Endocrine Functions

- Maintains homeostasis by producing and releasing chemicals called hormones
- Controls long-term processes
  - examples:
  - Growth & development
  - Reproduction
  - Metabolism

Types of Glands

- Exocrine Glands
  - Formed from epithelial tissue.
  - Release their products at the body's surface or into body cavities through ducts.
- Endocrine Glands
  - Formed from epithelial tissue.
  - Release their products - hormones - into the blood or lymph - ductless glands
What are Hormones?

- Chemical messengers secreted by endocrine glands.
- Responsible for specific regulatory effects on certain parts or organs.

Mechanisms of Hormone Action 1

- Hormones affect only certain target tissue cells or organs (specificity)
  - Note: blood-borne hormones circulate to all body organs
- Hormones interact with specific receptors in specific target cells
Mechanisms of Hormone Action 2

- **Receptor Responses:**
  - Stimulate synthesis of proteins or certain regulatory molecules in cell
  - Activate or inactivate enzymes
  - Stimulate mitosis
- **Increase or decrease the rate of normal cell function**
  - **NOT new function**

Control of Hormone Release

- **Negative feedback mechanism**
  1. Hormone secretion triggered by some stimulus.
  2. Rising hormone levels inhibit further hormone release.
  3. Hormones vary only within a very narrow range.

Endocrine Gland Stimuli

1. **Hormonal stimulus**
   - Endocrine gland prodded into action by other hormones
2. **Humoral stimulus**
   - Changing blood levels of certain ions and nutrients may stimulate hormone release
3. **Neural stimulus**
   - Nerve fibers stimulate hormone release
Major Endocrine Organs

- Hypothalamus
- Pituitary Gland
- Thyroid Gland
- Parathyroid Glands
- Adrenal Glands
- Pancreatic Islets
- Pineal Gland
- Thymus
- Ovaries
- Testes

Anterior & Posterior Pituitary Gland
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Controlling Hormone Levels

- Hypothalamus hormones stimulate Anterior pituitary
- Anterior pituitary stimulates Thyroid, Adrenal cortex, Gonads

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Hypothalamus

- When appropriate, ADH and oxytocin are produced in nerve cell bodies in the hypothalamus.
- These hormones move down axons to axon endings.
- ADH acts on the kidney tubules, and oxytocin acts on the uterus and the mammary glands.

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Posterior Pituitary Hormones

- **Oxytocin**
  - Acts on mammary glands, uterus
- **ADH - antidiuretic hormone**
  - Acts on kidney tubules
Anterior Pituitary Hormones

- TSH - thyroid stimulating hormone
- FSH & LH - follicle stimulating hormone & luteinizing hormone
- ACTH - adrenocorticotropic hormone
- MSH - melanocyte stimulating hormone
- PRL - prolactin stimulating hormone
- GH - growth hormone
**FSH and LH**

- **Females**
  - FSH – stimulates follicle development
  - LH – triggers ovulation of egg

- **Males**
  - FSH – stimulates sperm development
  - LH – stimulates testosterone production

**Male Gonads**

- Testes
- Suspended in scrotal sac
- Produces:
  - Sperm
  - Androgens
    - testosterone

**Female Gonads**

- Ovaries
- Produces:
  - Eggs
  - Steroid hormones
    - estrogens
    - progesterone
Adrenal Medulla

- Stimulated by Sympathetic NS
  - “fight or flight”

- Secretes two (2) hormones (catecholamines)
  - Epinephrine
  - Norepinephrine

Action of ACTH

ACTH stimulates the adrenal cortex.
Adrenal Cortex

- **Secretes 3 different corticosteroids**
  1. Mineralocorticoids
     - Increases salt & water levels in blood
     - aldosterone
  2. Glucocorticoids
     - Increases blood glucose levels
     - cortisol
  3. Androgens
     - males & females

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**Action of PRL**

PRL promotes lactation.

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Fielder (plus several other hormones)
Aging Baby Boomers turn to hormone

Some doctors concerned about growing 'off-label' use of drug

Sabin Russell, Chronicle Staff Writer
Monday, November 17, 2003
Growth Hormone

- Youth - promotes bone and muscle growth
  - final body size
- Adulthood – promotes repair
- Hypersecretion
  - youth - gigantism
  - adult - acromegaly
- Hypossecretion

Pancreas

- location
- mixed gland
  - endocrine
    - insulin & glucagon
  - exocrine
    - digestive enzymes
- pancreatic islets
  - beta cells
  - alpha cells

Homeostatic System (Insulin and Glucagon)
Thyroid Gland

- Location
- Most cells of body have receptors for thyroid hormone
- Produces:
  - thyroid hormone
    - increases rate of O₂ use
    - Basal metabolic rate (BMR)
    - increases use of glucose
      - for ATP production
  - Calcitonin
    - calcium homeostasis
    - increases osteoblast activity

Hyperthyroidism

- Graves’ Disease
- Low iodine intake
Parathyroid Gland

- Location & Number
- Produces parathyroid hormone
  - calcium homeostasis
    - increases blood calcium levels
    - increases osteoclast activity

Regulation of Blood Calcium

- high blood calcium level
- thyroid calcitonin
- buildup of bone by osteoblasts
- blood Ca++ level decreases
- low blood calcium level
- parathyroid hormone
- bone contains Ca++
- breakdown of bone by osteoclasts
- blood Ca++ level increases
- normal blood calcium level

Pineal Body

- Location: in epithalamus of diencephalon
- Functions: (some uncertainty)
  - biological clock
  - inhibits sexual maturation in childhood
  - inhibits secretion of FSH & LH
Thymus Gland

- Location: posterior to sternum
- Size relative to age
- Functions:
  - promotes immune system development and function
  - T-lymphocytes maturation

Potential Negative Side Effects of Anabolic Steroids

Effects of Anabolic Steroids:
- balding in men and women;
- hair on face and chest in women
- deepening of voice in women
- breast enlargement in men and breast reduction in women
- kidney disease and retention of fluids, called "steroid bloat"
- reduced testicular size, low sperm count, and impotency
- high blood cholesterol and atherosclerosis; high blood pressure and damage to heart
- liver dysfunction and cancer
- stunted growth in youngsters by prematurely halting lengthening of bones
Barry Bonds 1987-2000

1987
206lbs

1998
210lbs

2000
210lbs 49HR

1999
210lbs

Barry Bonds 2001-03

2001
73HR
228lbs

2002
228lbs

2003
228lbs

Body Growth

The following hormones stimulate body growth and development of nervous tissue:

- Growth hormone
- Insulin
- Thyroid hormones
Aging and Endocrine Function

Pituitary gland
- decrease GH → muscle atrophy

Thyroid gland
- decrease thyroxin → decrease metabolism
  → increase fat deposition

Pancreas
- decrease insulin → poorer control of glucose levels

The End