Lab Activity 21

Endocrine System
Glucometer

Portland Community College
BI 232
**HYPOTHALAMUS**
- Production of ADH, oxytocin, and regulatory hormones

**PITUITARY GLAND**
- Anterior lobe: ACTH, TSH, GH, PRL, FSH, LH, and MSH
- Posterior lobe: Release of oxytocin and ADH

**THYROID GLAND**
- Thyroxine (T₄)
- Triiodothyronine (T₃)
- Calcitonin (CT)

**THYMUS**
- (Undergoes atrophy during adulthood)
- Thymosins (Chapter 22)

**ADRENAL GLANDS**
- Each adrenal gland is subdivided into:
  - Adrenal medulla: Epinephrine (E), Norepinephrine (NE)
  - Adrenal cortex: Cortisol, corticosterone, aldosterone, androgens

**PINEAL GLAND**
- Melatonin

**PARATHYROID GLANDS**
- (on posterior surface of thyroid gland)
- Parathyroid hormone (PTH)

**HEART**
- Natriuretic peptides: ANP and BNP (Chapter 21)

**KIDNEY**
- Erythropoietin (EPO)
- Calcitriol (Chapters 19 and 27)

**ADIPOSE TISSUE**
- Leptin
- Resistin

**DIGESTIVE TRACT**
- Numerous hormones (detailed in Chapter 24)

**PANCREATIC ISLETS**
- Insulin, glucagon

**GONADS**
- Testes (male):
  - Androgens (especially testosterone), inhibin
- Ovaries (female):
  - Estrogens, progestins, inhibin
Hormone Functions

- **ACTH** (adrenocorticotropic hormone)
  - Regulates the activity of the cortex of the adrenal gland
- **TSH** (thyroid stimulating hormone)
  - Stimulates production and release of thyroid hormone
- **GH** (growth hormone)
  - Stimulates growth of bones, cartilage, muscle
  - Timing and amount released determines body size
Hormone Functions

- **PRL** (prolactin)
  - Stimulates breast development
  - Promotes and maintains lactation after childbirth
- **FSH** (follicle stimulating hormone)
  - Causes formation of ovarian follicles and stimulates them to produce estrogen
  - Stimulates sperm development in men
- **LH** (luteinizing hormone)
  - Initiates ovulation, maintains corpus luteum
  - Regulates testosterone production in males
Hormone Functions

- **ADH** (antidiuretic hormone)
  - Reduces urine output by increasing water reabsorption in the kidney
  - Plays small role in blood pressure regulation
- **Oxytocin**
  - Causes uterine contractions in labor
  - Causes milk let down in lactating mothers
- **Thyroid Hormone**
  - Regulates metabolic rate of the entire body
  - Important in development of the nervous system
Hormone Functions

- Calcitonin
  - Decreases bone reabsorption, lowering serum calcium levels

- PTH (parathyroid hormone)
  - Increases serum calcium
  - Decreases serum phosphorus

- Insulin
  - Released in response to high blood sugar
  - Increases cellular absorption of glucose
  - Increases rate of lipogenesis and formation of glycogen in the liver
Hormone Functions

- **Glucagon**
  - Released in response to low blood sugar
  - Increases rate of gluconeogenesis (formation of sugar from fat and protein)
  - Increases lipolysis and glycogenolysis

- **Epinephrine & Norepinephrine**
  - Fight or flight response
  - Increase heart rate, increase skeletal muscle blood flow, decrease skin blood flow
Hormone Functions

- **Glucocorticoids** (Cortisone)
  - Released in response to stress
  - Increases formation of glucose from protein and fat breakdown
  - Decreases inflammation
- **Aldosterone**
  - Increases blood volume by causing kidneys to retain sodium (where sodium goes water goes too) in exchange for potassium
  - Increased blood volume will increase blood pressure
Hormone Functions

• Androgens
  • Initiates pubertal changes
  • Precursors to estrogen in postmenopausal women

• Melatonin
  • Involved in circadian rhythms
  • Day ↓ melatonin, Night ↑ melatonin
  • Produces sleepiness

• Erythropoietin
  • Stimulates RBC production
Hormone Functions

- **Calcitriol**
  - Stimulates calcium and phosphate absorption
  - Stimulates calcium release from bone
  - Inhibits PTH secretion
Pituitary Histology

Anterior lobe
- Pars distalis
- Pars intermedia

Posterior lobe

Secretes other pituitary hormones
Secretes MSH
Releases ADH and oxytocin
Thyroid Histology
Thyroid Histology

- Follicular cells produce the colloid (contains precursors to thyroid hormone)
- Parafollicular cells secrete calcitonin
Parathyroid Histology
Adrenal Glands

Right adrenal gland

Left adrenal gland

Medulla

Cortex
Adrenal Histology
Adrenal Cortex

- **Zona Reticularis:** Androgens
- **Zona Fasiculata:** Glucocorticoids (Cortisone)
- **Zona Glomerulosa:** Aldosterone
Pancreas

- Acinar cells secrete digestive enzymes (exocrine)
- Islet cells secrete insulin (beta cells) and glucagon (alpha cells)
Diabetes

- Type 1: Insulin Dependent Diabetes
- AKA: juvenile diabetes
- Caused by a lack of insulin
- Autoimmune disorder
  - Immune system destroys beta cells in the pancreas
Diabetes

- Type 2: Non-Insulin Dependent
- Caused by an insensitivity of cells to insulin.

- Diabetes mellitus marked by hyperglycemia
  - ↑ urine production (polyuria)
  - ↑ thirst (polydipsia)
  - ↑ eating (polyphagia)
Diagnosing Diabetes Mellitus

- **Normal** blood glucose levels: 70-100 mg/dl
- **Diabetes mellitus:**
  - A fasting glucose level above 140 mg/dl on two separate occasions, or
  - A blood sugar over 200 mg/dl 2 hours after oral glucose tolerance test with 75gm of glucose
- **Impaired Glucose Tolerance (Pre-Diabetes)**
  - A fasting glucose level between 100-126 mg/dl on two separate occasions, or
  - A blood sugar between 140-200 mg/dl 2 hours after oral glucose tolerance test with 75gm of glucose
The End