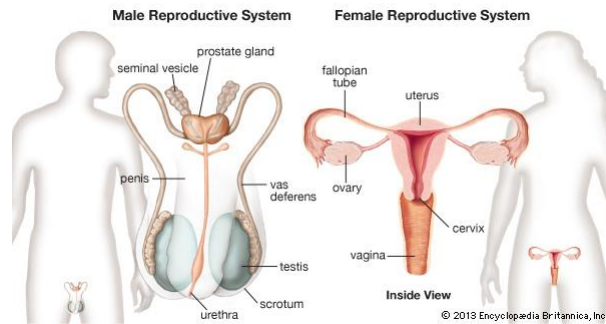


The Reproductive System



1

Male Reproductive System Delivers Sperm

- **Testes** produce sperm
 - **Scrotum**
 - sac of skin and smooth muscle that holds the testes
 - Maintains testes at a slightly lower temperature
 - **Seminiferous tubules** within testes
 - produce sperm
- **Epididymis** and **ductus deferens**
 - sperm become motile and are stored here
- **Ductus deferens**
 - transports sperm to where it becomes the ejaculatory duct

2

Male Reproductive System Delivers Sperm

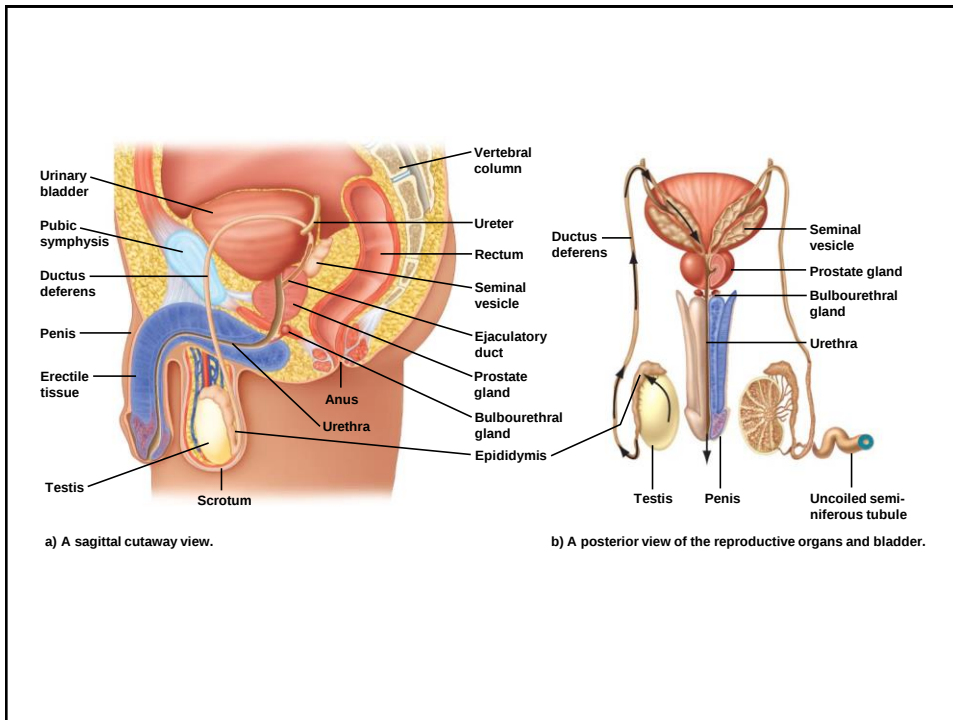
- Route of sperm through male reproductive structures
 1. Seminiferous tubules
 2. Epididymis
 3. Ductus deferens
 4. Ejaculatory duct
 5. Penis

3

Accessory Glands Help Sperm Survive

- Seminal vesicles
 - Secrete fructose (provides source of energy for sperm) and most of seminal fluid
- Prostate gland
 - Secretes watery alkaline fluid to raise vaginal pH
- Bulbourethral gland
 - Secretes lubricating mucus
 - Cleanses urethra

4

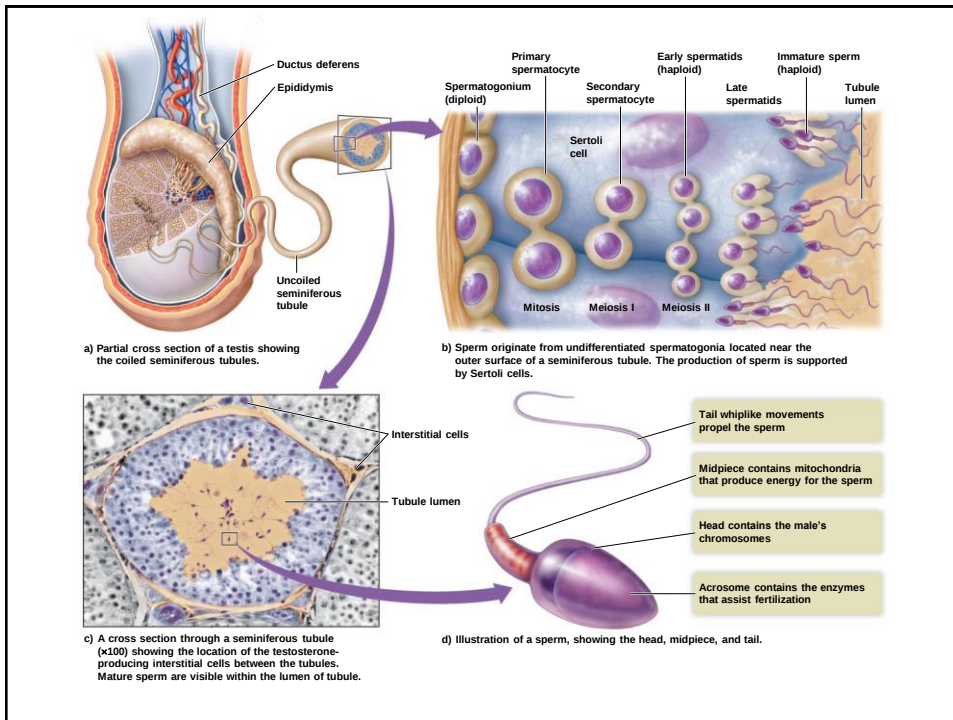


5

Sperm Production Requires Several Cell Divisions

- Several cell divisions (mitosis and meiosis) in seminiferous tubules
- Purpose
 - Produce a large number of sperm with half the number of chromosomes of somatic cells (haploid)
- Sequence of cell types, leading to sperm
 - Spermatogonia ($2n$), primary spermatocyte ($2n$), secondary spermatocyte (n), spermatids (n), sperm (n)
- Sertoli cells provide support, nourishment

6



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Testosterone Affects Male Reproductive Capacity

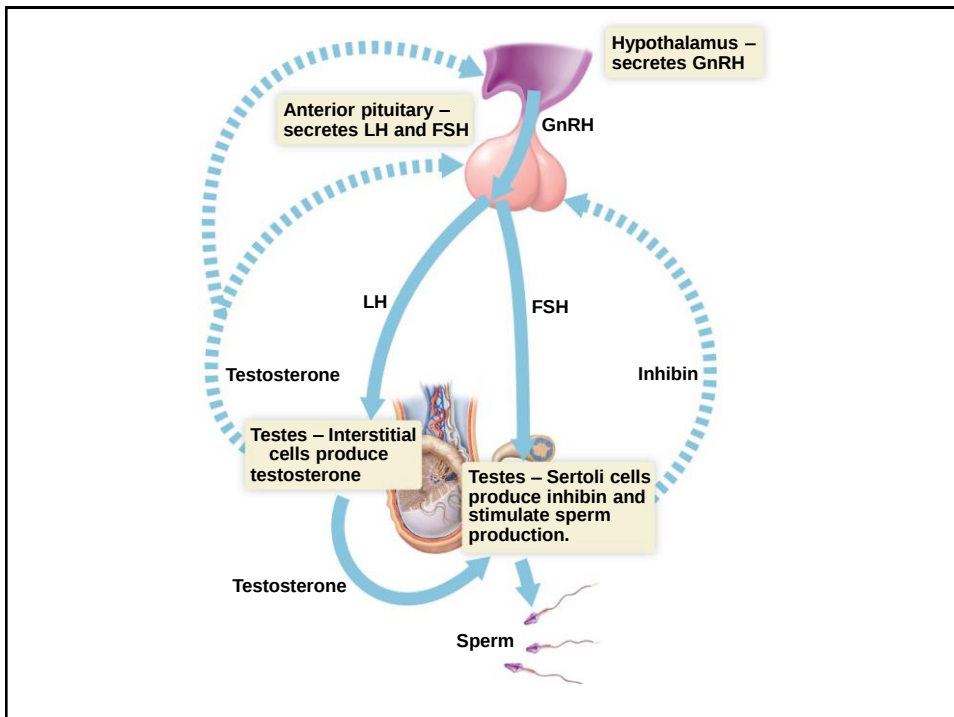
- Testosterone
 - Steroid hormone produced by **interstitial cells** in testes (between seminiferous tubules)
 - Function
 - controls growth and function of male reproductive tissues
 - stimulates aggression and sexual behavior
 - secondary sexual characteristics
 - Determines rate of sperm formation

8

Testosterone Affects Male Reproductive Capacity

- Hormones that regulate testosterone and sperm production
 - Gonadotropin-releasing hormone (**GnRH**) from hypothalamus
 - **LH** (from anterior pituitary) stimulates production of testosterone
 - **FSH** (from anterior pituitary) may enhance sperm formation with Sertoli cells
 - **Inhibin**: produced by Sertoli cells, inhibits secretion of FSH

9



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Female Reproductive System Produces Eggs and Supports Pregnancy

- Ovaries
 - Release oocytes (immature eggs) and secrete the hormones estrogen and progesterone
- Uterine Tube (oviduct / fallopian tube)
 - Leads from the ovary to the uterus
 - Fertilization occurs in the upper third of the uterine tube

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Female Reproductive System Produces Eggs and Supports Pregnancy

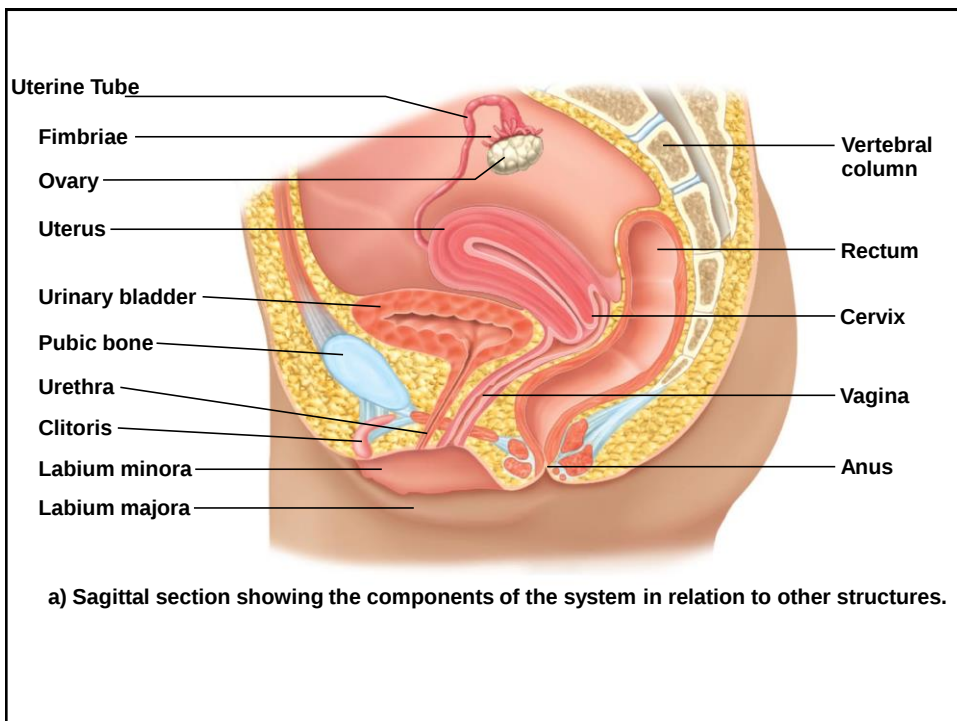
- Uterus
 - the hollow, pear-shaped organ where fertilized egg grows and develops
- Layers
 - **Endometrium**: supports fertilized egg, part of it sloughs off during menstrual flow
 - **Myometrium**: smooth muscle, expands during pregnancy, constricts during labor
 - **Cervix**: the narrow opening in the lower part of the uterus that permits sperm to enter the uterus and allows the fetus to exit during birth

12

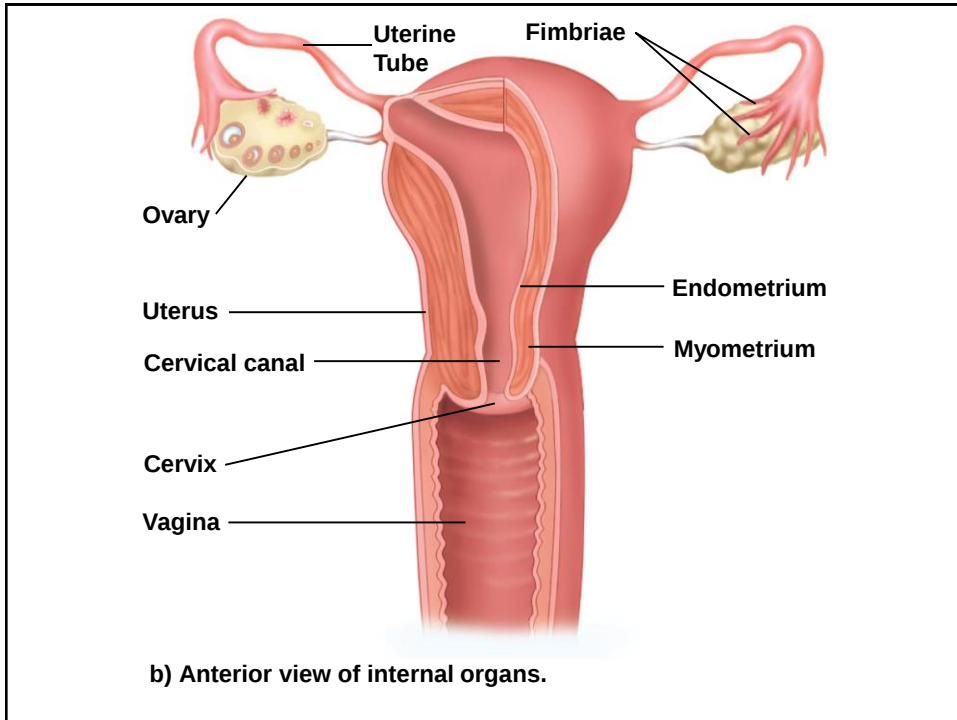
Female Reproductive System Produces Eggs and Supports Pregnancy

- Vagina
 - Organ of sexual intercourse and birth canal
- External genitalia
 - Labia majora and minora
 - Clitoris

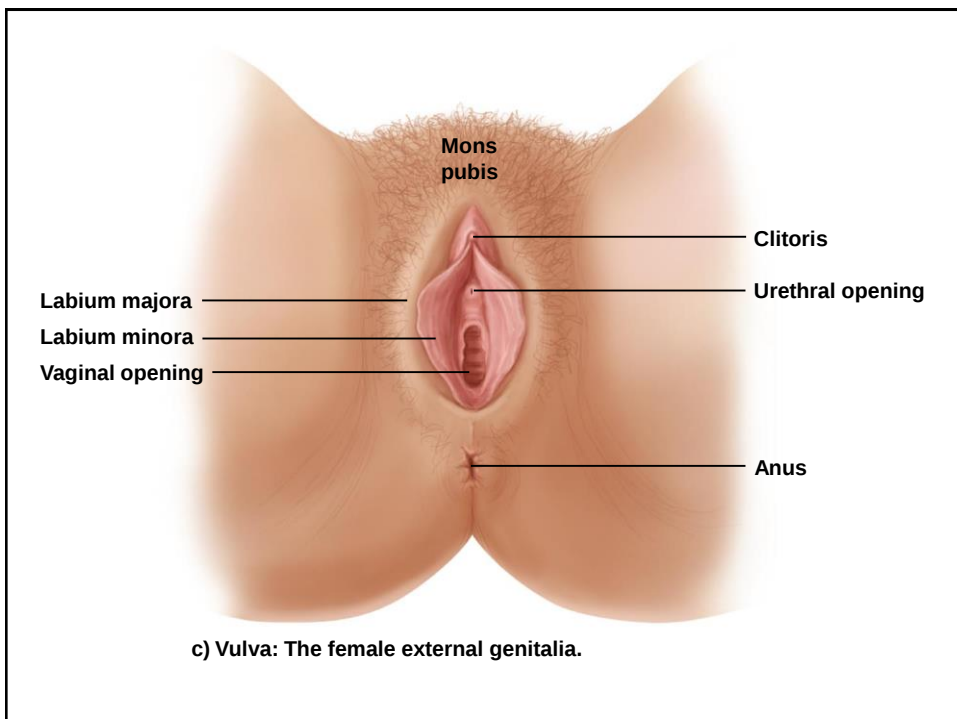
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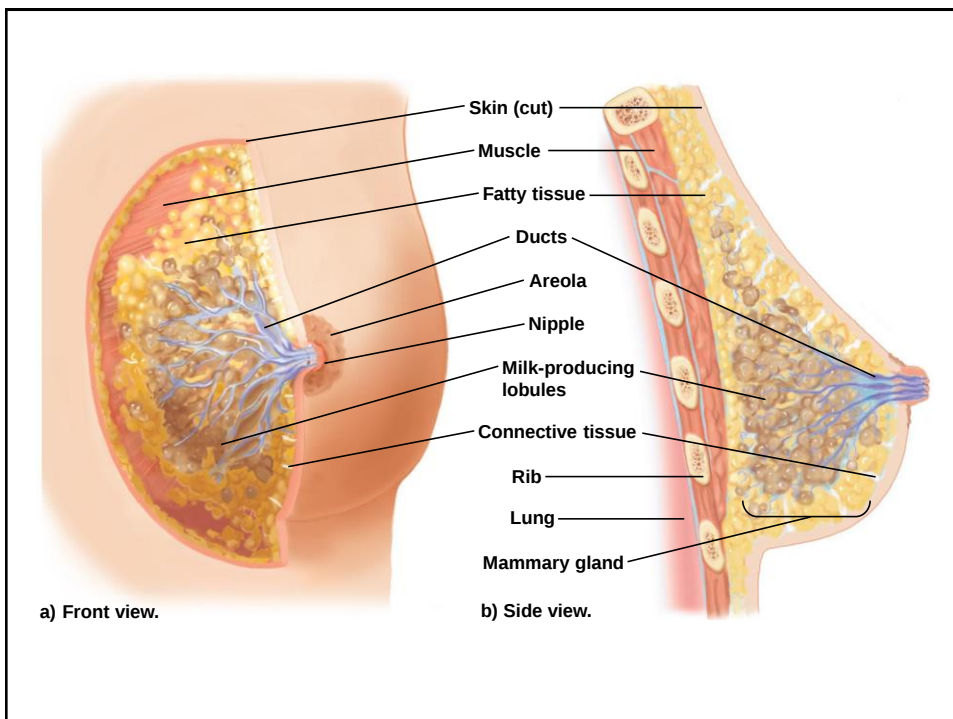


16

Mammary Glands Nourish the Infant

- Breasts contain mammary glands
- Technically, mammary glands are modified sweat glands, part of the integumentary system
- Specialized for lactation (production of milk)
- Hormonal control of lactation:
 - Prolactin (anterior pituitary hormone) – stimulates milk production
 - Oxytocin (posterior pituitary hormone) – stimulates contractions that eject milk

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Menstrual Cycle

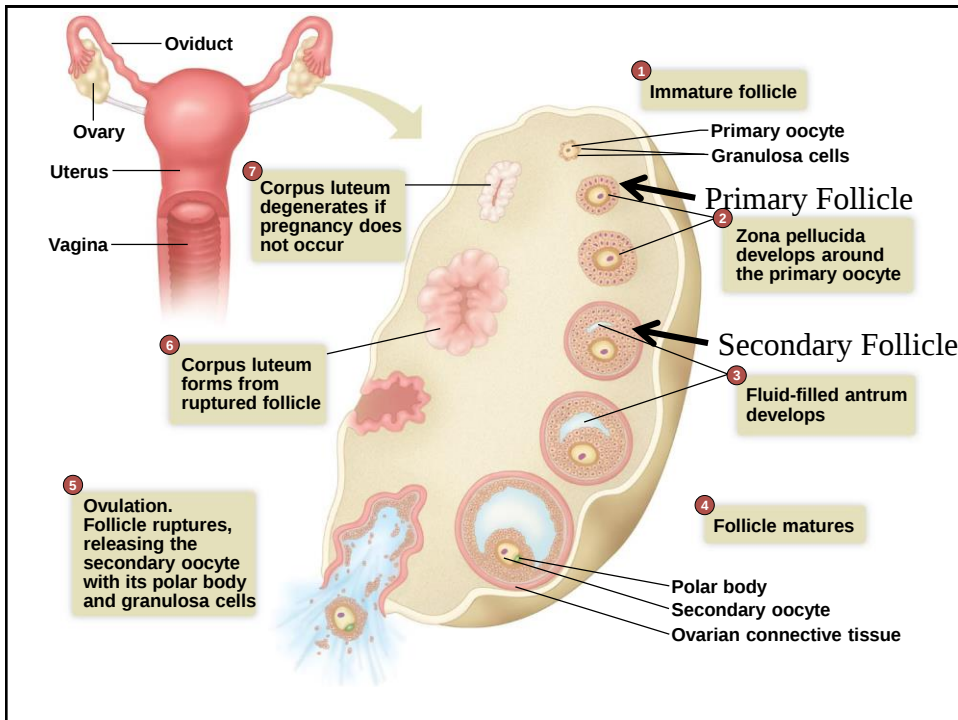
- Consists of two linked cycles
 - **Ovarian cycle**
 - Series of changes in ovaries associated with oocyte maturation
 - Controlled by FSH and LH
 - **Uterine cycle**
 - Changes in the endometrial lining of the uterus
 - Controlled by estrogen and progesterone

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Ovarian Cycle: Oocytes Mature and are Released

- Immature follicle of primary oocyte and granulosa cell develops; FSH and LH increase
- Antrum develops within follicle; some estrogen and progesterone secreted
- Secondary oocyte and polar body produced; follicle matures (Graafian follicle)
- Increasing estrogen causes surge of LH; ovulation occurs
- Corpus luteum formed from follicle; large amounts of estrogen and progesterone secreted

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Ovarian Cycle: Oocytes Mature and are Released

- If fertilization and pregnancy occurs
 - Chorion (embryonic tissue) secretes human chorionic gonadotropin (hCG)
 - hCG is detected by pregnancy tests
 - hCG causes corpus luteum to continue to produce estrogen and progesterone for another 9–10 weeks
 - After 9–10 weeks, the placenta takes over progesterone and estrogen production
 - High levels of estrogen and progesterone prevent ovulation during pregnancy

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Uterine Cycle Prepares Uterus for Pregnancy

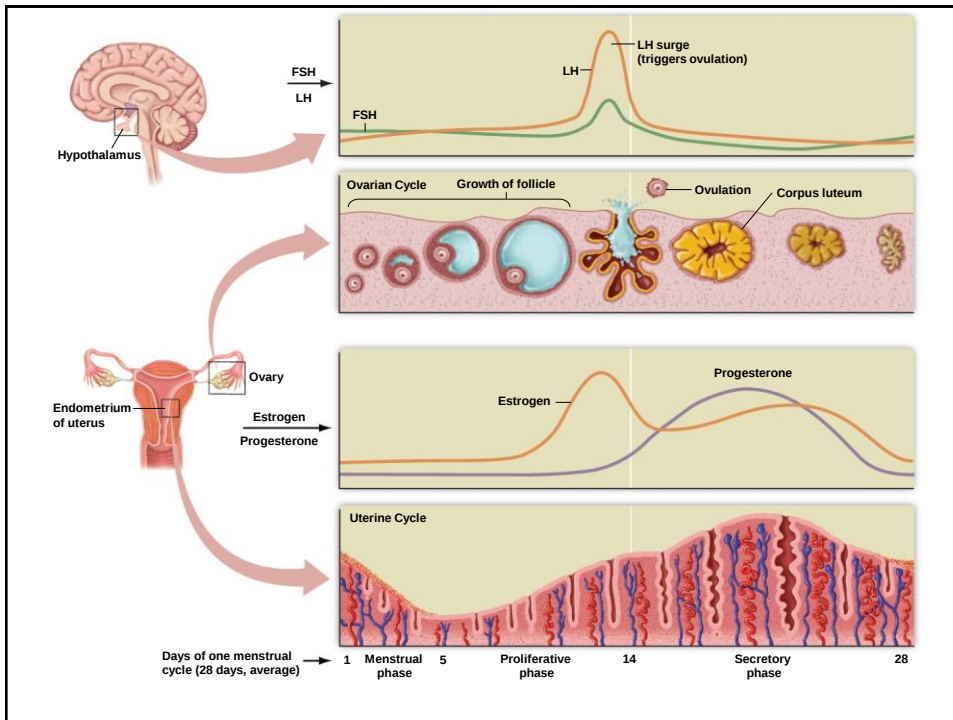
- Series of changes that occur in endometrium as it prepares for the possibility of a fertilized egg
- **Menstrual phase**
 - Days 1–5
 - Estrogen and progesterone decrease
 - Endometrial lining degenerates
 - Menstruation occurs
- **Proliferative phase**
 - Days 6–14
 - Estrogen and progesterone increase
 - Endometrial lining proliferates

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Uterine Cycle Prepares Uterus for Pregnancy

- **Ovulation**
 - Day 14
- **Secretory phase**
 - Days 15–28
 - Corpus luteum produces progesterone and estrogen
 - Endometrium continues to proliferate
 - Uterus is prepared to accept and nourish a fertilized egg

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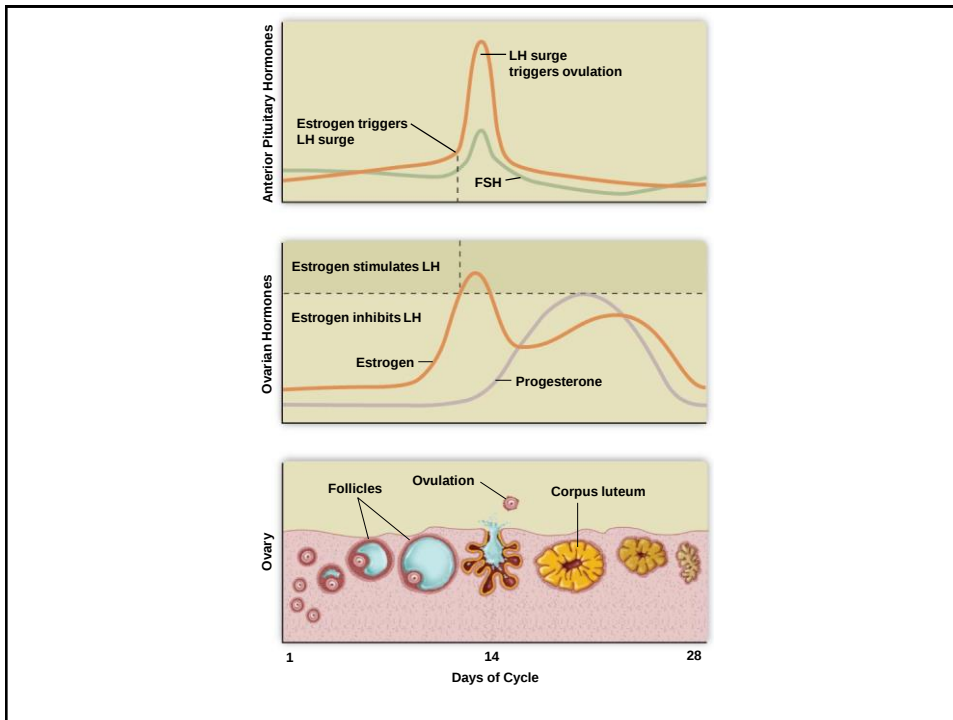


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Cyclic Changes in Hormone Levels Produce Menstrual cycle

- Cycles of hormones
 - Positive feedback
 - Causes an event to continue
 - In proliferative phase, increasing estrogen causes surge in LH, which in turn causes ovulation
 - Negative feedback
 - Causes an event to be stopped / reversed
 - In secretory phase, steady levels of estrogen and progesterone inhibit LH and FSH release

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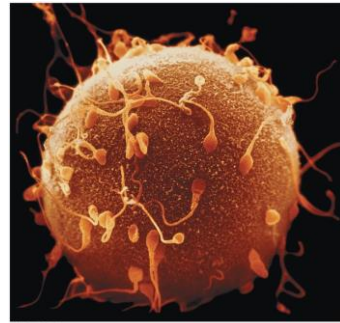
Human Sexual Response, Intercourse, and Fertilization

- Human sexual response
 - Excitement, plateau, orgasm, resolution
 - Male sexual response
 - orgasm, marked by ejaculation, refractory period
 - Female sexual response
 - orgasm, marked by rhythmic muscular contractions

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Human Sexual Response, Intercourse, and Fertilization

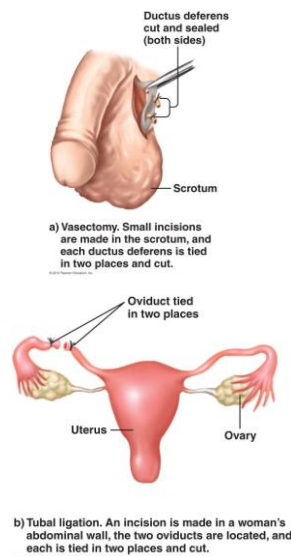
- Fertilization
 - Ejaculate may contain several hundred million sperm
 - One sperm penetrates egg



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Birth Control Methods: Controlling Fertility

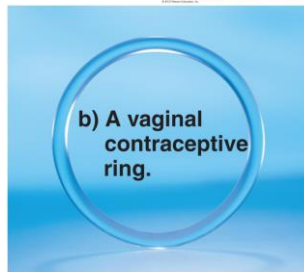
- Abstinence
 - not having intercourse
- Surgical sterilization
 - **Vasectomy** in males: cut and tie off both ductus deferens
 - **Tubal ligation** in females: cut and tie off both oviducts
 - **Hysteroscopy** in females: cauterize the oviducts to seal them



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Birth Control Methods: Hormonal Methods

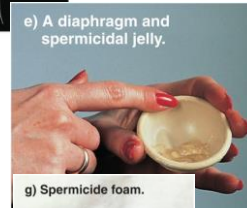
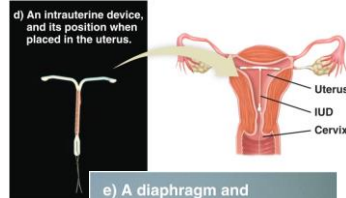
- Birth control pills (oral contraceptives)
 - Combination of synthetic progesterone and estrogen
 - Inhibit release of FSH and LH
 - Block ovulation
- Hormone injections
 - DepoProvera, Lunelle
- Hormone patch
 - Ortho Evra
- Vaginal ring
 - NuvaRing



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Birth Control Methods: Other

- IUDs (Intrauterine devices)
 - Small plastic or metal piece inserted into uterus
 - Create mild chronic inflammation that prevents fertilization or implantation
- Diaphragms and cervical caps
 - Prevent sperm from entering the cervix
- Chemical spermicides
 - Kill sperm cells
- Condoms
 - Trap ejaculated sperm



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Birth Control Methods: Other

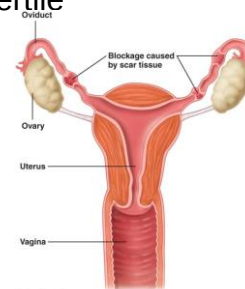
- Natural alternatives
 - Rhythm method, withdrawal
- Morning-after pills
 - Prevent pregnancy from continuing
 - Preven, Plan B, Mifeprex (RU-486)
- Abortion
 - Terminates pregnancy
- The future
 - Male birth control pill
 - Vaccines for women



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Infertility: Inability to Conceive

- Many causes of infertility
 - Number and quality of sperm
 - < 60 million/ejaculation is considered infertile
 - Pelvic inflammatory disease (PID)
 - Scarred, blocked oviducts
 - Abnormal production of FSH, LH
 - Irregular menstrual cycles
 - Endometriosis
 - Decreased reproductive capacity with age
 - Miscarriage (spontaneous abortion)



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Enhancing Fertility

- Artificial insemination
- In vitro fertilization (IVF)
 - Fertilization in test tube outside of the body
- GIFT (gamete intrafallopian transfer)
 - Unfertilized eggs and sperm placed directly in oviduct

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Enhancing Fertility (cont.)

- ZIFT (zygote intrafallopian transfer)
 - Fertilized egg is placed in oviduct
- Fertility-enhancing drugs
 - Boost production of developing eggs
- Surrogate motherhood

36

Sexually Transmitted Diseases (STDs): Worldwide Problem

- Transmitted by sexual contact, including
 - Genital, oral-genital, anal-genital
- Bacterial
 - Gonorrhea, syphilis, chlamydia
- Other
 - Yeasts (Candida), protozoan (Trichomonas), arthropod (pubic lice)



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Sexually Transmitted Diseases (STDs): Worldwide Problem

- Viral
 - HIV, hepatitis B, genital herpes, HPV



a) Genital herpes on the external genitalia of the female. Genital herpes is generally caused by HSV-2.

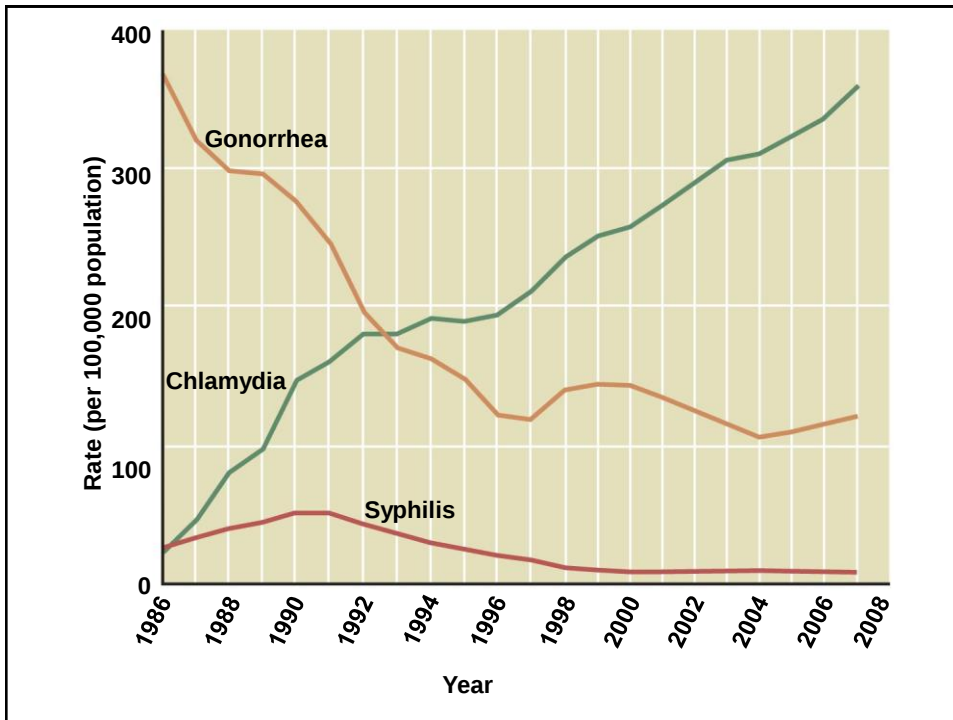


b) Genital herpes on the penis of the male.

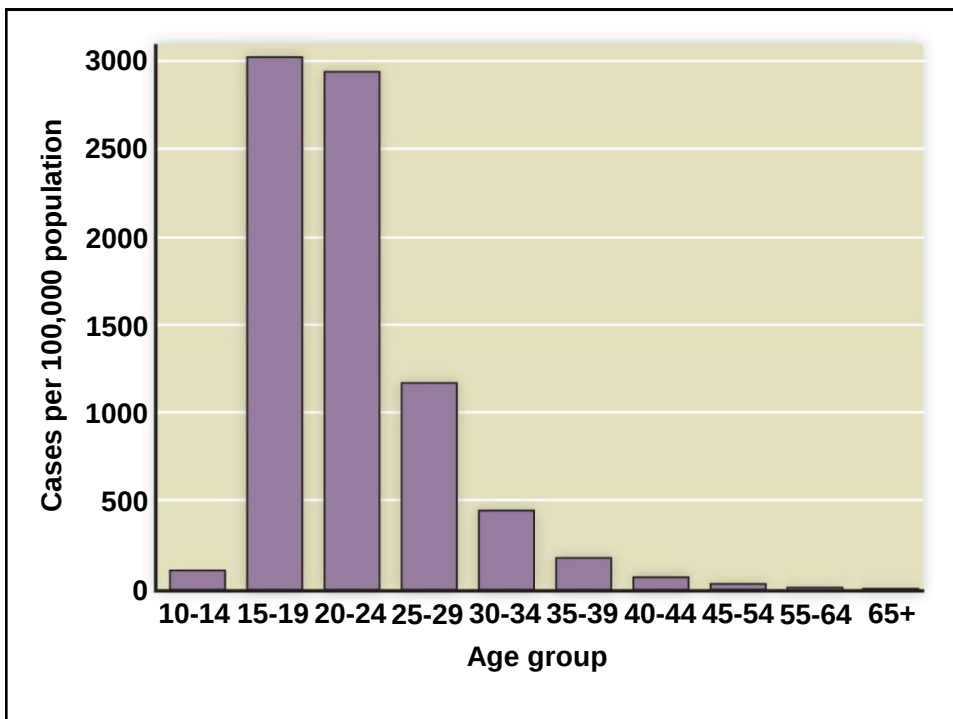


c) Oral herpes. Cold sores on the lips (also called fever blisters) generally are caused by HSV-1.

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Sexually Transmitted Diseases (STDs): Worldwide Problem

- Prevention strategies
 - Choose partner wisely
 - Communicate
 - Use suitable barriers
 - Get tested and treated
 - Get vaccinated