November 15, 2013

- What is the function of the endocrine system?
- What are the male reproductive organs?
- What are the female reproductive organs?
• What is a hormone?

• Where are two places hormones are produced?

• Name two hormones.
• What is the difference between an exocrine gland and endocrine gland?

• Explain the difference between how steroid hormones and non-steroid hormones affect their target cells.

• Where are the thyroid glands and what is their primary function?
Unit 10 The Human Body

Ch. 39 Endocrine & Reproductive Systems
The Endocrine System

- The endocrine system is made up of glands that release their products into the bloodstream.
- These products deliver messages throughout the body.
Hormones

- **Hormones** - chemicals released in one part of the body that travel through the bloodstream & affect activities of cells in other parts of the body

- **Target cells** (receptor cells) - cells that have receptors for a particular hormone
Glands

• Organs that produce & releases a substance

• **Exocrine glands** - release hormones through ducts (tubes), directly affecting target organs

• **Endocrine glands** - release hormones directly into bloodstream
**Hypothalamus**
The hypothalamus makes hormones that control the pituitary gland. In addition, it makes hormones that are stored in the pituitary gland.

**Pituitary gland**
The pituitary gland produces hormones that regulate many of the other endocrine glands.

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

**Thymus**
During childhood, the thymus releases thymosin, which stimulates T cell development and proper immune response.

**Adrenal glands**
The adrenal glands release epinephrine and norepinephrine, which help the body respond to stress.

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

**Thyroid**
The thyroid produces thyroxine, which regulates metabolism throughout the body.

**Pancreas**
The pancreas produces insulin and glucagon, which regulate the level of glucose in the blood.

**Ovary**
Ovaries produce estrogen and progesterone. Estrogen is required for the development of female secondary sex characteristics and for the development of eggs. Progesterone prepares the uterus for a fertilized egg.

**Testis**
The testes produce testosterone, which is responsible for sperm production and the development of male secondary sex characteristics.
Hormone Action

- Steroid hormones:
  - Lipids—they can cross cell membranes, passing directly into the cytoplasm & into nuclei of target cell

- Non-steroid hormones:
  - They generally cannot pass through cell membrane of target cells
Steroid hormone

Target cell membrane

Receptor

Hormone-receptor complex

Altered cellular function

Protein synthesis

Cytoplasm

mRNA

DNA

Nucleus

Nonsteroid hormone (first messenger)

Receptor

Target cell membrane

ATP

cAMP (second messenger)

Enzyme activities

Altered cellular function

Cytoplasm

Nucleus
Prostaglandins

- **Prostaglandins** - modified fatty acids that produce hormones affecting nearby cells & tissues ("local hormones")
  - Ex. some cause smooth muscle to contract
Control of the Endocrine System

- Endocrine system is regulated by feedback mechanisms that function to maintain homeostasis.
  - Ex. Pancreas & insulin: blood sugar level rises after lunch → pancreas releases insulin → blood sugar level decreases → pancreas stops releasing insulin
Human Endocrine Glands

• The major glands of the endocrine system are:
  – Pituitary gland
  – Hypothalamus
  – Thyroid gland
  – Parathyroid glands
  – Adrenal glands
  – Pancreas
  – Reproductive glands
Pituitary Gland

- Divided into 2 parts:
  - Anterior & Posterior

- Secretes 9 hormones that directly regulate body functions & controls actions of other endocrine glands
<table>
<thead>
<tr>
<th>Pituitary Gland</th>
<th>Hormone</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior pituitary</td>
<td>Antidiuretic hormone (ADH)</td>
<td>Stimulates the kidneys to reabsorb water from the collecting tubules</td>
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<tr>
<td></td>
<td>Oxytocin</td>
<td>Stimulates contractions of uterus during childbirth; releases milk in nursing mothers</td>
</tr>
<tr>
<td>Anterior pituitary</td>
<td>Follicle-stimulating hormone (FSH)</td>
<td>Stimulates production of mature eggs and sperm</td>
</tr>
<tr>
<td></td>
<td>Luteinizing hormone (LH)</td>
<td>Stimulates ovaries and testes; prepares uterus for implantation of fertilized egg</td>
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<tr>
<td></td>
<td>Thyroid-stimulating hormone (TSH)</td>
<td>Stimulates the synthesis and release of thyroxine from the thyroid gland</td>
</tr>
<tr>
<td></td>
<td>Adreno-corticotropic hormone (ACTH)</td>
<td>Stimulates release of some hormones from the adrenal cortex</td>
</tr>
<tr>
<td></td>
<td>Growth hormone (GH)</td>
<td>Stimulates protein synthesis and growth in cells</td>
</tr>
<tr>
<td></td>
<td>Prolactin</td>
<td>Stimulates milk production in nursing mothers</td>
</tr>
<tr>
<td></td>
<td>Melanocyte-stimulating hormone (MSH)</td>
<td>Stimulates the melanocytes of the skin, increasing their production of the skin pigment melanin</td>
</tr>
</tbody>
</table>
Hypothalamus

- Controls secretions of pituitary gland
- Endocrine and Nervous Systems work together to coordinate body functions.
Thyroid Gland

- Major role in regulating the body’s metabolism
- Releases thyroxin which increases metabolism & cellular respiration
Parathyroid Glands

- Four glands found on the back surface of the thyroid gland.

- Hormones from thyroid gland & parathyroid glands act to maintain homeostasis of calcium levels in the blood
  - Parathyroid hormone (PTH)
  - Calcitonin
Adrenal Glands

- Two glands that sit on top of the kidneys
- Release hormones that help the body prepare for & deal with stress
Adrenal Glands

• Adrenal Cortex
  – 80% of adrenal glands
  – Produces corticosteroid hormones
• Aldosterone: regulates sodium and potassium levels in kidneys
• Cortisol: helps control metabolism rate of carbs, fats, and proteins
Adrenal Glands

- Adrenal Medulla
  - Regulated by sympathetic nervous system
  - Two hormones secreted:
    - epinephrine and norepinephrine: produce the “fight or flight” response to stress
Pancreas

- Has both exocrine & endocrine functions
- Acts as a digestive gland whose enzymes help break down food
- However, different cells in the pancreas release hormones into the blood
• Insulin & glucagon are released to help keep blood glucose levels stable
  – **Insulin** stimulates liver to remove sugar from the blood & store it as glycogen
  – **Glucagon** stimulates the liver to break down stored glycogen & release sugar back into the blood
Pancreas

• **Diabetes mellitus** - when the pancreas does not produce insulin or it's not properly used

• Type I and Type II
  – Type I requires daily injections of insulin
  – Juvenile diabetes
Pancreas

- **Type II** develops in people after age 40
  - normal to low insulin production
  - cells don’t respond properly to the hormone
- **Usually controlled through diet, exercise, & medication**
Reproductive Glands

- **Gonads** are the body’s reproductive glands

- **Two important functions:**
  - production of gametes
  - secretion of sex hormones
Female Gonads

- **Ovaries**
  - produce eggs & sex hormones
- **Estrogen**: proper egg development and changes to the body during puberty.
- **Progesterone**: prepares uterus for arrival of developing embryo.
Male Gonads

- **Testes**
  - produce sperm & testosterone
- **Testosterone**: normal sperm production and changes to the body due to puberty
November 20, 2013

- What are the two parts of the adrenal glands and what is the function of each?
- Explain how the pancreas functions as both an endocrine gland and an exocrine gland.
- Explain the differences between Type I and Type II diabetes.
The Reproductive System

- Reproduction is the formation of new individuals
- Reproduction is important for the survival of a species, but not for a specific organism to survive
Sexual Development

- **First 6 weeks of development:**
  - male & female embryos are identical
- **7th week:**
  - reproductive organs begin to develop
- **Hormones produced by gonads determine male or female development**
Sexual Development

- Neither the testes or ovaries are capable of producing active reproductive cells until puberty.

- **Puberty** - period of rapid growth & sexual maturation
  - Reproductive system becomes fully functional
  - Ages 9-15
The Male Reproductive System

• The main function is to produce & deliver sperm
• **Scrotum** - external sac that holds the testes (external to reduce heat so sperm won’t die)
• **Seminiferous tubules** – tiny tightly coiled tubules where the sperm are produced within each testis.
The Male Reproductive System

- **Sperm** - male sex cells (gametes)
The Male Reproductive System

- **Epididymis** - structure that sperm move into to mature & be stored until released
- **Vas deferens** - tube that carries sperm from the epididymis to the urethra to be released
- **Penis** - urethra carries sperm out of body through the penis
The Male Reproductive System

- Urinary bladder
- Vas deferens
- Pubic bone
- Urethra
- Penis
- Epididymis
- Seminal vesicle
- Rectum
- Prostate gland
- Bulbourethral gland
- Testis
- Scrotum
Male Reproductive System

• Seminal vesicles, prostate, and bulbourethral glands produce nutrient rich fluid called **seminal fluid**.
  – Protects sperm from acidity of female reproductive tract

• **Semen**—combination of sperm and seminal fluid
The Female Reproductive System

- The main function of the female reproductive system is to produce ova (eggs)
- Also prepares the female’s body to nourish a developing embryo
The Female Reproductive System

- **Follicles** – clusters of cells surrounding a single egg to help it mature
- Females are born with thousands of immature eggs (primary follicles); only about 400 will be released
The Female Reproductive System

• **Ovulation** - when a follicle has completely matured, its egg is released.

• **Egg** - female sex cells (gametes).

• **Fallopian tubes** - tube from each ovary that carries the egg to the uterus; where fertilization occurs.
The Female Reproductive System

- **Uterus** - location of egg a few days after ovulation where embryo develops if fertilization took place.
- **Cervix** - the outer end of the uterus.
- **Vagina** - canal that leads to the outside of the body.
The Female Reproductive System

- Fallopian tube
- Ovary
- Uterus
- Urinary bladder
- Pubic bone
- Cervix
- Rectum
- Vagina
- Urethra
The Menstrual Cycle

- **Menstrual cycle** - when an egg develops & is released from an ovary
- Completes every 28 days
- **4 phases**: follicular phase, ovulation, luteal phase, & menstruation
The Menstrual Cycle

The Follicular Phase

- Development of an egg
- Anterior Pituitary releases FSH and LH
  - cause follicles to develop into mature eggs.
  - As follicle matures, it releases estrogen
- Increased estrogen causes the lining of the uterus to thicken
- This phase takes about 10 days to complete
The Menstrual Cycle

- Ovulation
  - Lasts 3-4 days
  - Mature egg is released into 1 of the fallopian tubes
  - Pituitary releases a large quantity of FSH and LH which causes the follicle to burst releasing the egg
The Menstrual Cycle

- **Luteal Phase**
  - The remaining ruptured follicle becomes the Corpus Luteum and releases estrogen and progesterone
  - Adds finishing touches to uterus to prepare for embryo

- **Menstruation** - when the lining of the uterus sheds, lasts about 3-7 days (period)
  - When fertilization does not occur
What pathway does an egg take through the female reproductive system once it reaches maturity?

What triggers ovulation?

What hormones are involved in the menstrual cycle and what are their functions?
Sexually Transmitted Diseases

- Sexually transmitted diseases - diseases spread from 1 person to another through sexual contact

- Common STDs are chlamydia, syphilis, & gonorrhea (caused by a bacteria)
  - Treatable
Sexually Transmitted Diseases

- Others caused by viruses include: HIV, hepatitis B, genital herpes, HPV
- Non-Curable!
What hormones are released from the pituitary gland during the menstrual cycle?

What pathway does sperm take through the male reproductive tract before release?

What are three common bacterial STDs?
Fertilization

- A single cell undergoes cell divisions that result in the formation of a new human being.
Fertilization

- Fertilization - the process of a sperm joining an egg, usually occurs in the fallopian tube

- Zygote - a fertilized egg
Early Development

- The stages of early development include: implantation, gastrulation, & neurulation

- **Implantation** - when the blastocyst implants itself in the uterine wall

- **Differentiation** – cells develop into specific types of tissues in the body
Early Development

- **Gastrulation** - formation of 3 cell layers
  - **Ectoderm**—becomes skin and nervous system
  - **Mesoderm**—becomes internal tissues and organs
  - **Endoderm**—becomes digestive system
Early Development

- **Neurulation** - the development of the nervous system, occurs shortly after gastrulation
Early Development

- **Placenta** - connections between mother & developing embryo
  - Supplies nutrients & oxygen and also provides a way to get rid of carbon dioxide & wastes
  - Nutrients & oxygen diffuse from the mother’s blood into the baby’s blood
  - The placenta is the embryo’s organ of respiration, nourishment, & excretion
The placenta is the connection between the mother and the developing embryo. It is through the placenta that the embryo gets its oxygen and nutrients and excretes its waste products. Notice how the chorionic villi from the embryo extend into the mother’s uterine lining (indicated by the overlapping brackets).
Early Development

- **Fetus** - after 8 weeks of development
- The umbilical cord connects the fetus to the placenta
- Pregnancy is divided into 3 trimesters.
  - 3rd trimester: organ systems mature & fetus grows in size & mass; lungs also mature
Later Development

Figure 39-24  At 7 weeks, most of the organs have begun to form. The heart—the large, dark rounded structure—is beating. By 14 weeks, the hands, feet, and legs have reached their birth proportions. The eyes, ears, and nose are well developed. When the fetus is full-term, it is fully developed and capable of living on its own. Interpreting Graphics

What significant changes do you see from 7 weeks to 14 weeks?
Childbirth

- After 9 months, the fetus is ready for birth
- Oxytocin, a hormone released from the pituitary gland, causes contractions to begin
- The contractions become more frequent & powerful
Childbirth

- The cervix opening expands until it is large enough for the baby’s head to pass through (~10cm)
- Contractions of the uterus force the baby out through the vagina