Endocrine and Reproductive Systems

Chapter 39
Section 39-1

THE ENDOCRINE SYSTEM
The Endocrine System – Section Outline

- Hormones
- Glands
- Hormone Action
- Prostaglandins
- Control of the Endocrine System
- Complementary Hormone Action
Endocrine System - Hormones

- **Endocrine Glands** – Produce and release hormones ("Messengers" to connect organ systems)
  - Maintains homeostasis and controls metabolism
- **Hormones** – *bind to receptors on target cells to change cellular function*
- **Steroid hormones** – Alters cell function by regulating gene expression
- **Non-steroid hormones** – Alters cell function by activating an enzyme inside the cell

![Steroid Hormone Diagram]

- Steroid Hormone
- Target cell membrane
- Receptor
- Hormone-receptor complex
- Nucleus
- DNA
- Altered cellular function
- Protein synthesis
- Cytoplasm
- mRNA

![Nonsteroid Hormone Diagram]

- Nonsteroid hormone (first messenger)
- Receptor
- Target cell membrane
- cAMP (second messenger)
- Altered cellular function
- Enzyme activities
- Cytoplasm
- Nucleus
Endocrine Glands – produce & release hormones

**Hypothalamus**
- Makes hormones that control and are stored in the pituitary gland
- Monitors thyroxine levels which controls metabolism.

**Pituitary gland**
- Produces hormones to regulate the other endocrine glands
- Produces *growth hormone to regulate growth and rate of growth during childhood*

**Parathyroid glands**
These four glands release parathyroid hormone, which regulate the level of calcium in the blood.

**Thymus**
During childhood, the thymus releases thymosin, which stimulates Tcell development.

**Adrenal glands**
- Secretes hormones to regulate kidneys and metabolism
- Release epinephrine and norepinephrine, *which help the body deal with stress.*

**Pineal gland**
- Releases melatonin, which is involved in rhythmic activities, such as daily sleep-wake cycles.

**Thyroid**
- Produces and secretes thyroxine, which regulates metabolism by increasing uptake of O₂.

**Pancreas**
- Produces *insulin and glucagon*, which regulate the level of glucose in the blood.

**Ovary**
- Produce *estrogen and progesterone*
- *Estrogen* - required for development of secondary sex characteristics and for development of eggs
- *Progesterone* prepares uterus for fertilized egg development.

**Testis**
- Produce *testosterone*, which is responsible for sperm production in *seminiferous tubules* and the development of male secondary sex characteristics.
Hormone Action

Steroid Hormone

Target cell membrane

Receptor

Hormone-receptor complex

Nucleus

DNA

mRNA

Protein synthesis

Cytoplasm

Altered cellular function

Nonsteroid hormone (first messenger)

Receptor

Target cell membrane

cAMP (second messenger)

Enzyme activities

Altered cellular function

Cytoplasm

Nucleus
The Endocrine System – Section Outline

- Hormones
- Glands
- Hormone Action
- Prostaglandins
- Control of the Endocrine System
- Complementary Hormone Action
Section 39-2

HUMAN ENDOCRINE GLANDS
Human Endocrine Glands – Section Outline

- Pituitary
- Hypothalamus
- Thyroid
- Parathyroid
- Adrenal (Adrenal Cortex and Adrenal Medulla)
- Pancreas
- Reproductive Glands
Endocrine Glands – produce & release hormones

**Hypothalamus**
- Makes hormones that control and are stored in the pituitary gland
- Monitors **thyroxine** levels which controls metabolism.

**Pituitary gland**
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- Produces **growth hormone** to regulate growth and rate of growth during childhood

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Human Endocrine Glands – Section Outline

- Pituitary
- Hypothalamus
- Thyroid
- Parathyroid
- Adrenal (Adrenal Cortex and Adrenal Medulla)
- Pancreas
- Reproductive Glands
Actions of Insulin and Glucagon

- Beta cells release insulin into the blood
- Body cells absorb glucose
- Blood glucose level increases
- Liver converts glycogen to glucose
- Blood glucose level decreases
- Blood glucose level increases
- Liver converts glycogen to glucose
- Blood glucose level decreases
- Alpha cells release glucagon into blood
- Homeostasis: Normal blood glucose level
The Endocrine System

*Regulates* by means of the:

- Growth
- Water balance
- Reproduction
- Metabolism
- Calcium and glucose levels
- Response to stress

By means of:

- Pituitary
- Testes
- Thyroid
- Pancreas
- Adrenals
- Ovaries
- Parathyroids
Section 39-3

REPRODUCTIVE SYSTEM
Reproductive System – Section Outline

- Sexual Development
- Male Reproductive System
- Female Reproductive System
- Menstrual Cycle
- Sexually Transmitted Diseases
Reproductive Glands

- **Puberty** – Reproductive system becomes fully functional (age 9-15)
  - **Pituitary** – secretes increased levels of F.S.H. and L.H.
    - Follicle-Stimulating Hormone and Luteinizing Hormone
- **Male Reproductive System** – Testes – produce sperm and testosterone
  - FSH and LH – stimulate testosterone production
    - FSH and testosterone stimulate development of sperm
- **Female Reproductive System** – produces ova and nourishes developing embryo
  - FSH and LH stimulate egg formation and ovulation
  - Ovaries – produce one ova between them each month, as well as estrogen and progesterone
  - Fallopian Tube – Tube in which egg or zygote travels to get to uterus
    - where fertilization occurs
- **Uterus** – for development of embryo
Menstrual Cycle – 4 phases & about 28 days

- **Follicular phase** - Pituitary secretes *FSH* and *LH*
  - Causes follicle to develop
  - Follicle produces estrogen
  - Estrogen causes Uterine wall to thicken and prepare for embryo
- **Ovulation** – Increased *LH* is secreted by pituitary
  - Causes Follicle to rupture and release egg into Fallopian tube
- **Luteal Phase** – *best time for fertilization*
  - *LH* levels peak
  - Uterus prepares for embryo
  - Ruptured follicle becomes Corpus Luteum
    - **Corpus Luteum** – releases *progesterone* to continue preparing uterus for embryo
- **Menstruation** – Egg not fertilized
  - Corpus luteum disintegrates
  - Estrogen and progesterone levels drop
  - Unfertilized egg and uterine lining are discharged
Menstrual Cycle – 4 phases

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Section 39-4

FERTEILIZATION AND DEVELOPMENT
Fertilization & Development – Section Outline

- Fertilization
- Early Development
- Control of Development
- Later Development
- Childbirth
  - Multiple Births
- Early Years
- Adulthood
Fertilization and Implantation

- Egg fertilized by sperm in **fallopian tube** during **Luteal Phase**
- Egg reacts to fertilization by releasing substance to form barrier on outside of egg
- **Zygote** – first (diploid) cell of baby
- **Development:**
  - **Implantation** – blastocyst attaches to uterine wall
  - **Gastrulation** – formation of germ layers; **ectoderm, mesoderm and endoderm** from which all organs and tissues form from
  - **Differentiation** – Cells of blastocyst begin to specialize and develop various types of tissue in body due to gene activation
    - Inner cell mass forms embryo while other cells differentiate into the extraembryonic membranes
  - **Neurulation** – development of nervous system
During embryonic development, membranes form to protect and nourish the embryo.

- **Amnion** – forms fluid filled *amniotic sac* to cushion embryo within uterus.
- **Chorion** - connects to uterine lining through *chorionic villi* to form the *placenta*.
- **Placenta** – provides nutrients to the fetus and connects the fetus to the mother’s uterus.
- Amniotic sac and placenta are delivered and expelled from uterus after birth of baby.
- **Umbilical cord** – connects the fetus to the placenta.
Fertilization & Development – Section Outline

- Fertilization
- Early Development
- Control of Development
- Later Development
- Childbirth
  - Multiple Births
- Early Years
- Adulthood
Multiple Birth

Types of multiples

- Monozygotic – multiple (typically two) fetuses produced by the splitting of a single zygote
- Dizygotic – multiple (typically two) fetuses produced by two zygotes
- Polyzygotic – multiple fetuses produced by two or more zygotes
- **Higher order multiples refers to triplets or higher**

**Higher order multiples** refers to:
- Two offspring – twins
- Three offspring – triplets
- Four offspring – quadruplets
- Five offspring – quintuplets
- Six offspring – sextuplets
- Seven offspring – septuplets
- Eight offspring – octuplets
- Nine offspring – nonuplets
- Ten offspring – decaplets
- Eleven offspring – undecaplets
- Twelve offspring – duodecaplets
- Thirteen offspring – tridecaplets
- Fourteen offspring – quadecaplets
- Fifteen offspring – quindecaplets
- Sixteen offspring – quindecaplets
Fraternal twins
Identical quintuplets
Fraternal triplets
Identical triplets
Fraternal triplets
Identical quintuplets
Fertilization & Development – Section Outline

- Fertilization
- Early Development
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