

## I. Female Reproductive System

### A. **Oogenesis** is the formation of the egg (**ovum**) in the female.

1. During fetal development females have **oogonia** which are diploid sex cells.
  - a. While still in the womb the oogonia divide by mitosis to form 1/2-1 million **primary oocytes**.
  - b. These primary oocytes will begin the first meiotic division but stall during prophase I.
  - c. The female is born with these primary oocytes.
2. By the time the female reaches puberty approximately 40,000 of the primary oocytes will remain.
3. Beginning during puberty, each month hormones from the anterior pituitary stimulate a primary oocyte to complete the first meiotic division generating two **secondary oocytes** of unequal size.
  - a. The smaller secondary oocyte is called a **polar body**, containing one set of chromosomes.
  - b. The larger secondary oocyte is the **ovum** (egg) that will be released from the ovary for fertilization by the spermatozoa.
    - i. Only if the ovum is fertilized will it continue the second meiotic division.
    - ii. If fertilized the ovum divides again to produce a second polar body, with the fertilized ovum forming the diploid zygote.
    - iii. If the ovum is not fertilized within 24 hours after release it will be broken down.

### B. The **vulva** (external genitalia)

1. The **labia majora**
  - a. Consist of longitudinal folds of skin with adipose tissue that enclose and protect the other external organs.
  - b. Develops from the same embryonic tissue as the scrotum.
2. The **labia minora**
  - a. Two folds of skin inside the labia majora.
  - b. Anteriorly, form a hood over the clitoris.
  - c. Merge posteriorly with the labia majora.
  - d. Covers the region of the **vestibule**.
3. The **clitoris**
  - a. Consists of two columns of erectile tissue that is richly supplied with sensory receptors.
  - b. Plays a role in initiating sexual excitation and orgasm in the female.
4. The **hymen**
  - a. A fold of mucous membrane that partially closes the vaginal opening.
5. **Paraurethral glands**
  - a. Located in the wall of the urethra.
  - b. Secrete mucous for lubrication.

- c. Develop from the same tissue as the prostate gland in the male.

#### 6. Bartholin's glands

- a. Located on either side of the vaginal opening.
- b. The primary source of mucous for lubrication during intercourse.
- c. Are similar to the bulbourethral glands in the male.

#### C. Internal organs

##### 1. The **vagina**

- a. A canal that extends from the exterior of the body to the cervix of the uterus.
- b. Functions as the birth canal and the female organ of copulation (where the sperm are deposited).
- c. The wall:
  - i. Lined by a mucous membrane with stratified squamous epithelia at the free surface.
  - ii. Includes smooth muscle capable of contraction during intercourse and dilation during childbirth.

##### 2. The **uterus**

- a. A hollow, muscular organ where the fetus develops and is the source of menstrual flow.
- b. Consists of a **fundus, body** and **cervix**.
  - i. The fundus is the dome shaped portion of the uterus superior to the uterine tubes.
  - ii. The body is the central portion of the uterus.
  - iii. The cervix is the portion of the uterus that extends into the vagina.
    - (a) Is typically plugged with mucous to block the entrance of microbes into the uterus.
    - (b) **Cervical cancer** is highly linked to the **Human Papillomavirus**, the virus that causes genital warts.
- c. The wall of the uterus consists of three layers.
  - i. The outermost layer is the **perimetrium**.
    - (a) Is synonymous with the visceral portion of the peritoneum, the serous membrane that covers organs within the abdominal and pelvic cavities.
    - (b) Covers the uterus and forms the **broad and round ligaments** that attach the uterus to the pelvic wall.
  - ii. The middle layer is the **myometrium**.
    - (a) Consists of 3 layers of smooth muscle that forms the bulk of the uterine wall.
    - (b) Contraction of this muscle help to expel the fetus during childbirth.
  - iii. The innermost layer is the **endometrium**.
    - (a) Consists of a mucous membrane with simple columnar epithelium at the free surface.
    - (b) Is divided into the **stratum functionalis** and the **stratum basalis**.

- (i) The stratum functionalis is the superficial layer that is shed with each menstrual cycle.
  - (ii) The stratum basalis is the deeper mitotic layer that regenerates the stratum functionalis.
  - (c) Forms the maternal portion of the placenta.
  - (d) **Endometriosis** is a condition where endometrial tissue is deposited and grows outside the uterus.
    - (i) The tissue enters the pelvic cavity by way of the fallopian tubes and implants on other organs within the abdominopelvic cavity.
    - (ii) The fragments respond to hormonal fluctuations and bleed monthly leading to scarring and inflammation.
    - (iii) A leading cause of female infertility.
3. The **uterine (fallopian) tubes**
- a. Carry the ovum from the ovaries to the uterus.
  - b. Typically where fertilization of the ovum occurs.
  - c. Are twice as wide as a human hair and lined by ciliated epithelium.
  - d. End in fingerlike projections known as **fimbriae** that surround, but are not attached to, the ovary.
    - i. Brush over the surface of the ovary to draw the ovum into the uterine tube.
4. The **ovary**
- a. Where oogenesis occurs.
  - b. Produces the hormones **progesterone** and **estrogen**.
  - c. Are covered by the **germinal epithelium** consisting of cuboid cells.
  - d. The **tunica albuginea** is fibrous tissue deep to the germinal epithelium.
  - e. The inner portion of the ovary is divided into a **cortex** and a **medulla**.
    - i. The cortex contains **ovarian follicles** in different stages of development.
      - (a) The ovarian follicle is the developing ovum surrounded by follicular cells producing estrogen.
      - (b) The **Graafian follicle** is a mature follicle that ruptures and expels the ovum.
      - (c) Once the Graafian follicle has released the ovum the remnant of the follicle is known as a **corpus luteum** which produces progesterone.
    - ii. The medulla consists of connective, vascular and lymphatic tissue.
- D. The female **breast**
- 1. Are the location of **mammary glands**, modified sweat glands that generate milk.

- a. Each mammary gland consists of 15-20 lobes of glandular tissue with ducts that lead to an **ampulla** (milk reservoir) beneath the nipple and adipose tissue.
2. Hormones associated with breast development and function.
  - a. Estrogen stimulates duct formation, adipose deposition and nipple development.
  - b. Progesterone stimulates the development of the glandular tissue.
    - i. Since progesterone is not produced until the female is ovulating, glandular development does not begin until the female has reached sexual maturity.
  - c. **Prolactin** produced during pregnancy, along with estrogen and progesterone, cause breast enlargement and help prepare the breast for milk production.
    - i. After the child is born the reduced levels of estrogen and progesterone (due to loss of the placenta) allow prolactin to stimulate milk production by the glands.
    - ii. Suckling stimulates continued production of prolactin.
  - d. **Oxytocin** is also released due to suckling of the nipple and stimulates the ejection of the milk by the ductile system.
- E. Hormones of the female reproductive cycle
  1. The hypothalamus secretes **gonadotropin-releasing hormones (follicle-stimulating hormone releasing hormone and leuteinizing hormone releasing hormone)** to the anterior pituitary glands which stimulates the release of the hormones **follicle stimulating hormone (FSH)** and **leuteinizing hormone (LH)**.
    - a. FSH (follicle stimulating hormone)
      - i. Targets developing follicles stimulating growth of the follicle and maturation of the oocytes.
      - ii. Stimulates the production of estrogen from the follicular cells.
    - b. LH (leuteinizing hormone)
      - i. Stimulates final maturation of the follicle and the full production of estrogen by the follicular cells.
      - ii. A surge of LH at midcycle stimulates ovulation, release of the developed ovum from the Graafian follicle.
      - iii. Once the ovum is released LH maintains the follicular cells as a corpus luteum.
      - iv. LH stimulates the corpus luteum to produce progesterone and some estrogen.
    - c. Estrogen
      - i. Is the primary female sex hormone produced by the follicle cells, the corpus luteum and the placenta.
      - ii. Responsible for the production and maintenance of the female primary and secondary sex characteristics.
      - iii. Stimulate protein synthesis.

- iv. Targets the uterus stimulating the build up of the endometrium prior to ovulation.
  - d. Progesterone
    - i. Produced by the corpus luteum and the placenta.
    - ii. Targets the uterus with estrogen to prepare the endometrium for implantation and maintains the endometrium during the early stages of pregnancy.
    - iii. If implantation does not occur a drop in progesterone initiates the onset of menstrual flow.
- F. Phases of the 28 day menstrual cycle
  - 1. Menstrual phase**
    - a. Represents the first 5 days of the cycle.
    - b. The stratum functionalis of the endometrium sloughs off during this phase.
      - i. Low levels of progesterone cause the uterine arteries to constrict.
      - ii. The loss of blood flow to the stratum functionalis causes the cells to die and eventually slough off.
  - 2. Proliferative (preovulatory) phase**
    - i. Follows the menstrual phase and continues from day 6 to day 14 when ovulation occurs.
    - ii. Controlled primarily by high levels of estrogen.
    - iii. The stratum functionalis of the endometrium regenerates and a Graafian follicle matures.
  - 3. Secretory (postovulatory) phase**
    - i. Begins with ovulation on day 14 and continues to day 28.
    - ii. Controlled primarily by progesterone.
    - iii. The stratum functionalis continues to thicken in preparation for implantation.
    - iv. If implantation does not occur the corpus luteum begins to degenerate and progesterone levels drop, resulting in the beginning of the menstrual phase.