

Endocrine drugs

Drugs affecting the endocrine system


- Drugs affecting pituitary and thyroid
- Insulin and Other Glucose-Lowering Drugs
- Estrogens and Androgens
- Adrenal Hormones

Hormone Pharmacotherapy

- Hormones used as
 - ▣ Replacement therapy
 - ▣ Antineoplastics
 - ▣ Natural therapeutic effects
 - Exaggerated response or suppression of body defenses
- Hormone blockers used to inhibit actions of certain hormones

Drugs affecting pituitary and thyroid



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- The neuroendocrine system, which is controlled by the pituitary and hypothalamus, coordinates body functions by transmitting messages between individual cells and tissues
 - The endocrine system releases hormones into the bloodstream, which carries these chemical messengers to target cells throughout the body
 - Hormones have a longer response time than nerve impulses, requiring from seconds to days, or longer, to cause a response that may last for weeks or months

Hypothalamus and anterior pituitary hormones

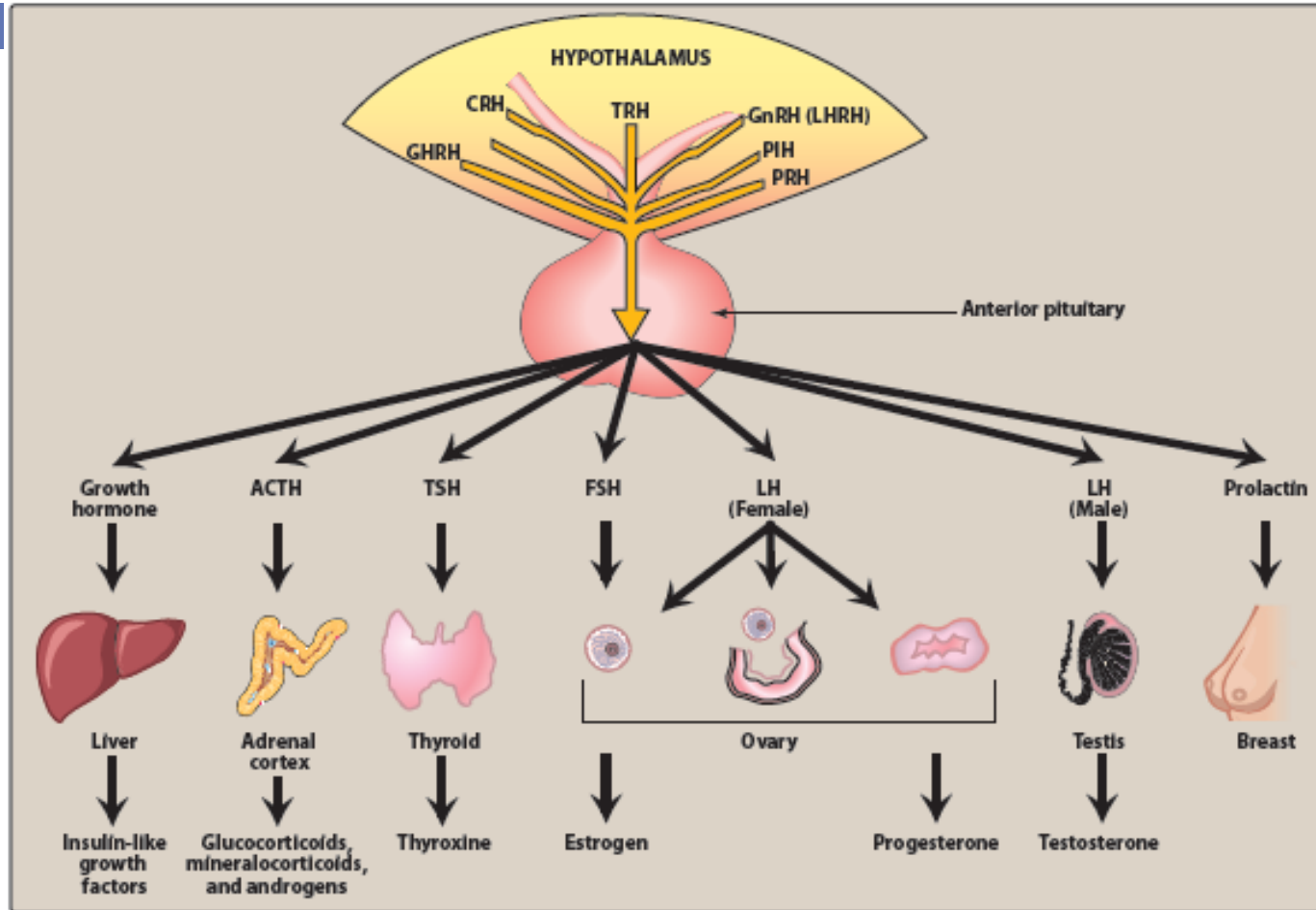



Figure 23.2

Hypothalamic-releasing hormones and actions of anterior pituitary hormones. GHRH = growth hormone-releasing hormone; TRH = thyrotropin-releasing hormone; CRH = corticotropin-releasing hormone; GnRH (LHRH) = gonadotropin-releasing hormone (luteinizing hormone-releasing hormone); PIH = prolactin-inhibiting hormone (dopamine); and PRH = prolactin-releasing hormone; ACTH = adrenocorticotropic hormone; TSH = thyrotropin-stimulating hormone; FSH = follicle-stimulating hormone; LH = luteinizing hormone.

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- Pituitary hormone preparations are used therapeutically for specific hormonal deficiencies
 - Hormones of the anterior and posterior pituitary are administered either intramuscularly (IM), subcutaneously, or intranasally, but not orally, because their peptidyl nature makes them susceptible to destruction by the proteolytic enzymes of the digestive tract

Growth hormone (GH) (somatotropin)

- Released by the anterior pituitary in response to GH-releasing hormone produced by the hypothalamus

- Therapeutic uses:
 - ▣ Treatment of GH deficiency or growth failure in children
 - ▣ Management of AIDS wasting syndrome
 - ▣ GH replacement in adults with GH deficiency

Somatostatin

- Somatostatin (Growth hormone inhibiting hormone)
- Inhibits release of GH, insulin, glucagon and gastrin
- Octreotide (synthetic somatostatin)
 - ▣ Used for acromegaly
 - ▣ Adverse effects
 - Diarrhea
 - Nausea

Gonadotropin releasing hormone (GnRH)

- GnRH, also called gonadorelin
- Essential for release of follicle stimulating hormone (FSH) and luteinizing hormone (LH) from the pituitary
- Continuous administration inhibit gonadotropin release
- **Leuprolide** and **goserelin** are GnRH receptor agonists
 - ▣ When administered continuously they suppress production of gonadal hormones
 - ▣ Used for treatment of prostate cancer and endometriosis
 - ▣ Adverse effects
 - Decreased libido
 - In men can cause gynecomastia

Gonadotropins

- Produced in the anterior pituitary
- Regulate gonadal steroid hormones
- Used in treatment of infertility in men and women
- **Menotropins** (human menopausal gonadotropins,(hMG))
 - ▣ Contain FSH and luteinizing hormone (LH)
- **Chorionic gonadotropin** (hCG) is LH receptor agonist
- **Urofollitropin** is FSH
- **Follitropin alpha** and **follitropin beta** are human FSH

Gonadotropins

- All of these hormones are injected via the IM or subcutaneous route
- Injection of hMG or FSH over a period of 5 to 12 days causes ovarian follicular growth and maturation, and with subsequent injection of hCG, ovulation occurs
- In men who are lacking gonadotropins, treatment with hCG causes external sexual maturation, and with the subsequent injection of hMG or follitropin, spermatogenesis occurs
- Adverse effects
 - ▣ In females: ovarian enlargement
 - ▣ In men: gynecomastia

Prolactin

- Secreted by the anterior pituitary
- Its secretion is inhibited by dopamine acting at D2 receptors
- Its primary function is to stimulate and maintain lactation
- Decreases sexual drive and reproductive function
- Hyperprolactinemia, which is associated with galactorrhea and hypogonadism, is usually treated with D2-receptor agonists, such as **bromocriptine**

Hormones of the posterior pituitary

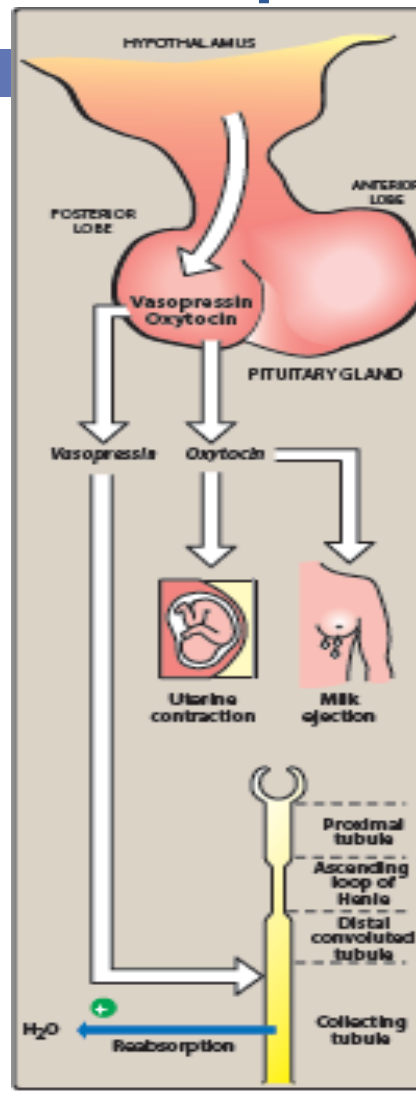


Figure 23.5
Actions of oxytocin and vasopressin.
ACTH = adrenocorticotropic
hormone.

Oxytocin



- Used is in obstetrics to stimulate uterine contraction to induce or reinforce labor

Vasopressin

- Antidiuretic hormone
- Increase water permeability and reabsorption in the collecting tubules in the kidney
- Therapeutic use:
 - ▣ Treatment of diabetes insipidus
- Adverse effects:
 - ▣ Hyponatremia
 - ▣ Headache
 - ▣ Tremor
- **Desmopressin**
 - ▣ Vasopressin analog
 - ▣ Used for diabetes insipidus and nocturnal enuresis
 - ▣ Administered intranasally or orally

Thyroid hormones

- The thyroid gland facilitates normal growth and maturation by maintaining metabolism in tissues
- The two major thyroid hormones are triiodothyronine (T3) and thyroxine (T4)
- Euthyroidism normal thyroid function
- Hypothyroidism, inadequate secretion of thyroid hormone, results in bradycardia, poor resistance to cold, and mental and physical slowing (in children, this can cause mental retardation and dwarfism)
- Hyperthyroidism, an excess of thyroid hormones secretion, causing tachycardia and cardiac arrhythmias, body wasting, nervousness, tremor, and excess heat production

Thyroid Hormones: Actions

- 1- General metabolic effects: Increase oxygen consumption, metabolic rate, heat production (thermogenesis) (uncoupling of oxidation and respiration)
- 2- Increase glucose utilization and oxidation by muscles, increase hepatic gluconeogenesis
- 3- CNS: Influence growth and development, axon proliferation, myelin sheath formation
- 4- CVS: Increase cardiac output and heart rate, decrease peripheral resistance
- 5- G.I. tract and kidneys: Important for function, increases intestinal motility

Treatment of hypothyroidism

- Hypothyroidism is diagnosed by elevated TSH
- Condition presented at birth: Cretinism: Impaired mental and skeletal development
- Condition presented at adulthood: Myxedema, Muscle weakness, decreased appetite, fatigue, and lethargy
- Levothyroxine (T4) is used for hypothyroidism
- Toxicity is directly related to T4 levels
 - ▣ Nervousness
 - ▣ Heart palpitations
 - ▣ Tachycardia
 - ▣ Intolerance to heat
 - ▣ Unexplained weight loss

Treatment of hyperthyroidism (thyrotoxicosis)

- Excessive amounts of thyroid hormones in the circulation are associated with a number of disease states, including Graves disease, toxic adenoma, and goiter.
- TSH levels are reduced due to negative feedback.
- The goal of therapy is to decrease synthesis and/or release of additional hormone by
 - Removing part or all of the thyroid gland either surgically or by destruction **radioactive iodine**
 - Inhibiting synthesis of the hormones by the drugs **propylthiouracil** and **methimazole**
 - Blocking release of the hormones from the follicle by administration of **iodide** which inhibits the iodination of tyrosines and inhibits the release of thyroid hormones
 - β -blockers like **propranolol** to block sympathetic activation, in patients with asthma calcium channel blockers can be used like **diltiazem**