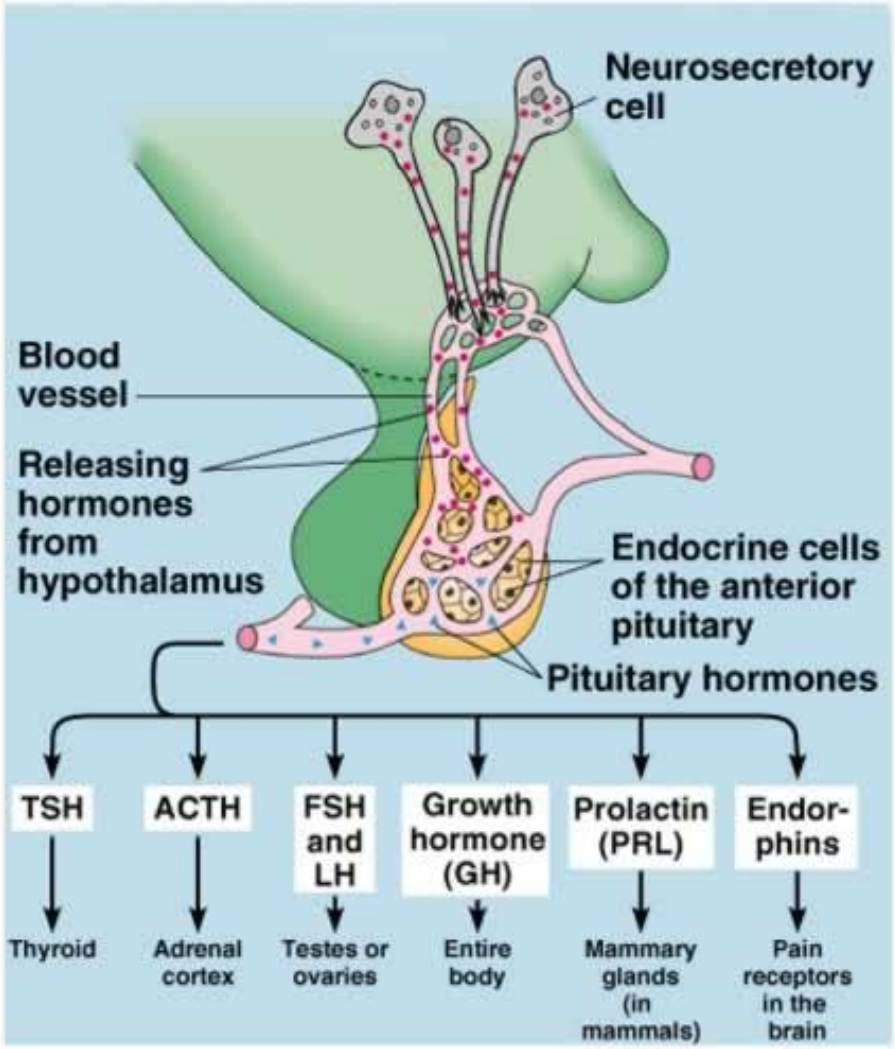


Fig. 26-23

SUMMARY OF POSTERIOR PITUITARY HORMONES ACTIONS







Thank you