**CHAPTER 22: REPRODUCTIVE SYSTEMS**

**OBJECTIVES:**

1. Briefly explain why human reproduction is significant, and how sexual reproduction always results in a unique zygote.

2. List the functions of the reproductive systems.

3. Define the terms *meiosis, DNA, somatic cells, gametes, diploid, haploid* and *zygote*.

4. Name the common term for both the male and female gamete.

5. Distinguish between spermatogenesis and oogenesis.

6. Illustrate the steps involved in gamete formation (meiosis), explain the highlight(s) of each step, and explain any differences between male and female end-products.

7. Name the specific step of meiosis where homologous chromosomes are arranged together in tetrads (this is also called synapsis).

8. Compose a table comparing mitosis and meiosis in terms of time of DNA replication, number of divisions involved, number of daughter cells produced and their genetic composition, and the importance of each process.

9. Locate each of the following male reproductive organs on a diagram, discuss the structure of each organ, and name a major function for each organ: testes, scrotum, epididymis, vas (ductus) deferens, seminal vesicle, ejaculatory duct, prostate gland, bulbourethral glands, urethra, and penis

10. Describe the microscopic structure of the testes and explain where spermatogenesis and androgen production occurs.

11. List and describe the sequence of events involved in spermatogenesis, beginning with a spermatogonium and ending with mature sperm cells. Be sure to keep track of chromosome number (2n = 46, or 1n = 23) and the number (i.e. 1, 2, or 4) of each cell type produced.

12. Name the location where sperm is stored.

13. Fully describe the structure of a mature sperm cell.

14. Explain why a sperm cell contains so many mitochondria and name the portion of the spermatocyte that houses these mitochondria.

15. Explain how the functions of the testes are hormonally controlled. Be sure to include the overall scheme from the hypothalamus all the way to the final target organs (2o sexual organs).

16. Name the components of the spermatic cord and name the "canal" that houses these organs and passes them into the abdominopelvic cavity.

17. Name the site where the seminal vesicle and vas deferens unite within the prostate gland.

18. List the components of semen, name the organ (or gland) that secretes each of these components, and name the function of each semen component.

19. Explain the function of the cremaster muscle.

20. Sketch a cross-sectional view of the penis and include the following structures: corpora cavernosa, corpus spongiosum, glans penis, prepuce, tunica albuginea, and urethra.

21. Explain what portion of the penis is surgically removed during a circumcision.

22. Distinguish between erection, emission, ejaculation and orgasm in males.

23. Locate each of the following female reproductive organs on a diagram, describe the structure of each organ, and discuss the major function of each organ:

ovaries, fallopian tubes, uterus, cervix, vagina, labia, and clitoris

24. Describe the internal structure of an ovary and locate where oogenesis occurs.

25. Discuss the sequence of events involved in oogenesis. Be sure to include chromosome # and number of each cell produced.

26. Explain why a secondary oocyte does not always undergo Meiosis II.

27. Describe the events involved in maturation of an ovarian follicle each month. Draw a sketch to illustrate the components of the follicle.

28. Distinguish between a primary and secondary follicle.

29. Define the term *ovulation* and name the gonadotropin responsible for its occurrence.

30. Name the female reproductive organ containing fimbriae and cilia.

31. Discuss the structure (3 layers) of the uterus, and provide the name for the lower one-third where the uterus narrows.

32. Distinguish between a pap smear and colposcopy.

33. Name the female reproductive organ that houses the erect penis during intercourse, the organ(s) that protect the internal organs, and the organ that corresponds to the male penis.

34. Describe the structure of the mammary glands and track the flow of milk from the alveoli to the nipple.

35. Outline how ovarian function is hormonally controlled, starting with the hypothalamus to the final target organs (i.e. uterus, and 2o sex organs). Then discuss the hormones named above in terms of the female reproductive cycle that occurs each month (i.e. list each hormone, name the (specific) organ or gland that secretes that hormone, list the corresponding day(s) of the cycle when that hormone is secreted, and name the response that occurs at each target organ).

36. Describe the structure and function of the female breast.

I. **INTRODUCTION**

All living organisms must reproduce in order to continue their species. Humans reproduce by sexual reproduction with internal fertilization, where a flagellated sperm (from the male father) fertilizes an ovum (from the female mother) producing a zygote. In sexual reproduction, the genetic information is contributed by both parents, and therefore a unique combination of genetic information results in each zygote.

II. **THE FUNCTIONS OF THE REPRODUCTIVE SYSTEMS**

The various reproductive organs work together to:

A. produce gametes;

B. transport gametes;

C. maintain gametes;

D. maintain developing zygote/fetus(female);

E. produce sex hormones:

1. male = testosterone;

2. female = estrogen and progesterone.

III. **MEIOSIS**

A. The genetic information of living organisms is DNA (deoxyribonucleic acid) that is carried on the genes of chromosomes.

B. In humans, each **somatic (body) cell is diploid**, which means the cell contains **46 chromosomes** or 23 pairs.

C. Human sex cells or **gametes**, however, **are haploid**, which means the cell contains only **23 chromosomes**.

D. **Meiosis** is the type of cell division that results in gametes that possess half the chromosome number of the parent cell (i.e. meiosis reduces the chromosome number by one-half).

1. Male sperm (haploid) = 23 chromosomes (1 set)

2. Female egg (haploid) = 23 chromosomes (1 set)

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3. Fertilization

(zygote; diploid) = 46 chromosome (2 sets).

*\* What happens to this diploid zygote now?*

III. **MEIOSIS**

E. **Meiosis Overview**:

1. **One Parent Cell**

(Two sets of duplicated chromosomes)

[23 pairs duplicated chromosomes]

2. **Two Daughter Cells**

(one set of duplicated chromosomes)

[23 duplicated chromosomes]

3. **Four Gametes**

(one set of chromosomes)

[23 chromosomes]

\* Meiosis is called **spermatogenesis** in the male (testes).

\*\* Meiosis is called **oogenesis** in the female (ovaries).

III. **MEIOSIS**

F.  **The (Specific) Stages of Meiosis**: See Fig 22.6, page 835.

1. Introduction:

Meiosis is similar to mitosis in that the chromosomes (DNA) are duplicated prior to the process, however this single replication is followed by two consecutive cell divisions called Meiosis I and Meiosis II.

2.  **Interphase I:**

a. Chromosomes replicate in parent cell;

b. 23 pairs of duplicated chromosomes.

3. **Meiosis I**: See Fig 22.6, page 835.

a. reduction division:

b. 4 stages:

* **Prophase I:**

1.Chromosomes shorten & thicken;

2. Nuclear envelope/nucleoli disappear;

3. Mitotic spindle appears;

4. **Chromosomes form tetrads (synapsis)**; (i.e. Homologous pairs are arranged together).

• See Fig 22.7, page 835.

* **Metaphase I:**

1. Homologous chromosome pairs line up along metaphase plate.

* **Anaphase I**:

1. Homologous pairs separate;

2. One member of each pair moves to opposite pole;

3. Cleavage furrow starts to form.

* **Telophase I and cytokinesis**:

1. Cleavage furrow complete;

2. 2 daughter cells containing half the chromosome number of parent cell (23 duplicated chromosomes).

III. **MEIOSIS**

F.  **The (Specific) Stages of Meiosis**:

4. **Meiosis II**: Fig 22.6, page 835.

a. equatorial division;

b. 4 stages similar to those of mitosis, with

* centromere splitting (between duplicated chromosomes) and
* sister chromatids migrating to opposite poles during Anaphase II.
* Stages include:

1. Prophase II,

2. Metaphase II,

3. Anaphase II,

4. Telophase II and cytokinesis.

c. Result is **4 gametes with 23 chromosomes.**

**\* During spermatogenesis, 4 sperm** result.

**\* During oogenesis, only 1 ovum** results due to unequal cytokinesis (i.e. polar bodies result; discussed later).

G. **Comparison of Mitosis and Meiosis**: (Keyed at the end of this outline)

|  |  |  |
| --- | --- | --- |
| **Event** | **Mitosis** | **Meiosis** |
| **DNA Replication** |  |  |
| **Number of Divisions** |  |  |
| **Number of daughter cells & genetic composition** |  |  |
| **Importance** |  |  |

IV. **ORGANS OF THE MALE REPRODUCTIVE SYSTEM**

See Fig 22.1, page 831.

A. **TESTES** = The primary male sex organs which produce sperm and male sex hormones. ovoid structures held within the **scrotum** (outside the male body)

1. **Descent of the Testes**

* + - 1. Origin is as mass of tissue near adult kidney location
      2. At 7-8 months gestation testes move through abdominal wall to scrotum
      3. Descent is stimulated by **testosterone**
      4. Fibromuscular cords called the **gubernaculums** pulls the testes and developing vas deferens and blood vessels through the **inguinal canal** and into scrotum
      5. Vas and blood vessels make up adult **spermatic cord**
      6. See Figure 22.2 page 832.

2. **Internal Structure of testis:**

See Fig 22.3 and Fig 22.4, page 833.

a. Each testis is divided into **lobules**;

b. Each lobule contains:

* + - * + **seminiferous tubules** (production of sperm cells under the influence of what hormone?), which are separated by
        + **interstitial cells** (of Leydig) (production of male sex hormones under the influence of what hormone?)

c. The seminiferous tubules unite and give rise to the **epididymis** on the outer surface of the testis.

3. **Germinal Epithelium**:

See Fig 22.5, page 834.

a. The **seminiferous tubules** are lined by stratified **epithelium**;

b. This germinal epithelium consists of **two types of cells**:

1. **Spermatogenic cells** which give rise to sperm cells;

2. **Sustentacular cells (Sertoli cells)**, which support and nourish the spermatogenic cells.

IV. **ORGANS OF THE MALE REPRODUCTIVE SYSTEM**

A. **TESTES** (continued):

4. **Spermatogenesis:**

See Fig 22.5, page 834.

a. Males produce sperm from puberty and then throughout life:

b. The sperm is produced in the germinal epithelium of the seminiferous tubules;

c. Sperm cells are produced from **spermatogonia cells, which contain 23 pairs (or 46) of chromosomes**; (diploid)

d. Meiosis reduces this number by one-half, so that the number of chromosomes in mature sperm cells is **23 chromosomes**; (haploid)

e. Overall sequence: See Fig 22.5, page 834 and Fig 22.4, page 833.

* **One spermatogonium *(23 pairs of chromosomes)*** duplicates its DNA. This gives rise to
* **One primary spermatocyte *(23 duplicated pairs of chromosomes)*** which undergoes meiosis I. This gives rise to
* **Two secondary spermatocytes *(each with 23 duplicated chromosomes)***, which undergo meiosis II. This gives rise to
* **Four spermatids *(each with 23 chromosomes).*** These cells mature into
* **Four sperm cells *(each with 23 chromosomes)*.** The sperm cells collect in the lumen of the seminiferous tubule.

f. The sperm travel to, mature, and are stored in the epididymis.

IV. **ORGANS OF THE MALE REPRODUCTIVE SYSTEM**

A. **TESTES** (continued):

5. **Structure of a** **Sperm Cell**:

See Fig 22.9, page 837 and Fig 22.10, page 838.

The structure of a mature sperm cell consists of a head, a body, and a tail:

a. The **head**

* + - * + contains 23 chromosomes and
        + is covered by a helmet like structure called an **acrosome**.

1. contains enzymes to help penetrate the oocyte.

b. The **body** (mid-piece)

* + - * + contains many **mitochondria** needed to produce ATP for energy for the sperm cell to complete its long journey;

c. The **tail**

* + - * + is a **flagellum**
        + provides locomotion for the sperm cell.
        + See gray box on page 838 concerning toxic chemicals that affect a sperm's ability to swim.

B. **Epididymis**: Also see Fig 22.11, page 838.

1. tightly coiled tube leading to vas deferens;

2. site of storage of sperm cells.

C. **Vas (Ductus) Deferens**: Also see Fig 22.12, page 839.

1. muscular tube which passes upward from testis, passes through parietal peritoneum (**inguinal canal**) and into abdominal cavity;

\* The vas deferens, along with a testicular artery, autonomic nerves, testicular veins, lymphatic vessels, and the cremaster muscle pass upward within the inguinal canal and compose the **spermatic cord;** See Fig 22.2c, page 832.

2. fuses with duct from seminal vesicle to form **ejaculatory duct** (within prostate gland).

3. **s**ite of Vasectomy.

D. **Seminal Vesicle**:

1. sac-like structure attached to vas deferens;

2. secrete an alkaline fluid that is rich in nutrients (**fructose** for sperm energy).

E. **Prostate Gland**: Also see Fig 22.13, page 839.

1. surrounds urethra below bladder;

2. secrete a milky, **alkaline fluid**, which enhances **sperm motility**.

IV. **ORGANS OF THE MALE REPRODUCTIVE SYSTEM**

F. **Bulbourethral Glands**:

1. two small structures beneath prostate;

2. secrete **lubricant** for penis.

\* **Semen** = sperm cells (from testes), alkaline fluids (from prostate), fructose (from seminal vesicle) and lubricant (from bulbourethral).

G. **Scrotum**:

1. pouch of skin and subcutaneous tissue that encloses the testes;

2. The **cremaster muscle** is an extension of the internal oblique muscle that elevates the scrotum during sexual arousal and on exposure to cold.

H. **Penis**: See Fig 22.14, page 841.

1. male excitatory organ;

2. specialized to become erect for insertion into vagina during sexual intercourse;

3. cylindrical body composed of three columns of erectile tissue.

4. completely surround urethra.

5. Structure:

a. pair of dorsally located **corpora cavernosa**; whose crura (legs) are attached to the pubic arch

b. single **corpus spongiosum**, which extends at its distal end to form the enlarged **glans penis**; and enlarges at the proximal end to form the **bulb of the penis** deep in the perineum

c. the crura are covered by the **Ischiocavernosus muscle**

d. the bulb is covered by the **bulbospongiosus muscle**

e. Each column is surrounded by a tough capsule of white fibrous CT called **tunica albuginea;**

f. A loose fold of skin called the **prepuce** covers the glans as a sheath.

* + - * + The prepuce is sometimes removed by a surgical procedure called a **circumcision**;

IV. **ORGANS OF THE MALE REPRODUCTIVE SYSTEM**

H. **Penis**

\* **Erection** = vascular spaces within erectile tissue become engorged with blood when male becomes sexually stimulated.

Caused by increased arterial flow filling the erectile tissues and compressing the veins, thus trapping blood in the penis

See Fig 22.15, page 844.

\* **Emission** = movement of semen from epididymis into urethra.

\* **Ejaculation** = forceful movement of semen from urethra to outside.

Accomplished by the **bulbospongiosus muscle and Ischiocavernosus muscle** See Fig 22.16, page 844.

\* **Orgasm** = culmination of sexual stimulation accompanied by involuntary rhythmic contractions of the epididymis causing emission and ejaculation of semen, resulting in a sense of psychological and physiological release.

IV. **ORGANS OF THE MALE REPRODUCTIVE SYSTEM**

G. **Male Reproductive Organ Summary Table** See Table 22.1, page 844. The key is located at the end of this outline)

|  |  |  |
| --- | --- | --- |
| **Name of Organ** | **Structure** | **Function** |
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IV. **ORGANS OF THE MALE REPRODUCTIVE SYSTEM**

* 1. **Hormonal Control of Male Reproductive Function**: Fig 22.17, page 845.
     1. At puberty, the **hypothalamus** secretes a "releasing hormones" that target the male’s anterior pituitary gland;
     2. The **anterior pituitary gland** then secretes two gonadotropins:
        1. **Follicle stimulating hormone (FSH)**, which stimulates spermatogenesis in the germinal epithelium of Seminiferous tubules (ST’s); and
        2. **Luteinizing hormone (LH),** which stimulates the interstitial cells between the ST's to produce male sex hormones.
     3. Male Sex Hormones = **Androgens**
        1. **Testosterone** is the major androgen whose production begins at puberty:
        2. Testosterone targets the secondary sex organs of the male:
           + facial, axillary, and inguinal hair follicles.
           + bone and muscle
           + vocal cords of larynx.
        3. Actions include development of male **secondary sexual characteristics** at puberty and then maintenance throughout life
           + increased growth of body hair;
           + lower-pitched voice;
           + increased muscular growth;
           + strengthening of bones.

V. **THE FEMALE REPRODUCTIVE SYSTEM**

A. **Organs**  See Fig 22.18, page 847 and Fig. 22.19 page 848.

1. **OVARIES** = the primary female sex organs which produce ova (eggs) and female sex hormones.

a. solid ovoid structures located (one on each side) on the posterior wall of the pelvic cavity.

b. Internal Structure Fig 22.23, page 851.

* + - * + Each ovary is subdivided into a

1. **medulla** = CT, blood & lymph vessels and nerves;

= nourishment and support.

2. **cortex** = ovarian follicles covered by germinal epithelium.

c. **Oogenesis**: See Fig 22.20a, page 849.

* + - * + Mitosis of primordial germ cells within female embryos produces diploid **oogonia (*23 pairs of chromosomes)*,** which duplicate their DNA and give rise to
        + **Primary oocytes (*23 pairs of duplicated* *chromosomes*)**

1. Note that human females are born with all their potential ova as primary oocytes.

* + - * + At puberty, once each month, FSH stimulates one primary oocyte to undergo Meiosis I, which gives rise to one
        + **Secondary oocyte** (***23 duplicated chromosomes***) and a polar body due to unequal cytokinesis. The secondary oocyte is then ovulated from the ovary (LH)

1. If the secondary oocyte is penetrated by a sperm cell, Meiosis II initiated.

2. When and if Meiosis II is complete,

• a second polar body is separated from the

• large ovum (***23 chromosomes)***,

\* The haploid nuclei of the sperm and the now-matured ovum fuse.

V. **THE FEMALE REPRODUCTIVE SYSTEM**

A. **Organs**  See Fig 22.18, page 847 and Fig. 22.19 page 848.

1. **OVARIES**

d. **Follicle Maturation**: See Fig 22.25, page 852.

* During child bearing years, each month **FSH** stimulates one primordial follicle to mature: The following events occur over a 14 day period (approximately).

1. Primary oocyte enlarges and undergoes meiosis I ;

2. The follicular cells multiply and give rise to stratified epithelium composed of **granulosa cells**;

3. A layer called the **zona pellucida** appears and separates the oocyte from the granulosa cells.

• The follicle is now called a **primary follicle.**

4. A fluid-filled cavity, called the **antrum** appears.

• A crown of granulosa cells surrounds the oocyte (**corona radiata).**

• The follicle is now called a **secondary follicle**.

• See Fig 22.22, page 851.

e. **Ovulation:** See Fig 22.25, page 852.

* + - * + Oogenesis (meiosis I) is complete as the follicle matures (approximately **14 days**);
        + Upon maturation, luteinizing hormone (LH) causes the follicle to burst, **releasing a secondary oocyte.**

• See Fig 22.24, page 852.

* + - * + After ovulation, the oocyte is drawn into the fallopian tube (via fimbriae).

• See Fig 22.25, page 852.

V. **THE FEMALE REPRODUCTIVE SYSTEM**

A. **Organs (continued)**

2. **Fallopian Tubes** (Uterine Tubes, Oviduct): See Fig 22.26, page 853.

a. Tubes which pass medially from ovaries to uterus;

b. Distal ends are expanded over ovary and form extensions called **fimbriae**; .

c. Inner lining is covered with **cilia** to aid oocyte movement;

• See Fig 22.27, page 853.

d. Fertilization typically occurs in fallopian tube.

3. **Uterus**: See Fig 22.26, page 853.

a. A **muscular organ** that receives embryo and sustains its life during development;

1. Is located within the pelvis.
   * + - * See Fig 22.19, page 848.

c. The uterine wall has **three layers**: See Fig 22.26, page 853.

* + - * + **Endometrium** = inner lining;

**•** Site of implantation of blastocyst.

• **Endometriosis** = endometrial tissue in locations other than uterus; tissue bleeds, but does not shed, resulting in scars or adhesions; painful and possibly infertile condition.

* + - * + **Myometrium** = bundles of smooth muscle; bulk of uterus;
        + **Perimetrium** = visceral covering.

See Fig 22.28, page 854 to study the histology of the uterine wall.

d. Lower one-third of uterus narrows to form **cervix**:

* internal os;
* cervical canal;
* external os;
* posterior/anterior fornix.

• **Pap smears are taken from cervical tissue.**

V. **THE FEMALE REPRODUCTIVE SYSTEM**

**A. Organs (continued)**

4. **Vagina**: See Fig 22.18a, page 847.

.

a. passageway from cervix to outside;

b. serves to **receive erect penis**, to convey uterine secretions, and to transport offspring during birth.

c. The **hymen** is a membrane composed of epithelium and connective tissue, which partially closes the vaginal orifice.

5. **Labia**: See Fig 22.18a, page 847 and Fig 22.29, page 855.

a. external organs;

b. encloses and protects underlying organs and tissues;

c. composed of labia majora and labia minora.

d. The space enclosed by the labia minora = **vestibule of vulva.**

6. **Clitoris**: See Fig 22.18a, page 847 and Fig 22.29, page 855.

a. external excitatory organ;

b. small projection at the anterior end of the labia, which corresponds to the male penis;

c. composed of two columns of erectile tissue.

\*  **Erection** = erectile tissues of clitoris become engorged with blood and swell during sexual stimulation.

\* \* **Orgasm** = rhythmic contraction of muscles of perineum, uterine wall and fallopian tubes, which result in a feeling of psychological and physiological release.

See Fig 22.30, page 856.

V. **THE FEMALE REPRODUCTIVE SYSTEM**

A. **Organs (continued)**

**Summary Table: See Table 22.2, page 856. The key is at the end of this outline.**

|  |  |  |
| --- | --- | --- |
| **Name of Organ** | **Structure** | **Function** |
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|  |  |  |

V. **THE FEMALE REPRODUCTIVE SYSTEM**

1. **Hormonal Control of Female Reproductive Functions**

See Fig 22.31, page 857 and Table 22.3, page 858.

1. **Secretion of Gonadotropins**:

The female body remains reproductively immature until about eight years of age when secretion of **gonadotropins (FSH and LH)** from the anterior pituitary gland increases. (What gland causes the anterior pituitary to secrete these?)

1. **FSH causes maturation of a follicle**
   * FSH is secreted from Day 0 through 14 of the reproductive cycle and causes the following events to occur:

1. Primary oocyte enlarges and undergoes meiosis I ;

2. The follicular cells multiply and give rise to stratified epithelium composed of **granulosa cells**;

3. A layer called the **zona pellucida** appears and separates the oocyte from the granulosa cells.

• The follicle is now called a **primary follicle.**

4. A fluid-filled cavity, called the **antrum** appears.

• A crown of granulosa cells surrounds the oocyte (**corona radiata).**

• The follicle is now called a **secondary follicle**.

• See Fig 22.25, page 852.



1. **LH causes ovulation.**
   * A surge of LH on day 14 of the reproductive cycle causes:

• The secondary oocyte to be released into a fallopian tube and

• The follicle becomes the corpus luteum..

V. **THE FEMALE REPRODUCTIVE SYSTEM**

B. **Hormonal Control of Female Reproductive Functions**

See Fig 22.31, page 857 and Table 22.3, page 858.

2. **Secretion of Female Sex hormones:**

1. **Estrogen**
   * + - * is produced by the maturing follicle (of the ovary);

Days 1-14.

* + - * + is responsible for the development of **female secondary sexual characteristics** at puberty, and then maintains them throughout life.
        + Targets:

axillary and inguinal hair follicles.

breasts and mammary glands.

adipose tissue in hips, buttocks, and thighs

endometrium of uterus.

* + - * + Effects include:

increased hair growth in axillary and inguinal regions.

development of breasts and mammary glands.

increased fat deposition in breasts, thighs, and buttocks.

primes endometrium.

1. **Progesterone**
   * + - * is produced by the corpus luteum (of the ovary);

Day 14-24;

* + - * + targets the endometrium of the uterus.
        + prepares the uterus for implantation of the zygote:

thickens the lining;

promotes formation of glands and blood vessels.

V. **THE FEMALE REPRODUCTIVE SYSTEM**

1. **Female Reproductive Cycle**:

See Fig 22.32, page 860 and Table 22.4, page 859.

The female reproductive cycle is approximately **28 days** in length and involves the interaction between several glands, hormones, and target sites.

* + 1. Beginning **at puberty**, on Day 0, the **hypothalamus** secretes a releasing hormone that targets the **anterior pituitary gland** to secrete **FSH**.
       1. FSH is secreted from Days 0-14.
       2. FSH targets a primordial follicle and causes it to mature.
          - The maturing follicle secretes **estrogen**.

Estrogen is secreted from Days 1-14.

Estrogen targets the secondary sex organs to develop at puberty, and then maintains them throughout life.

* + 1. On Day 14, the hypothalamus secretes a second releasing hormone that targets the anterior pituitary gland to secrete **LH.**
       1. LH is secreted on Day 14 only.
       2. LH targets the mature secondary follicle and causes it to burst.
          - The secondary oocyte is released into the fallopian tube.
          - The follicle becomes the corpus luteum.

The corpus luteum secretes **progesterone**.

Progesterone is secreted from Days 14-24.

Progesterone targets the uterine endometrium to prepare for implantation.

Progesterone causes the endometrium to become thick, glandular, and vascular.

V. **THE FEMALE REPRODUCTIVE SYSTEM**

C. **Female Reproductive Cycle**:

* + 1. If implantation does not occur by Day 24, the corpus luteum degenerates and levels of progesterone (and estrogen) decline.
       1. This decline occurs from Days 24-28.
       2. The hypothalamus detects this decrease and initiates a new cycle by secreting a releasing hormone that targets the anterior pituitary gland to secrete FSH on Day 0.
          - FSH begins new cycle by maturing follicle.
          - FSH ends previous cycle through menstruation of the endometrium.
    2. If implantation does occur by Day 24, the corpus luteum continues to secrete progesterone to maintain the developing embryo, until the placenta is formed (end of month 3).

5. During this cycle, estrogen and progesterone inhibit the release of LH and FSH.

a. As the anterior pituitary senses the fall in the concentrations of these hormones, it secretes them again (negative feedback), initiating a new menstrual cycle.

Summary of **Female Reproductive Cycles**: Keyed at the end of this outline.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **HORMONE** |  |  |  |  |
| **secreted by what organ or gland?** |  |  |  |  |
| **days of secretion** |  |  |  |  |
| **target(s) of hormone** |  |  |  |  |
| **response** |  |  |  |  |

VI. **MAMMARY GLANDS (within breast tissue):** See Fig 22.33, page 862.

A. modified sudoriferous (apocrine) glands that produce milk;

B. consist of 15-20 lobes separated by adipose tissue;

C. Each lobe is composed of lobules composed of CT and milk-secreting glands called alveoli;

D. Production/Flow of milk:

1. Milk is produced by alveoli & passes into

2. secondary tubules then into

3. mammary ducts then into

4. lactiferous sinuses (near nipple) then into

5. lactiferous ducts and exits through the

6. nipple.

VII. **Birth Control Methods:** See Table 22.5, page 863.

VIII. **Sexually Transmitted Diseases** See Table 22.6, page 868 for more information.

A. AIDS

B. Chlamydia

C. Genital Herpes

D. Genital Warts

E. Gonorrhea

F. Syphilis

IX**. Other Disorders/Imbalances**

A. Male disorders:

1. Erectile Dysfunction. See introduction on page 830.

2. Testicular cancer: See gray box and page 832.

3. Prostate Enlargement: See Clinical Application 22.1, page 840.

4. Infertility. See Clinical Application 22.2, page 842-843.

B. Female Disorders:

1. Adenosis. See gray box and page 855.

2. Infertility. See Clinical Application 22.3, page 861.

3. Breast Cancer. See Clinical Application 22.4, page 864-865.

X. **Other Interesting Topics:**

A. Assisted Reproductive Technologies. pages 878-879.

B. Human Milk- The Perfect Food for Human Babies. See Clinical Application 23.3, page 907.

XI. **Clinical Terms Related to the Reproductive Systems**. See page 868.

XI. **Innerconnections of the Reproductive System**. See page 869.

**Comparison of Mitosis and Meiosis:**

|  |  |  |
| --- | --- | --- |
| **Event** | **Mitosis** | **Meiosis** |
| **DNA Replication** | **Occurs during interphase before nuclear division occurs.** | **Occurs during interphase before nuclear division occurs.** |
| **Number of Divisions** | **One (PMAT)** | **Two (2xPMAT); no replication between divisions; synapsis occurs during Prophase I.** |
| **Number of daughter cells & genetic composition** | **Two, each diploid (2n) and genetically identical to parent cell.** | **Four, haploid cells (1n), genetically non-identical to parent cell.** |
| **Importance** | **Growth, repair, development of multi-cellular organism from zygote.** | **Production of gametes; reduces chromosome # by ½;**  **variation.** |

**Male Reproductive Organ Summary Table**

|  |  |  |
| --- | --- | --- |
| **Name of Organ** | **Structure** | **Function** |
| **Testes** | **solid ovoid structure held in scrotum;**  **lobules of seminiferous tubules separated by interstitial cells;** | **production of sperm (seminiferous tubules/FSH);**  **secretion of testosterone (interstitial cells, LH)** |
| **Epididymis** | **tightly coiled tubule superior to testes; leads to vas deferens** | **storage of sperm** |
| **Vas Deferens** | **muscular tube leading from epididymis into abdominal cavity** | **movement of sperm** |
| **Seminal Vesicle** | **sac-like structure attached to vas deferens** | **addition of fructose (energy source) to sperm/semen** |
| **Prostate Gland** | **sponge-like structure below bladder and surrounding urethra** | **addition of milky alkaline fluid to semen for sperm motility** |
| **Bulbourethral Glands** | **two pea-shaped structures below prostate** | **addition of penis lubricant to sperm/semen** |
| **Urethra** | **tube leading from bladder/prostate to outside; held within penis** | **transport of sperm and urine to outside** |
| **Penis** | **male excitatory organ; vascular columns fill with blood causing erection** | **is held in female vagina during intercourse for transfer of sperm** |
| **Scrotum** | **pouch of skin and fat that holds testes** | **hold testes at cooler temperature to insure optimum sperm production** |

**FEMALE REPRODUCTIVE Organs Summary Table**

|  |  |  |
| --- | --- | --- |
| **Name of Organ** | **Structure** | **Function** |
| **Ovary** | **solid, ovoid structures on posterior pelvic cavity;**  **cortex of ovarian follicles** | **production of secondary oocytes for fertilization; production of estrogen for development of 2o sex organs;**  **production of progesterone to prepare endometrium for implantation** |
| **Fallopian Tube** | **tubes that pass medially from ovaries to uterus; lined with cilia, expanded ends (fimbriae) over ovary** | **site of fertilization; transportation of fertilized egg to uterus** |
| **Uterus** | **muscular (smooth) organ that houses developing embryo, fetus; 3 layers** | **houses developing embryo/fetus** |
| **Cervix** | **lower one-third of uterus** | **Pap smear location** |
| **Vagina** | **passageway from cervix to outside** | **birth canal; houses erect penis during intercourse** |
| **Labia** | **external reproductive organs** | **protect underlying organs** |
| **Clitoris** | **small projection at anterior end of labia; two columns of vascular tissue** | **female excitatory organ** |

**Summary of Female Reproductive Cycle**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **FSH** | **LH** | **estrogen** | **progesterone** |
| **secreted by what organ or gland?** | **anterior pituitary gland** | **anterior pituitary gland** | **maturing ovarian follicle** | **corpus luteum** |
| **days of secretion** | **Days 0-14** | **day 14** | **days 1-14** | **days 14-24** |
| **target(s) of hormone** | **primordial ovarian follicle** | **Secondary (mature) ovarian follicle** | **secondary sex organs (breasts, hair follicles in axillary and inguinal region, adipose tissue in buttocks and thigh region)** | **endometrium of uterus** |
| **response** | **maturation of ovarian follicle and oocyte (Meiosis I)** | **bursting of ovarian follicle; ovulation = release of secondary oocyte** | **development at puberty; maintenance throughout life until menopause** | **causes endometrium to thicken, become vascular and glandular; preparation for implantation** |