

Endocrine System

The ductless, hormone secreting glands of the body

A. Nervous vs endocrine system

	Nervous System	Endocrine System
<i>Mode</i>	Electrical → Chemical	Blood borne
<i>Messengers</i>	Neurotransmitters	Hormones
<i>Release</i>	Close to cell of influence	Distant to cell of influence
<i>Target Cells</i>	Specific location (only at nerve supply)	More widespread
<i>Speed</i>	Fast	Slow
<i>Duration</i>	Short	Long

B. The effects of hormones

1. Regulate chemical composition/volume of internal environment
2. Regulate metabolism/energy
3. Regulate contraction of smooth/cardiac muscles and glands
4. Maintain homeostasis
5. Immune system
6. Growth/development
7. Reproduction influence

C. Hormone chemistry

Lipid derivative		
	Steroid	Aldosterone
		Testosterone
		Estrogen
		Progesterone
	Eicosanoids	Prostaglandins
Amino acid derivatives		T ₃ and T ₄
		Epinephrine/norepinephrine
Peptides and Proteins		OT, ADH,
		Anterior pituitary hormones
		Insulin/glucagon

D. How they work

1. Lipid soluble hormones bind to receptors inside target cells. These activate a hormone complex that alters gene expression to make certain proteins.

2. Water soluble hormones bind to receptors in the plasma membrane of the cell and use a 2nd messenger called cAMP to activate certain enzymes. These enzymes cause the needed physiological reactions

E. How control –

1. Generally a negative feedback system
 - a. Levels of a chemical in the blood – EX calcium ions
 - b. Nerve impulses - ANS inhibiting hormones
 - c. Hypothalamus secretions

F. Glands

Gland	Hormone(s) Secreted	Chief Action(s) Of Hormone(s)
Pituitary gland	<i>By the anterior pituitary:</i>	
	Growth Hormone (HGH)	Promotes growth of skeletal muscles and long bones.
	Prolactin (PRL)	Stimulates milk production
	Thyroid-stimulating hormone (TSH)	Stimulates thyroid gland
	Adrenocorticotrophic hormone (ACTH)	Stimulates adrenal cortex Stimulates ovarian follicles
	Follicle - stimulating hormone (FSH)	Triggers release of egg in females; stimulates testosterone production in males
	Luteinizing hormone (LH)	MSH increases, melanin increases, skin darkness increases
	Melanocyte stimulating hormone (MSH)	
	<i>By the posterior pituitary:</i>	
	Oxytocin (OT)	Stimulates uterine contractions in labor; produces “let-down” reflex to cause milk ejection Decrease in urine to retain water
	Antidiuretic hormone (ADH)	

Pineal Gland	Melatonin	Sleep / wake cycle
Thyroid Gland	Thyroid Hormone (T3, T4)	Controls rate of metabolism needed for normal tissue growth and development
	Calcitonin (CT)	↓ in blood calcium → ↑ in bone
Parathyroid Glands	Parathyroid hormone (PTH)	↑ in blood calcium → decrease in bone
Thymus	Thymosin	Turns white blood cells into antibodies
Pancreas	Insulin	Stores glucose from blood to cells - ↓ blood sugar
	Glucagon	Releases glycogen stored in liver - ↑ blood sugar
Adrenal (Suprenal) Glands	<i>By the adrenal medulla:</i>	
	Nor/epinephrine	Fight or flight Response (Short-Term Stress)
	<i>By the adrenal cortex:</i>	
	Aldosterone	Regulate blood salts; retains salt to retain H ₂ O
	Cortisol	Breaks down fats, proteins, sugar for energy
	Androgens	Contribute to onset of puberty - mostly male
Testes	Testosterone	Stimulates development of male reproductive system and secondary sexual characteristics (muscles, aggression, facial/pit/leg hair, etc); promotes sperm production

Ovaries	Estrogen	Maturation of female reproductive system and development of secondary sexual characteristics in females, act with progesterone to produce menstrual cycle
	Progesterone	Acts on uterus in pregnancy to keep uterine lining blood rich; acts with estrogen to produce menstrual cycle
	Relaxin	Relaxes cervix during birth
	Inhibin	During pregnancy it inhibits FSH → no eggs

G. Organs that produce hormones, but are not endocrine glands

GI tract		
	Gastrin	↑ gastric juices
	Gastric inhibitory peptide	↓ gastric juices
	Secretin	↑ pancreatic juice/bile
	CCK	↑ gastric juices/fullness
Placenta		
	HCG	↑ estrogen/progesterone
	Estrogen/progesterone	Maintain pregnancy/preps mammary glands
	HGS	Preps mammary glands
Kidney		
	Erythropeitin	↑ RBCs
Skin		
	Vitamin D	↑ absorption Ca/P
Heart		
	ANP	↓ BP

H. Stress and G.A.S.

1. Stress – physical or psychological
2. G.A.S (general adaptation syndrome)

TABLE 13.2**The General Adaptation Syndrome**

Stage	Reaction
Alarm reaction	Initial reaction to stressor such as increased oxygen and blood supply to the necessary areas of the body
Resistance development	Increased functional capacity to adapt to stressor such as increasing motor unit recruitment
Exhaustion	A prolonged intolerable stressor produces fatigue and leads to a breakdown in the system or injury

- a. Controlled by hypothalamus
- b. Alarm and resistance reactions
- c. G.A.S stress levels rise above syndrome the reaction of the body when "normal" bounds