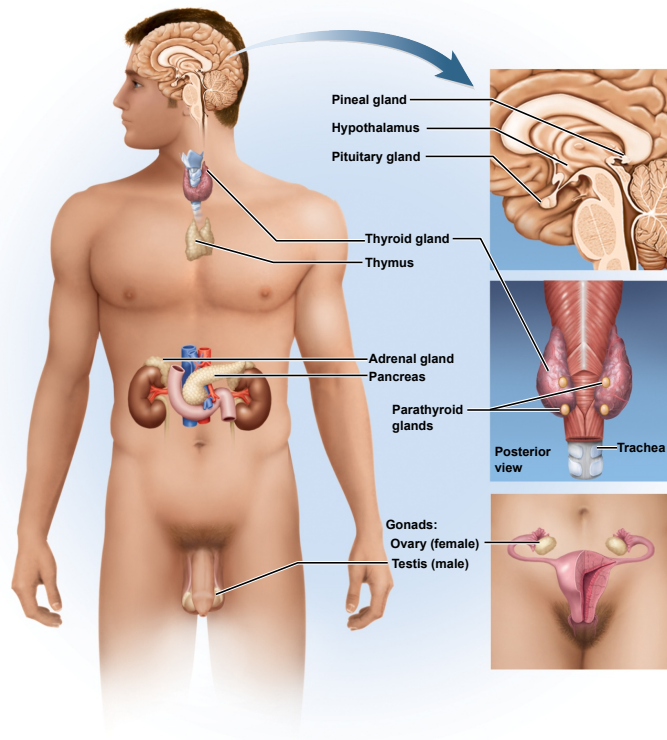


Fig. 17.1

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Table 17.1

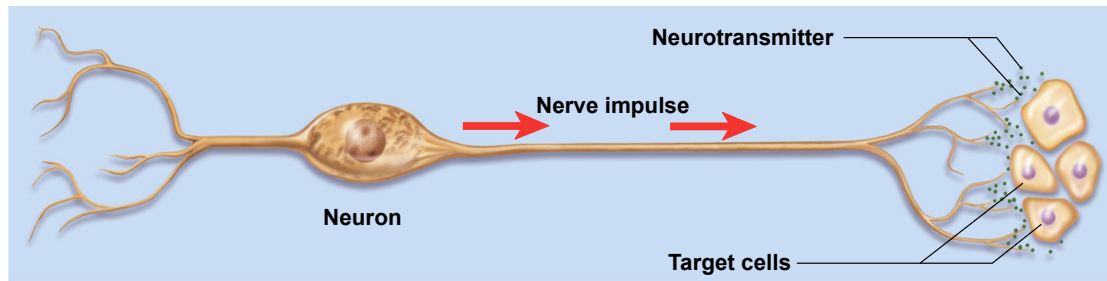
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TABLE 17.1	Comparison of the Nervous and Endocrine Systems
Nervous System	Endocrine System
Communicates by means of electrical impulses and neurotransmitters	Communicates by means of hormones
Releases neurotransmitters at synapses at specific target cells	Releases hormones into bloodstream for general distribution throughout body
Usually has relatively local, specific effects	Sometimes has very general, widespread effects
Reacts quickly to stimuli, usually within 1–10 ms	Reacts more slowly to stimuli, often taking seconds to days
Stops quickly when stimulus stops	May continue responding long after stimulus stops
Adapts relatively quickly to continual stimulation	Adapts relatively slowly; may respond for days to weeks

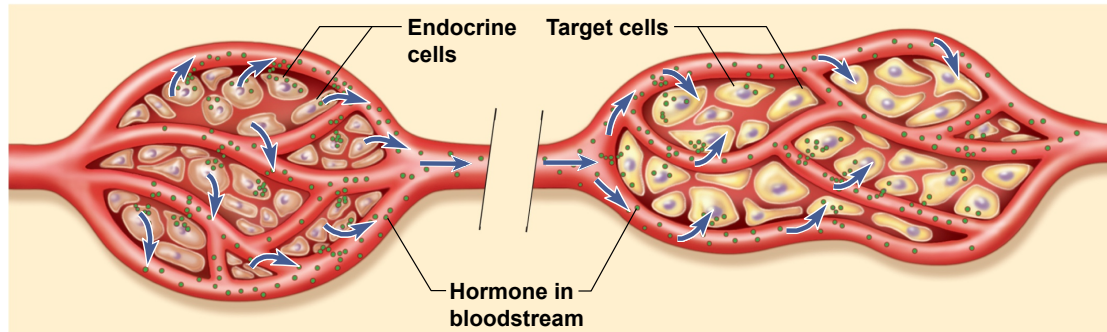
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(a) Nervous system



(b) Endocrine system

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Table 17.2

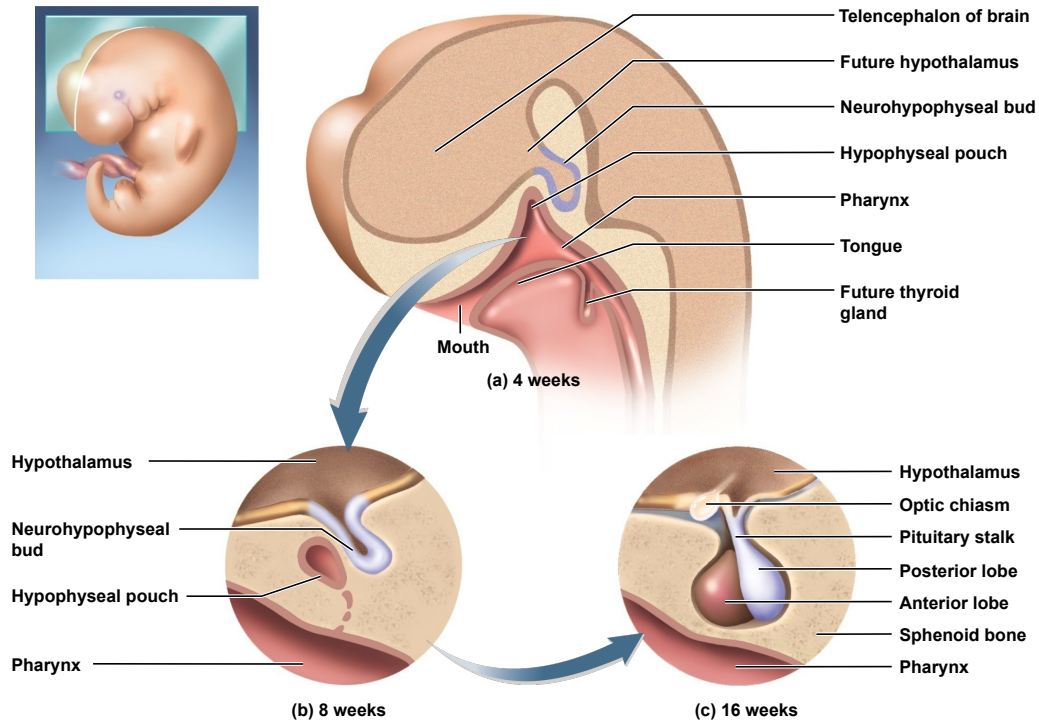
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TABLE 17.2 Names and Abbreviations for Hormones		
Abbreviation	Name	Source
ACTH	Adrenocorticotrophic hormone (corticotropin)	Anterior pituitary
ADH	Antidiuretic hormone (arginine vasopressin)	Posterior pituitary
ANP	Atrial natriuretic peptide	Heart
CRH	Corticotropin-releasing hormone	Hypothalamus
DHEA	Dehydroepiandrosterone	Adrenal cortex
EPO	Erythropoietin	Kidney, liver
FSH	Follicle-stimulating hormone	Anterior pituitary
GH	Growth hormone (somatotropin)	Anterior pituitary
GHRH	Growth hormone-releasing hormone	Hypothalamus
GnRH	Gonadotropin-releasing hormone	Hypothalamus
IGFs	Insulin-like growth factors (somatomedins)	Liver, other tissues
LH	Luteinizing hormone	Anterior pituitary
NE	Norepinephrine	Adrenal medulla
OT	Oxytocin	Posterior pituitary
PIH	Prolactin-inhibiting hormone (dopamine)	Hypothalamus
PRL	Prolactin	Anterior pituitary
PTH	Parathyroid hormone (parathormone)	Parathyroids
T <sub>3</sub>	Triiodothyronine	Thyroid
T <sub>4</sub>	Thyroxine (tetraiodothyronine)	Thyroid
TH	Thyroid hormone (T <sub>3</sub> and T <sub>4</sub> collectively)	Thyroid
TRH	Thyrotropin-releasing hormone	Hypothalamus
TSH	Thyroid-stimulating hormone (thyrotropin)	Anterior pituitary

4

Fig. 17.3

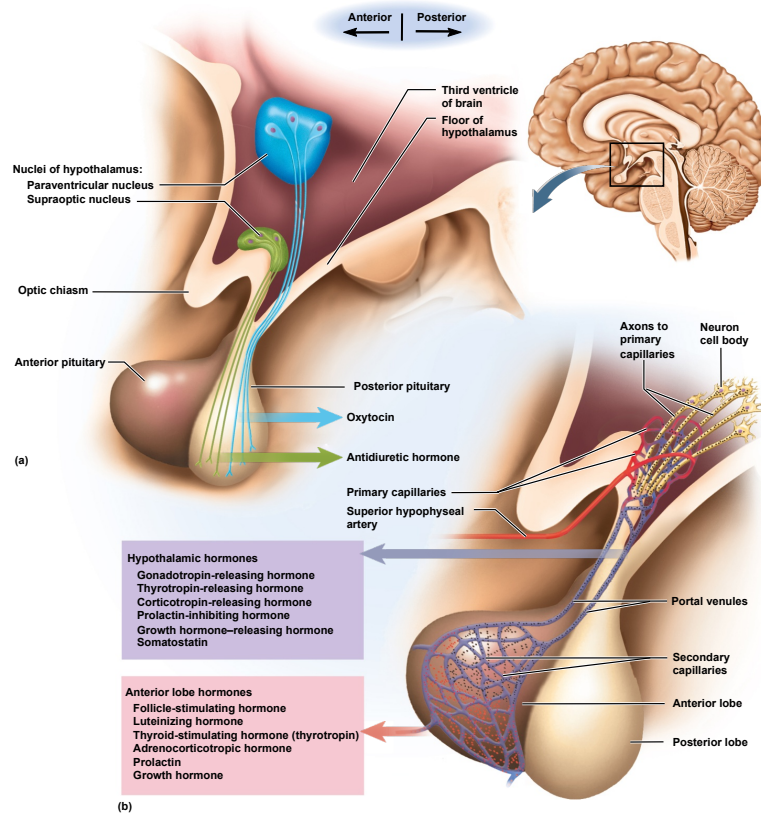
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Fig. 17.4

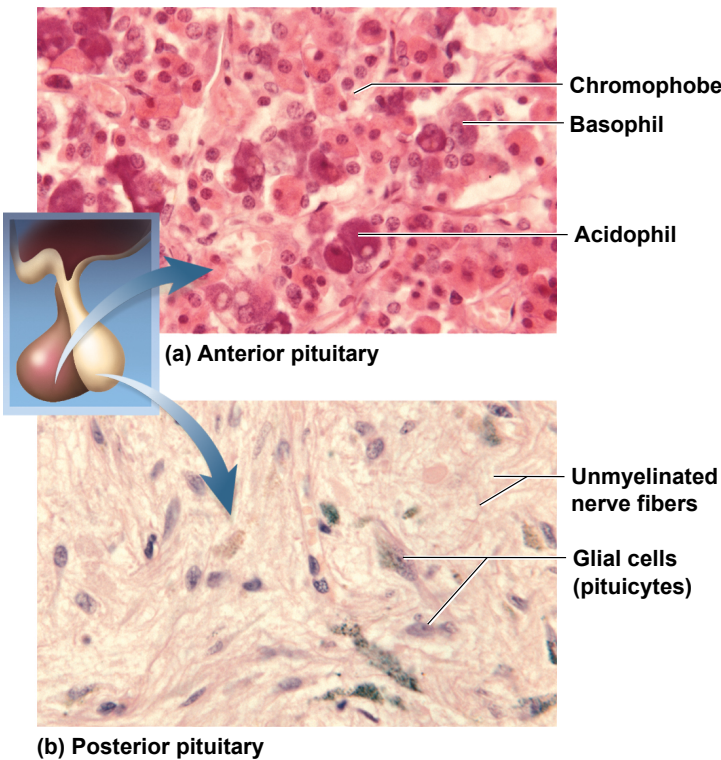
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Fig. 17.5

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TABLE 17.3 Hypothalamic Releasing and Inhibiting Hormones That Regulate the Anterior Pituitary	
Hormone	Principal Effects
Thyrotropin-releasing hormone (TRH)	Promotes secretion of thyroid-stimulating hormone (TSH) and prolactin (PRL)
Corticotropin-releasing hormone (CRH)	Promotes secretion of adrenocorticotrophic hormone (ACTH)
Gonadotropin-releasing hormone (GnRH)	Promotes secretion of follicle-stimulating hormone (FSH) and luteinizing hormone (LH)
Growth hormone–releasing hormone (GHRH)	Promotes secretion of growth hormone (GH)
Prolactin-inhibiting hormone (PIH)	Inhibits secretion of prolactin (PRL)
Somatostatin	Inhibits secretion of growth hormone (GH) and thyroid-stimulating hormone (TSH)



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TABLE 17.4 Pituitary Hormones		
Hormone	Target Organ or Tissue	Principal Effects
<b>Anterior Pituitary</b>		
Follicle-stimulating hormone (FSH)	Ovaries, testes	<i>Female:</i> Growth of ovarian follicles and secretion of estrogen <i>Male:</i> Sperm production
Luteinizing hormone (LH)	Ovaries, testes	<i>Female:</i> Ovulation, maintenance of corpus luteum <i>Male:</i> Testosterone secretion
Thyroid-stimulating hormone (TSH)	Thyroid gland	Growth of thyroid, secretion of thyroid hormone
Adrenocorticotropic hormone (ACTH)	Adrenal cortex	Growth of adrenal cortex, secretion of glucocorticoids
Prolactin (PRL)	Mammary glands, testes	<i>Female:</i> Milk synthesis <i>Male:</i> Increased LH sensitivity
Growth hormone (GH)	Liver, bone, cartilage, muscle, fat	Widespread tissue growth, especially in the stated tissues
<b>Posterior Pituitary</b>		
Antidiuretic hormone (ADH)	Kidneys	Water retention
Oxytocin (OT)	Uterus, mammary glands	Labor contractions, milk release; possibly involved in ejaculation, sperm transport, sexual affection, and mother–infant bonding

Fig. 17.6

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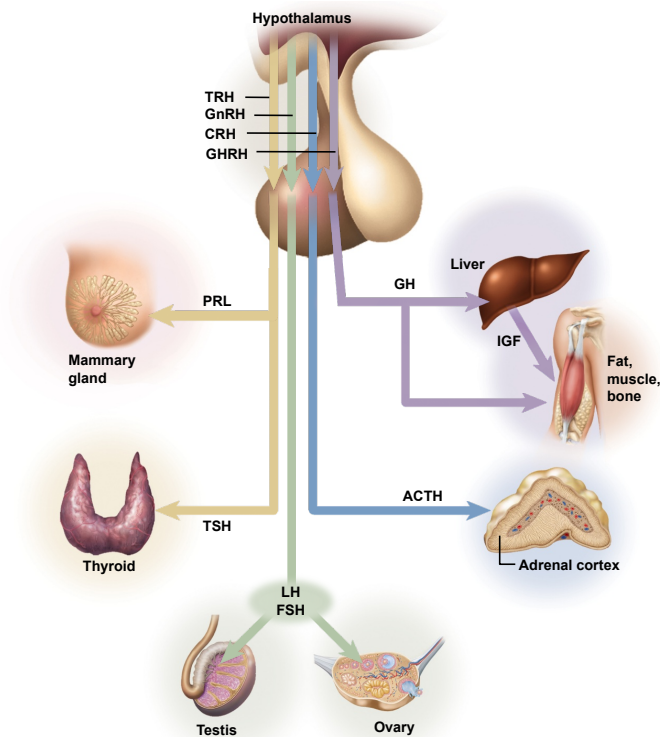
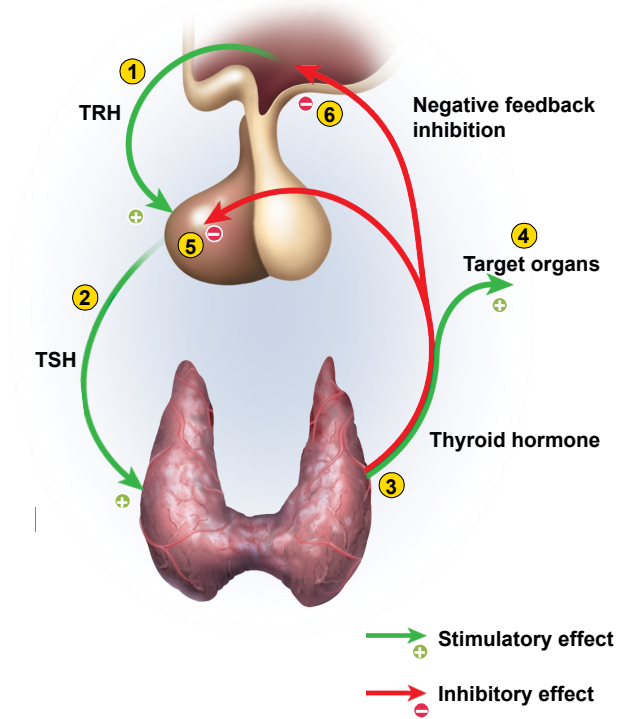


Fig. 17.7

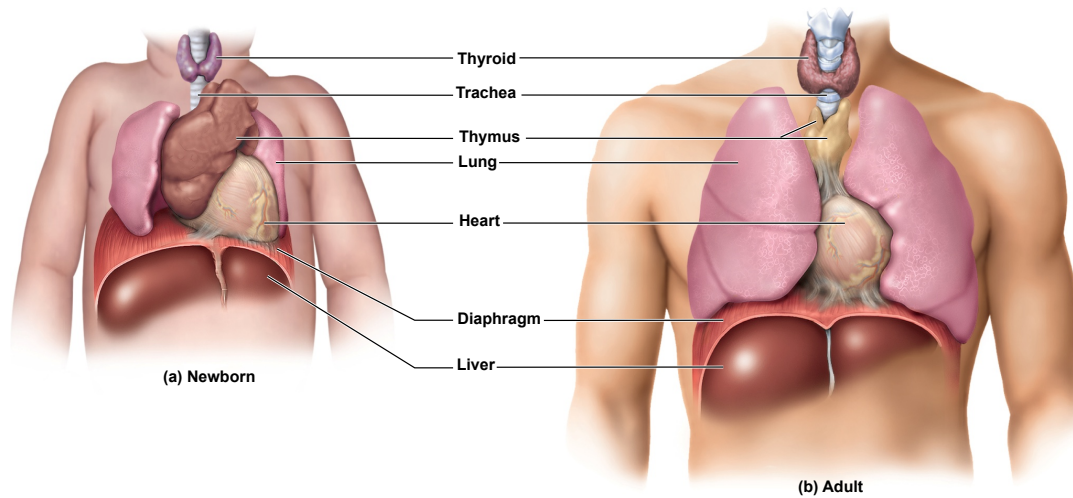
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Fig. 17.8

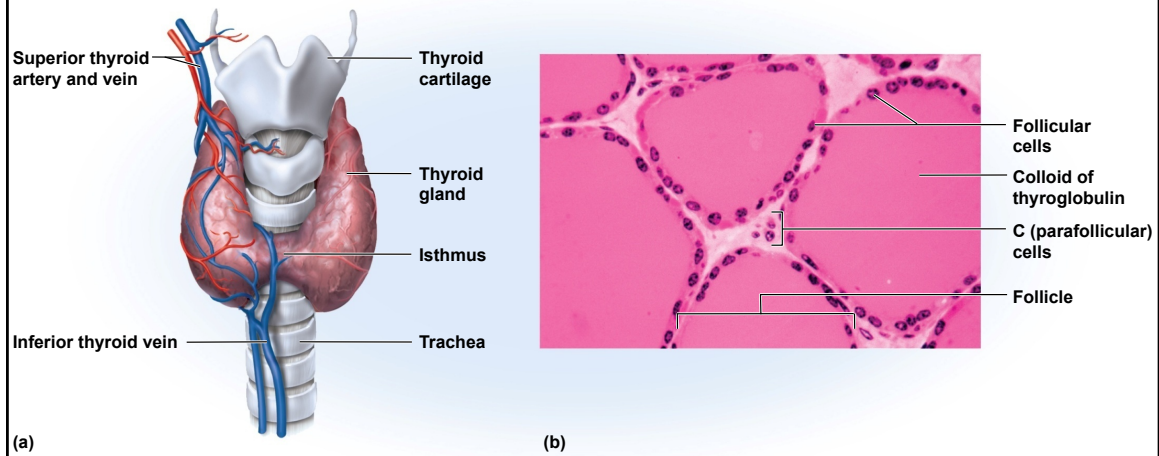
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Fig. 17.9

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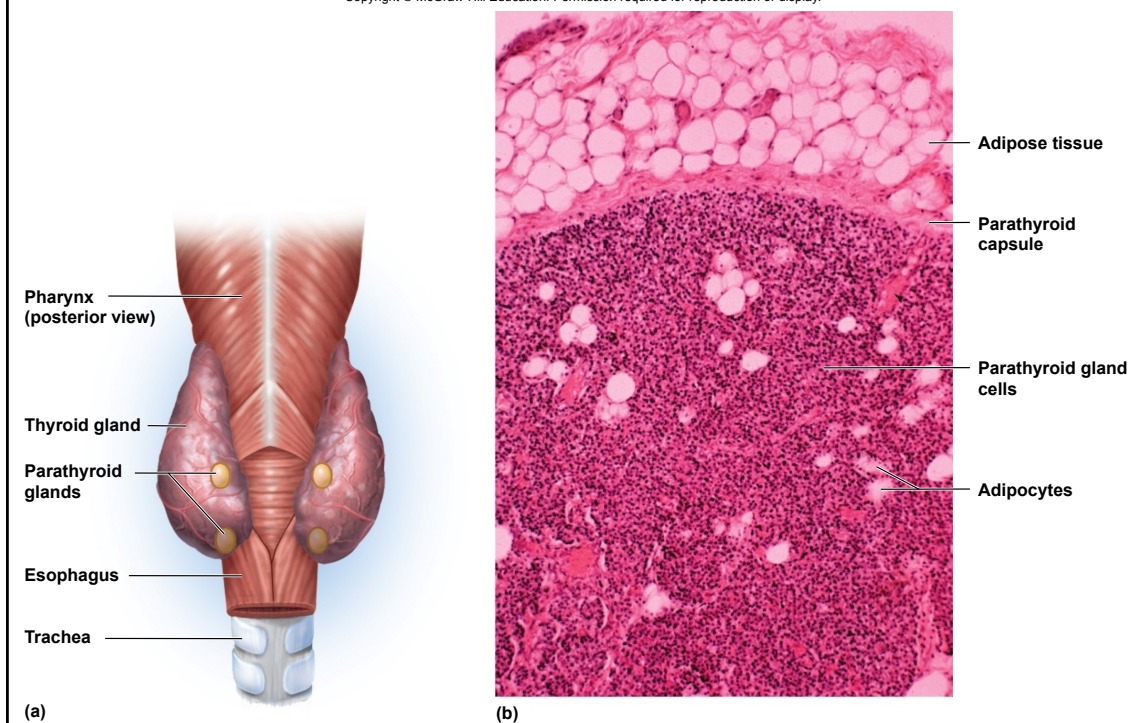


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Fig. 17.10

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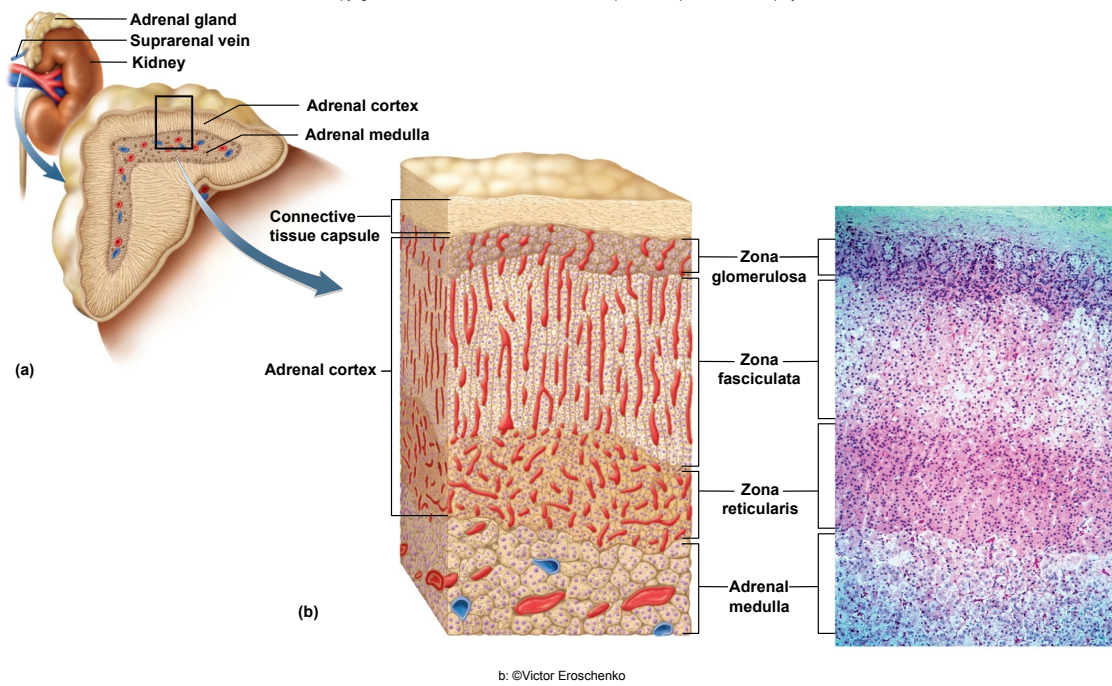
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Fig. 17.11

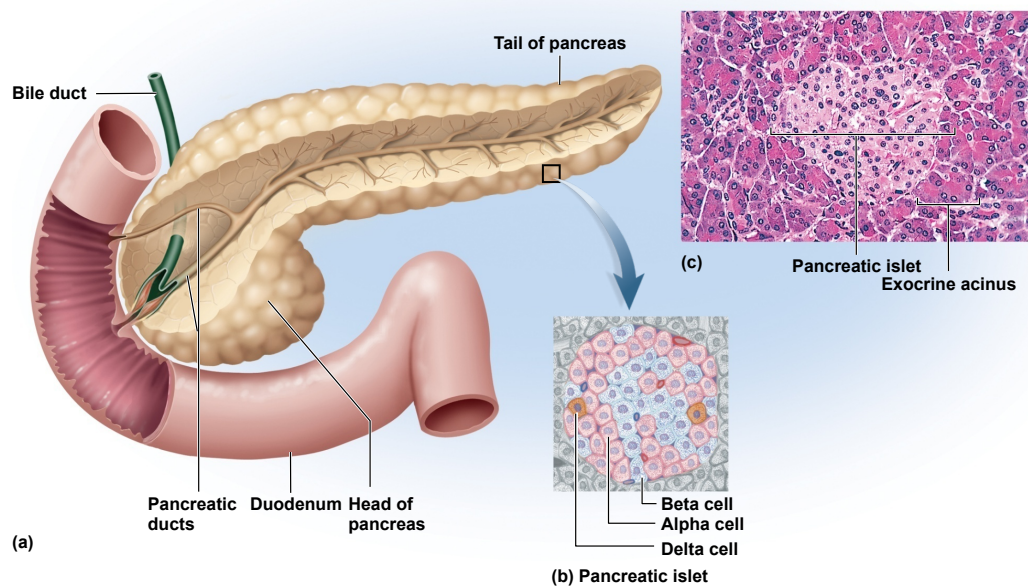
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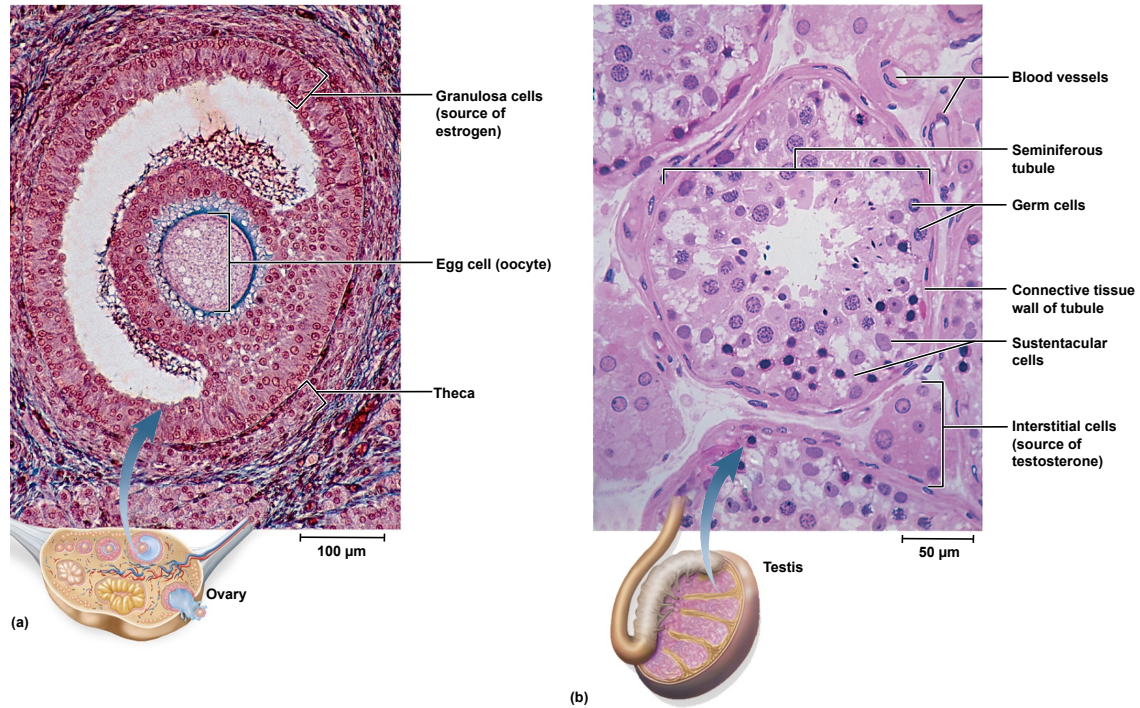
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Fig. 17.13

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Table 17.5a

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TABLE 17.5 Hormones from Sources Other than the Hypothalamus and Pituitary			
Source	Hormone	Target Organs and Tissues	Principal Effects
Pineal gland	Melatonin	Brain	Uncertain; may influence mood and sexual maturation
Thymus	Thymopoietin, thymosin, thymulin	Immune cells (T lymphocytes)	Stimulate T lymphocyte development and activity
Thyroid gland	Thyroxine ( $T_4$ ) and triiodothyronine ( $T_3$ )	Most tissues	Elevate metabolic rate and heat production; increase respiratory rate, heart rate, and strength of heartbeat; stimulate appetite and accelerate breakdown of nutrients; promote alertness and quicken reflexes; stimulate growth hormone secretion and growth of skin, hair, nails, teeth, and fetal nervous system
	Calcitonin	Bone	Stimulates bone deposition, mainly in children
Parathyroid glands	Parathyroid hormone (PTH)	Bone, kidneys, small intestine	Raises blood $Ca^{2+}$ level by stimulating bone resorption and inhibiting deposition, reducing urinary $Ca^{2+}$ excretion, and enhancing calcitriol synthesis
Adrenal medulla	Epinephrine, norepinephrine, dopamine	Most tissues	Promote alertness; mobilize organic fuels; raise metabolic rate; stimulate circulation and respiration; increase blood glucose level; inhibit insulin secretion and glucose uptake by insulin-dependent organs (sparing glucose for brain)
Adrenal cortex	Aldosterone	Kidney	Promotes $Na^+$ and water retention and $K^+$ excretion; maintains blood pressure and volume
	Cortisol and corticosterone	Most tissues	Stimulate fat and protein catabolism, gluconeogenesis, stress resistance, and tissue repair
	Dehydroepiandrosterone	Bone, muscle, integument, brain, many other tissues	Precursor of testosterone; indirectly promotes growth of bones, pubic and axillary hair, apocrine glands, and fetal male reproductive tract; stimulates libido

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TABLE 17.5 Hormones from Sources Other than the Hypothalamus and Pituitary (continued)			
Source	Hormone	Target Organs and Tissues	Principal Effects
Pancreatic islets	Glucagon	Primarily liver	Stimulates amino acid absorption, gluconeogenesis, glycogen and fat breakdown; raises blood glucose and fatty acid levels
	Insulin	Most tissues	Stimulates glucose and amino acid uptake; lowers blood glucose level; promotes glycogen, fat, and protein synthesis
	Somatostatin	Stomach, intestines, pancreatic islet cells	Modulates digestion, nutrient absorption, and glucagon and insulin secretion
	Pancreatic polypeptide	Pancreas, gallbladder	Inhibits release of bile and digestive enzymes
Ovaries	Gastrin	Stomach	Stimulates acid secretion and gastric motility
	Estradiol	Many tissues	Stimulates female reproductive development and adolescent growth; regulates menstrual cycle and pregnancy; prepares mammary glands for lactation
	Progesterone	Uterus, mammary glands	Regulates menstrual cycle and pregnancy; prepares mammary glands for lactation
Testes	Inhibin	Anterior pituitary	Inhibits FSH secretion
	Testosterone	Many tissues	Stimulates fetal and adolescent reproductive development, musculoskeletal growth, sperm production, and libido
	Inhibin	Anterior pituitary	Inhibits FSH secretion
Skin	Cholecalciferol	—	Precursor of calcitriol (see kidneys)
Liver	Calcidiol	—	Precursor of calcitriol (see kidneys)
	Angiotensinogen	—	Precursor of angiotensin II (see kidneys)
	Erythropoietin	Red bone marrow	Promotes red blood cell production, increases oxygen-carrying capacity of blood
	Hepcidin	Small intestine, liver	Promotes iron absorption and mobilization
Kidneys	Insulin-like growth factor I	Many tissues	Prolongs and mediates action of growth hormone
	Angiotensin I	—	Precursor of angiotensin II, a vasoconstrictor
	Calcitriol	Small intestine	Increases blood calcium level mainly by promoting intestinal absorption of $\text{Ca}^{2+}$
	Erythropoietin	Red bone marrow	Promotes red blood cell production, increases oxygen-carrying capacity of blood
Heart	Natriuretic peptides	Kidney	Lower blood volume and pressure by promoting $\text{Na}^+$ and water loss
Stomach and small intestine	Cholecystokinin	Gallbladder, brain	Bile release; appetite suppression
	Gastrin	Stomach	Stimulates acid secretion
	Ghrelin	Brain	Stimulates hunger, initiates feeding
	Peptide YY	Brain	Produces sense of satiety, terminates feeding
	Other enteric hormones	Stomach, intestines	Coordinate secretion and motility in different regions of digestive tract
Adipose tissue	Leptin	Brain	Limits appetite over long term
Osseous tissue	Osteocalcin	Pancreas, adipose tissue	Stimulates pancreatic beta cells to multiply, increases insulin secretion, enhances insulin sensitivity of various tissues, and reduces fat deposition
Placenta	Estrogen, progesterone	Many tissues of mother and fetus	Stimulate fetal development and maternal bodily adaptations to pregnancy; prepare mammary glands for lactation

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Table 17.6

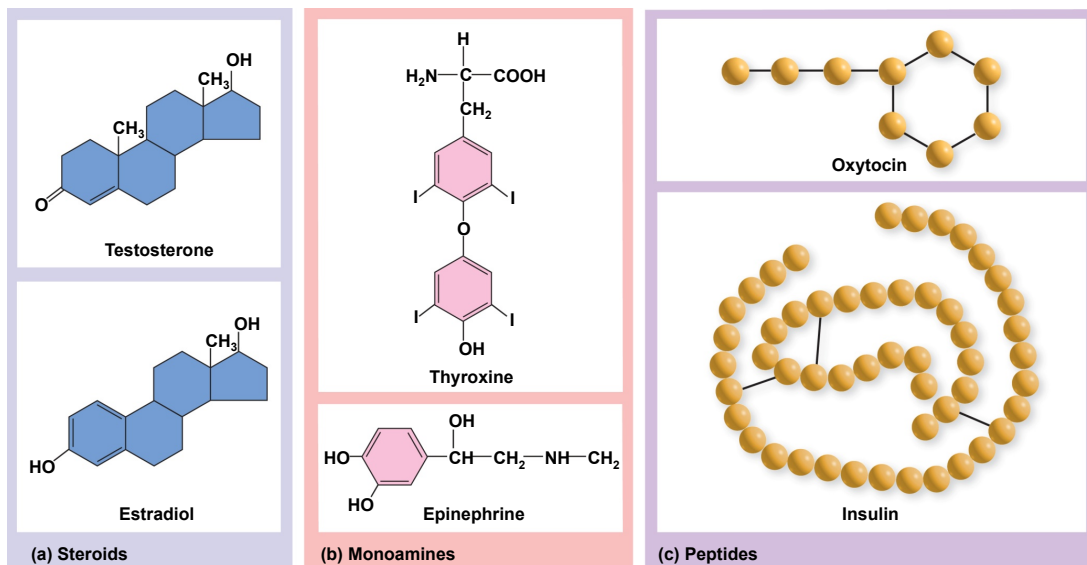
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TABLE 17.6 Chemical Classification of Hormones	
<b>Steroids and Steroid Derivatives</b>	
Aldosterone	
Androgens	
Calcitriol	
Corticosterone	
Cortisol	
Estrogens	
Progesterone	
<b>Monoamines</b>	
Dopamine	Norepinephrine
Epinephrine	Thyroid hormone
Melatonin	
<b>Peptides</b>	
<b>Oligopeptides (3–10 amino acids)</b>	
Angiotensin II	
Antidiuretic hormone	
Cholecystokinin	
Gonadotropin-releasing hormone	
Oxytocin	
Thyrotropin-releasing hormone	
<b>Polypeptides (more than 10 amino acids)</b>	
Adrenocorticotrophic hormone	Hepcidin
Natriuretic peptides	Insulin
Calcitonin	Leptin
Corticotropin-releasing hormone	Pancreatic polypeptide
Gastrin	Parathyroid hormone
Ghrelin	Prolactin
Glucagon	Somatostatin
Growth hormone	Thymic hormones
Growth hormone-releasing hormone	
<b>Glycoproteins (protein-carbohydrate complexes)</b>	
Erythropoietin	Luteinizing hormone
Follicle-stimulating hormone	Thyroid-stimulating hormone
Inhibin	

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Fig. 17.14

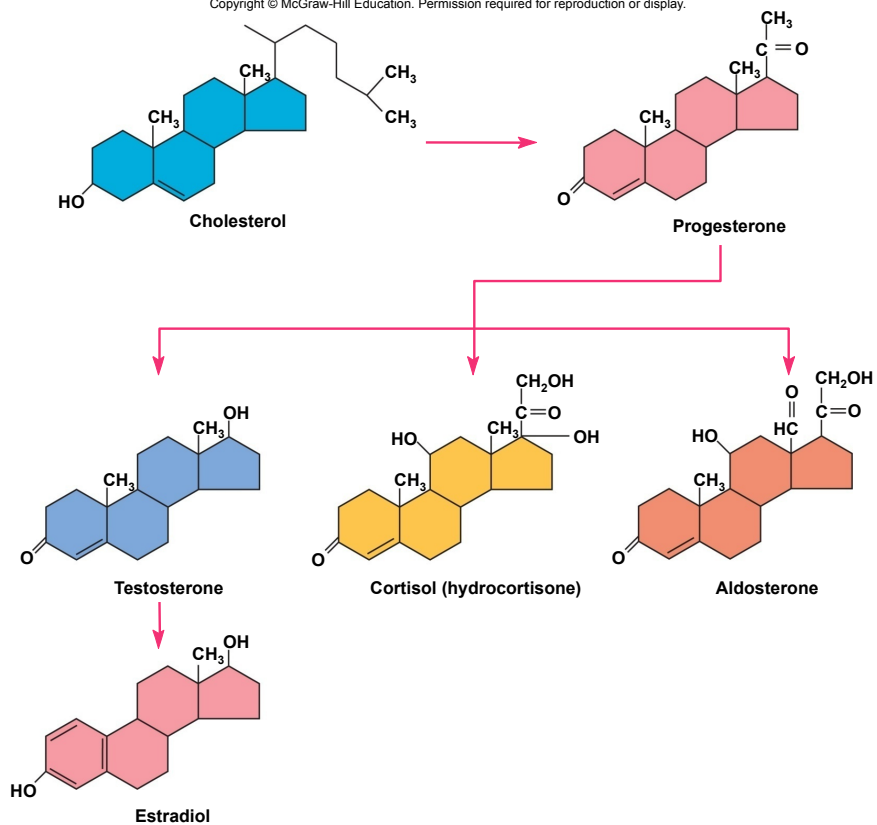
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Fig. 17.15

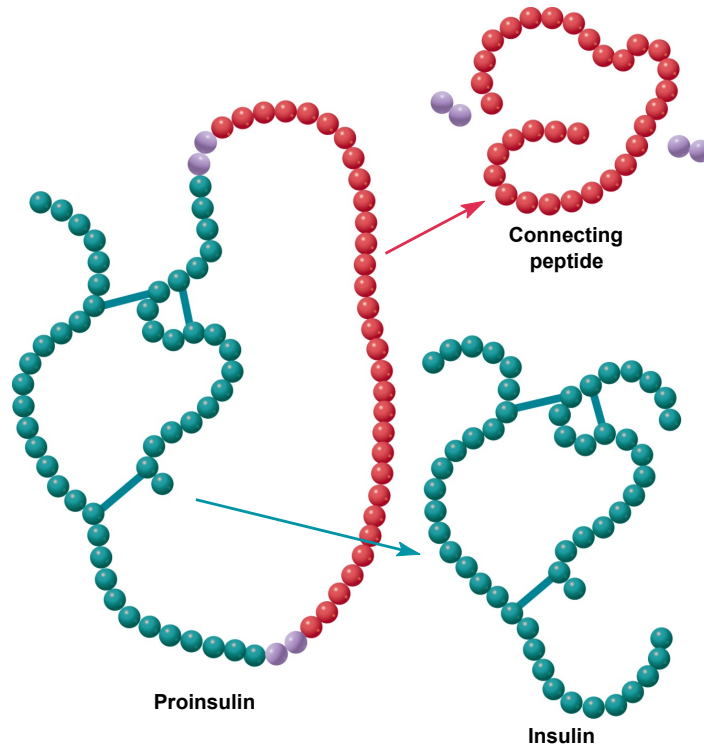
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Fig. 17.16

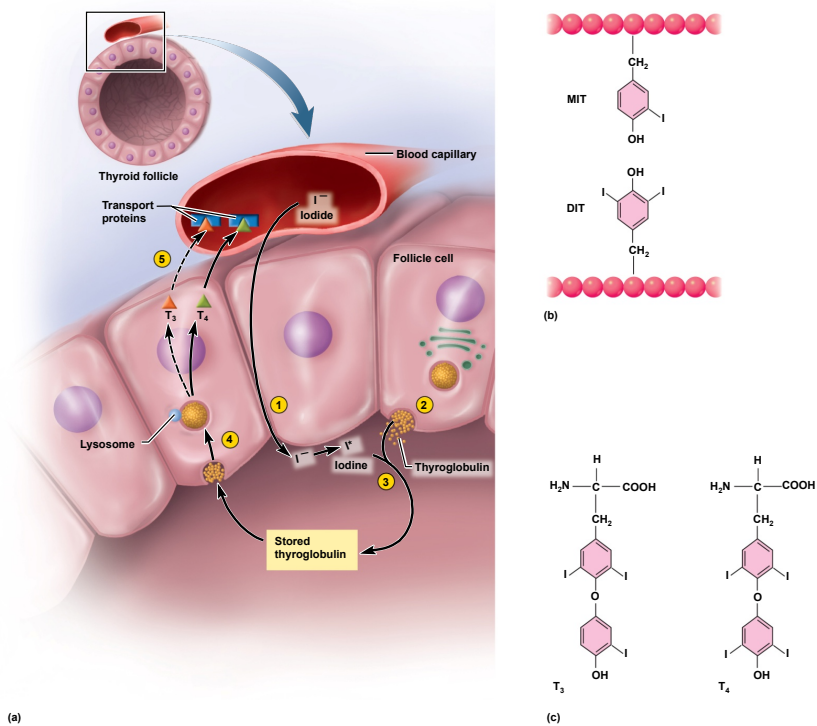
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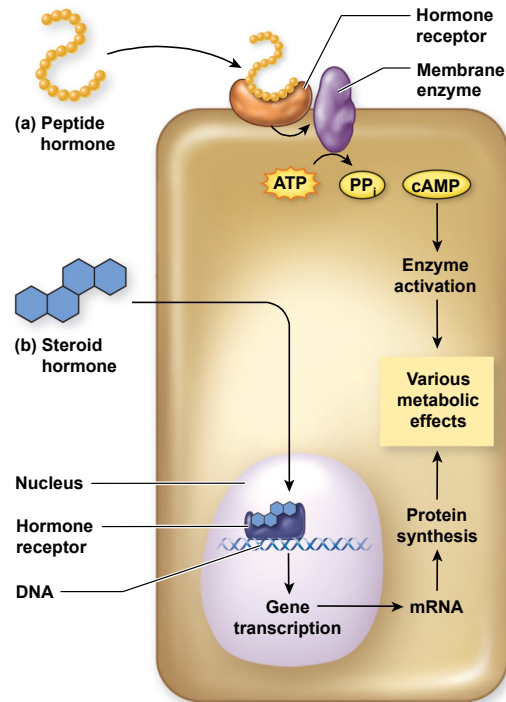


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Fig. 17.18

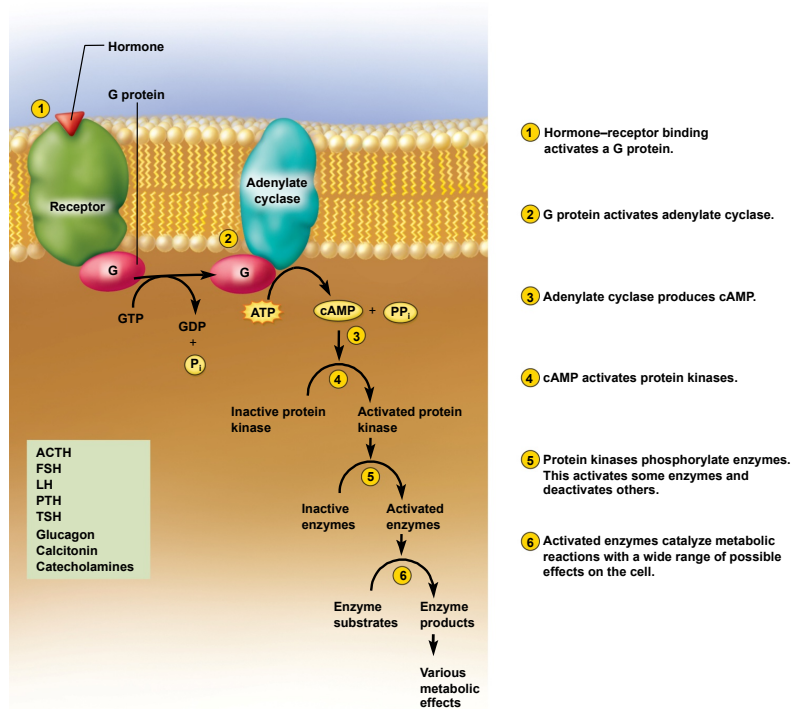
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Fig. 17.19

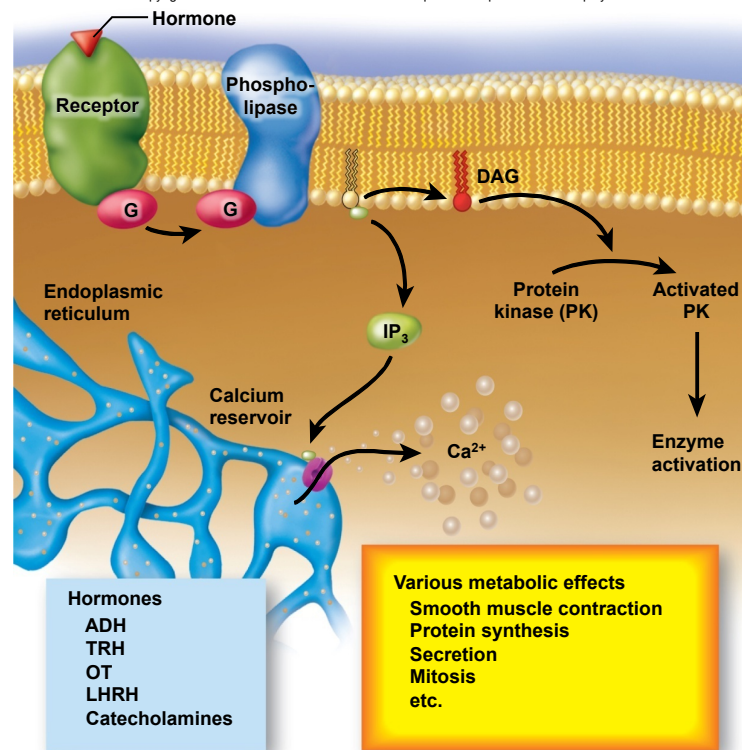
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Fig. 17.20

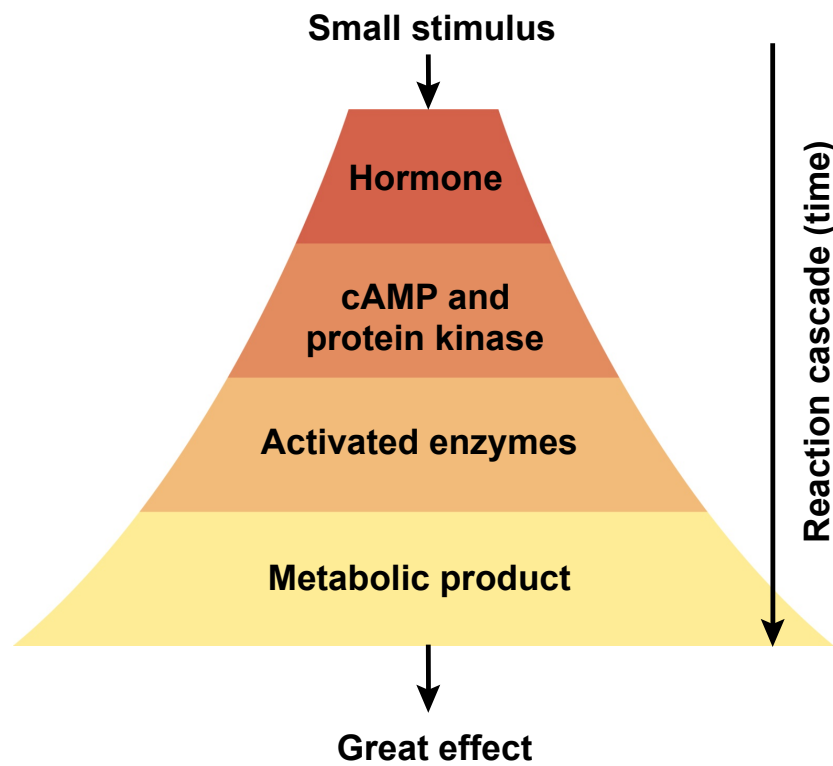
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Fig. 17.21

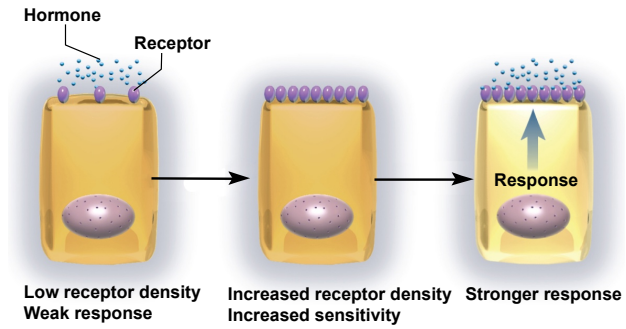
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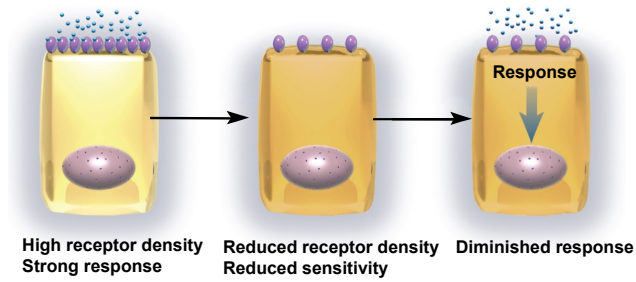
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(a) Up-regulation

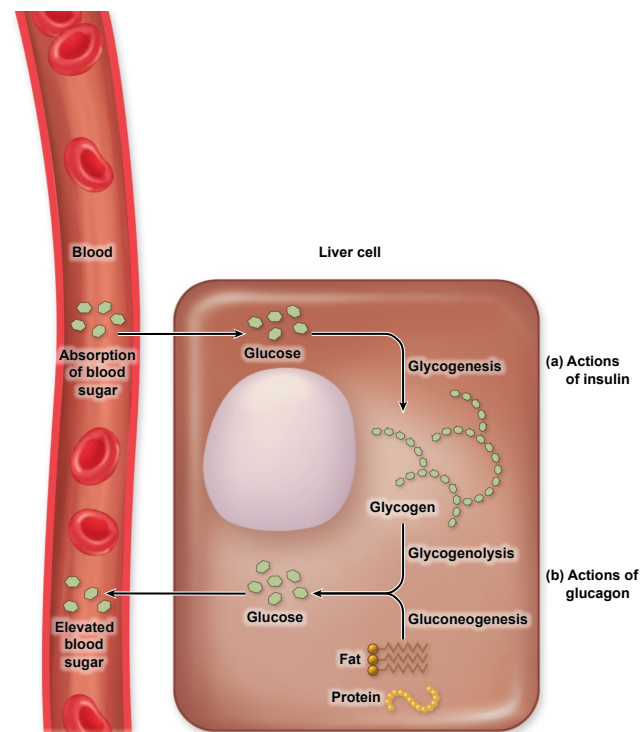


(b) Down-regulation

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Fig. 17.23

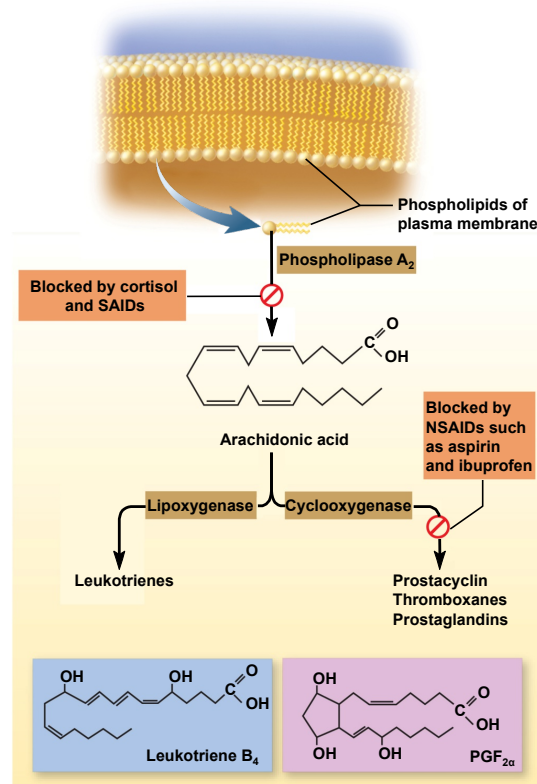
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**TABLE 17.7****Some of the Roles of Prostaglandins**

**Inflammatory:** Promote fever and pain, two cardinal signs of inflammation

**Endocrine:** Mimic effects of TSH, ACTH, and other hormones; alter sensitivity of anterior pituitary to hypothalamic hormones; work with glucagon, catecholamines, and other hormones in regulation of fat mobilization

**Nervous:** Function as neuromodulators, altering the release or effects of neurotransmitters in the brain

**Reproductive:** Promote ovulation and formation of corpus luteum; induce labor contractions

**Gastrointestinal:** Inhibit gastric secretion

**Vascular:** Act as vasodilators and vasoconstrictors

**Respiratory:** Constrict or dilate bronchioles

**Renal:** Promote blood circulation through the kidney, increase water and electrolyte excretion

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