

Chapter 41 Animal Hormones

Regulation

- Why are hormones needed?
 - ◆ chemical messages from one body part to another
 - ◆ communication needed to coordinate whole body
 - ◆ homeostasis & regulation
 - metabolism
 - growth
 - development
 - maturation
 - reproduction

growth hormones

Regulation & Communication

- Animals rely on 2 systems for regulation...
 - ◆ **endocrine system**
 - system of ductless glands
 - ◆ secrete chemical signals directly into blood
 - ◆ chemical travels to target tissue
 - ◆ slow, long-lasting response
 - ◆ **nervous system**
 - system of neurons
 - ◆ transmits "electrical" signal & release neurotransmitters to target tissue
 - ◆ fast, short-lasting response

Regulation by Chemicals

- **Neurotransmitters** released by neurons
- **Hormones** release by endocrine glands

Homology in Hormones

prolactin ← same gene family, gene duplication? → growth hormone

mammals	birds	fish	amphibians	growth hormone
milk production	fat metabolism	salt & water balance	metamorphosis & maturation	growth & development

Osmotic water gain through gills and other parts of body surface

Uptake of water and some ions in food

Uptake of salt ions by gills

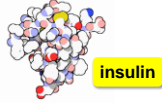
Excretion of large amounts of water to dilute wastes from kidneys

Types of Hormones

- **circulating hormones**
 - ◆ hormones that diffuse into the blood to activate target cells far away
- **local hormones**
 - ◆ hormones that affect target cells close to their release site
 - **autocrine**: hormone-releasing cell affected
 - **paracrine**: hormone affects nearby cells only

Classes of Hormones

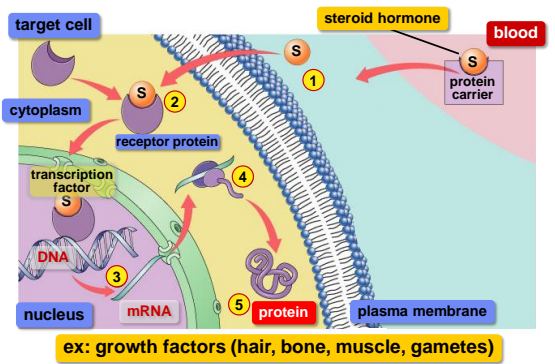
- **Lipid-based hormones**
 - ♦ steroids
 - modified cholesterol: sex hormones, aldosterone
- **Protein-based hormones**
 - ♦ polypeptides
 - small proteins: insulin, ADH
 - ♦ glycoproteins
 - large proteins + carbohydrate: FSH, LH
 - ♦ amines
 - modified amino acids: epinephrine, melatonin



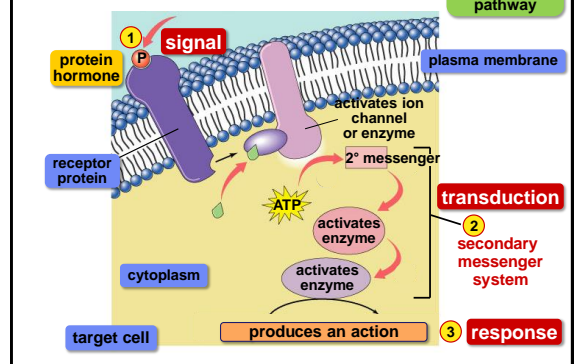
How do hormones act on target cells?

- **Lipid-based hormones**
 - ♦ hydrophobic & lipid-soluble
 - diffuse across membrane & enter cells
 - bind to receptor proteins in cytoplasm & nucleus
 - bind to DNA as transcription factors
- **Protein-based hormones**
 - ♦ hydrophilic & not lipid soluble
 - can't diffuse across membrane
 - receptor proteins in cell membrane
 - trigger secondary messenger pathway
 - activate internal cellular response
 - ♦ enzyme action, uptake or secretion of molecules...

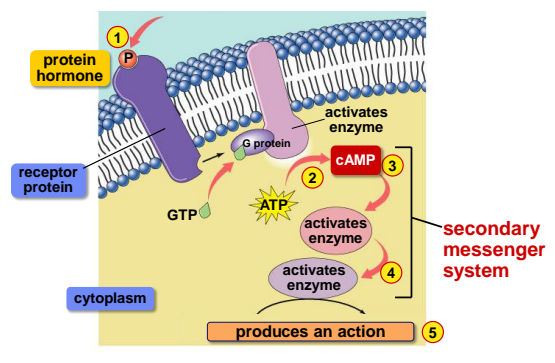
Action of Lipid (Steroid) Hormones



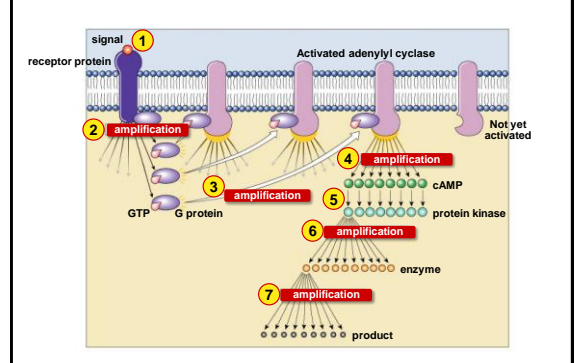
Action of Protein Hormones

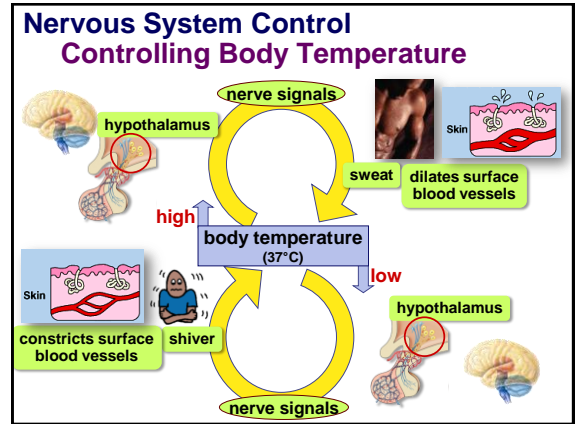
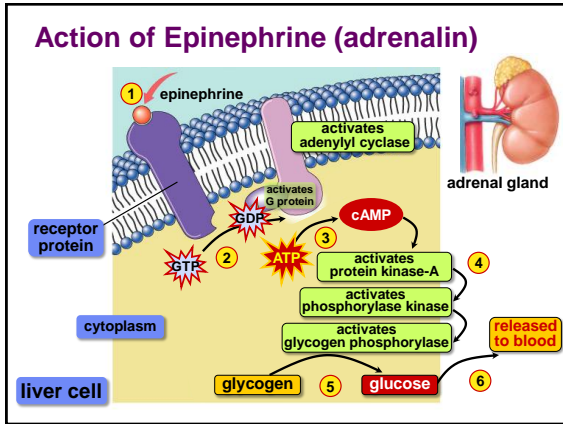


Signal Transduction Pathway



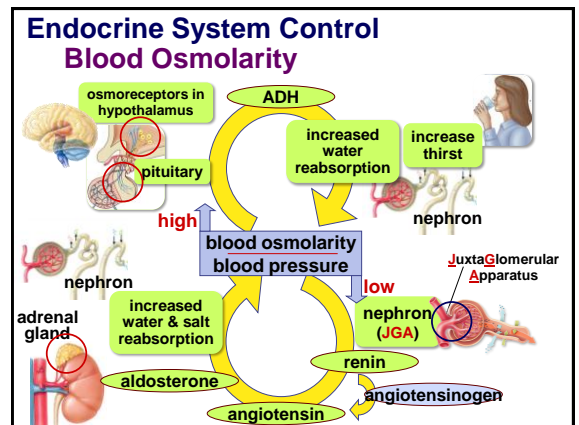
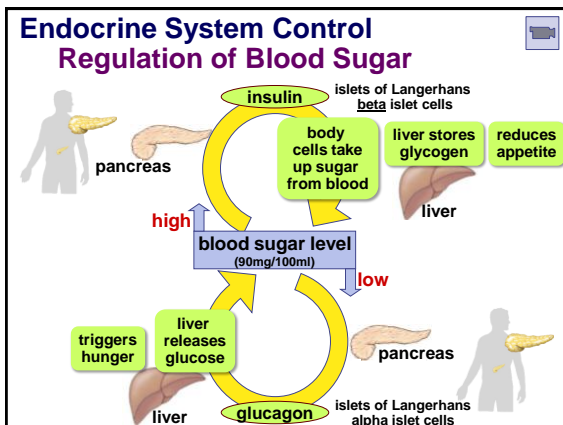
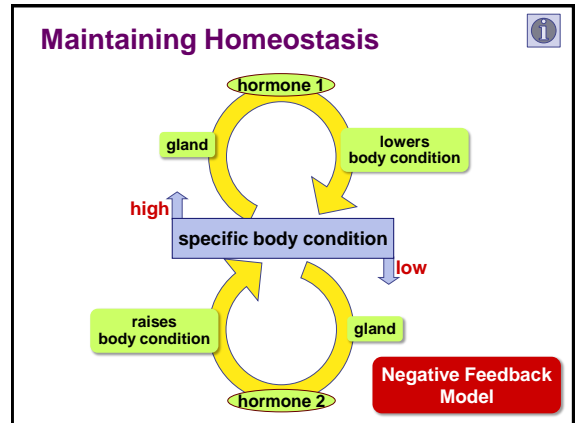
Benefits of a 2° Messenger System

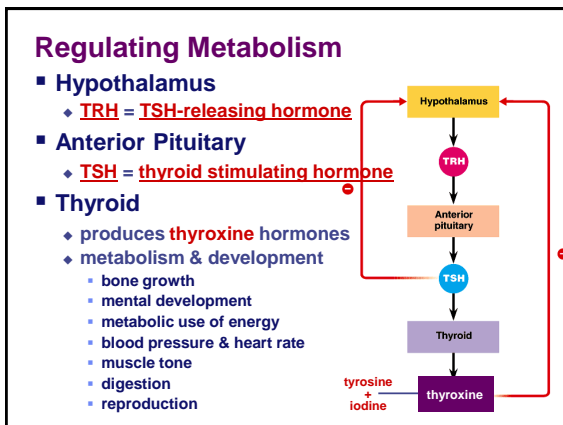
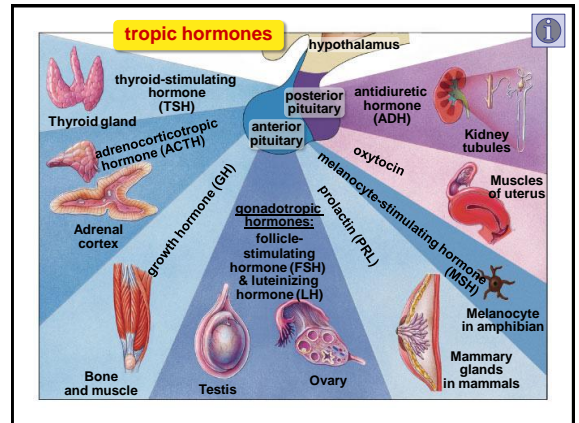
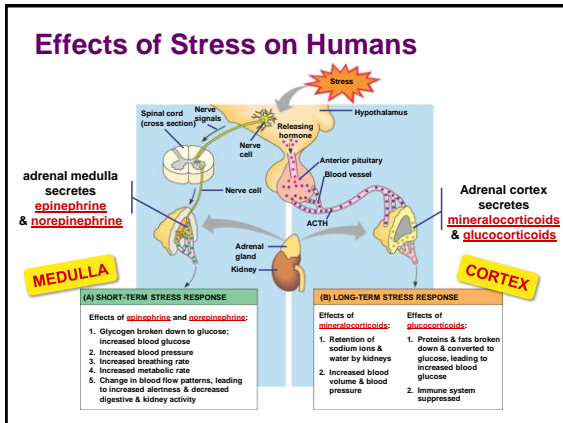
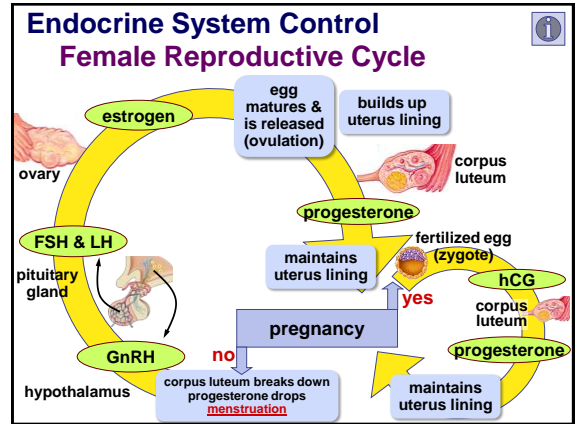
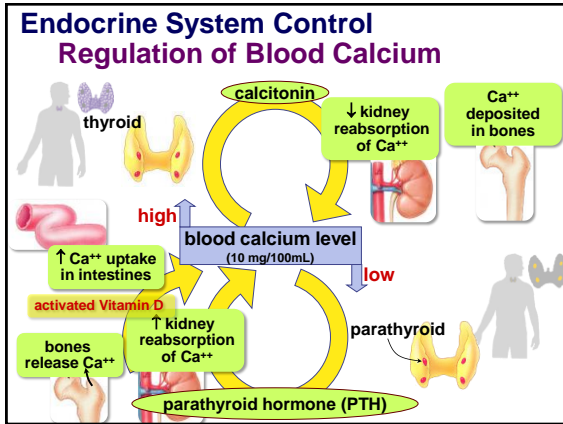




Nervous & Endocrine Systems Linked

- **Hypothalamus** = “master nerve control center”
 - ♦ nervous system
 - ♦ receives information from nerves around body about internal conditions
 - ♦ regulates release of hormones from pituitary
- **Pituitary gland** = “master gland”
 - ♦ endocrine system
 - ♦ secretes broad range of hormones regulating other glands





Goiter

Iodine deficiency causes thyroid to enlarge as it tries to produce thyroxine

Normal Thyroid vs **Goiter** (enlarged thyroid).

MORTON IODIZED SALT