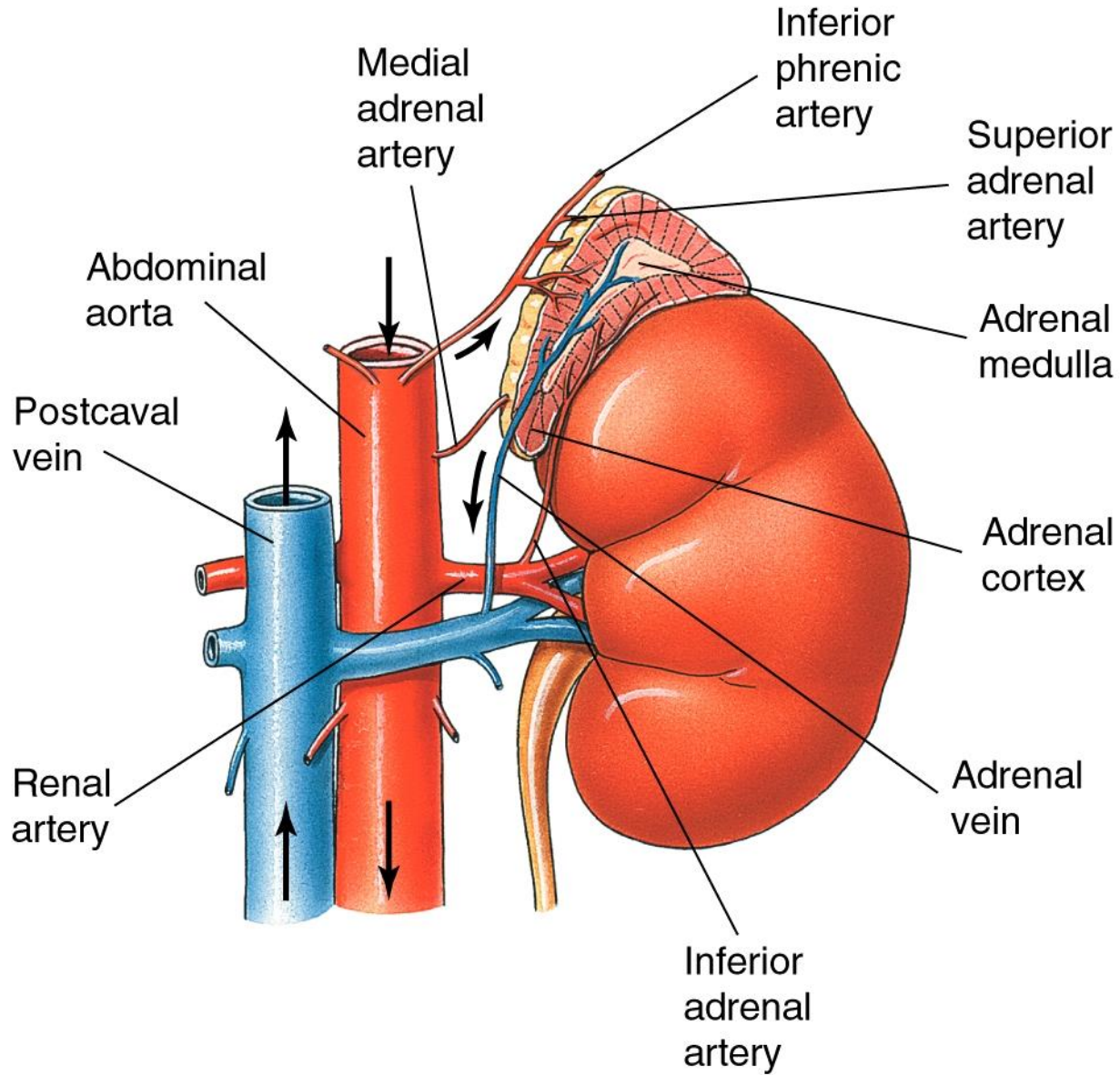


# Left Adrenal Gland



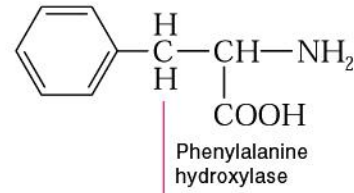
**Table 9-7** Metabolic and developmental hormones

Hormone	Tissue of origin	Structure	Target tissue	Primary action	Regulation
Glucagon	Pancreas (alpha cells)	Peptide	Liver, adipose tissue	Stimulates glycogenolysis and release of glucose from liver; promotes lipolysis	Low serum glucose increases secretion; somatostatin inhibits release
Glucocorticoids (e.g., cortisol)	Adrenal cortex	Steroid	Liver, adipose tissue	Stimulate mobilization of amino acids from muscle and gluconeogenesis in liver to raise blood glucose; increase transfer of fatty acids from adipose tissue to liver; exhibit anti-inflammatory action	Physiological stress increases secretion; biological clock via CRH and ACTH controls diurnal changes in secretion
Growth hormone (GH)	Anterior pituitary	Peptide	All tissues	Stimulates RNA synthesis, protein synthesis, and tissue growth; increases transport of glucose and amino acids into cells; increase lipolysis and antibody formation	Reduced plasma glucose and increased plasma amino acid levels stimulate release via GRH; somatostatin inhibits release

**Table 9-7 Metabolic and developmental hormones**

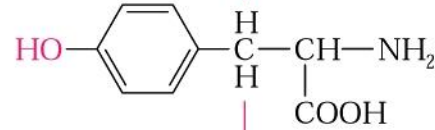
Hormone	Tissue of origin	Structure	Target tissue	Primary action	Regulation
Insulin	Pancreas (beta cells)	Peptide	All tissues except most neuronal tissue	Increases glucose and amino acid uptake by cells	High plasma glucose and amino acid levels and presence of glucagon increase secretion; somatostatin inhibits secretion
Norepinephrine and epinephrine	Adrenal medulla (chromaffin cells)	Catecholamine	Most tissues	Increase cardiac activity; induce vasoconstriction; increase glycolysis, hyperglycemia, and lipolysis	Sympathetic stimulation via splanchnic nerves increases secretion
Thyroxine	Thyroid	Tyrosine derivative	Most cells, but especially those of muscle, heart, liver, and kidney	Increases metabolic rate, thermogenesis, growth, and development; promotes amphibian metamorphosis	TSH induces release

Phenylalanine



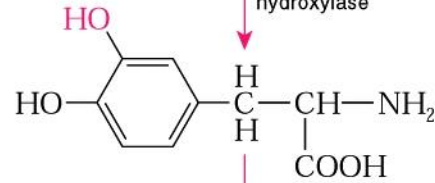
Phenylalanine hydroxylase

Tyrosine



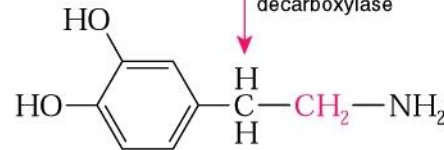
Tyrosine hydroxylase

Dopa



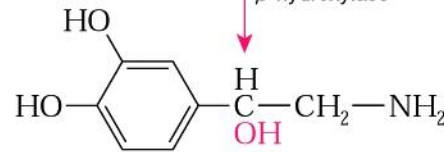
Dopa decarboxylase

Dopamine



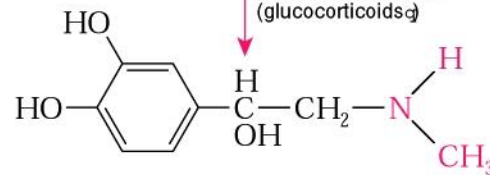
Dopamine β-hydroxylase

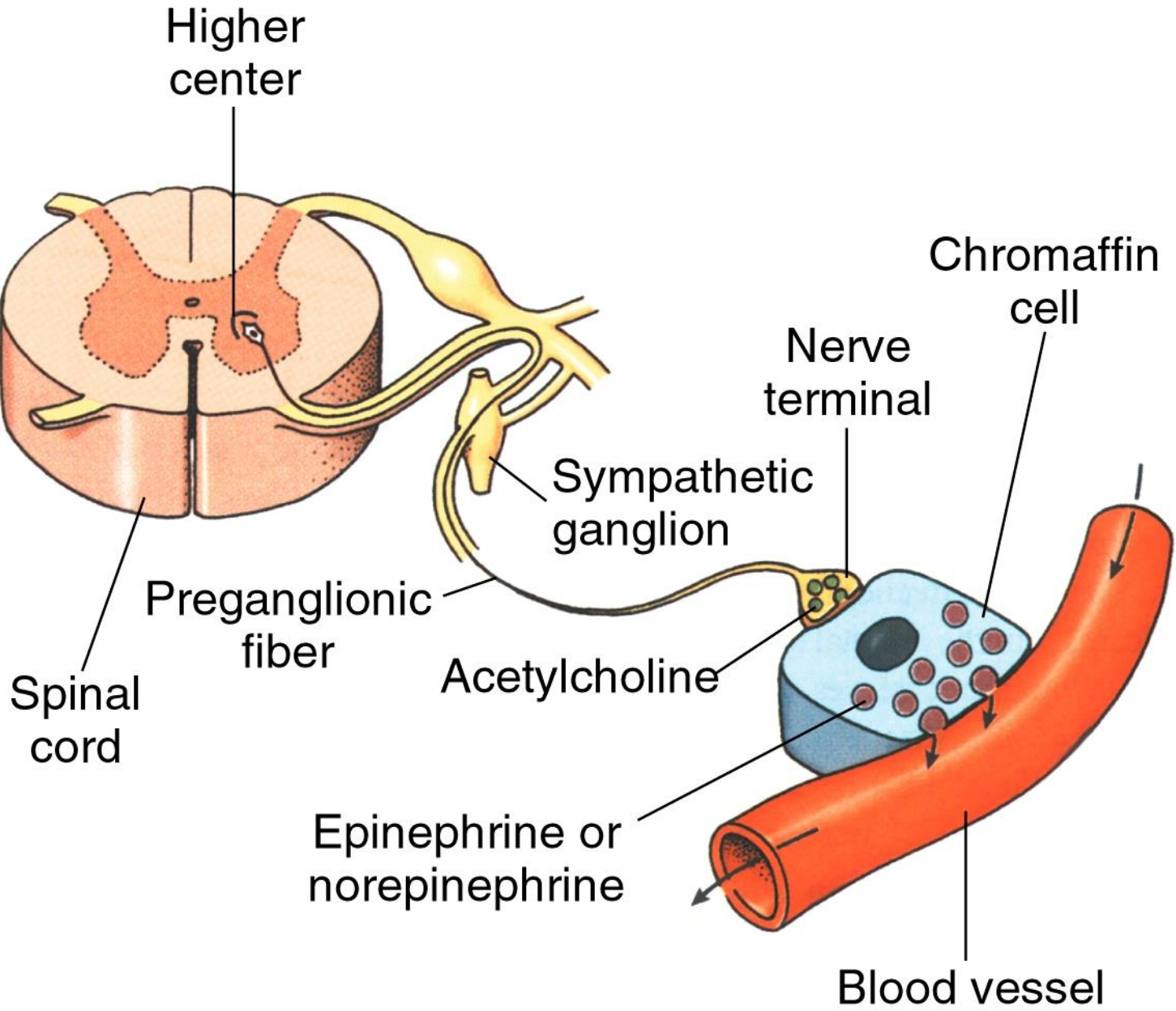
Norepinephrine

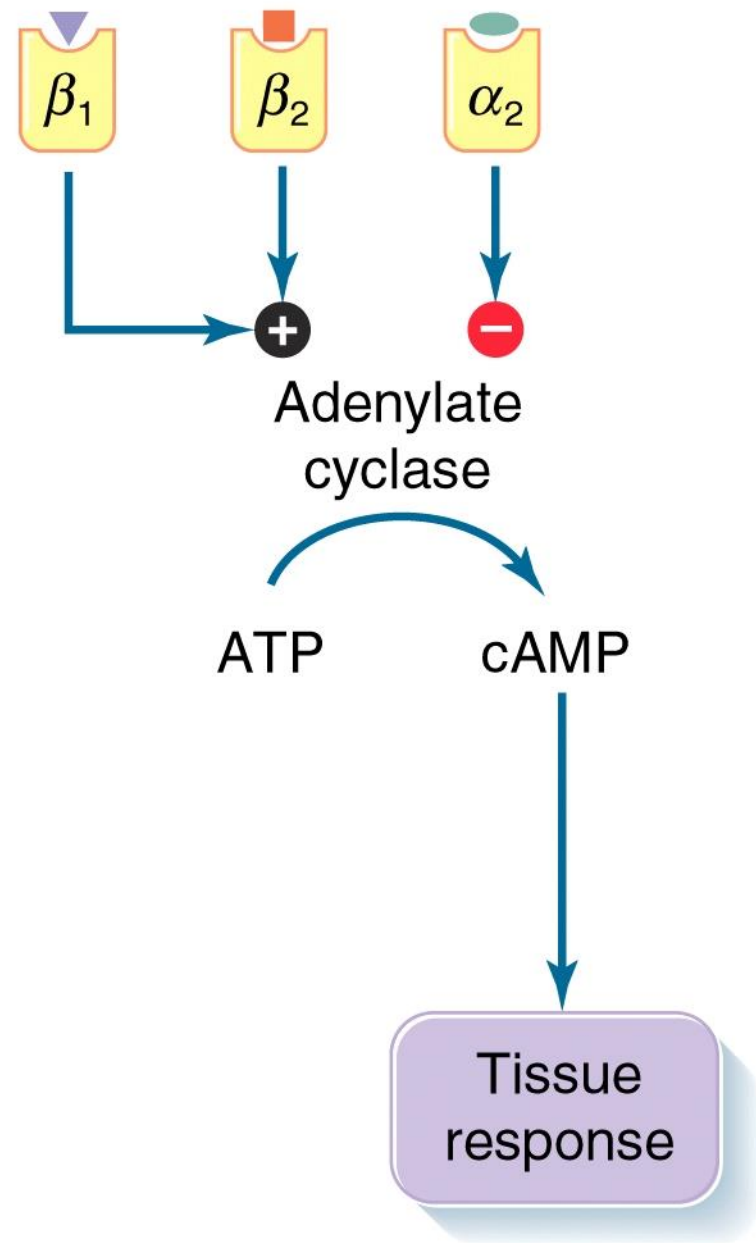
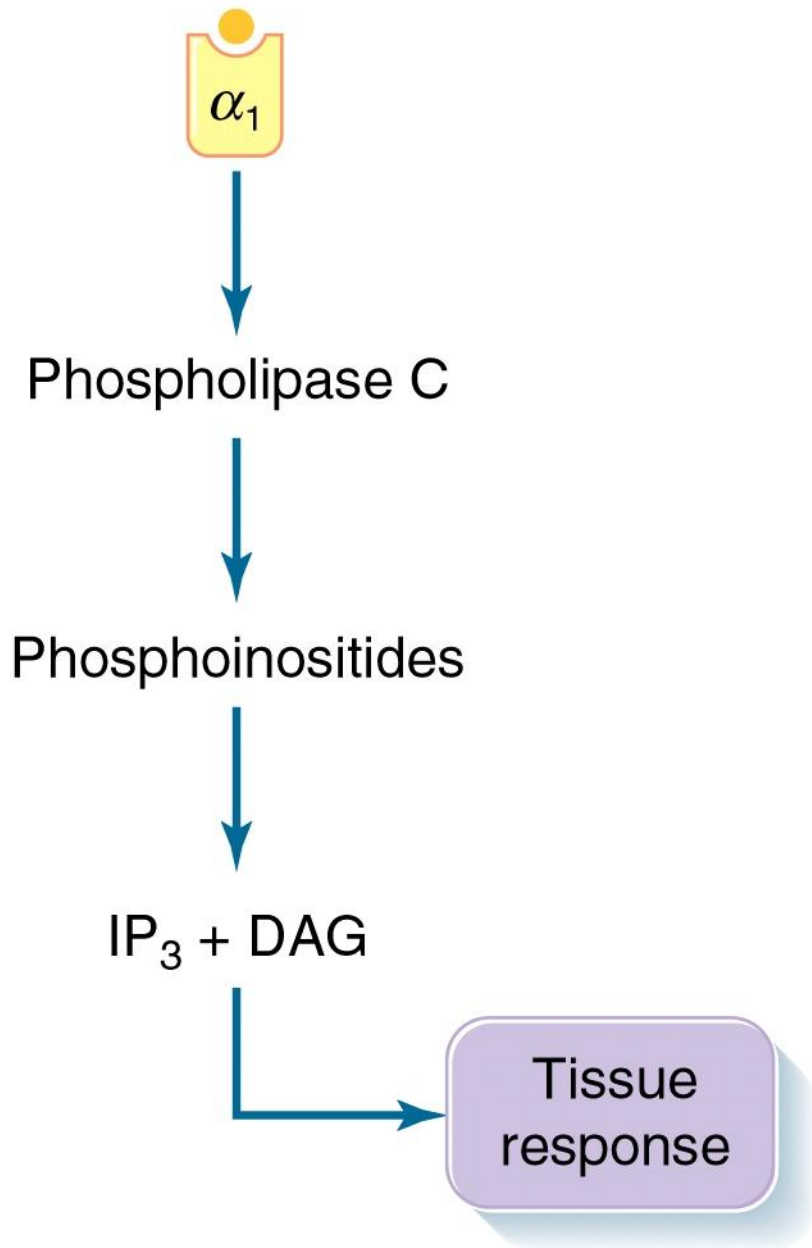


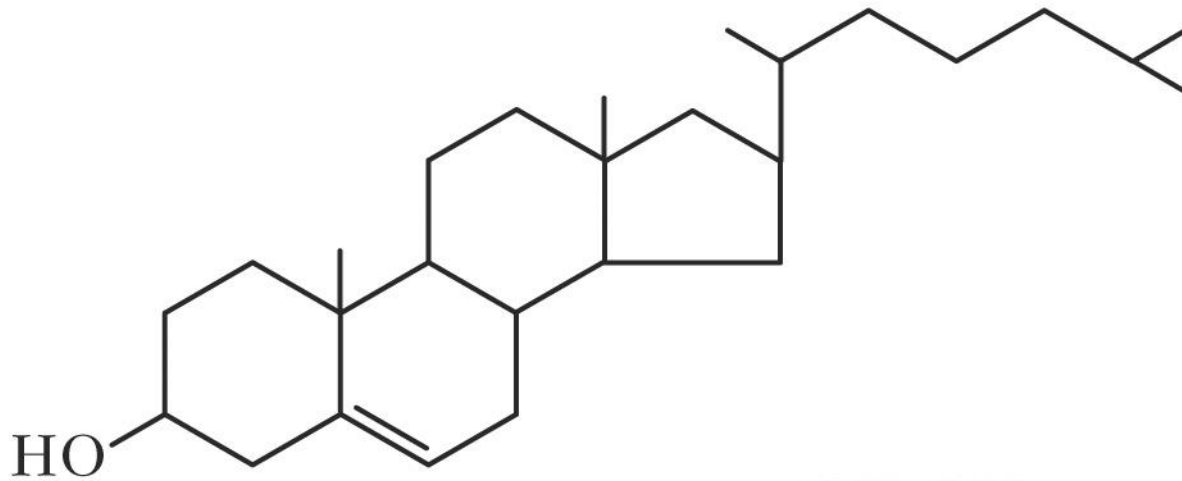
Phenylethanolamine N-methyltransferase (glucocorticoids)

Epinephrine

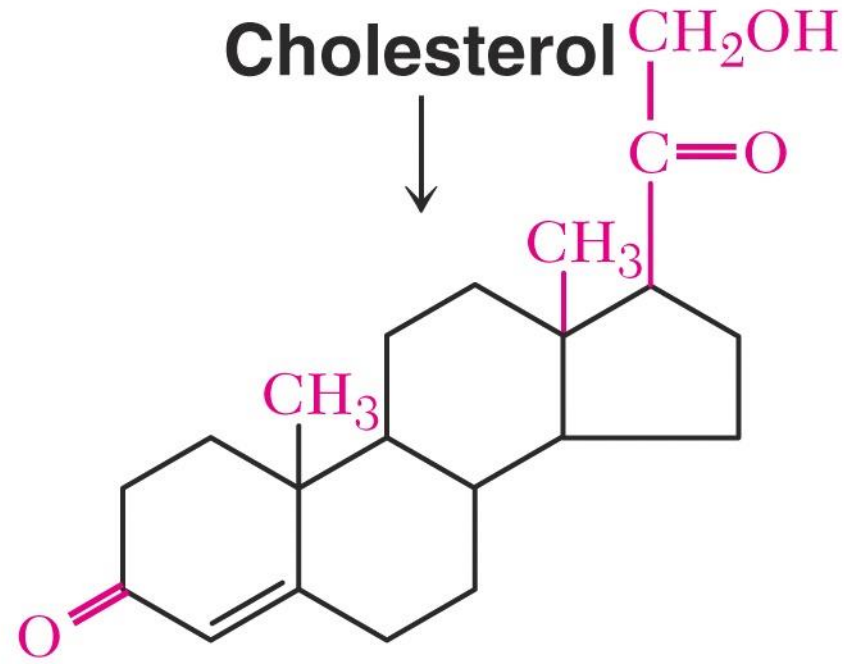






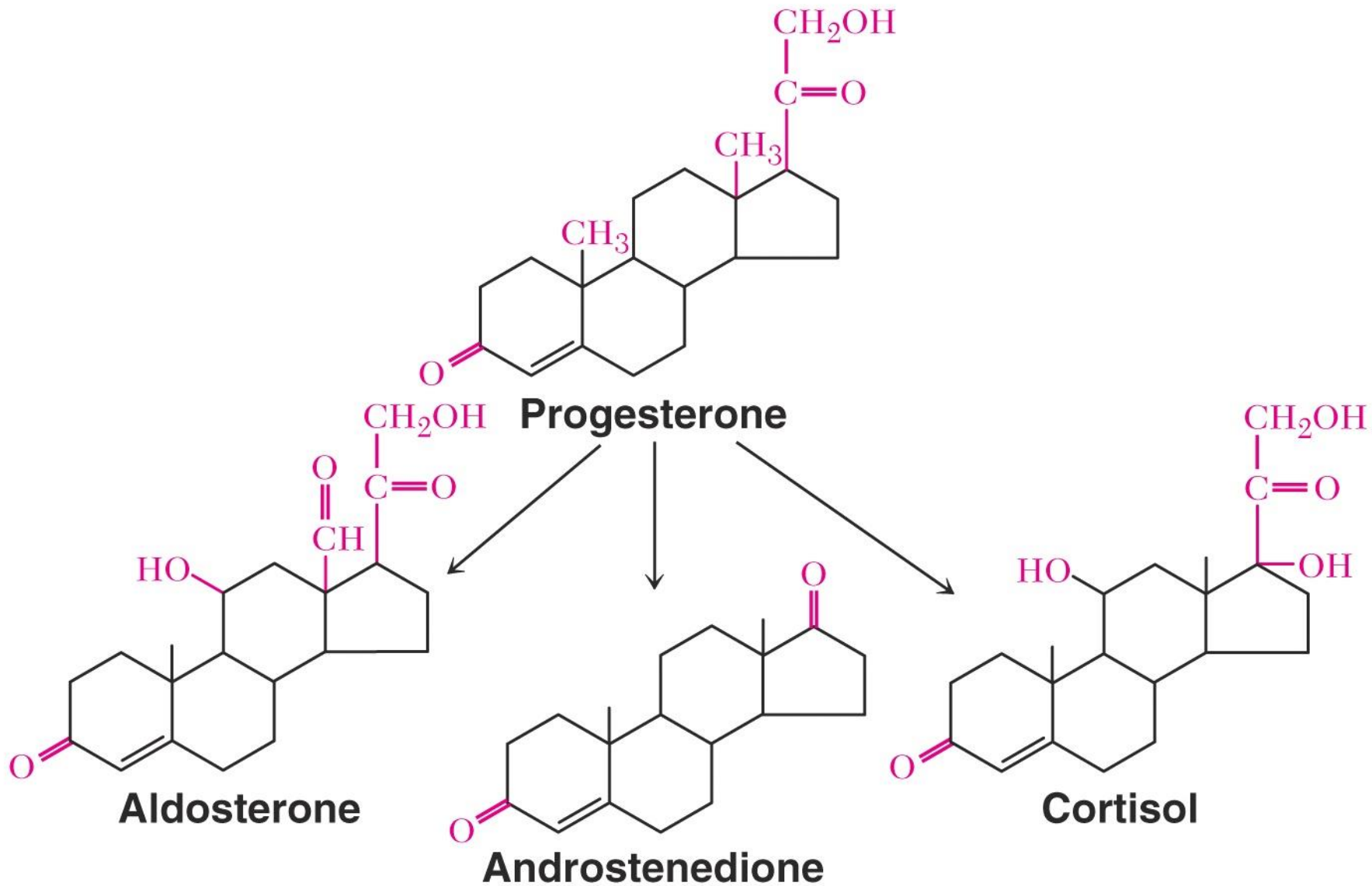


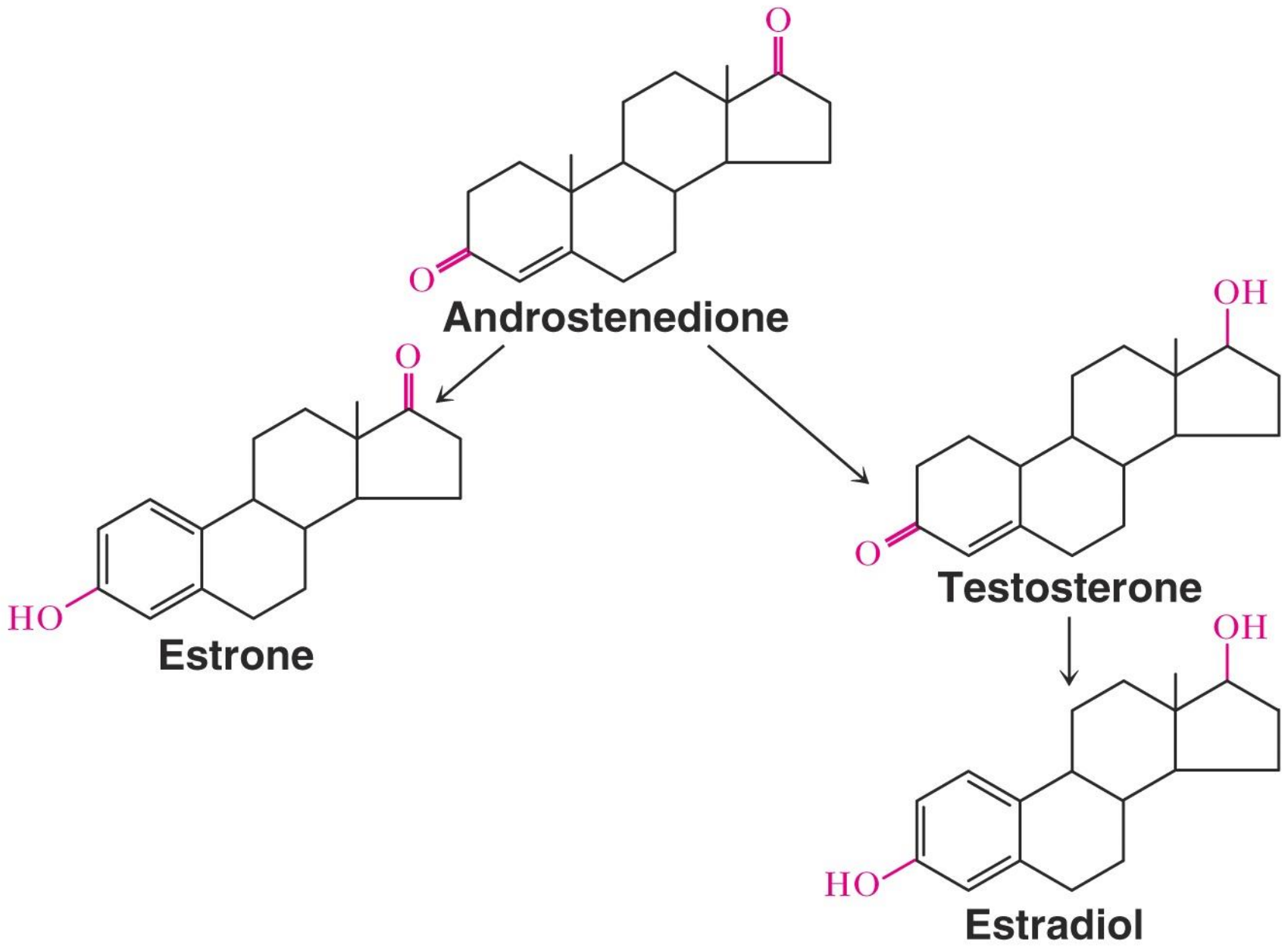
**Cholesterol**  $\text{CH}_2\text{OH}$

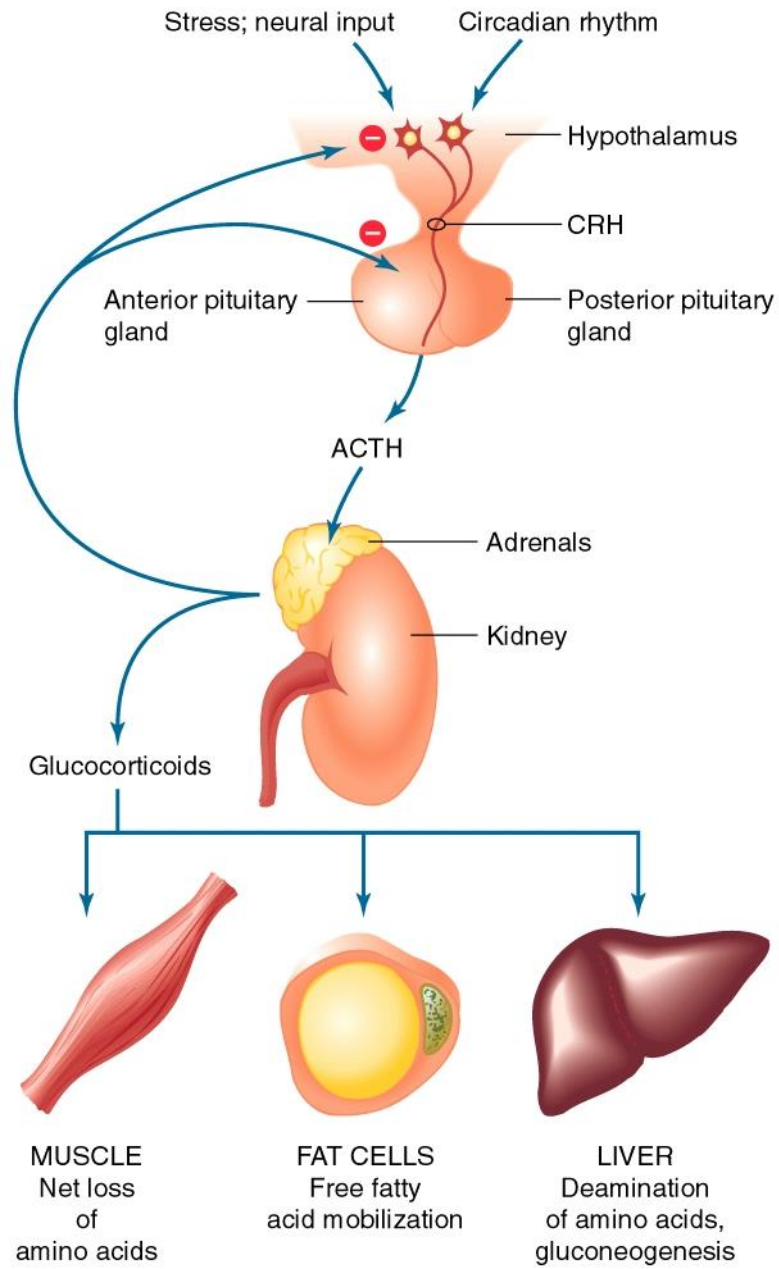


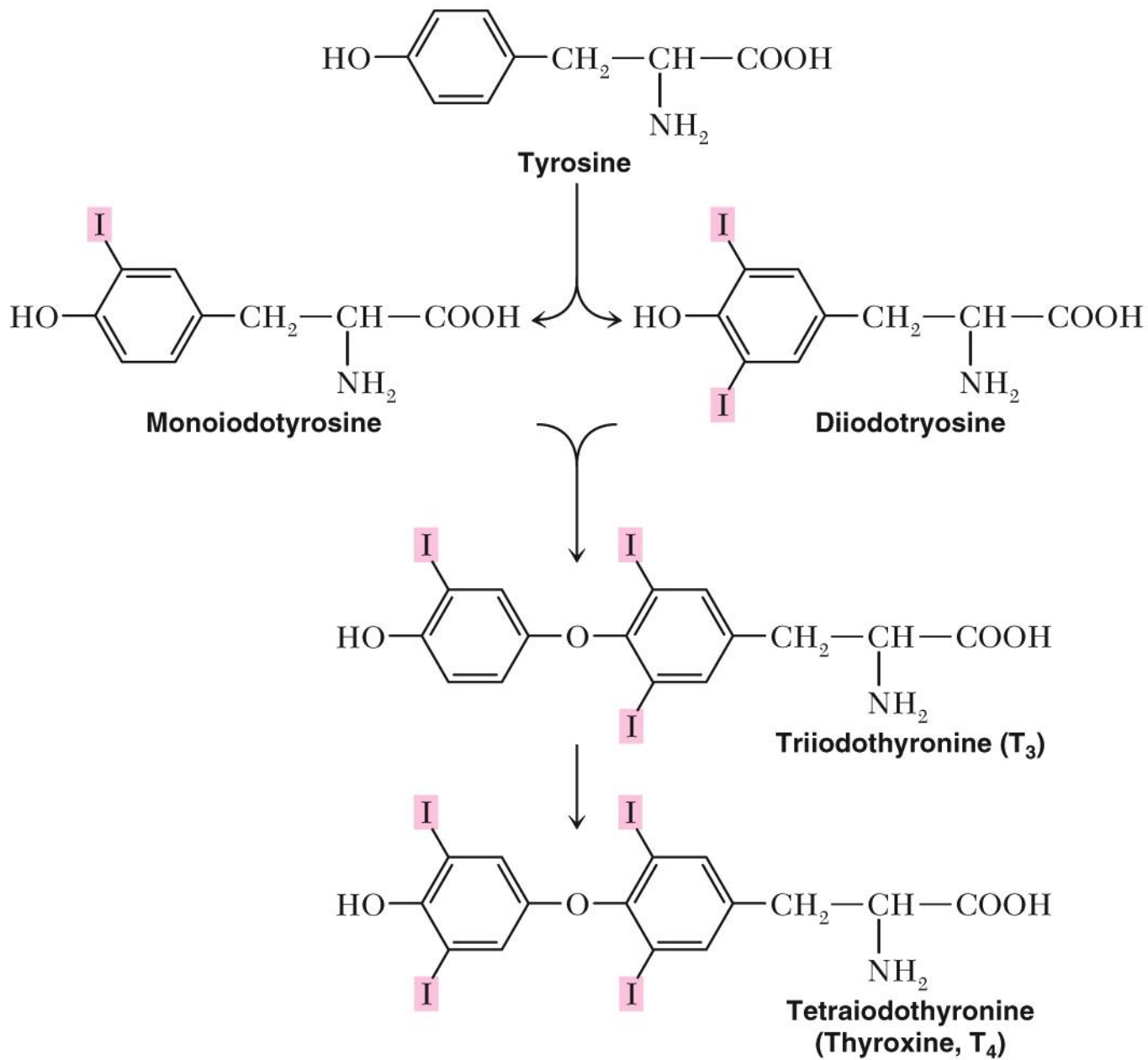
**Progesterone**

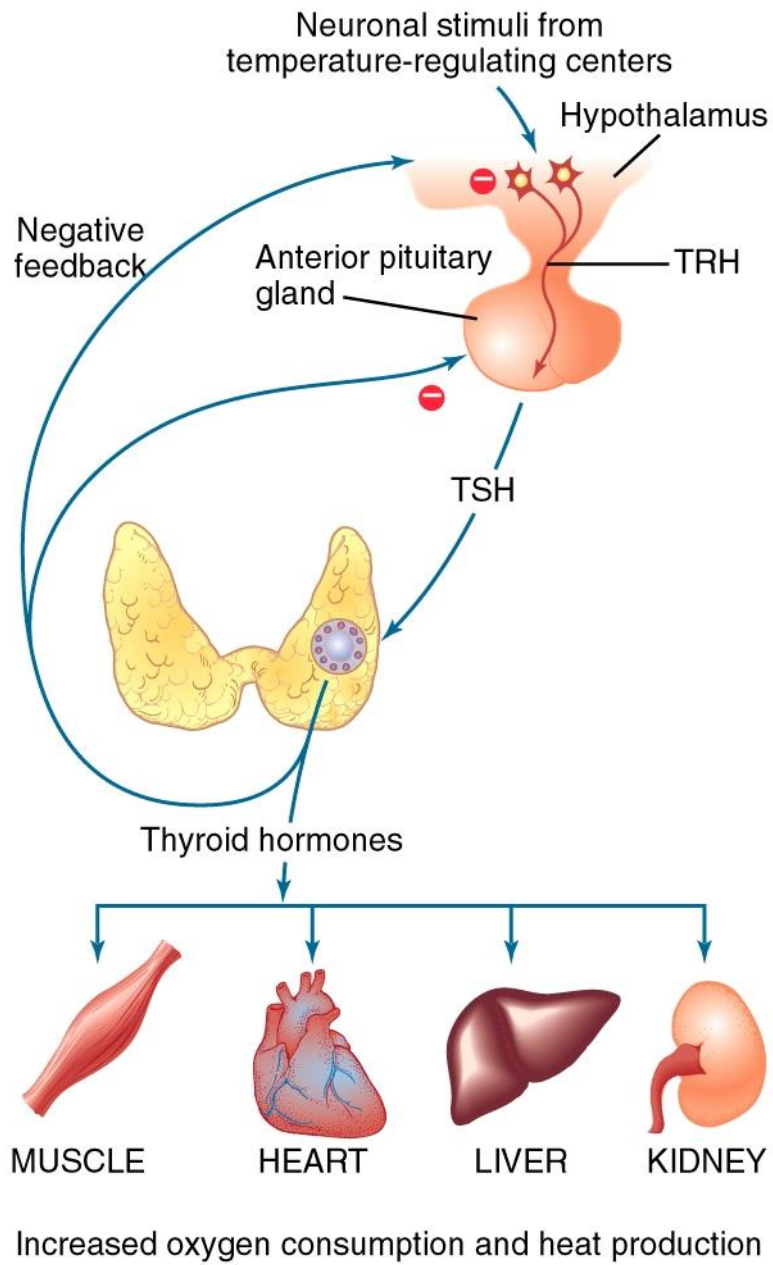












Neuronal stimuli from temperature-regulating centers

Hypothalamus

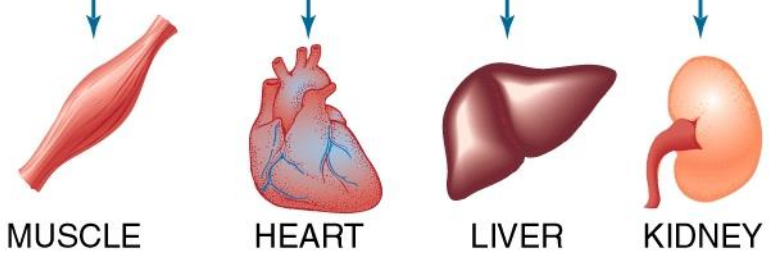
Negative feedback

Anterior pituitary gland

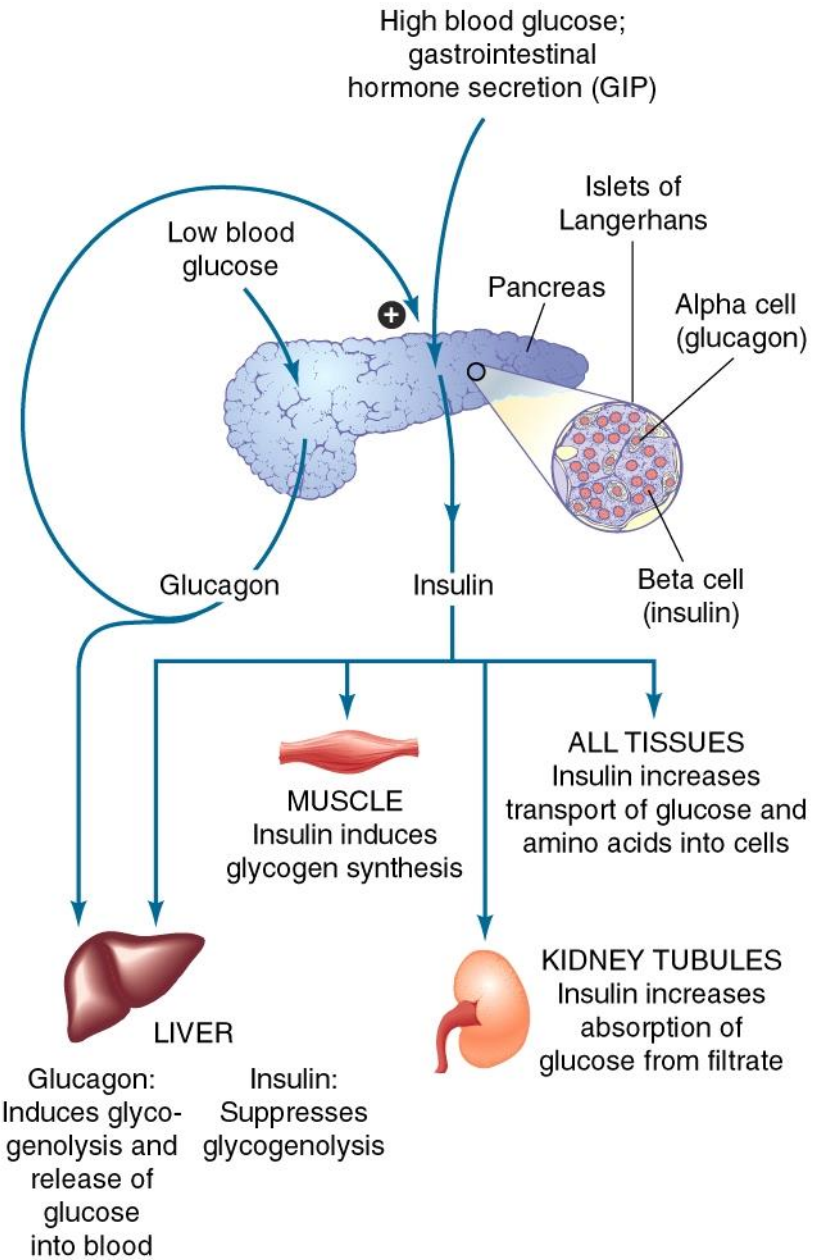
TRH

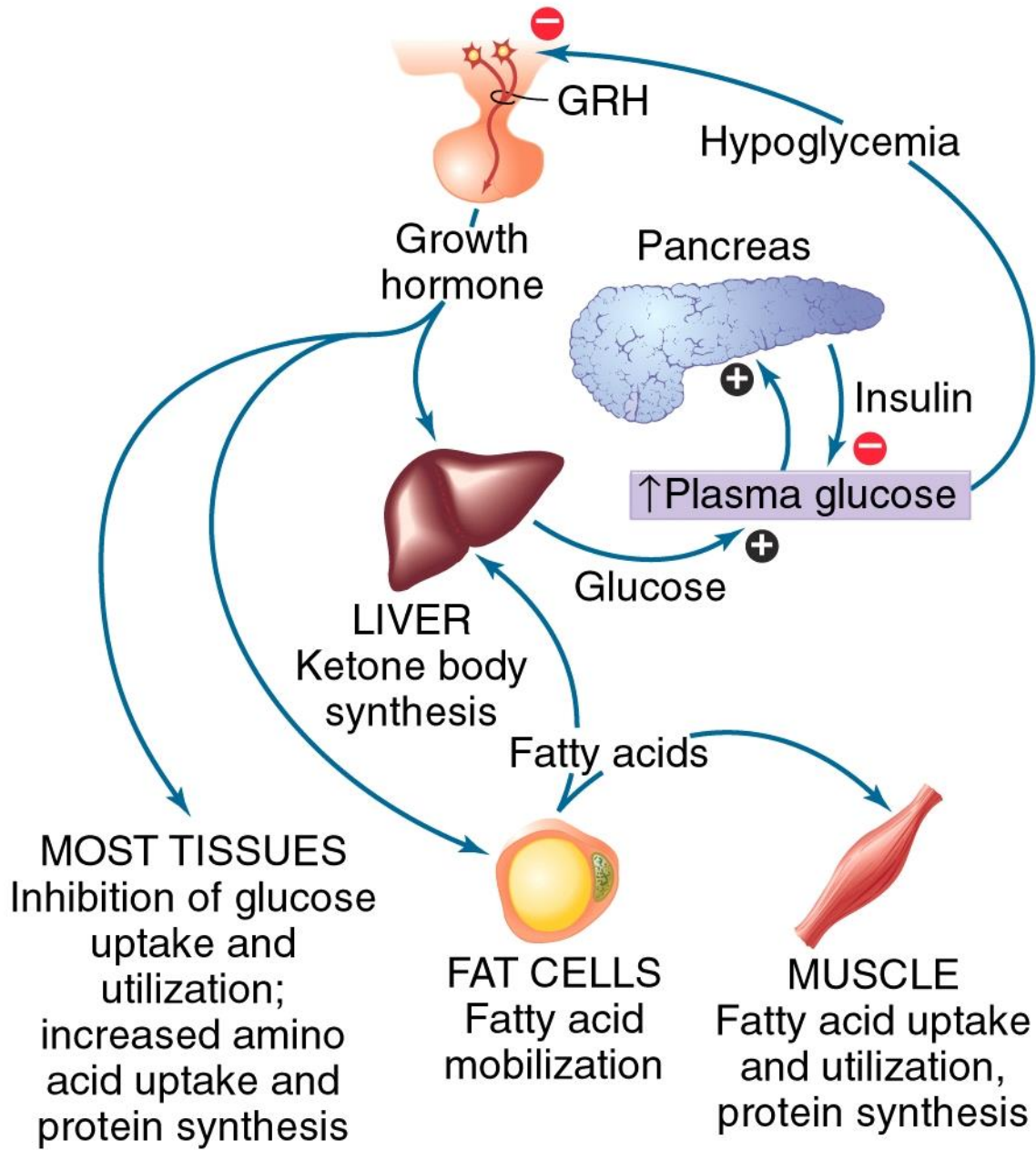
TSH

Thyroid hormones



Increased oxygen consumption and heat production



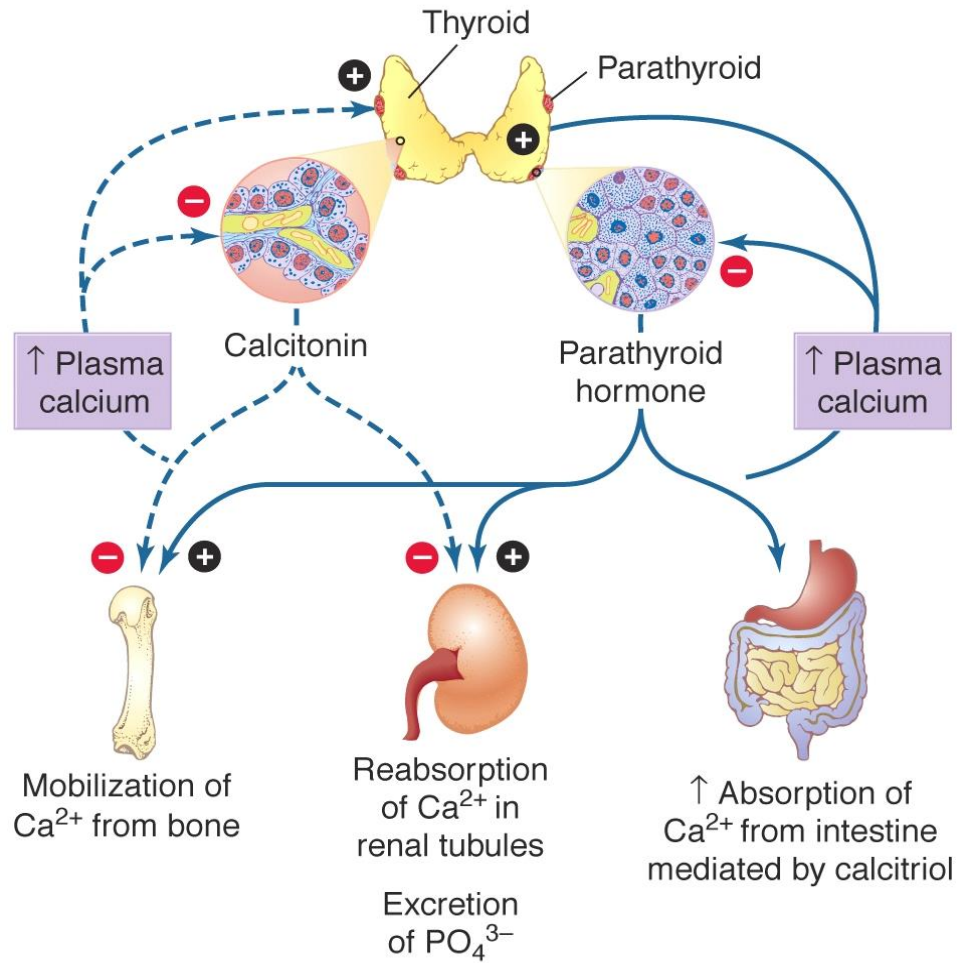


**Table 9-8 Mammalian hormones involved in regulating water and electrolyte balance**

Hormone	Tissue of origin	Structure	Target tissue	Primary action	Regulation
Antidiuretic hormone (ADH, vasopressin)	Posterior pituitary	Nonapeptide	Kidneys	Increases water reabsorption	Increased plasma osmotic pressure or decreased blood volume stimulates release
Atrial natriuretic peptide (ANP)	Heart (atrium)	Peptide	Kidneys	Reduces Na <sup>+</sup> and water reabsorption	Increased venous pressure stimulates release
Calcitonin	Thyroid (parafollicular cells)	Peptide	Bones, kidneys	Decreases release of Ca <sup>2+</sup> from bone; increases renal Ca <sup>2+</sup> and PO <sub>4</sub> <sup>3-</sup> excretion	Increased plasma Ca <sup>2+</sup> stimulates secretion
Mineralocorticoids (e.g., aldosterone)	Adrenal cortex	Steroid	Distal kidney tubules	Promotes reabsorption of Na <sup>+</sup> from urinary filtrate	Angiotensin II stimulates secretion
Parathyroid hormone (PTH)	Parathyroid gland	Peptide	Bones, kidneys, intestine	Increases release of Ca <sup>2+</sup> from bone; with calcitriol increases intestinal Ca <sup>2+</sup> absorption; decreases renal Ca <sup>2+</sup> excretion	Decreased plasma Ca <sup>2+</sup> stimulates secretion

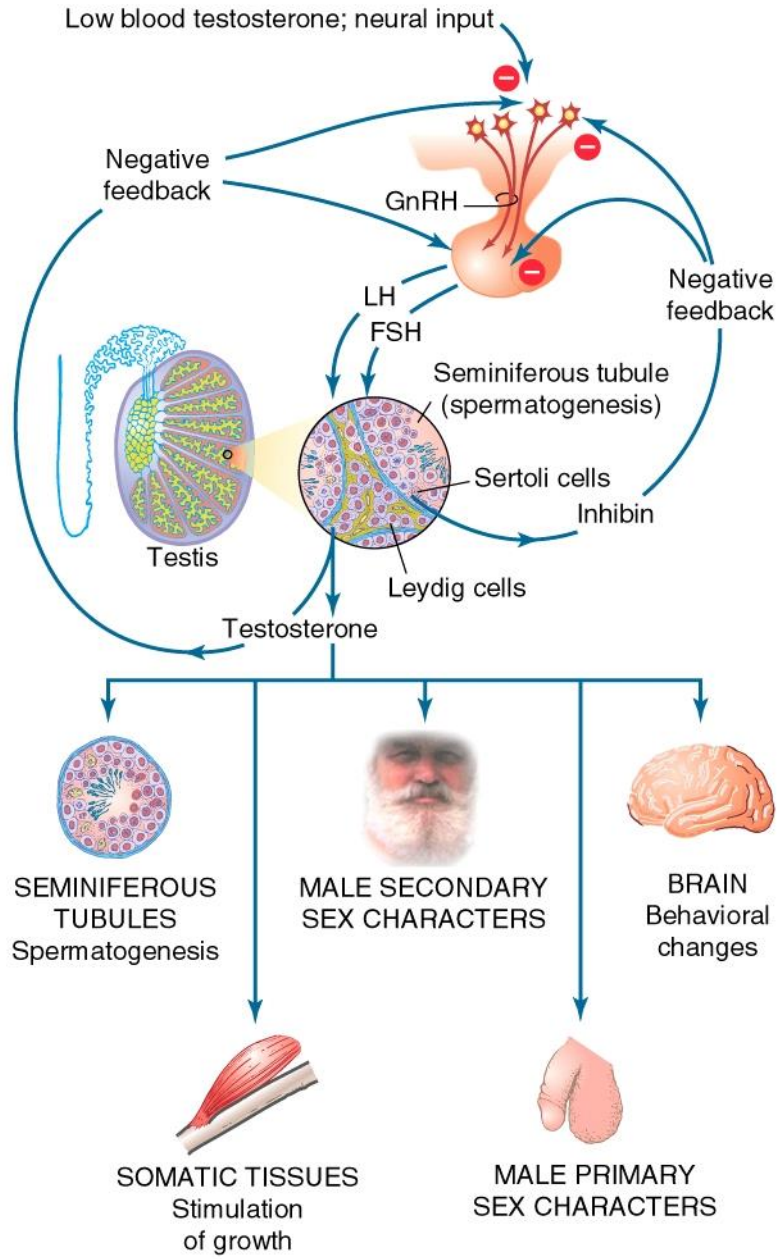


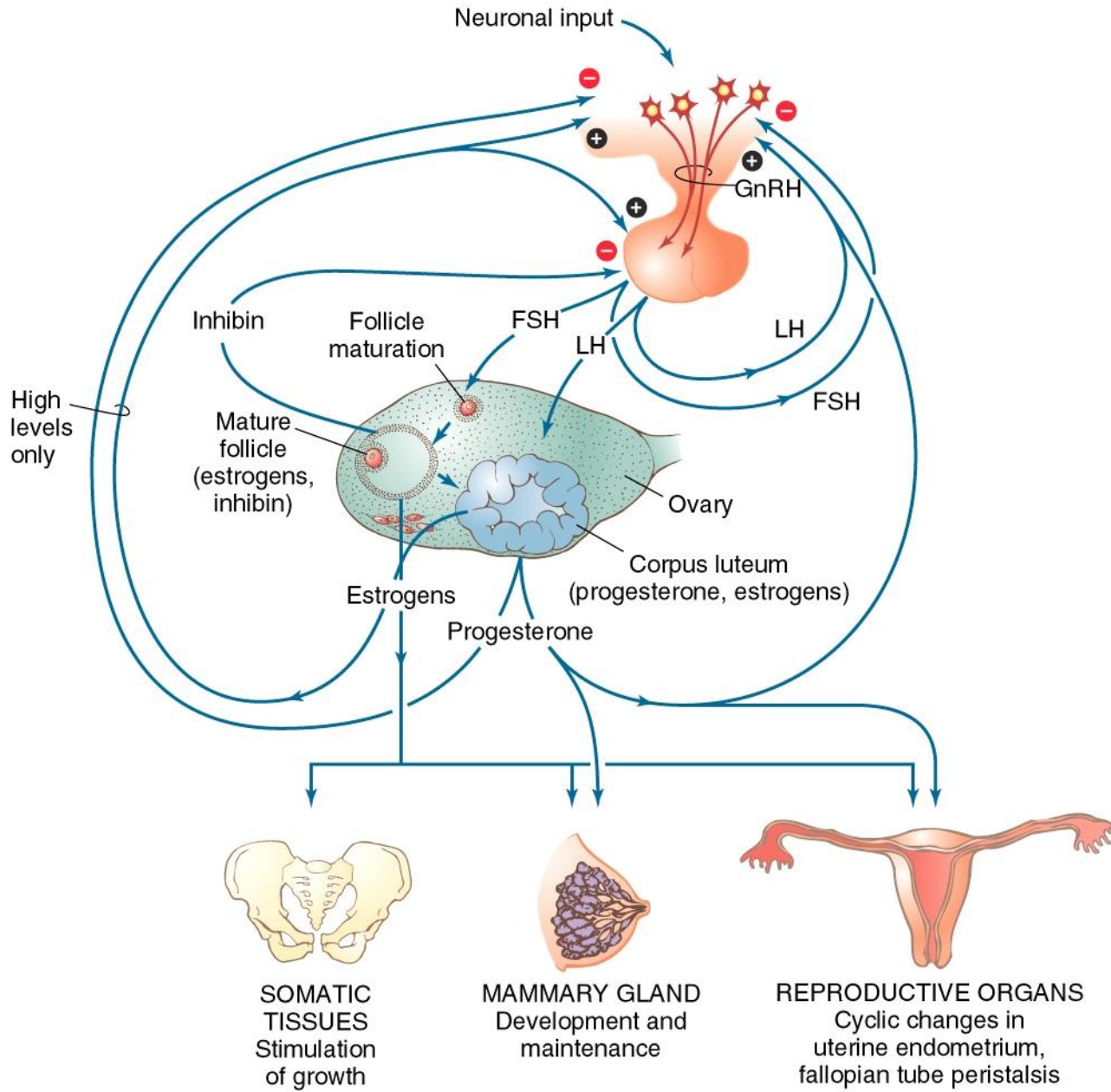
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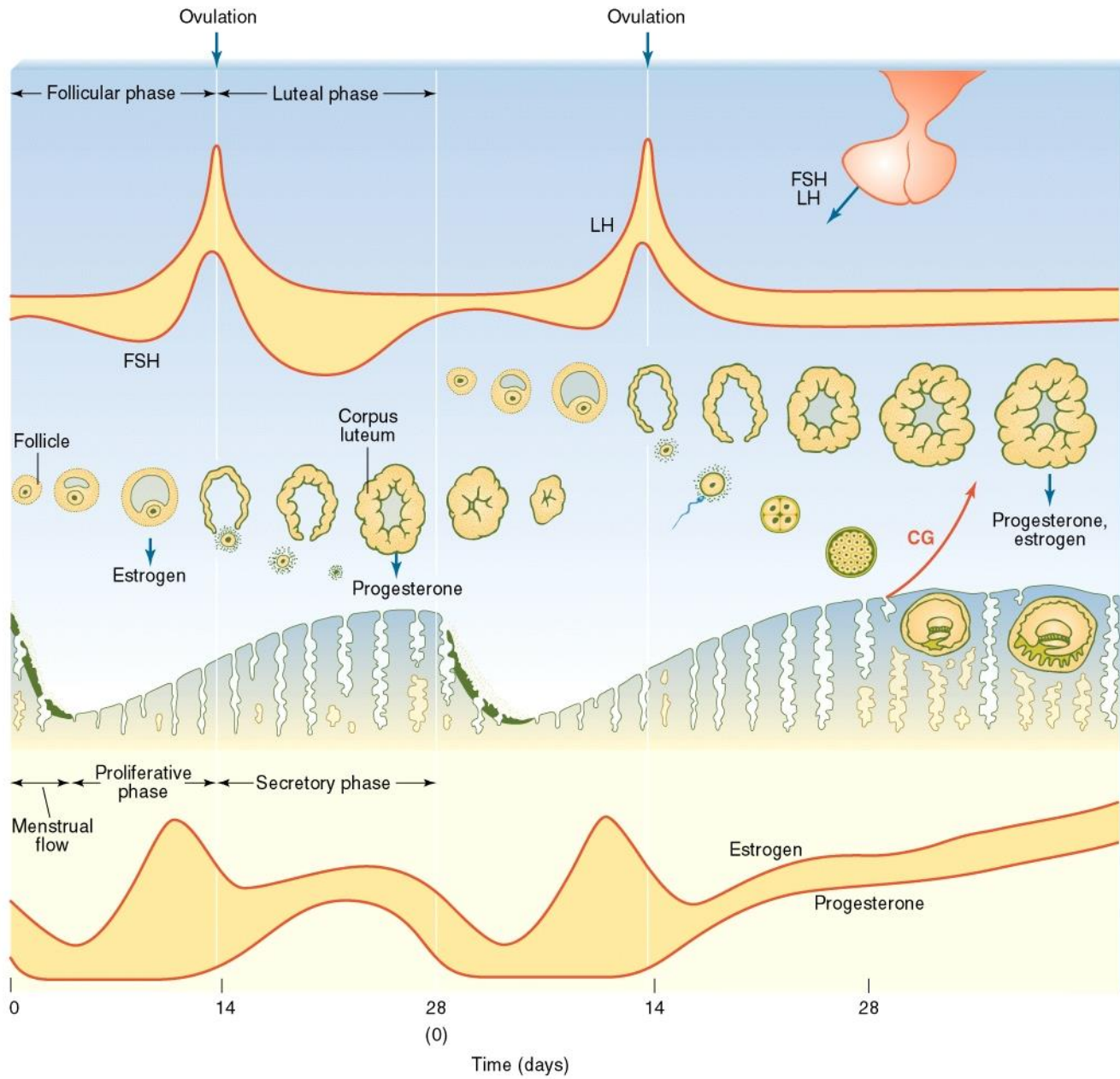


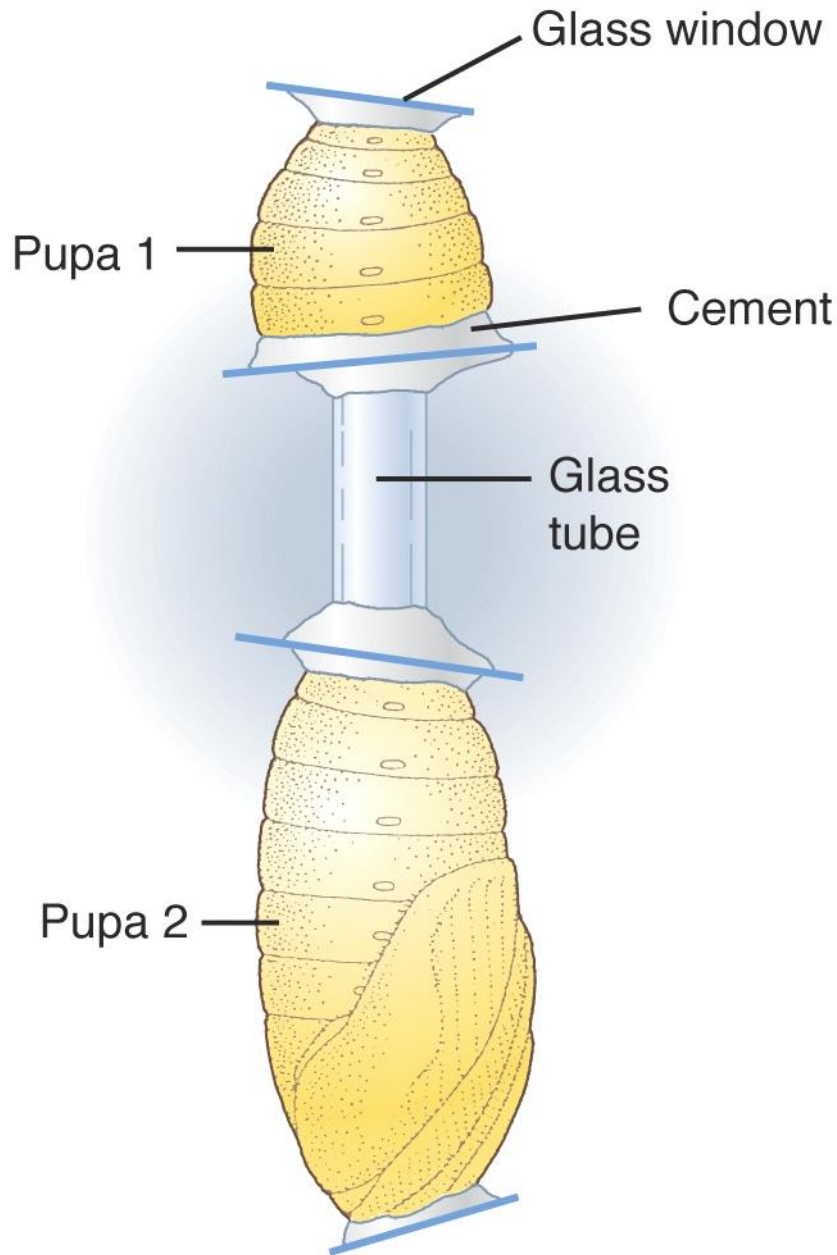
**Table 9-9** Important mammalian reproductive hormones

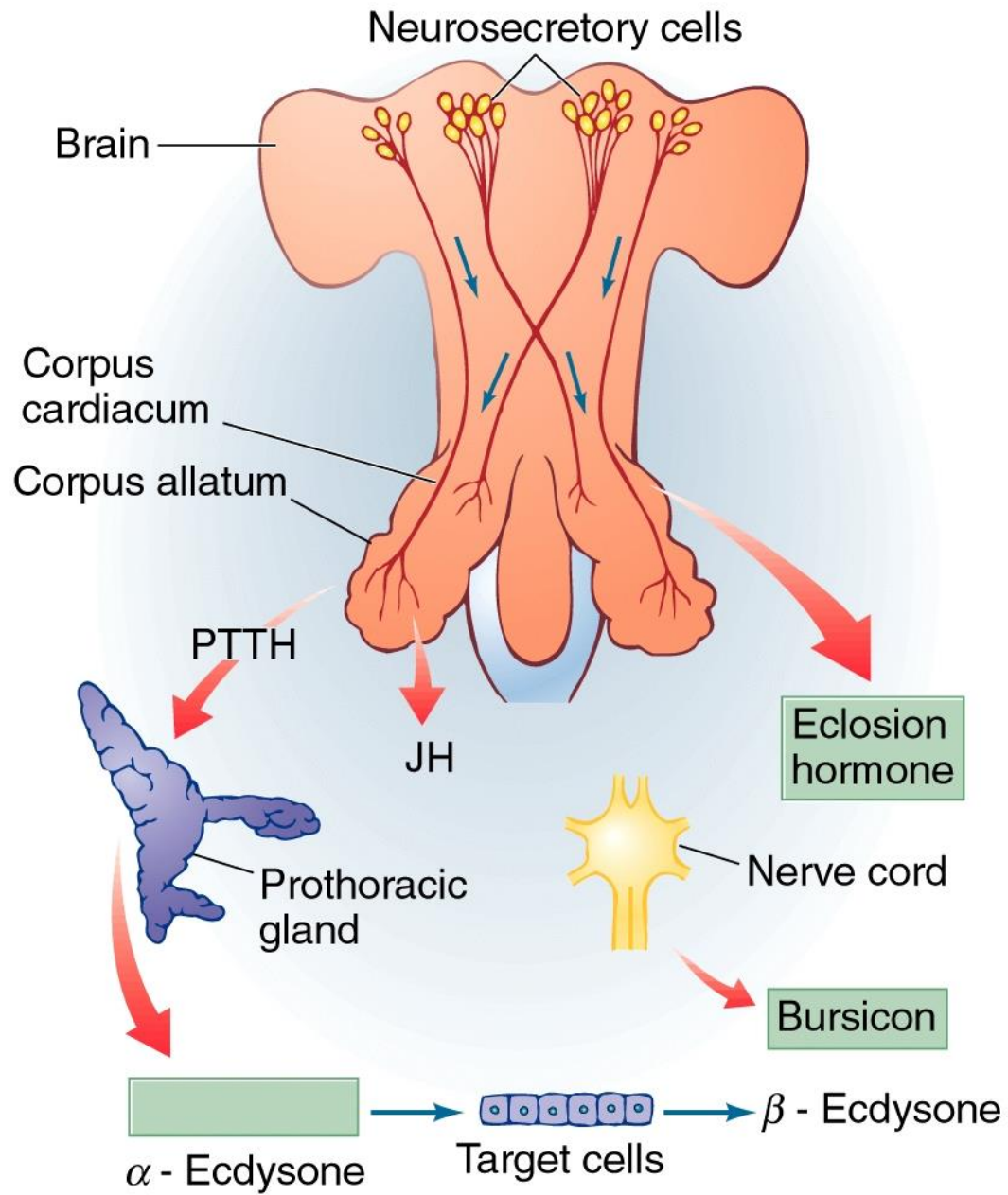
Hormone	Tissue of origin	Structure	Target tissue	Primary action	Regulation
<b>Primary sex hormones</b>					
Estradiol-17 $\beta$ (estrogens)	Ovarian follicle, corpus luteum, adrenal cortex	Steroid	Most tissues	Promotes development and maintenance of female characteristics and behavior, oocyte maturation, and uterine proliferation	Increased FSH and LH levels stimulate secretion
Progesterone	Corpus luteum, adrenal cortex	Steroid	Uterus, mammary glands	Maintains uterine secretion; stimulates mammary duct formation	Increased LH and prolactin levels stimulate secretion
Testosterone (androgens)	Testes (Leydig cells), adrenal cortex	Steroid	Most tissues	Promotes development and maintenance of male characteristics and behavior and spermatogenesis	Increased LH level stimulates secretion
<b>Other Hormones</b>					
Oxytocin	Posterior pituitary	Nonapeptide	Uterus, mammary glands	Promotes smooth muscle contraction and milk ejection	Cervical distention and suckling stimulate release; high progesterone inhibits release
Prolactin (PL)	Anterior pituitary	Peptide	Mammary glands (alveolar cells)	Increases synthesis of milk proteins and growth of mammary glands; elicits maternal behavior	Continuous secretion of PL-inhibiting hormone (PIH) normally blocks release; increased estrogen and decreased PIH secretion permit release

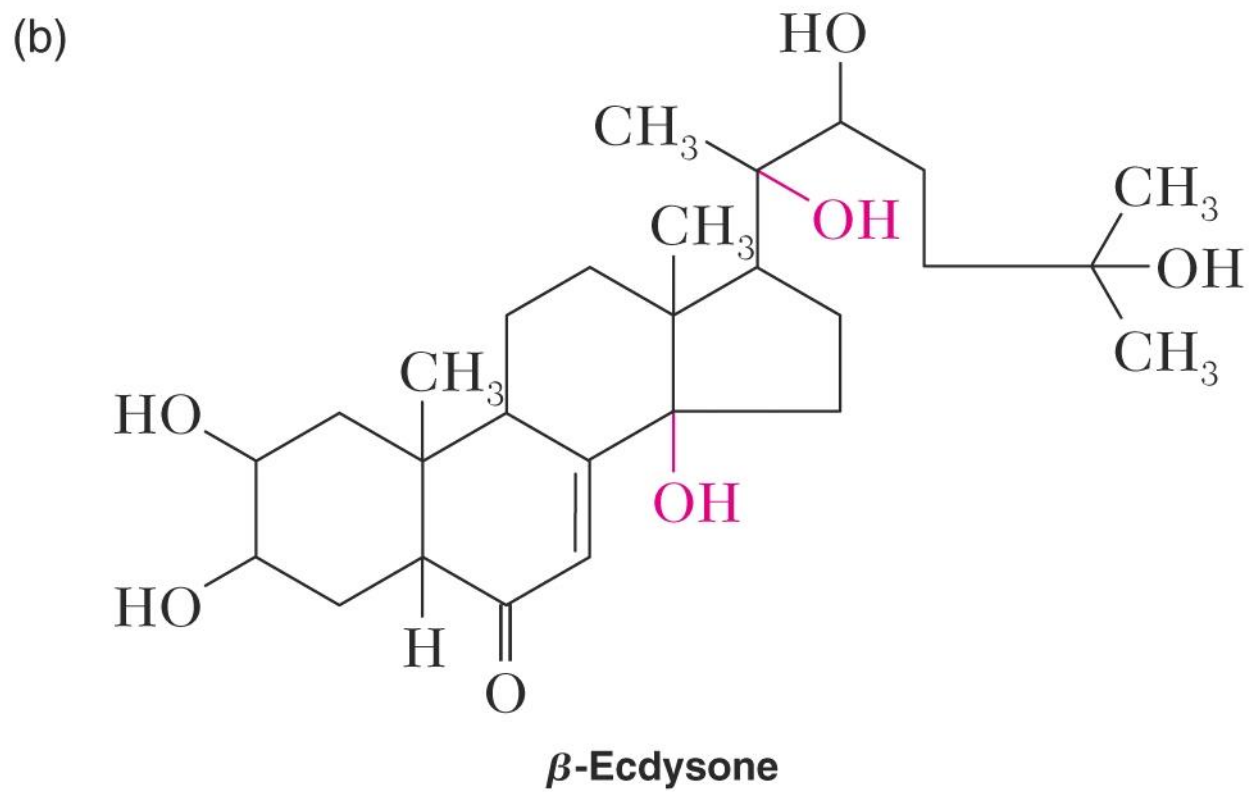
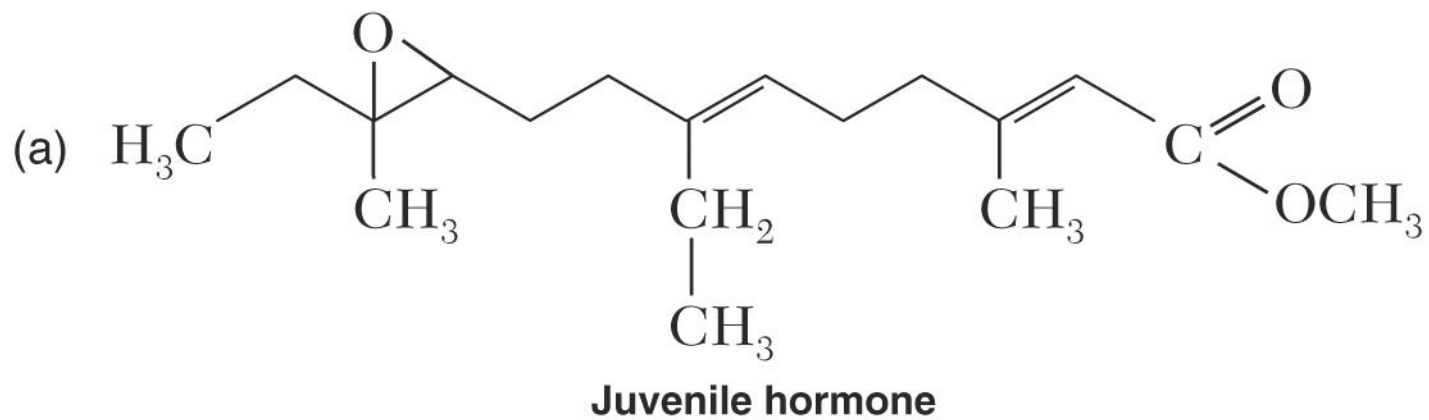




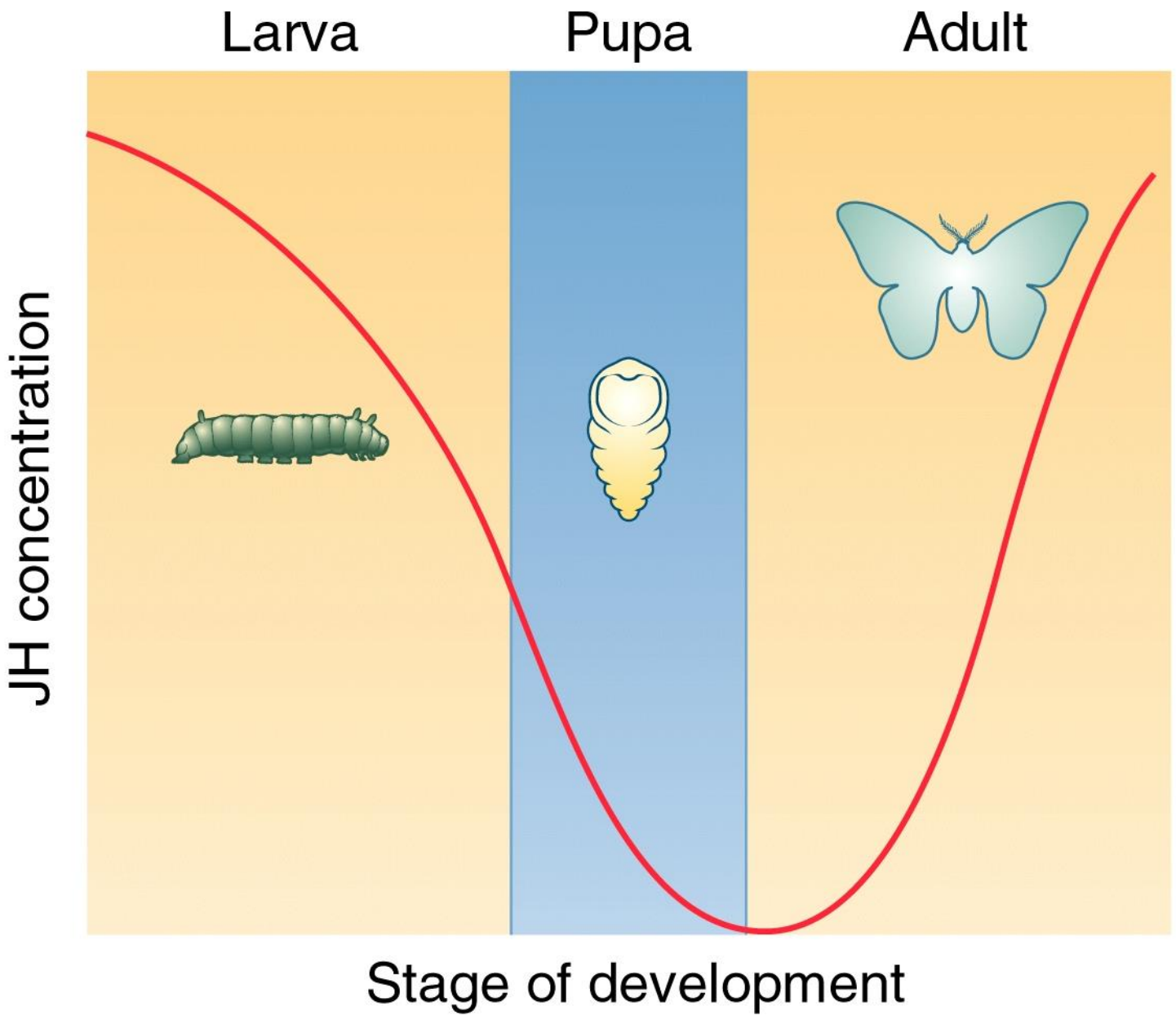


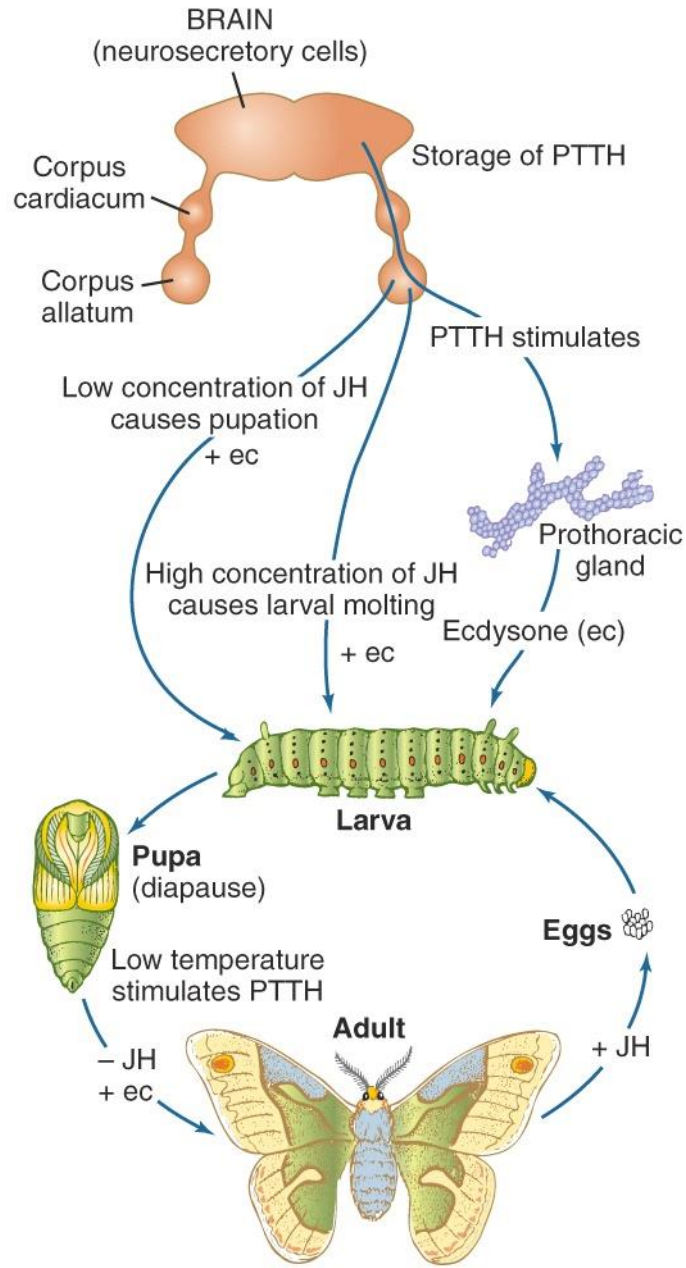




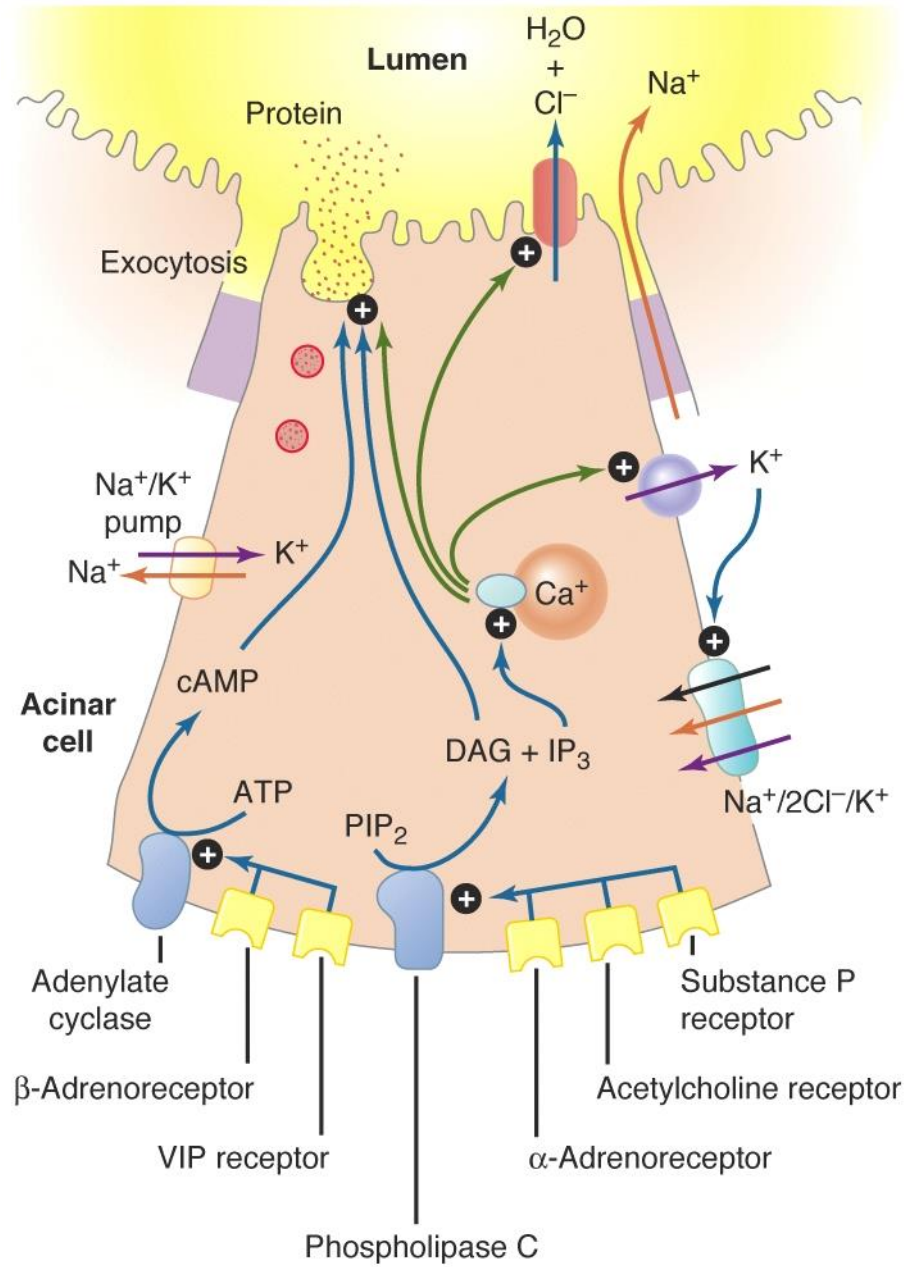












*Table 9-10* Selected prostaglandins

Tissue of origin	Target tissue	Primary action	Regulation
Seminal vesicles, uterus, ovaries	Uterus, ovaries, fallopian tubes	Potentiates smooth muscle contraction and possibly luteolysis; may mediate LH stimulation of estrogen and progesterone synthesis	Introduced during coitus with semen
Kidney	Blood vessels, especially in kidneys	Regulates vasodilation or vasoconstriction	Increased angiotensin II and epinephrine stimulate secretion; inactivated in lungs and liver
Neuronal tissue	Adrenergic terminals	Blocks norepinephrine- sensitive adenylate cyclase	Neuronal activity increases release

**Table 9-11** Insect developmental hormones

Hormone	Tissue of origin	Structure	Target tissue	Primary action	Regulation
Bursicon	Neurosecretory cells in brain and nerve cord	Protein (MW ~ 40,000)	Epidermis	Promotes cuticle development; induces tanning of cuticle of newly molted adults	Stimuli associated with molting stimulate secretion
Ecdysone (molting hormone)	Prothoracic glands, ovarian follicle	Steroid	Epidermis, fat body, imaginal disks	Increases synthesis of RNA, protein, mitochondria, and endoplasmic reticulum; promotes secretion of new cuticle	PTTH stimulates secretion
Eclosion hormone	Neurosecretory cells in brain	Peptide	Nervous system	Induces emergence of adult from puparium	Endogenous "clock"
Juvenile hormone (JH)	Corpus allatum	Fatty acid derivative	Epidermis, ovarian follicles, sex accessory glands, fat body	In larva, promotes synthesis of larval structures and inhibits metamorphosis; in adult, stimulates synthesis of yolk protein; activates ovarian follicles and sex accessory glands	Inhibitory and stimulatory factors from the brain control secretion
Prothoracicotropic (PTTH)	Neurosecretory cells in brain	Small protein (MW ~ 5000)	Prothoracic gland	Stimulates ecdysone release	Various environmental and internal cues (e.g., photoperiod, temperature, crowding, abdominal stretch) stimulate release; JH inhibits release in some species