

Physiology of Male Reproductive System

the anterior pituitary gland serves as the primary control of reproductive function

at puberty Ant Pituitary secretes FSH & large amounts of LH (ICSH)

FSH & LH cause testes to increase in size and begin sperm production

LH → triggers testes to produce testosterone

the secretion of FSH and LH is fairly constant from day to day in males

male hormone (=androgens) are secreted mainly by **interstitial cells** of testes

main male hormone is **Testosterone**

additional testosterone is secreted by Adrenal Cortex

Testosterone functions:

1. local effects on sperm development in seminiferous tubules

decrease in testosterone can cause sterility

2. stimulates general protein synthesis
3. promotes muscular development, bone growth, thickening of skin and growth of facial and body hair
4. development and maintenance of secondary sexual characteristics
hair pattern
thickening of vocal cords and enlargement of larynx to lower of voice pitch
5. behavioral changes (~sex drive, aggression, courtship behaviors)

Androgens are also produced in women

ovary & adrenal cortex

relatively weak

promotes protein synthesis, growth

not masculinizing

Negative feedback loop maintains constant level of testosterone in blood:

→high testosterone levels inhibit LH

Spermatogenesis

process of sperm production → process takes ~ 70-80 days

sperm are produced in **seminiferous tubules**

sperm develop from a type of stem cell = **spermatogonia**

Steps of spermatogenesis:

1. **spermatogonia** remain dormant in childhood
2. at puberty they begin to divide (mitosis)
3. some **spermatogonia** begin moving away from the wall of the tubule and enlarge to become **primary spermatocytes**
4. **primary spermatocyte** undergoes meiosis I to produce **secondary spermatocytes**
5. **secondary spermatocytes** undergo another division to produce **spermatids**

one primary spermatocyte produces 4 spermatids
6. spermatids mature into sperm cells

by the time spermatozoa form they are near the lumen of the seminiferous tubules

spermatozoa are released and washed down the tubule to the epididymus

Spermatozoan Structure

composed of a **head** and a **tail**

head

long "pear" shaped

acrosome – contains enzymes that will be used to penetrate the egg

tail

includes

midpiece → produce the ATP needed for propulsion

flagellum → means of locomotion

Physiology of Female Reproductive System

the major female reproductive processes:

- a. **hormone secretion** by ovary
- b. development of **follicle cells** surrounding egg
- c. **oogenesis & ovarian cycle** → maturation of egg
- d. **menstrual cycle** → development & shedding of uterine lining

in women, all are cyclic events
→ not continuous as in males

involve a complex combination of several interdependent hormonal cycles

Hormone production

Puberty: Ant Pituitary begins secreting FSH and LH
~7-8 yrs old

FSH & LH production increases until ~11-13 yrs old
→ triggers menstrual cycle & development of secondary sex characteristics

FSH & LH stimulate follicle cells in ovary to begin secreting estrogen & progesterone

Estrogen function:

1. development and maturation of reproductive tract
2. development and maintenance of secondary sexual characteristics
 - change in fat distribution
 - enlargement of mammary glands
 - inhibits growth of extremities
3. behavioral changes (~sex drive, courtship behaviors)

Progesterone function:

1. has its greatest effect on estrogen primed tissues
2. changes that favor pregnancy and lactation
 - endometrial thickening
 - development of mammary glands

Oogenesis

in fetus, immature egg cells (=oogonia) multiply by mitosis until 5th month of gestation

during reproductive years, 10-20 primary oocytes and follicles begin to develop each month.

normally just one of these reaches maturity and ovulates and the rest degenerate

as follicle cells develop, egg develops within under influence of FSH & LH from Ant. Pituitary

egg undergoes meiosis but stops as **secondary oocyte** (metaphase II) until fertilization

only ~400 – 500 follicles will ever develop into mature ova and be released by ovaries during a woman's reproductive years

when woman reaches menopause (~50 yrs) very few primary follicles are left in ovaries
→ reproduction ceases

Development of Follicle Cells

within the ovary immature egg cells = **primary oocytes** are enclosed within **primordial follicles**

each month secretions of FSH stimulates some of these to develop into **primary follicles**

mitosis & development of these cells → they begin to produce **estrogens**

by 10 days or so only one primary follicle remains and has matured into a mature follicle (= **graafian follicle**)

mature (graafian) follicle contains egg surrounded by fluid filled **antrum**
→ this is the follicle that will ovulate

after ovulation, the follicle collapses and becomes the **corpus luteum**
→ secretes large amounts of progesterone

egg nest → follicle → antrum → develops → Graafian follicle → ovulation → Corpus Luteum → Corpus Albicans

corpus albicans = scar tissue

the maturation of the egg, ovulation, hormone production and preparation of uterine lining are all cyclic events

these cycles are roughly 28 days long and have different names

depending on the process in focus

The Ovarian Cycle

divided into:

a. follicular phase

a single follicle matures and is released at ovulation
lasts ~12 days

b. luteal phase

remaining follicle cells develop into corpus luteum
lasts ~11 days

c. menstrual phase

uterine endometrium is shed =menstruation
lasts ~5 days

The Menstrual Cycle

This cycle is tied to variations in several hormones

4 phases:

menstrual phase (days 1-6)

shedding of uterine lining if no fertilization

proliferative (follicular) phase (days 6-12)

as follicle develops it secretes increasing amounts of estrogen
endometrium cells proliferate

ovulatory phase (days 12-16)

ovulation → release of mature egg from ovary

secretory (luteal) phase (days 16-28)

follicle cells left behind after ovulation develop into corpus luteum
corpus luteum secretes increasing amounts of progesterone
continued increase in development of endometrium

Mammary Glands

during pregnancy breast development is stimulated by **estrogen** and **progesterone** secreted by placenta

at birth shedding of placenta

→ cuts off source of these hormones

→ stimulates Ant. Pit. to secrete prolactin

Prolactin stimulates lactation (devel of milk in glands)
usually takes several days for full milk production

Suckling of infant further stimulates secretion of
prolactin

oxytocin (from Post. Pituitary)

→ promotes ejection of milk into ducts

+feedback: more suckling → more milk released