Introduction to Health Science

The Endocrine System
Standards and Objectives

By the end of this unit student should be able to:

• Describe the Basic Functions of the Endocrine System
• Identify the Locations, Secretion and Functions of Selected Endocrine Glands
• Describe Diseases and Disorders of the Endocrine System
• Careers Associated with the Endocrine System
VOCABULARY

Adeno-  Gland
Endo-  Within
-pecty  Fixation
-stasis  Standing still
-genic  origin, production
sym/syn  Together
-poesis  to make or production
GH -- Growth Hormone, stimulates production of protein and growth in body cells
TSH -- Thyroid-Stimulating Hormone -- stimulate thyroid to produce hormones that regulate metabolism
ACTH -- Adrenocorticotropic Hormone -- hormone to regulate water balance, electrolyte balance, glucose and blood pressure.
General Functions of the Endocrine System

• The endocrine system is made up of glands that release their products (hormones) directly into the bloodstream. These products send messages throughout the entire body.

• The response of hormones is slower and longer-lasting than those of nerve impulses. The effects may last up to several hours or days.

• The functions of the endocrine system include:
  – regulation of growth,
  – development
  – maturation as well as
  – regulation of chemicals and metabolism.
Once released into the bloodstream...

- Only receptor cells made for the specific hormone can be affected by the hormone.
- The hormone is carried by a protein from the gland that produces it and the receptor cell.
Pineal Gland

• Approximately the size of a pea, the Pineal Gland is located in the center of the brain.

• Produces Melatonin
  – Melatonin is stimulated by darkness and suppressed by light.
  – Melatonin helps regulate sleep cycles on a 24-hour basis.
  – Timing and release of female reproductive hormones is controlled by melatonin.
Pineal Gland
Identify the Locations, Secretion and Functions of Selected Endocrine Glands

• Pituitary Gland
  – The pituitary gland is a small pea-shaped gland that is hanging from the underside of the brain.
  – It is often referred to as the “Master Gland” since it produces so many (nine) of the body’s hormones.
  – The pituitary gland works closely the hypothalamus which helps to regulate the secretions from the pituitary gland.
Hypothalamus

• “Brain” of the brain
• Hypothalamus stimulates the pituitary to release its hormones
• The hypothalamus receives information from the brain stem and stimulates the pituitary gland according to the information given.
Growth Hormone

- Growth Hormone (GH)
- Produced by the anterior part of the pituitary gland, growth hormone stimulates the production of proteins and growth in body cells.
Hypothalamus

- Water balance & Stress
- Hunger
- Reproduction
- Thermoregulation
- Sleep-wake
- Optic chiasm
- Satiety
- Pituitary
Adrenocorticotropic Hormone (ACTH)

• Produced by the anterior part of the pituitary gland, ACTH stimulates the adrenal cortex (outer layer) to produce hormones that regulate water balance, electrolyte balance, glucose levels, and blood pressure.
Thyroid Stimulating Hormone

- Thyroid-Stimulating Hormone (TSH)
- Produced by the anterior part of the pituitary gland, TSH stimulates the thyroid gland to produce its hormones which regulate the body’s metabolism.
Follicle Stimulating Hormone

- Anterior pituitary
- FSH
- Production of egg cell in the ovaries
Oxytocin

• Stored in the posterior pituitary gland, oxytocin stimulates uterine contractions during childbirth and helps to release milk from the milk ducts of nursing mothers.
Anti-Diuretic Hormone ADH

- Posterior Pituitary
- Re-absorption of water in the kidneys
The thyroid gland is a bow-tie shaped gland located in the neck just below the voice box (larynx) and around the upper part of the windpipe (trachea).
Thyroxine

• **Thyroxine** is the hormone which affects nearly all the cells of the body by regulating their metabolic rates, or the ability of cells to convert food to energy through cellular respiration.
Hypothyroidism

- Hypothyroidism occurs when the thyroid gland fails to produce enough thyroxine hormone.
- Goiter...swelling of the thyroid in the neck
Hyperthyroidism

• Hyperthyroidism occurs when the thyroid gland produces too much of the thyroid hormones.
• In growth year, can cause dwarfism, retardation, or cretinism: In cretinism, the base of the skull is foreshortened, the face is wide and short, the mandible underdeveloped, and the maxilla overdeveloped
Quick Write/Pair Share

- Referring to the symptoms of hypothyroidism and hyperthyroidism, how would a disorder of the thyroid affect the well-being of the person with the disorder?

- (hint: Remember well being is life expectancy and quality of life)
Pancreas

- The pancreas is a fish-shaped gland located behind the stomach.
- The pancreas is considered to be an endocrine gland when it produces hormones and is also part of the digestive system when it produces digestive enzymes.
Insulin

- Insulin is released when the blood sugar (glucose) is high.
- It helps the body cells to move glucose into the cells and helps the liver and muscle to convert glucose into glycogen.
- It also helps to convert excess glucose to fat which is then stored.
Glucagon

- Glucagon is released when the blood sugar (glucose) is low.
- It helps to break down the glycogen in the liver and the muscles into glucose which then raises the blood glucose levels.
Type I Diabetes Mellitus

- Type I Diabetes Mellitus is a lifelong disease that occurs when the pancreas does not produce enough insulin to regulate blood sugar.
- Without insulin, the glucose increases in the bloodstream instead of going into the body cells where it can be used for energy which leads to increased hunger.
Diabetes Mellitus Type II

• Type II Diabetes Mellitus is a life-long disease marked by high levels of sugar in the blood that occurs when the body does not respond correctly to insulin.

• In other words, glucose cannot enter the body cells to be used in energy production. It is the most common form of diabetes.
Gestational Diabetes Mellitus

- Gestational Diabetes Mellitus occurs when the diabetes is first diagnosed during pregnancy.
- Usually blood sugar returns to normal soon after delivery.
- If a woman develops gestational diabetes, they are at an increased risk of developing Type II later in life.
Venn Diagram of Diabetes
Adrenal Glands

- The adrenal glands are two triangular-shaped glands that sit on top of each kidney.
Cortisol is released from the adrenal cortex, the outer layer of the adrenal gland. It helps to control the rate of metabolism of carbohydrates, fats, and proteins.

It is known as the stress hormone and is released during times of continuous stress.

While cortisol has many positive aspects, a negative aspect is that it suppresses the action of the white blood cells which makes a person more susceptible to illness.
Epinephrine

- Adrenaline (epinephrine) is released from the adrenal medulla, or the middle section.
- Adrenaline makes up 80% of the secretions from the adrenal medulla.
- It helps to regulate the stress (sympathetic) response or the “fight or flight.”
Norepinephrine

- Norepinephrine is released from the adrenal medulla, or the middle section.
- Norepinephrine makes up 20% of the secretions from the adrenal medulla.
- Along with adrenaline, it helps to reverse the stress (sympathetic) response or the “fight or flight.”
Fight-or-Flight Response

1) Adrenaline released into blood.
2) Heart rate and blood pressure increase.
3) Flow of blood to brain increases.
4) Breathing rate increases.
5) More sugar released into blood. Ability of blood clot increases.
6) Flow of blood to skin reduced. Sweating increases.
7) Flow of blood to digestive system reduced. Digestion slows. More stomach acid produced.
8) Pupils open wide.
10) Lump forms in throat as muscles contract.
The Sympathetic Response

- increased heart rate
- increased breathing rate
- increased blood flow to the muscles
- increased blood pressure
- increase in the depth of breathing
  increasing oxygen intake
- release of extra glucose for more energy
- sweaty hands and palms
Thymus Gland

- Releases the hormone Thymogen
- Found under the sternum, the gland shrinks as you get older into adulthood
- Helps with the development of antibodies in the immune system
Thymus
Gonads

• Ovaries
  – Located on both sides of the uterus below the opening of the fallopian tubes.
  – Produce estrogen and progesterone which affect the female characteristics and reproductive functions.

• Testes
  – Egg-shaped organ that hang in a pouch of skin called the scrotum outside the male body.
  – Produce testosterone which affects male characteristics and the production of sperm.
Careers Associated With the Endocrine System

• Clinical Trials Research Coordinator
  – Responsible for conducting scientifically sound clinical trials using ethical clinical practices under the guidelines of the Principal Investigator.
  – Education: Associates degree or complete a certificate program
    • Must also pass a written exam and be certified
  – Salary: $37,000-65,000
Medical Researcher

• Research human diseases in order to **improve human health**, advance knowledge of life processes
• Past research has resulted in advances in diagnosis, treatment, and prevention of many diseases.
• PhD in Biological Science
• Work in hospitals, labs, universities, pharmaceutical companies
• $50,000-90,000
Health Educator

• Provide information to individuals and communities in an effort to promote, maintain, and improve healthy lifestyles

• Issues that are of importance include substance abuse, safety, HIV/STDs, nutrition, high blood pressure, smoking, pregnancy, and diabetes.

• Bachelor/Masters degree in Health Education/Promotion

• $36,000-55,000

• Work at local and state health departments and state mandated programs, non-profit organizations
Nursing Pathway

- CNA
  - Certified Nursing Assistant
- LPN
  - Licensed Practical Nurse
- RN
  - Registered Nurse
- BSN
  - Bachelors of Science in Nursing
- NP
  - Nurse Practitioner (Masters or Doctorate of Nursing)
Certified Nursing Assistant

- Perform routine tasks under the supervision of nursing and medical staff
  - They answer patients’ call lights; serve meals; make beds; and help patients to eat, dress, and bathe, provide skin care to patients; *take* their temperature, pulse rate, respiration rate, and blood pressure; and help them to get into and out of bed and walk

- Complete 64 hour course AND 16 hours clinical hours, PASS state certification exam

- $9-15/ hour
Licensed Practical Nurse

- Care for patients under the supervision of physicians and registered nurses.
- Provide basic bedside care, taking vital signs, prepare and give injections and enemas, monitor catheters, apply dressings, treat bedsores, and give alcohol rubs and massages, collect samples for testing, perform routine laboratory tests, feed patients, and record food and fluid intake and output.
- 1 year program/ pass national exam
- $20+/ hour around $40,000/year
Registered Nurse

- Treating patients, educating patients and the public about various medical conditions, and providing advice and emotional support to patients’ family members. RNs record patients’ medical histories and symptoms, help to perform diagnostic tests and analyze results, operate medical machinery, administer treatment and medications, and help with patient follow-up and rehabilitation.
- 2 year program + pass National exam (boards)
- $22+ hour /$ 48,000-65,000 a year