

# 16

## **The Reproductive System**

# The Reproductive System

- **Gonads** — primary sex organs
  - **Testes** in males
  - **Ovaries** in females
- Gonads produce gametes (sex cells) and secrete hormones
  - **Sperm** — male gametes
  - **Ova** (eggs) — female gametes

- Male Reproductive System Overview

# Male Reproductive System (Overview)

- **(a) Testes**
- **(b) Duct system**
  - Epididymis
  - Ductus (vas) deferens
  - Urethra

# Male Reproductive System (Overview) continued

- **(c) Accessory organs**

- **Seminal vesicles**
- **Prostate**
- **Bulbourethral glands**

- **(d) External genitalia**

- **Penis**
- **Scrotum**

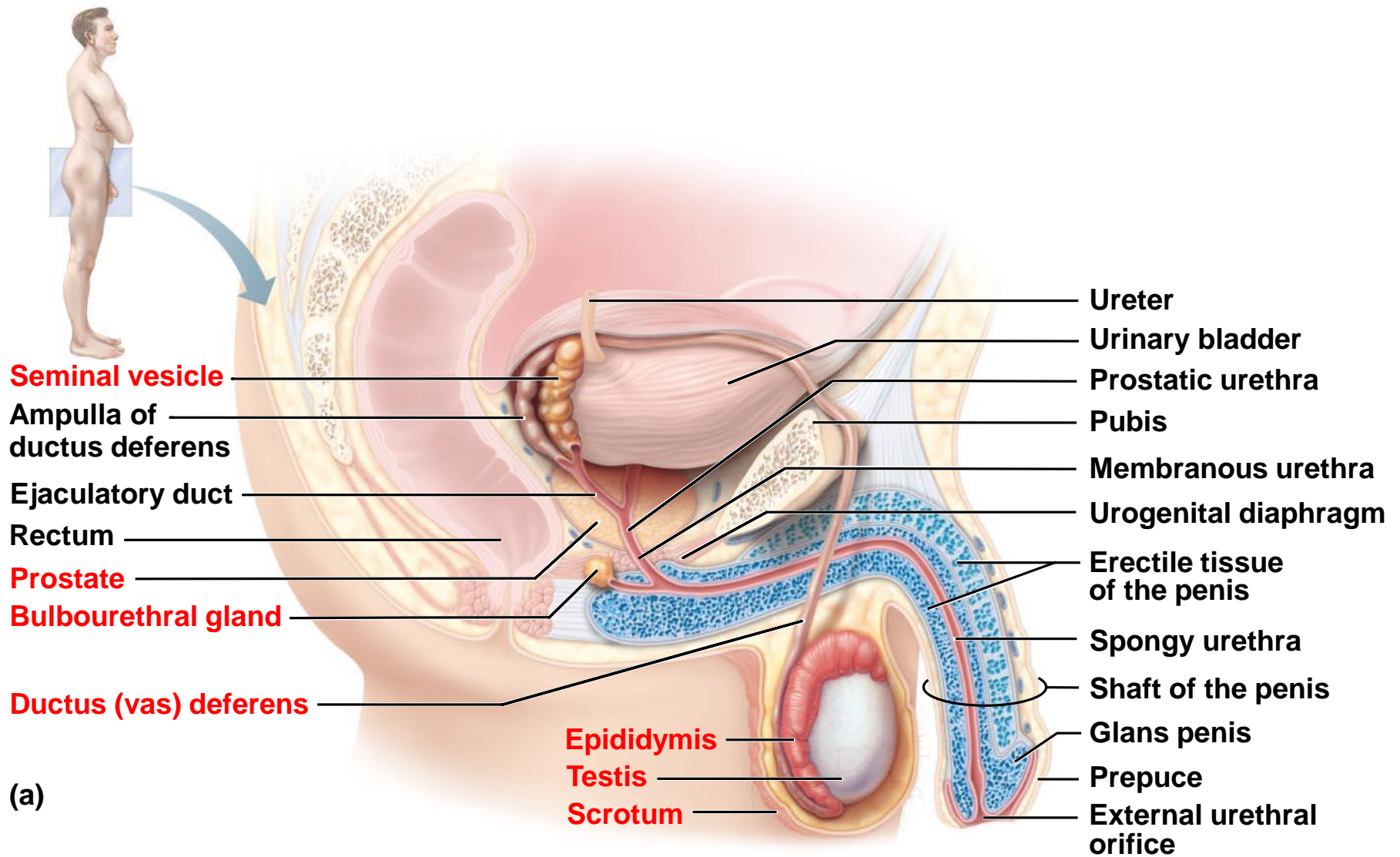
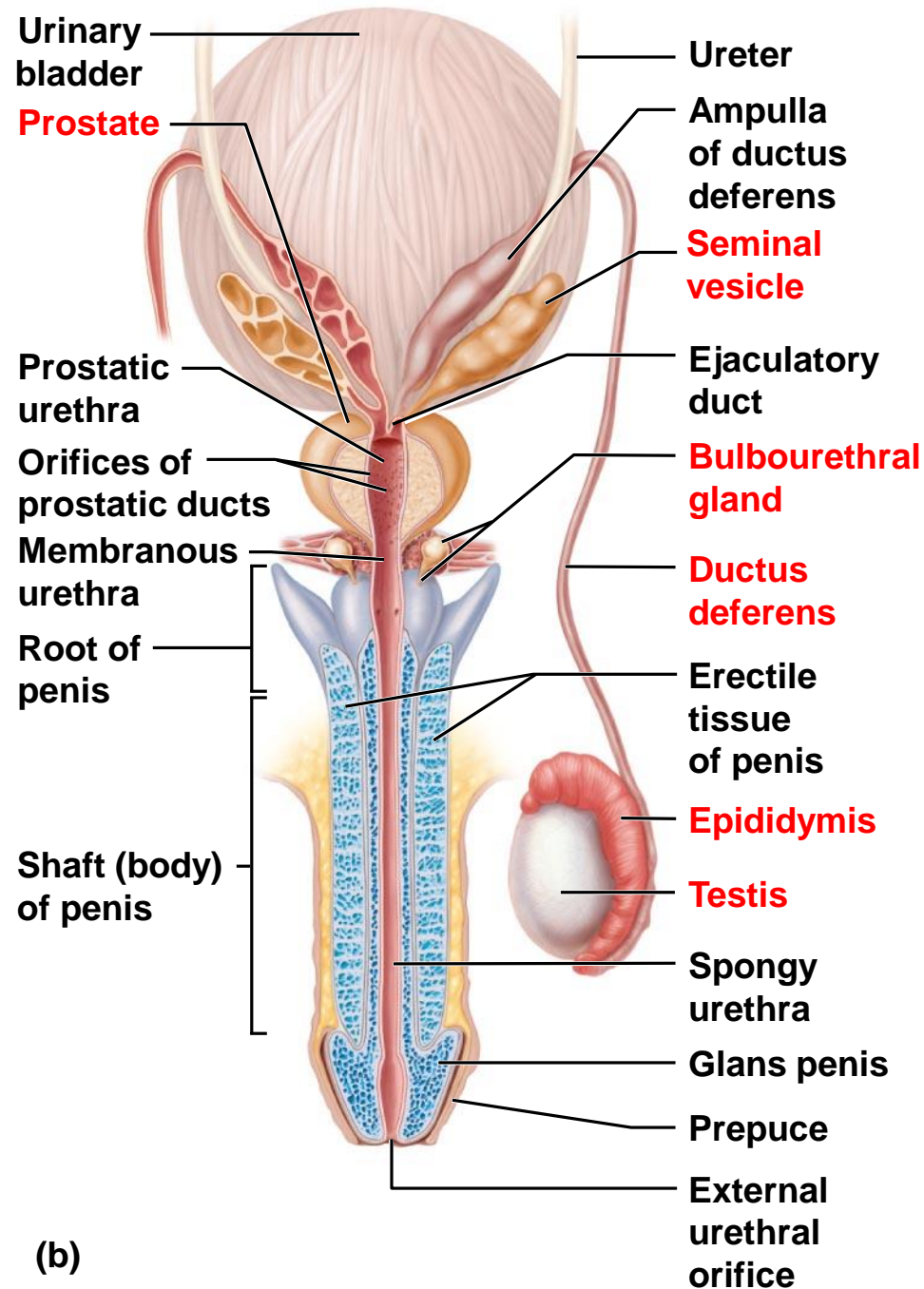


Figure 16.2a



(b)

Figure 16.2b

# (a) Testes

- Coverings of the testes
  - **Tunica albuginea** — capsule that surrounds each testis
  - **Septa** — extensions of the capsule that extend into the testis and divide it into lobules



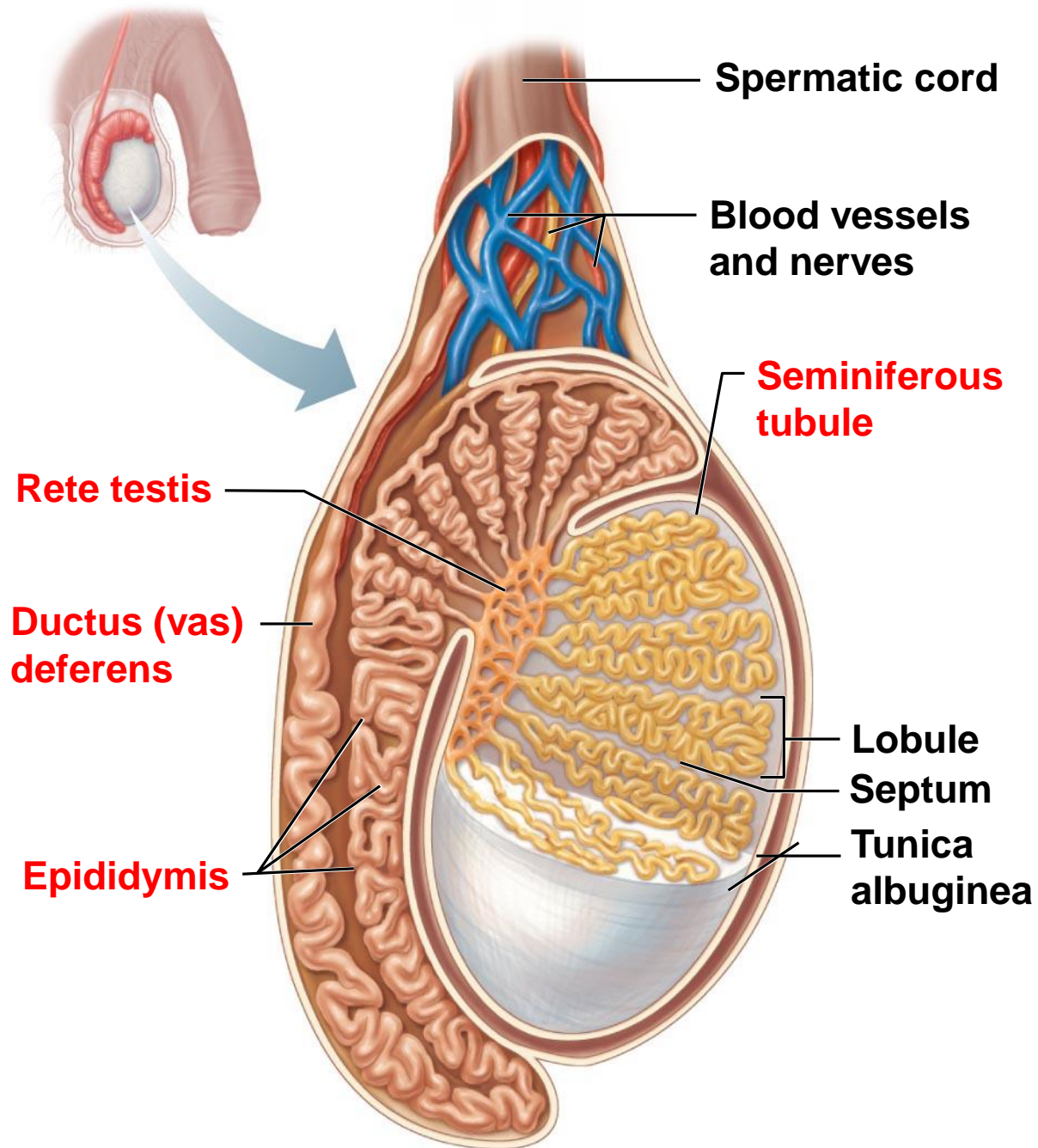


Figure 16.1

## (a) Testes (continued)

- Each lobule contains one to four **seminiferous tubules**
  - Tightly coiled structures
  - Function as **sperm-forming factories**
  - Empty sperm into the **rete testis** (first part of the duct system)
- Sperm travels through the rete testis to the **epididymis**
- Interstitial cells in the seminiferous tubules produce **androgens** such as **testosterone**

## (b) Duct System

- Epididymis
- Ductus (vas) deferens
- Urethra

# Epididymis

- Comma-shaped, tightly coiled tube
- Found on the superior part of the testis and along the posterior lateral side
- **Functions to mature and store sperm cells (at least 20 days)**
- Expels sperm with the contraction of muscles in the epididymis walls to the vas deferens

# Ductus Deferens (Vas Deferens)

- Carries sperm from the **epididymis** to the **ejaculatory duct**
- Passes through the **inguinal canal** and over the bladder
- Moves sperm by **peristalsis**
- **Spermatic cord** — ductus deferens, blood vessels, and nerves in a connective tissue sheath

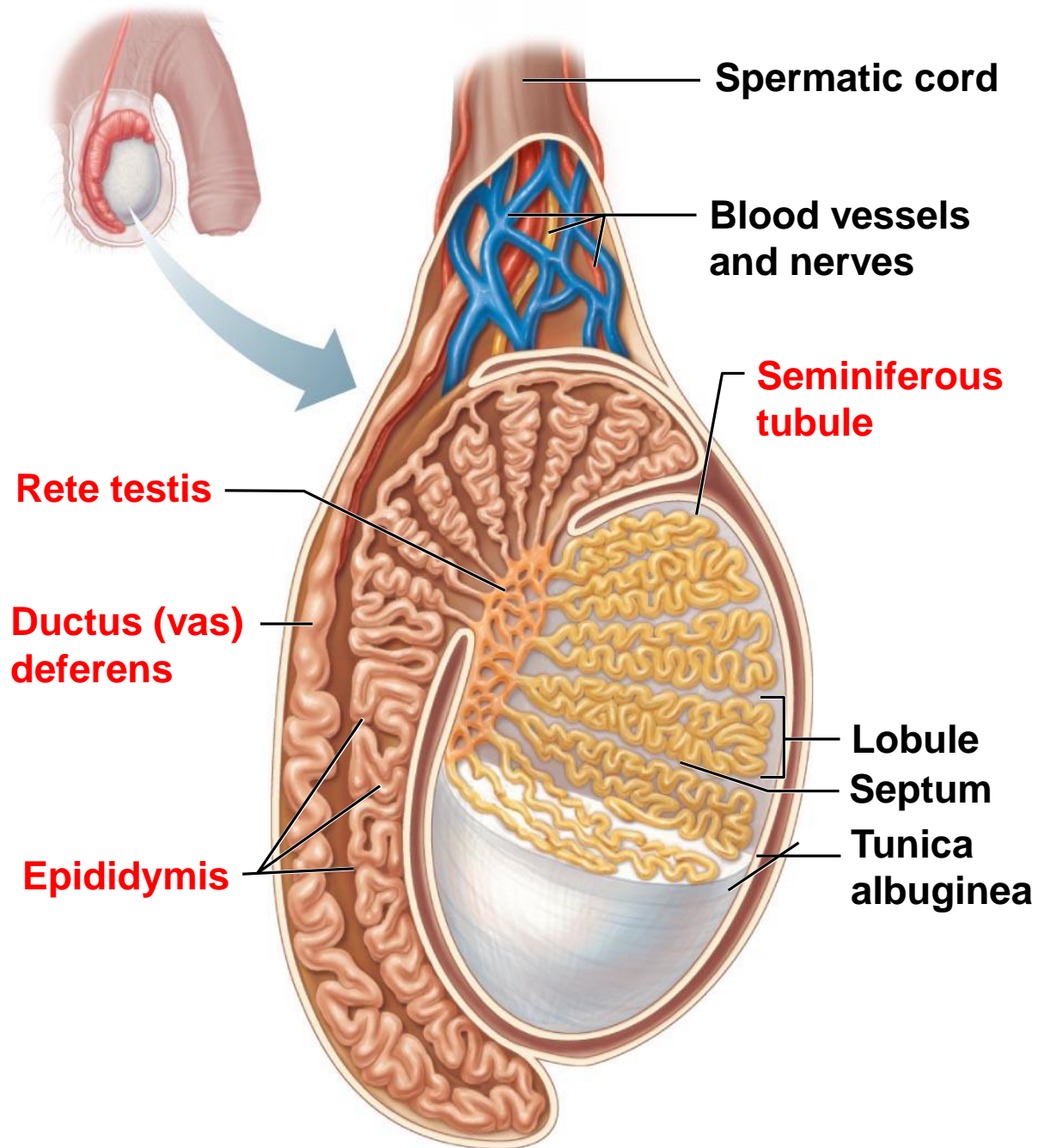


Figure 16.1

# Ductus Deferens (Vas Deferens)

- Terminates in the **ejaculatory duct** which unites with the urethra
- Expanded end of the ductus deferens is called the **ampulla**
  - **Ejaculation** — smooth muscle in the walls of the ductus deferens create peristaltic waves to squeeze sperm forward
  - **Vasectomy** — cutting of the ductus deferens at the level of the testes to prevent transportation of sperm (form of birth control)

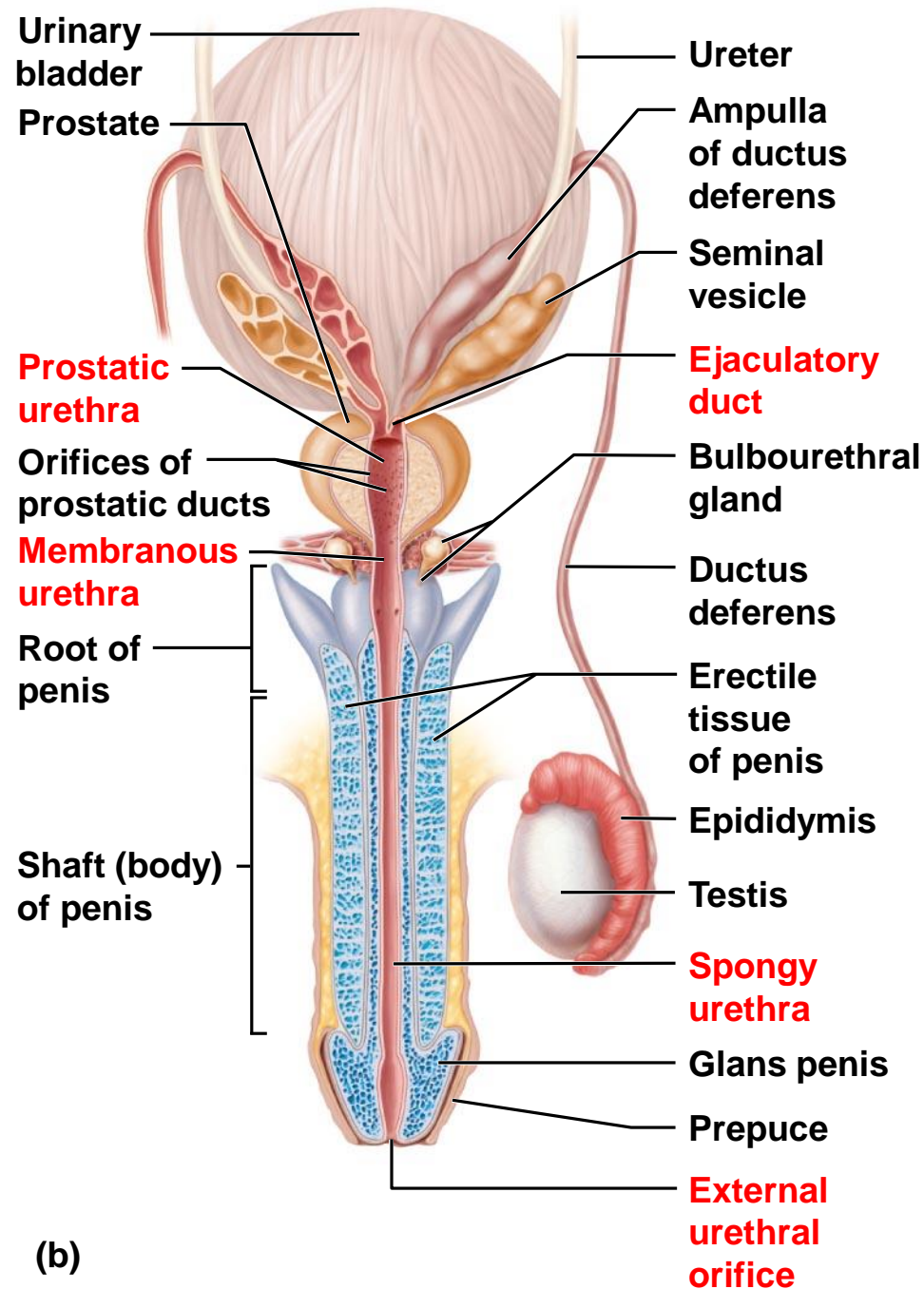
# Urethra

- Extends from the base of the urinary bladder to the tip of the penis
- Carries both **urine and sperm**
- Sperm enters from the ejaculatory duct



# Urethra

- Regions of the urethra
  - **Prostatic urethra** — surrounded by prostate
  - **Membranous urethra** — travels from prostatic urethra to penis
  - **Spongy (penile) urethra** — runs the length of the penis



(b)

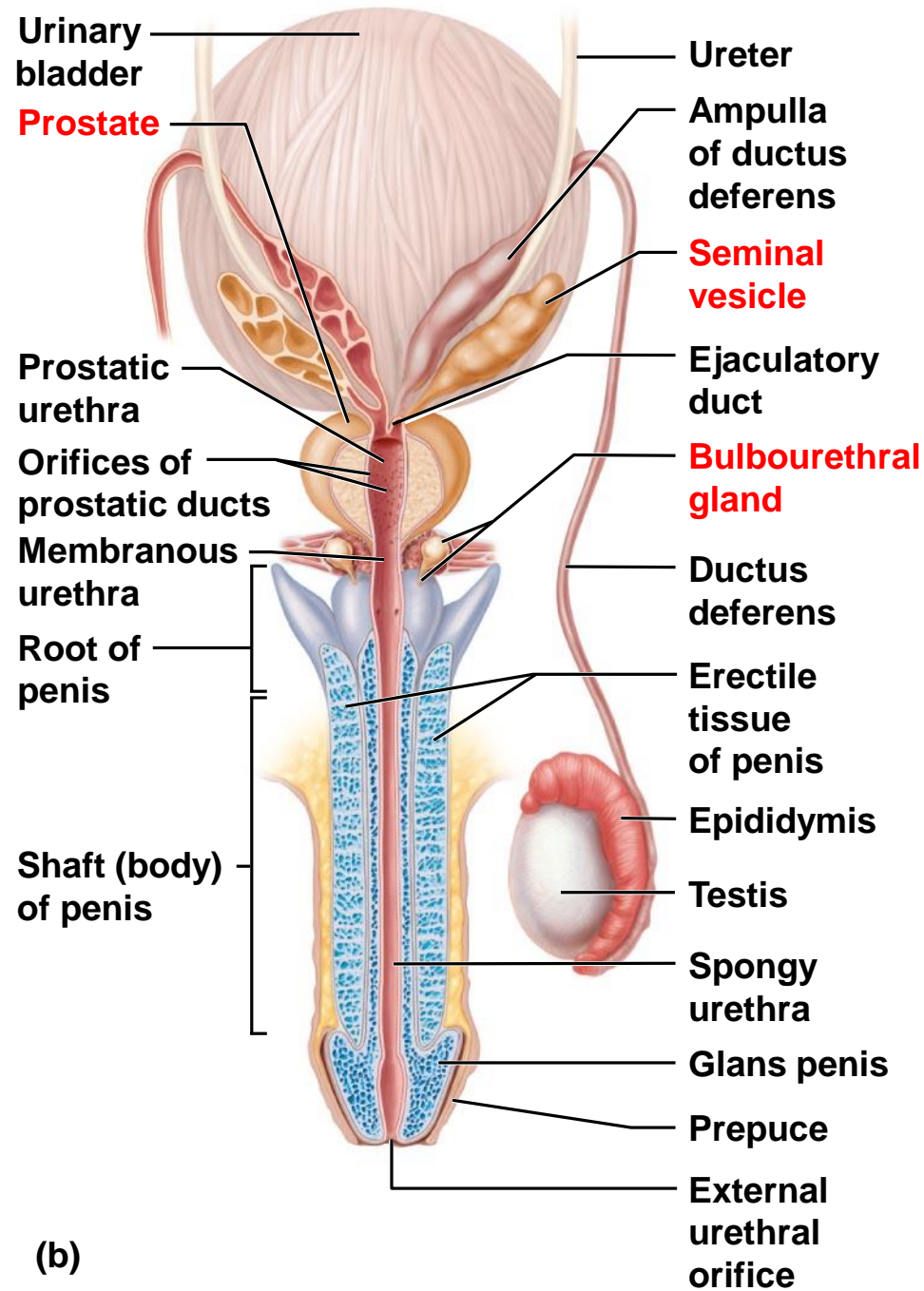
Figure 16.2b

## (c) Accessory Organs

- **Seminal vesicles**
- **Prostate**
- **Bulbourethral glands**

# Seminal Vesicles

- Located at the base of the bladder
- Produces a **thick, yellowish secretion** (60 percent of **semen**)
  - Fructose (sugar)
  - Vitamin C
  - Prostaglandins
  - Other substances that nourish and activate sperm



(b)

Figure 16.2b

# Prostate

- Encircles the upper part of the urethra
- Secretes a **milky fluid**
  - Helps to **activate sperm**
  - Enters the urethra through several small ducts
- **Prostatitis** – inflammation of the prostate
- **Prostate cancer** – third most common cancer in males

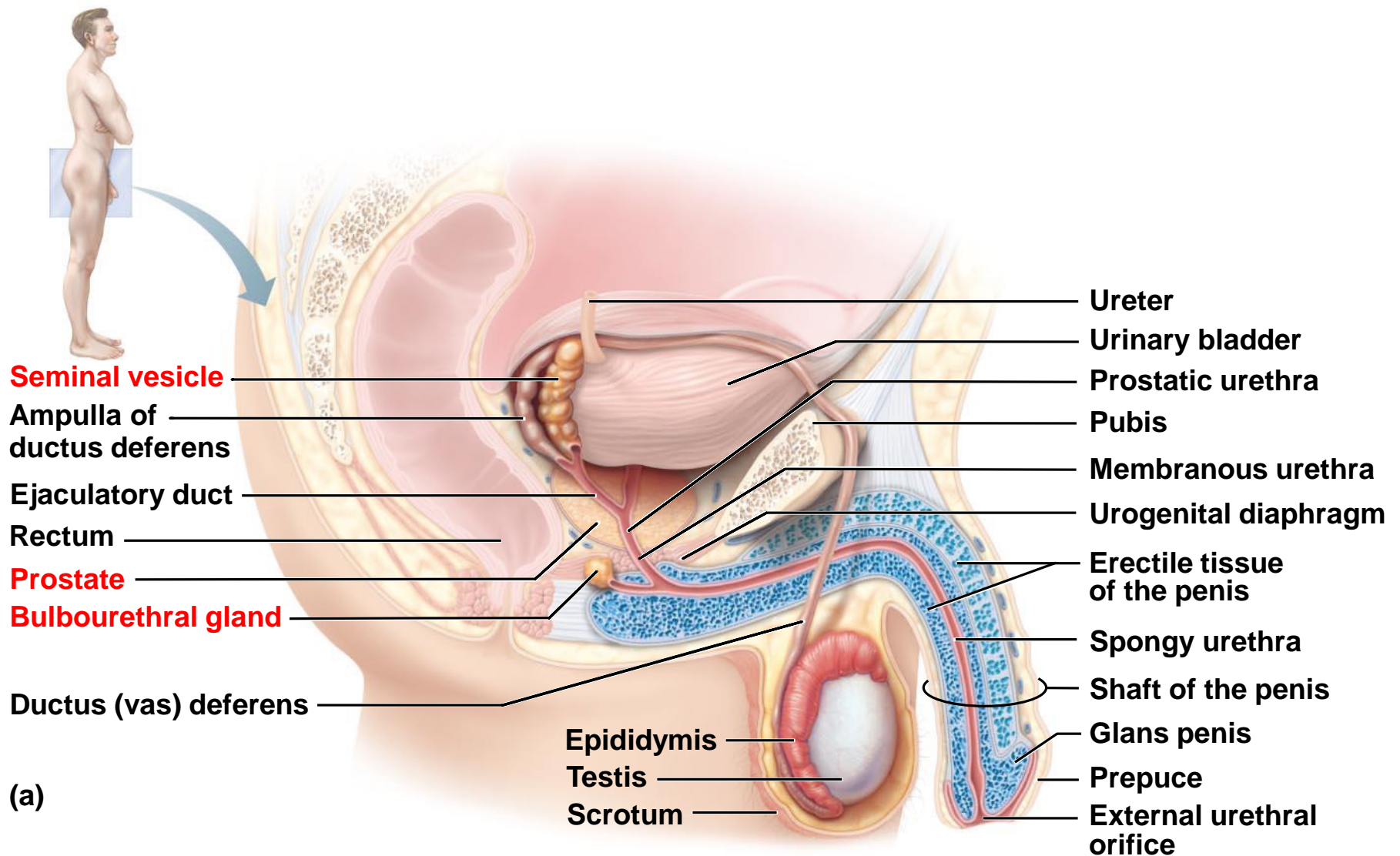


Figure 16.2a

# Bulbourethral Glands

- Pea-sized gland inferior to the prostate
- Produces a **thick, clear mucus**
  - **Cleanses the urethra** of acidic urine prior to ejaculation
  - Serves as a **lubricant** during sexual intercourse
  - Secreted into the **penile urethra**



# Semen

- Mixture of sperm and accessory gland secretions
- Advantages of accessory gland secretions
  - Fructose provides **energy for sperm cells**
  - Alkalinity of semen helps **neutralize the acidic environment of vagina**
  - Semen **inhibits bacterial multiplication**
  - Elements of semen enhance **sperm motility**

## (d) External Genitalia

- **Scrotum**
- **Penis**

## (d) External Genitalia

- **Scrotum**

- Divided sac of skin outside the abdomen
- Maintains testes at **3°C lower** than normal body temperature to protect sperm viability

## (d) External Genitalia

- **Penis**

- **Delivers sperm** into the female reproductive tract

- Regions of the penis

- **Shaft**
  - **Glans penis** (enlarged tip)
  - **Prepuce** (foreskin)
    - Folded cuff of skin around proximal end
    - Often removed by circumcision

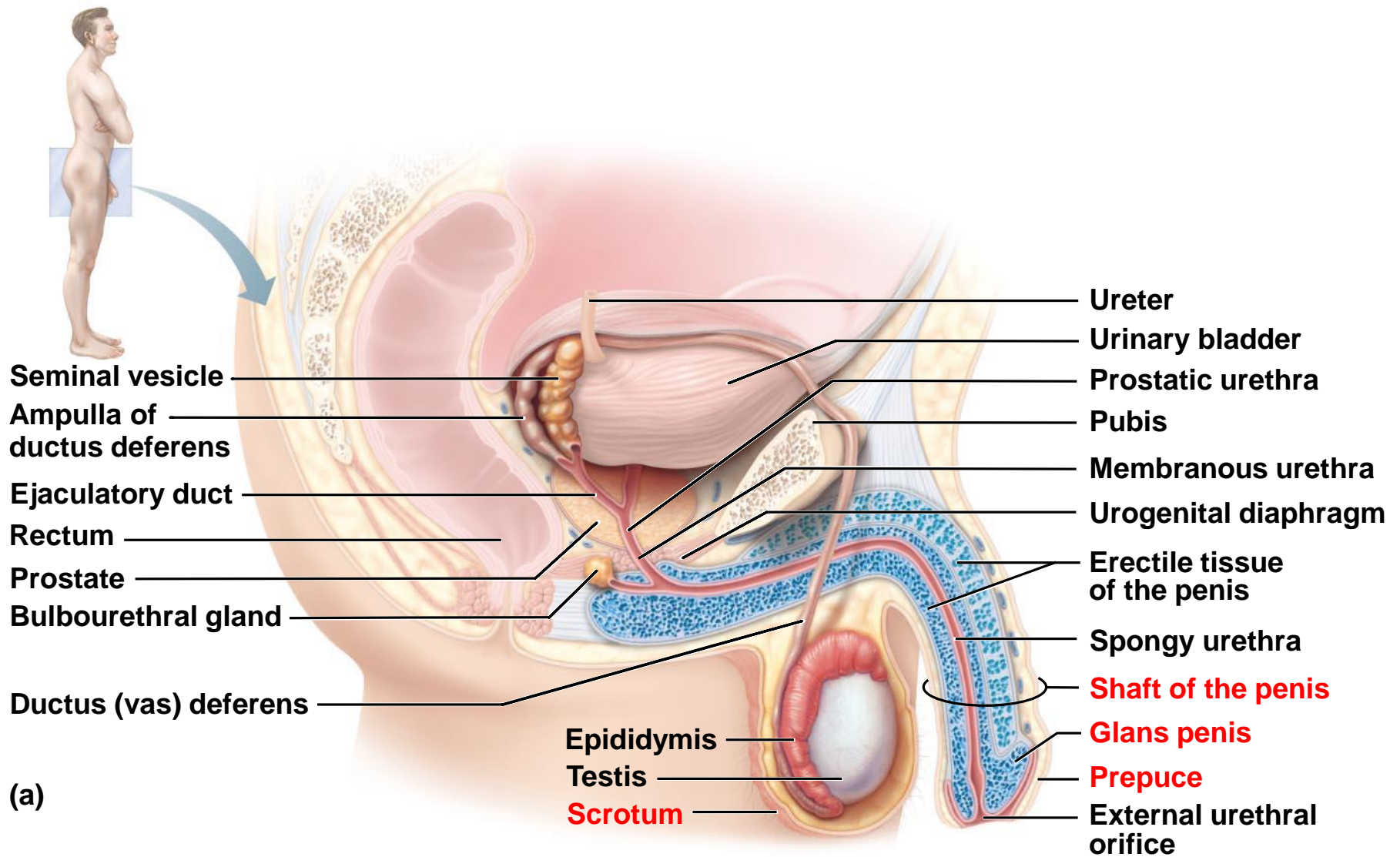


Figure 16.2a

## (d) External Genitalia

- internally there are three areas of spongy erectile tissue around the urethra
- erections occur when this erectile tissue fills with blood during sexual excitement

# Spermatogenesis

- **Production of sperm cells**
- Begins at puberty and continues throughout life
- Occurs in the **seminiferous tubules**

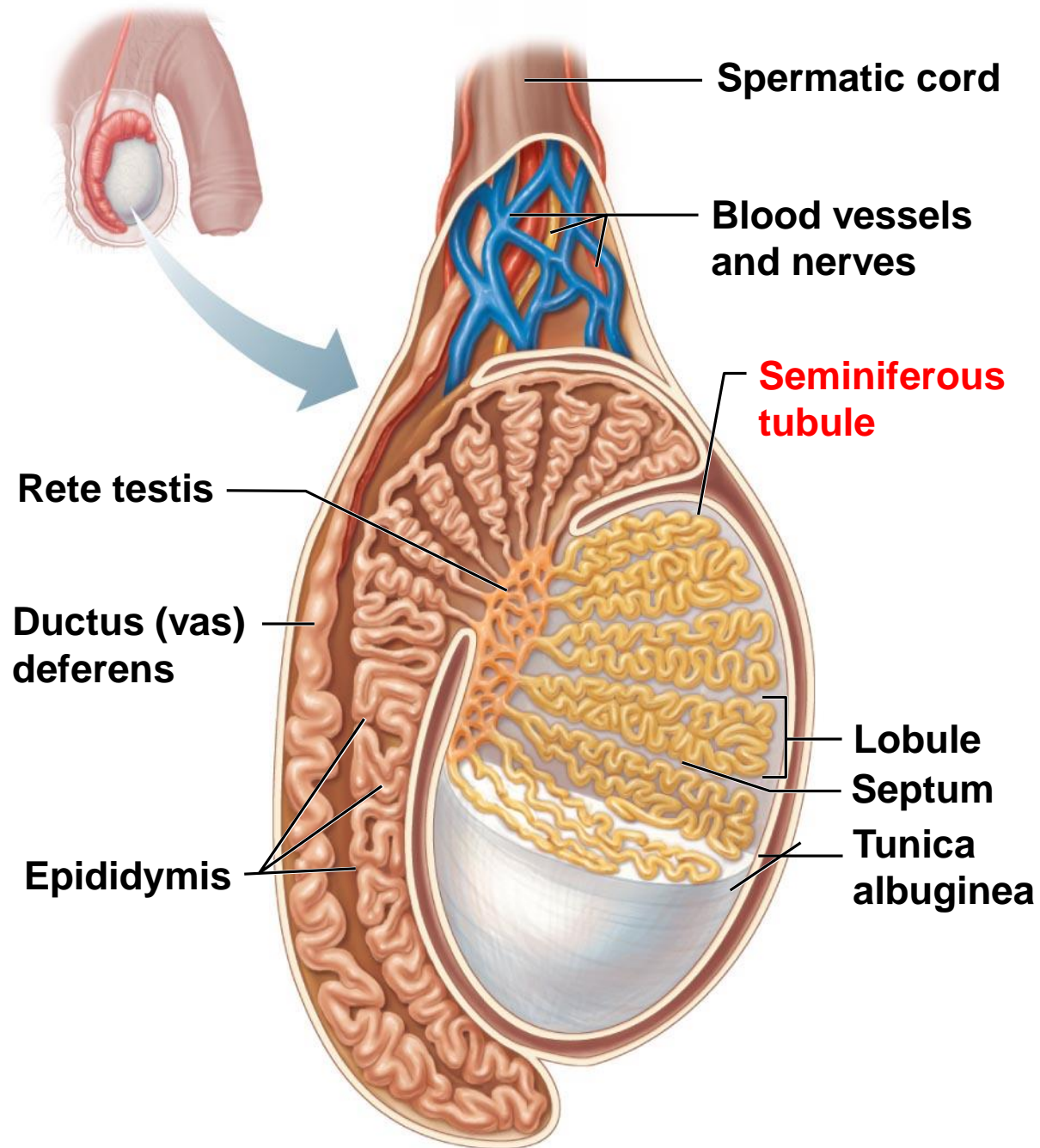


Figure 16.1



# Spermatogenesis

- **Spermatogonia** (stem cells) undergo rapid mitosis to produce more stem cells before puberty
- Follicle-stimulating hormone (FSH) modifies spermatogonia division
  - One cell produced is a stem cell, called a **type A daughter cell**
  - The other cell produced becomes a primary spermatocyte, called a **type B daughter cell**

# Spermatogenesis

- primary spermatocytes undergo **meiosis**
- one primary spermatocyte produces **four haploid spermatids**
  - **Spermatids** — 23 chromosomes (half as much material as other body cells)
  - Union of a sperm (23 chromosomes) with an egg (23 chromosomes) creates a **zygote** (2n or 46 chromosomes) at **fertilization**

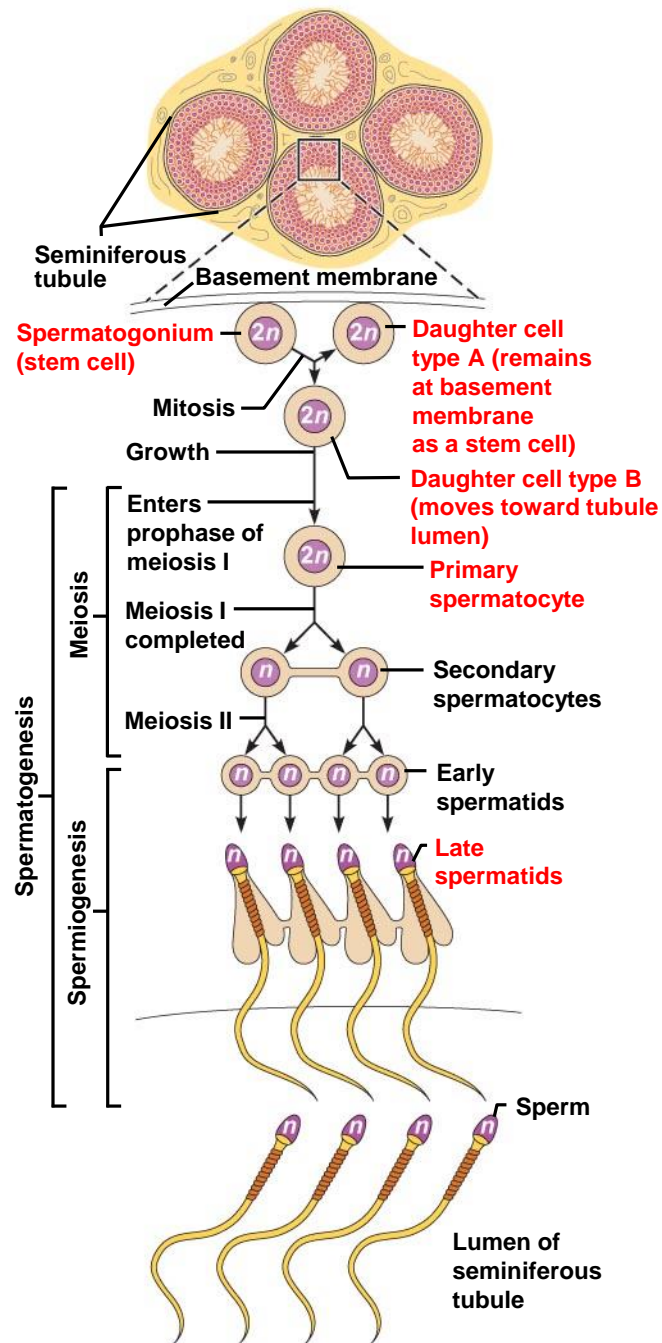
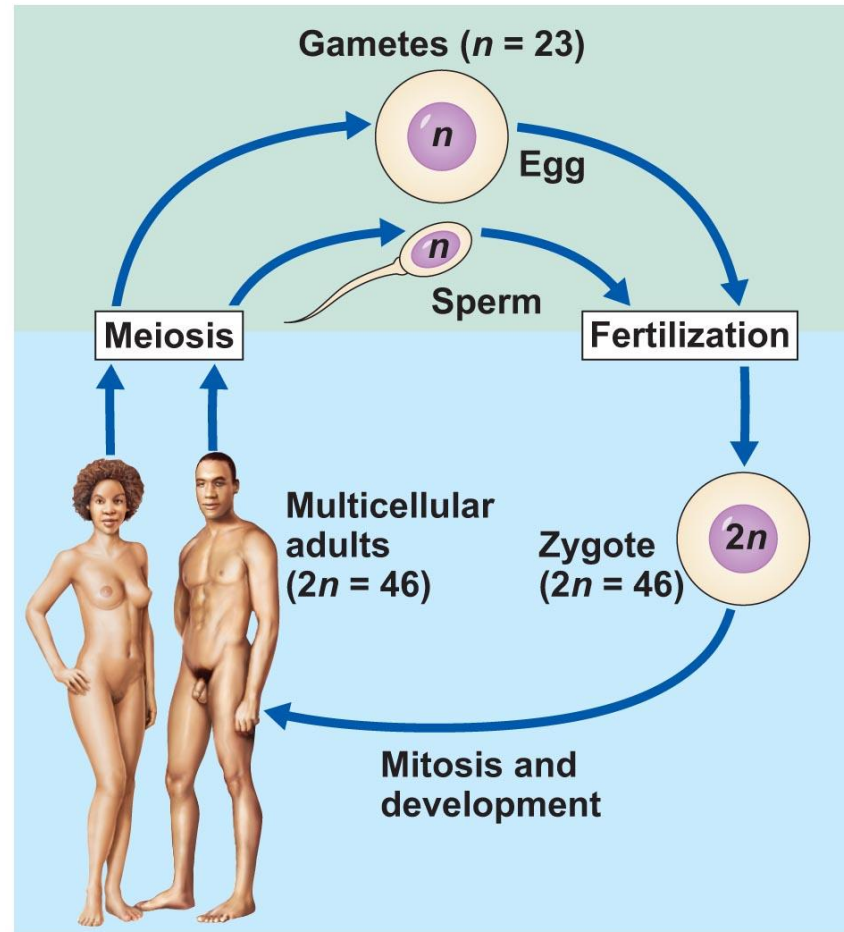


Figure 16.3

# Human Life Cycle



# Spermiogenesis

- Late spermatids are produced with distinct regions
  - Head
  - Midpiece
  - Tail
- Sperm cells result after maturing of spermatids
- Spermatogenesis (entire process, including spermiogenesis) takes 64 to 72 days

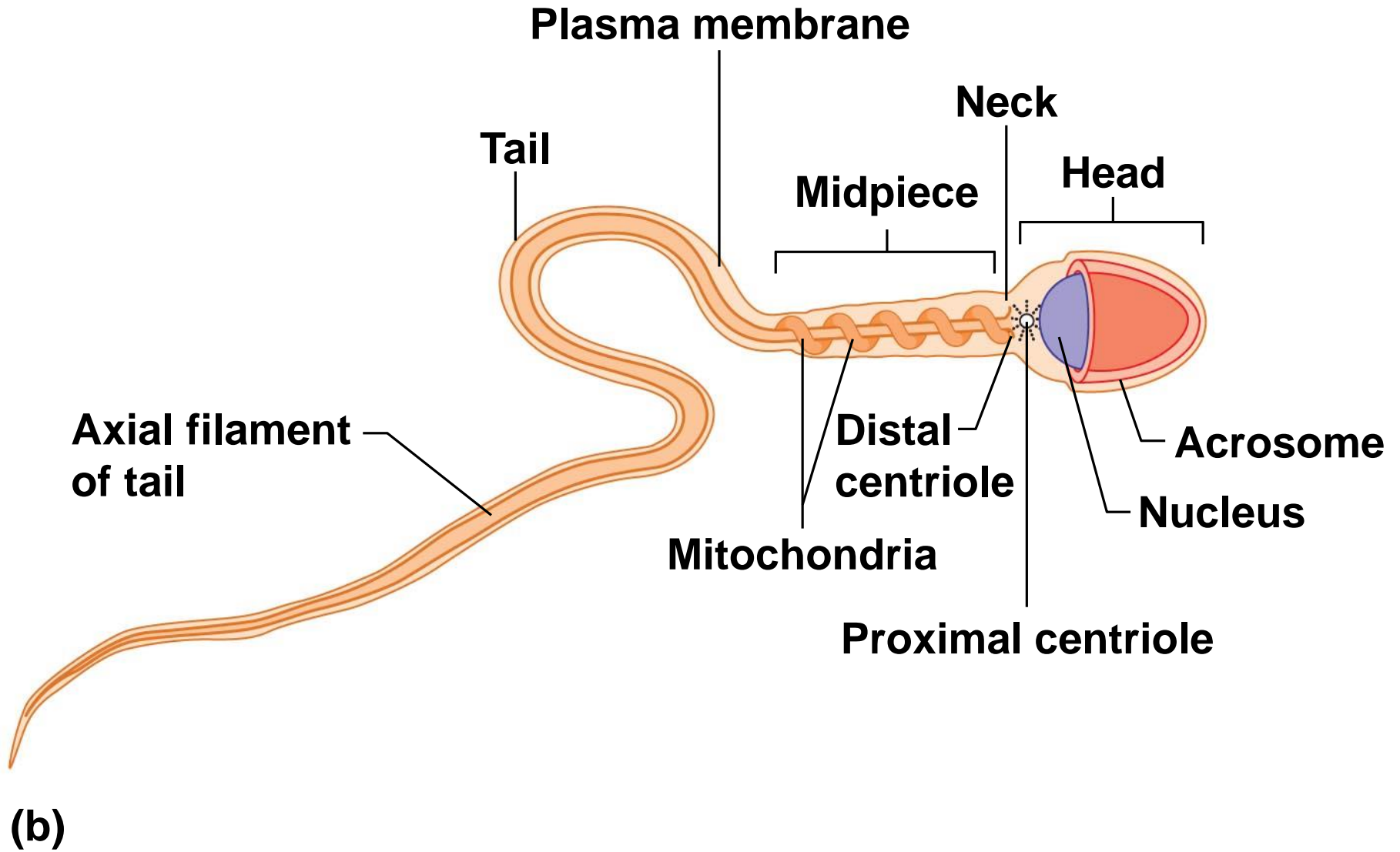
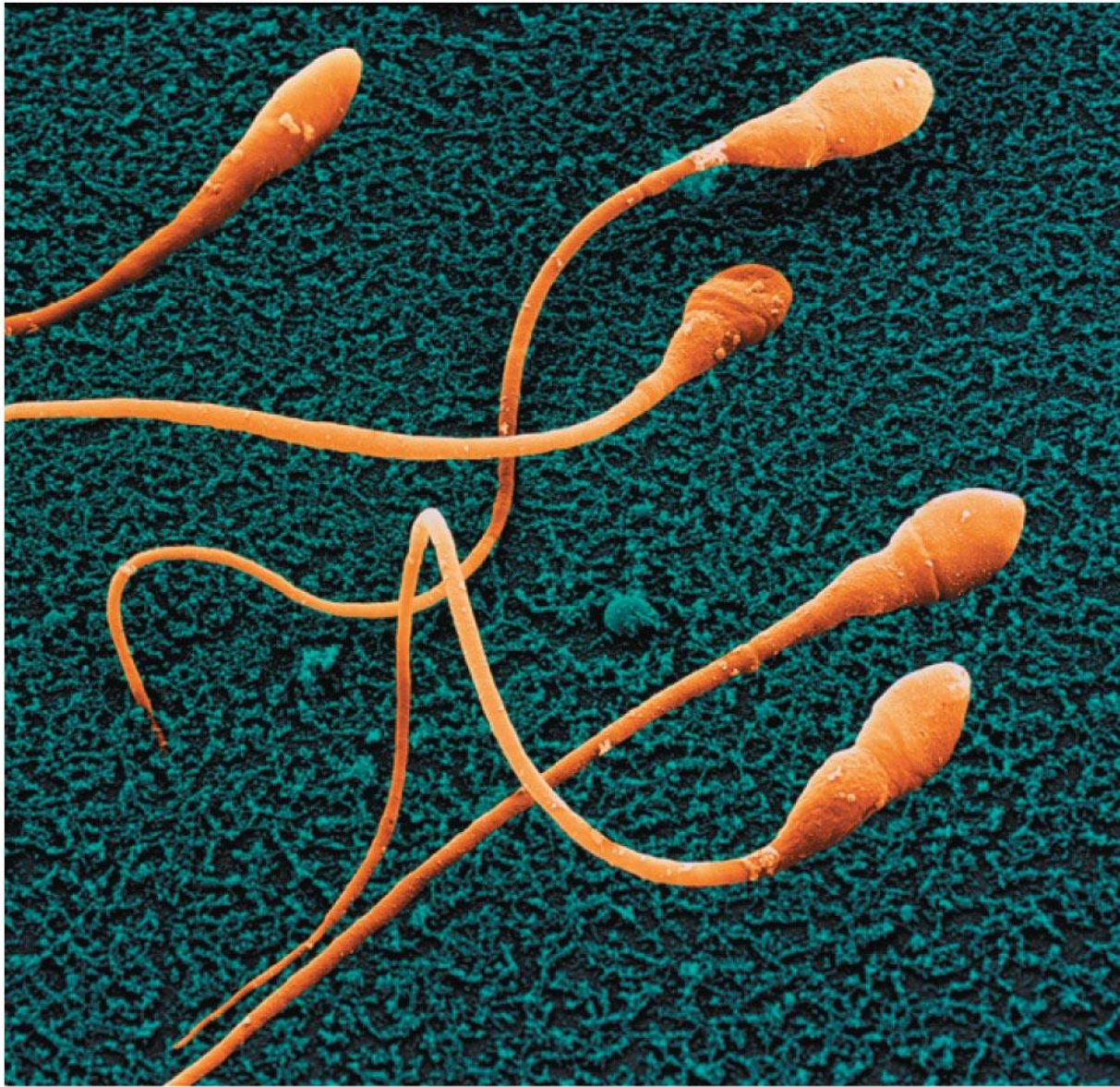


Figure 16.5b





(a)

# Anatomy of a Mature Sperm Cell

- *The only human flagellated cell*
- **Head**
  - Contains **DNA**
  - **Acrosome** — “helmet” on the nucleus, similar to a large lysosome
  - Breaks down and releases enzymes to help the sperm penetrate an egg
- **Midpiece**
  - Wrapped by mitochondria for **ATP** generation



# Testosterone Production

- The most important hormone of the testes
- Produced in **interstitial cells**
- During puberty, **luteinizing hormone (LH)** activate the interstitial cells
- In turn, **testosterone** is produced

# Testosterone Production

- Functions of testosterone
  - Stimulates reproductive organ development
  - Underlies sex drive
  - Causes **male secondary sex characteristics**
    - Deepening of voice
    - Increased hair growth
    - Enlargement of skeletal muscles
    - Thickening of bones

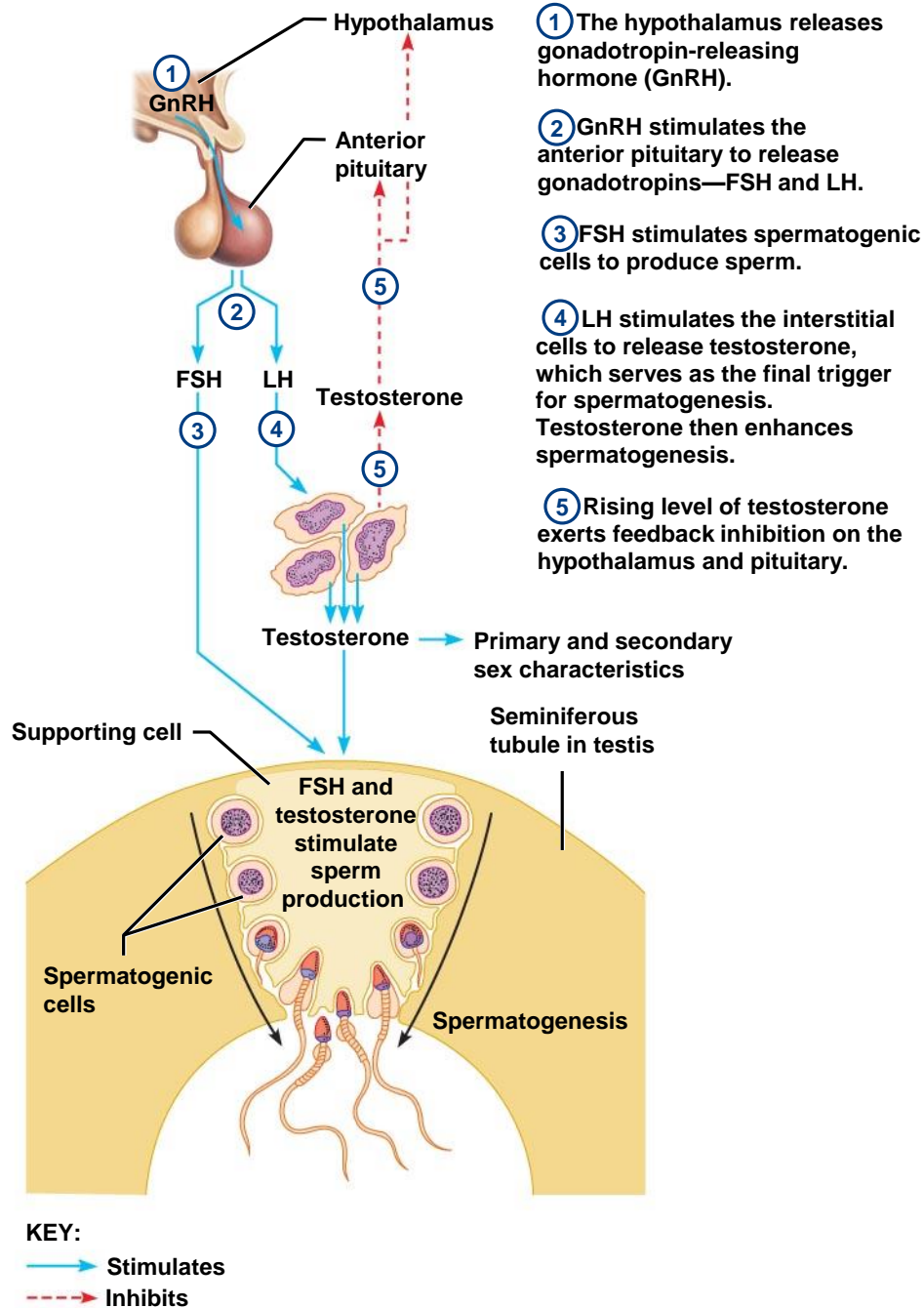


Figure 16.6

- Female Reproductive System

# Female Reproductive System

- (a) **Ovaries**
- (b) **Duct System**
  - Uterine tubes (fallopian tubes)
  - Uterus
  - Vagina
- (c) **External genitalia**

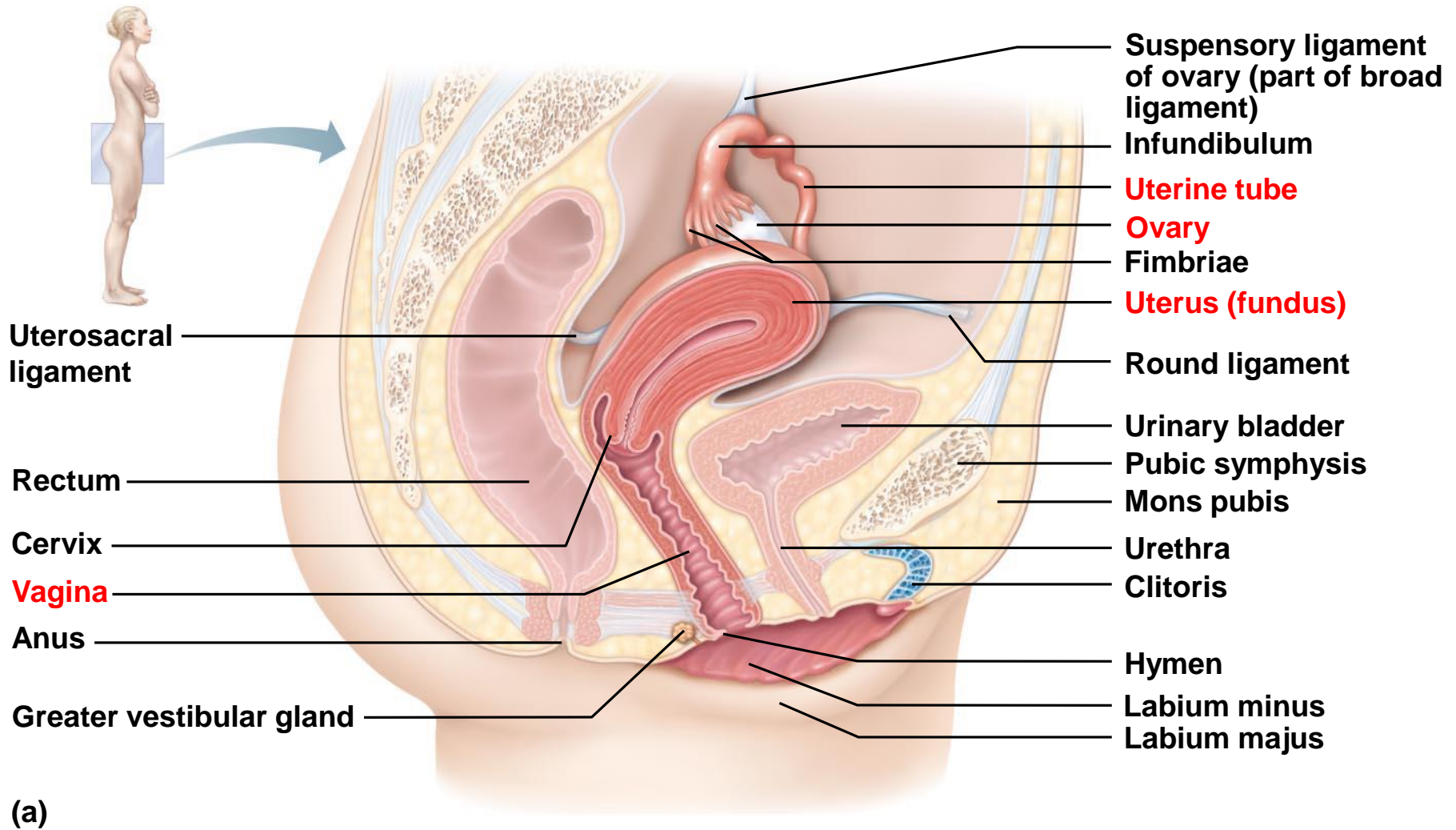


Figure 16.8a

# (a) Ovaries

- Composed of ovarian follicles (sac-like structures)
- Each follicle consists of
  - **Oocyte** (immature egg)
  - **Follicular cells** — surround the oocyte

# Ovarian Follicle Stages

- **Primary follicle** — contains an immature oocyte
- **Graafian (vesicular) follicle** — growing follicle with a maturing oocyte
- **Ovulation** — when the egg is mature, the follicle ruptures; occurs about every 28 days
- The ruptured follicle is transformed into a **corpus luteum**



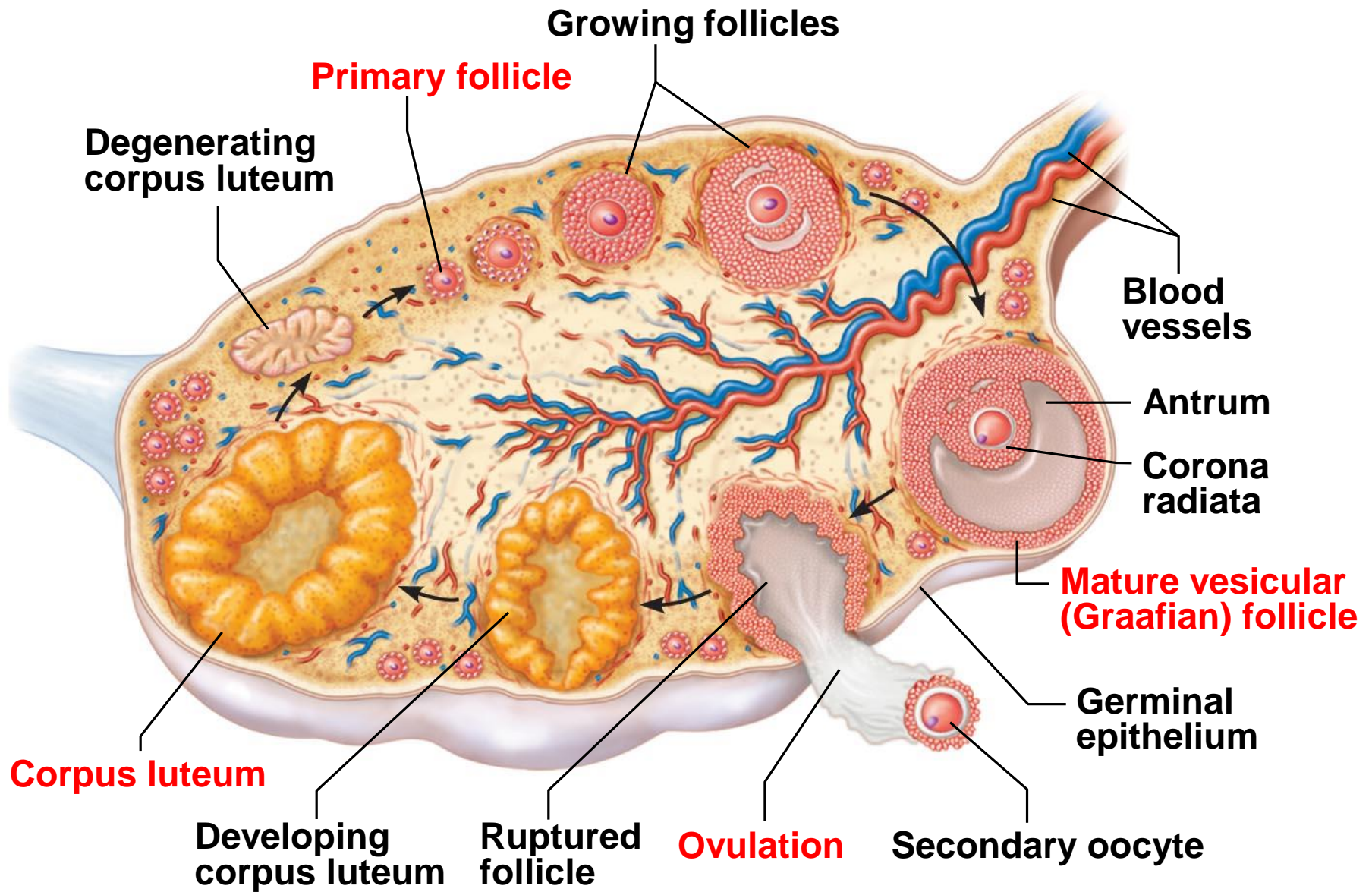


Figure 16.7

# Support for Ovaries

- **Suspensory ligaments** — secure ovary to lateral walls of the pelvis
- **Ovarian ligaments** — attach to uterus
- **Broad ligament** — a fold of the peritoneum, encloses suspensory ligament

## (b) Duct System

- **Uterine tubes (fallopian tubes)**
- **Uterus**
- **Vagina**

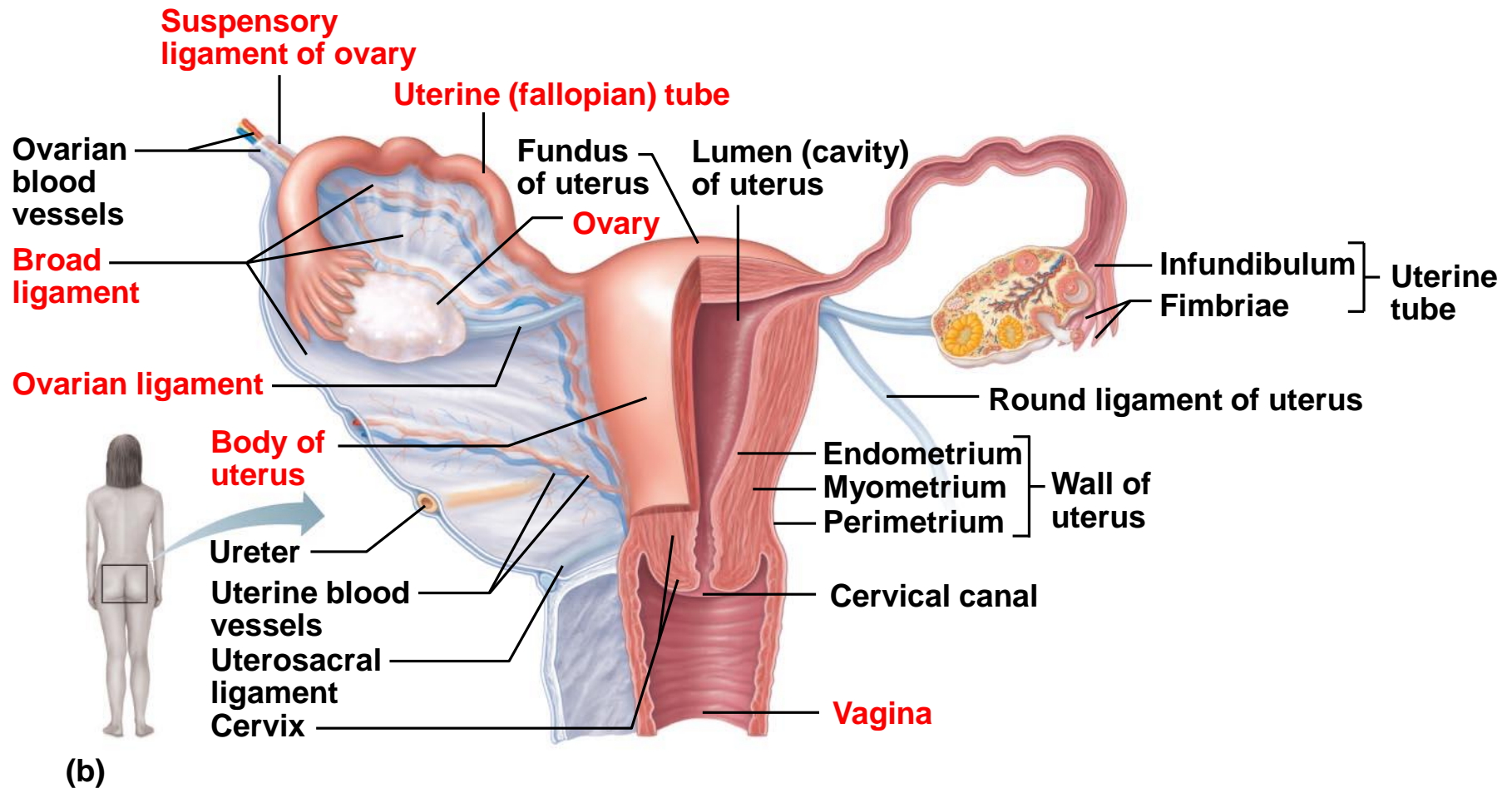


Figure 16.8b

# Uterine (Fallopian) Tubes

- **Receive the ovulated oocyte**
- **Provide a site for fertilization**
- **Attach to the uterus**
- Little or no contact between ovaries and uterine tubes
- Supported and enclosed by the **broad ligament**

# Uterine Tube Anatomy and Physiology

- **Fimbriae**

- Finger-like projections at the distal end of the uterine tube
- **Receive the oocyte** from the ovary

- **Cilia**

- Located inside the uterine tube
- **Slowly move the oocyte towards the uterus**  
(takes 3 to 4 days)

- **!** Fertilization occurs inside the uterine tube since oocyte lives about 24 hours

# Uterus

- Located between the urinary bladder and rectum
- Hollow organ
- Functions of the uterus
  - Receives a fertilized egg
  - Retains the fertilized egg
  - Nourishes the fertilized egg

# Support for the Uterus

- **Broad ligament** — attached to the pelvis
- **Round ligament** — anchored anteriorly
- **Uterosacral ligaments** — anchored posteriorly



# Regions of the Uterus

- **Body** — main portion
- **Fundus** — superior rounded region above where uterine tube enters
- **Cervix** — narrow outlet that protrudes into the vagina

# Walls of the Uterus

- **Endometrium**
  - Inner layer
  - Allows for implantation of a fertilized egg
  - Sloughs off if no pregnancy occurs (menses)
- **Myometrium** — middle layer of smooth muscle
- **Perimetrium (visceral peritoneum)** — outermost serous layer of the uterus

# Vagina

- Extends from cervix to exterior of body
- Located between bladder and rectum
- **Serves as the birth canal**
- Receives the penis during sexual intercourse
- **Hymen** — partially closes the vagina until it is ruptured

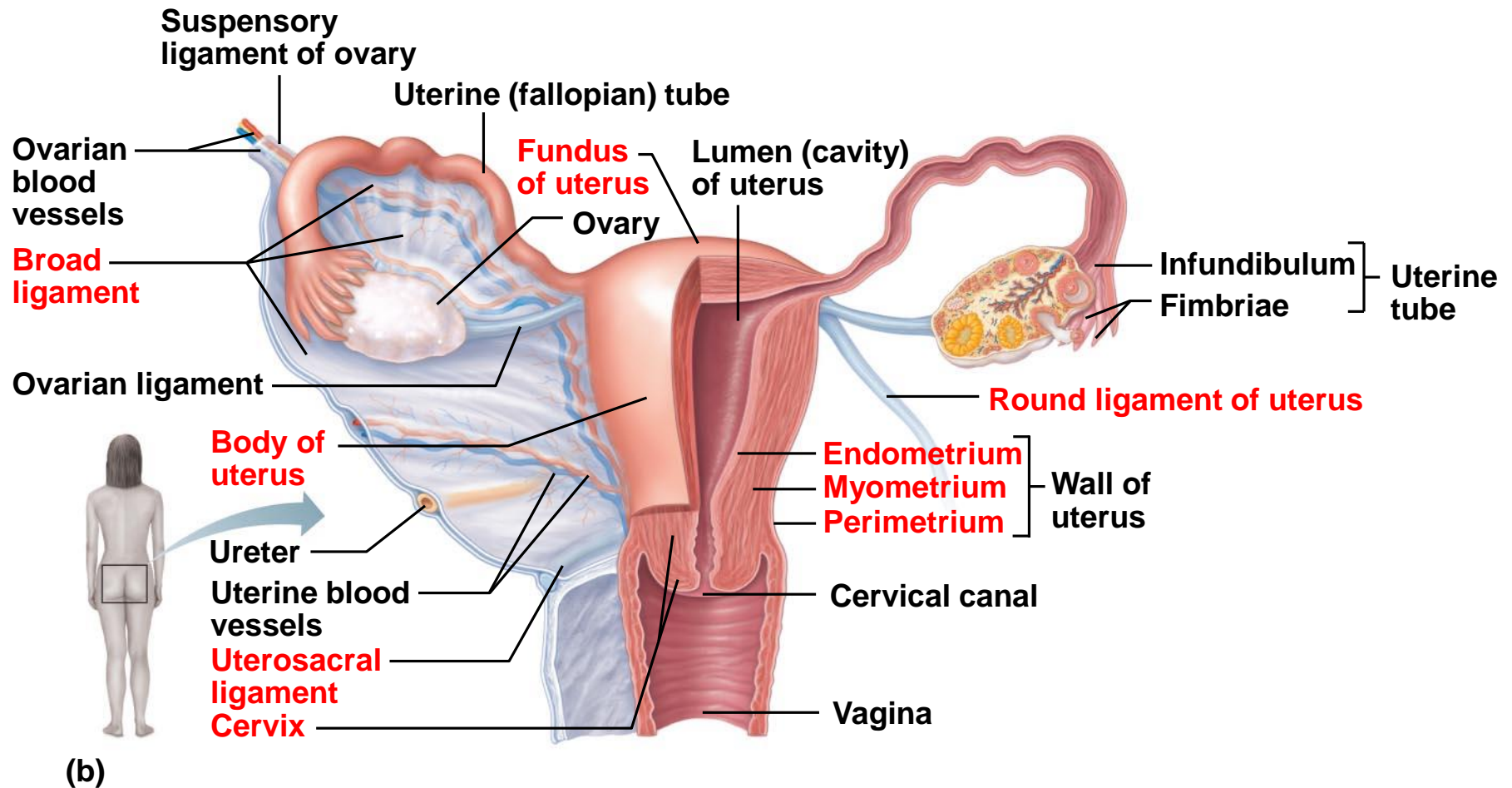


Figure 16.8b

## (c) External Genitalia (Vulva)

- **Mons pubis**
- **Labia**
- **Clitoris**
- **Urethral orifice**
- **Vaginal orifice**
- **Greater vestibular glands**

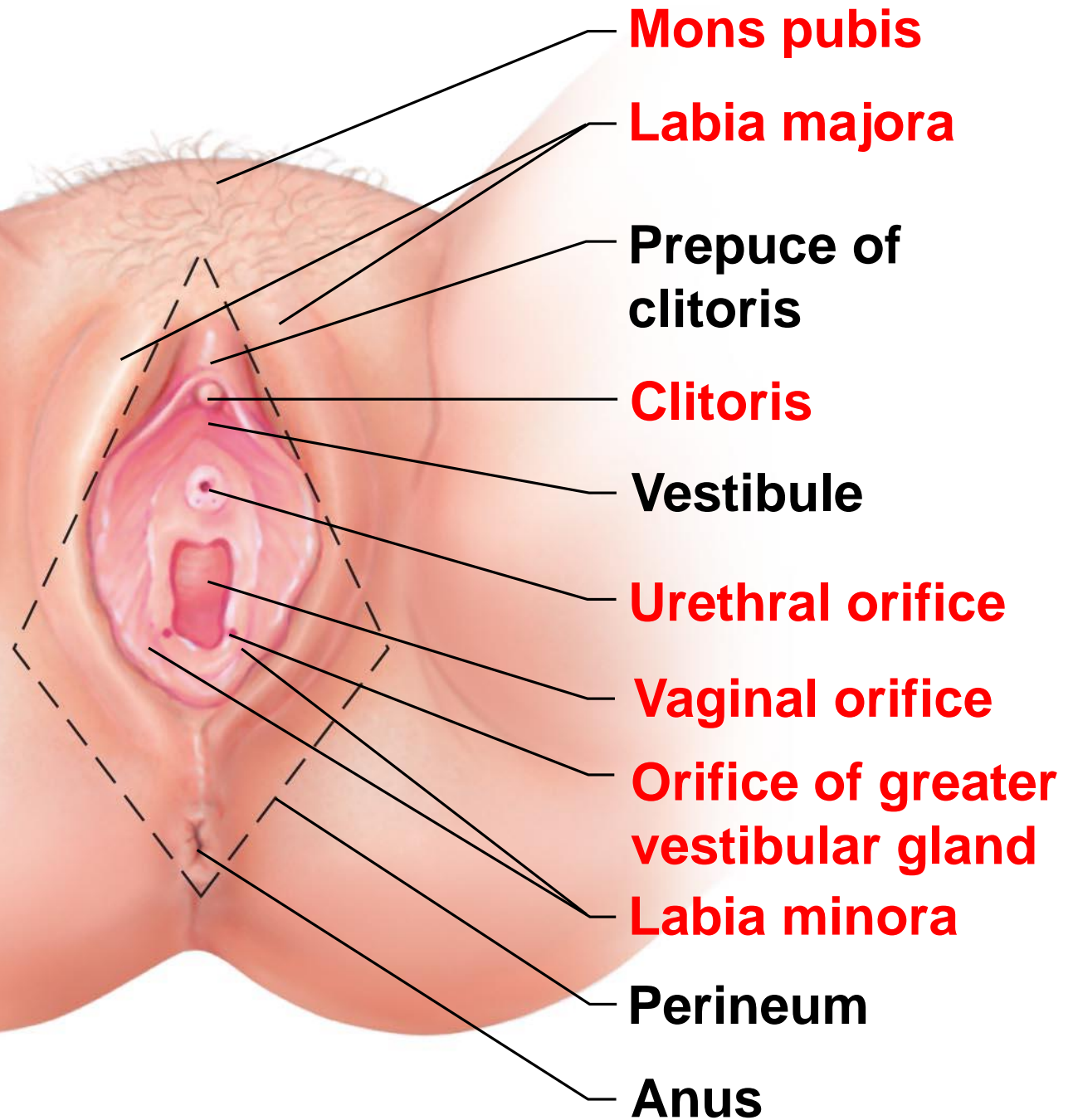


Figure 16.9

# Mons Pubis

- Fatty area overlying the pubic symphysis
- Covered with pubic hair after puberty

# Labia

- **Labia** — skin folds
  - **Labia majora**
    - Hair-covered skin folds
    - Enclose the labia minora
    - Also encloses the vestibule
  - **Labia minora** — delicate, hair-free folds of skin



# Vestibule and Greater Vestibular Glands

- **Vestibule**
  - Enclosed by labia majora
  - Contains external openings of the urethra and vagina
- **Greater vestibular glands**
  - One is found on each side of the vagina
  - Secretes lubricant during intercourse

# Clitoris

- Contains erectile tissue
- Corresponds to the male penis
- The clitoris is similar to the penis in that it is
  - Hooded by a prepuce
  - Composed of sensitive erectile tissue
  - Becomes swollen with blood during sexual excitement

# Perineum

- Diamond-shaped region between the anterior ends of the labial folds, anus posteriorly, and ischial tuberosities laterally

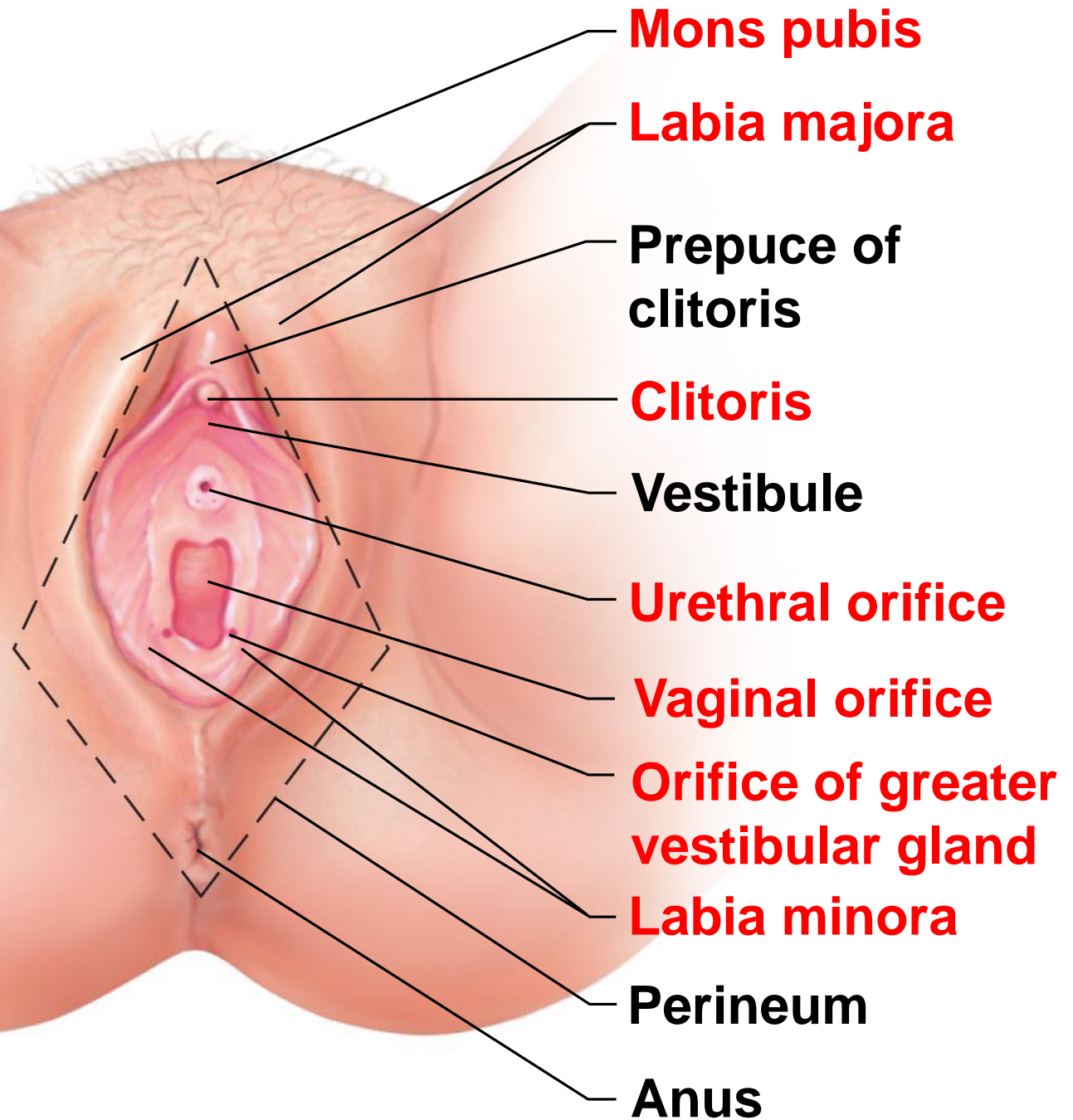


Figure 16.9

# Oogenesis and the Ovarian Cycle

- The total supply of eggs are present at birth
  - by end of 1<sup>st</sup> trimester of existence
- Ability to release eggs **begins at puberty**
- Reproductive ability **ends at menopause**
- **Oocytes** are matured in developing **ovarian follicles**

# Oogenesis and the Ovarian Cycle

- **Oogonia** — female stem cells found in a developing fetus
- Oogonia undergo mitosis to produce **primary oocytes**
- Primary oocytes are surrounded by cells that form primary follicles in the ovary
- Oogonia no longer exist by the time of the female's own birth

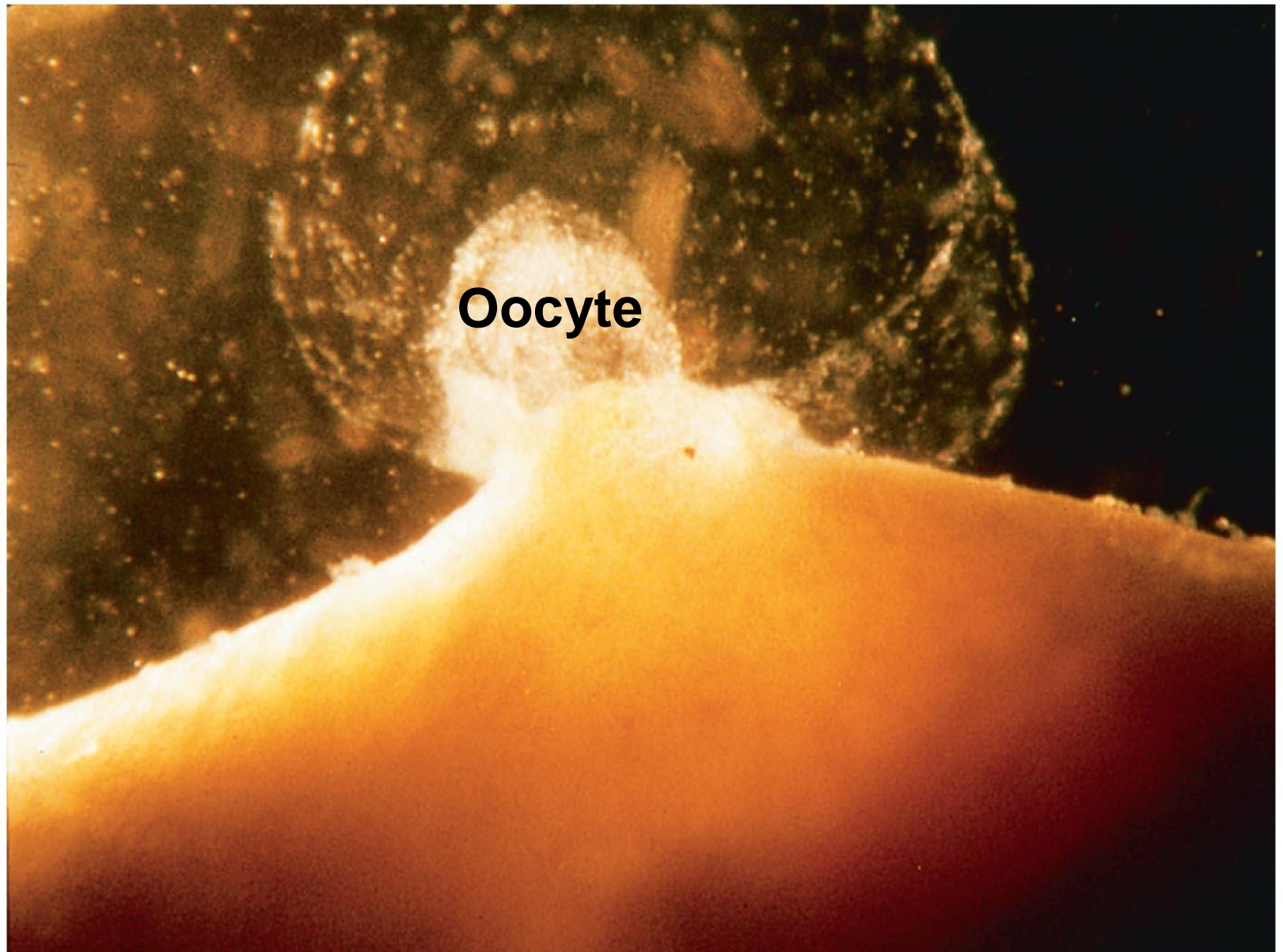
# Oogenesis and the Ovarian Cycle

- Primary oocytes are inactive until puberty
- **Follicle stimulating hormone (FSH)** causes some primary follicles to mature each month
- Cyclic monthly changes constitute the ovarian cycle

# Oogenesis and the Ovarian Cycle

- **Meiosis** starts inside maturing follicle
- Produces a **secondary oocyte** and the **first polar body**
- Follicle development to the stage of a vesicular follicle takes about 14 days
- Ovulation of a secondary oocyte occurs with the release of **luteinizing hormone (LH)**
- Secondary oocyte is released and surrounded by a **corona radiata**





**Figure 16.11**

# Oogenesis and the Ovarian Cycle

- Meiosis is completed after ovulation ***only if*** sperm penetrates unfertilized egg
  - Ovum is produced
  - Two additional polar bodies are produced
- Once ovum is formed, the 23 chromosomes can be combined with those of the sperm to form the fertilized egg (**zygote**)
- If the secondary oocyte is ***not*** penetrated by a sperm, it dies and does not complete meiosis to form an ovum

# Male and Female Differences

- Meiosis

- **Males** — produces **four** functional sperm
- **Females** — produces **one** functional ovum and **three** polar bodies

- Sex cell size and structure

- Sperm are tiny, motile, and equipped with nutrients in seminal fluid
- Egg is large, non-motile, and has nutrient reserves to nourish the embryo until implantation

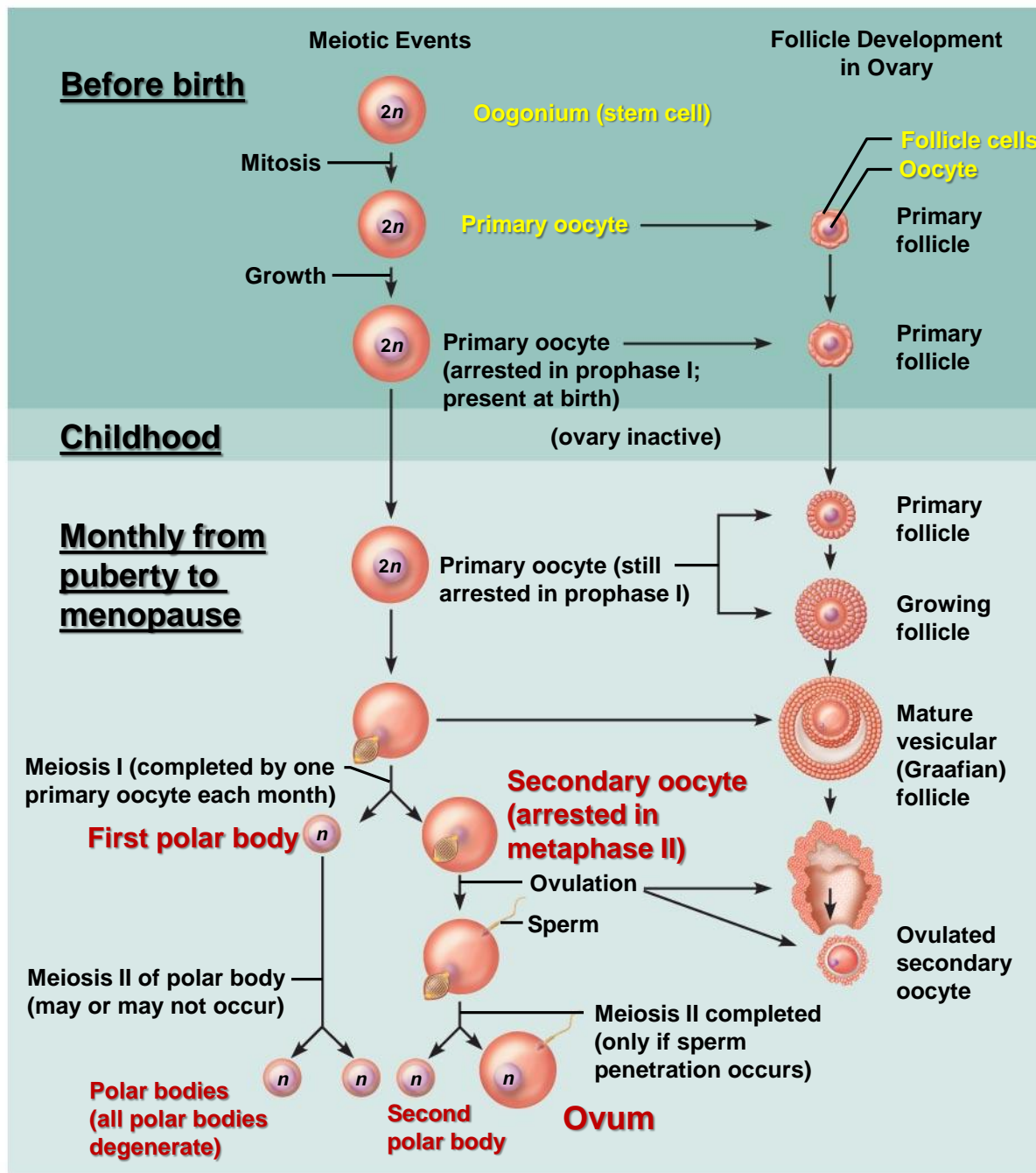


Figure 16.10

# Uterine (Menstrual) Cycle

- Cyclic changes of the **endometrium**
- Regulated by cyclic production of **estrogens** and **progesterone**
  - **which are regulated by FSH and LH**
- Both menstrual and ovarian cycles are about **28** days in length
- Ovulation typically occurs about midway through cycle on day **14**

# Uterine (Menstrual) Cycle

- Stages of the menstrual cycle
  - **Menstrual phase**
  - **Proliferative stage**
  - **Secretory stage**

**\* Biology 2 Workbook pg. 229 & 230**

# Uterine (Menstrual) Cycle

- **Menstrual** phase

- Days 1 to 5
- Functional layer of the **endometrium is sloughed**
- **Bleeding** occurs for 3 to 5 days
- By day 5, growing ovarian follicles are producing more **estrogen**

# Uterine (Menstrual) Cycle

- **Proliferative** stage
  - Days 6 to 14
  - Regeneration of functional layer of the endometrium
  - Estrogen levels rise
  - Ovulation occurs in the ovary at the end of this stage



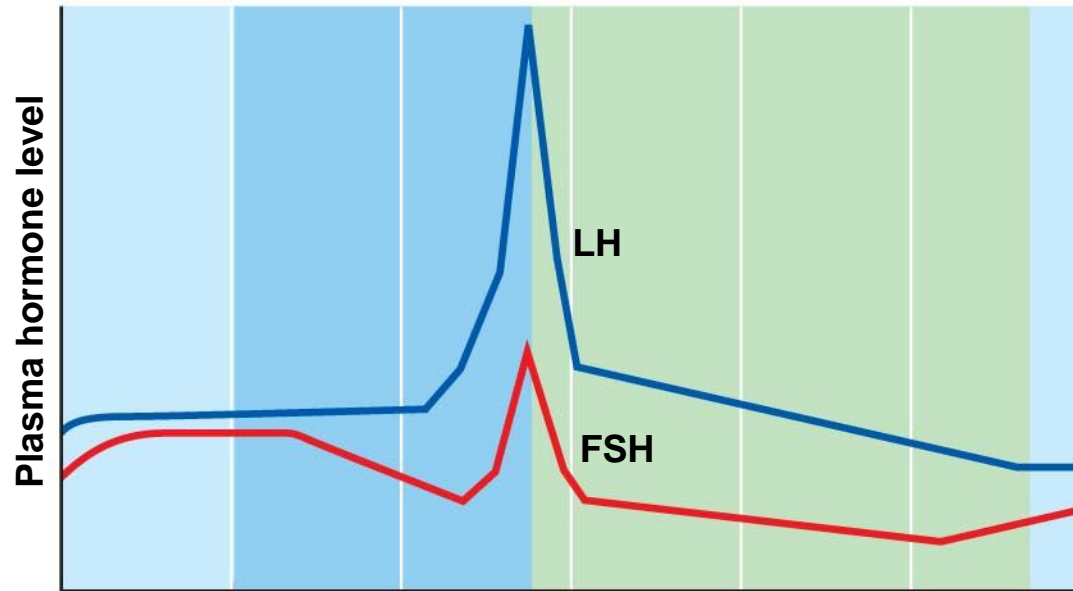
# Uterine (Menstrual) Cycle

- **Secretory** stage

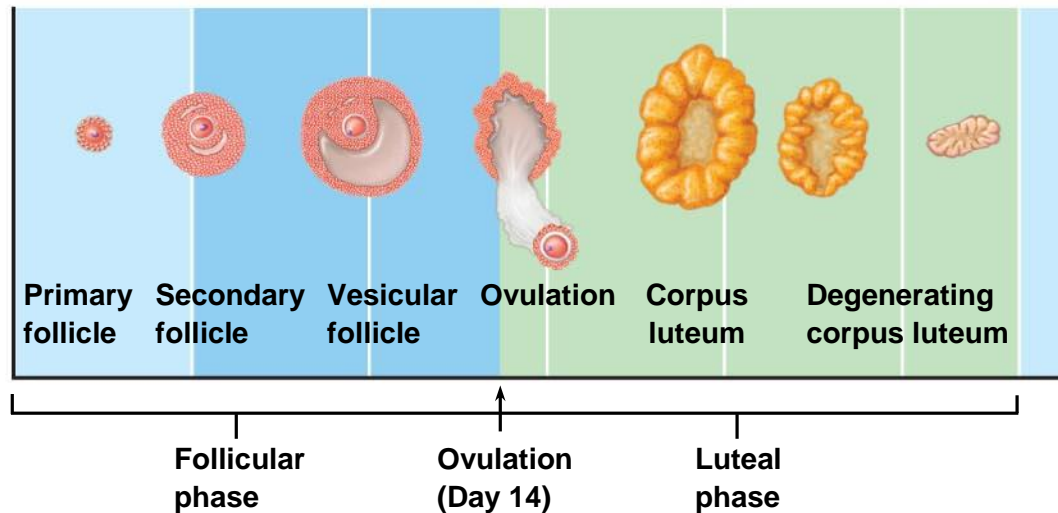
- Days 15 to 28
- Levels of progesterone rise and increase the blood supply to the endometrium
- Endometrium increases in size and readies for implantation

# Uterine (Menstrual) Cycle

- **Secretory** stage (continued)
  - If fertilization **DOES** occur
    - Embryo produces a hormone that causes the corpus luteum to continue producing its hormones
  - If fertilization **does NOT** occur
    - Corpus luteum degenerates as LH blood levels decline

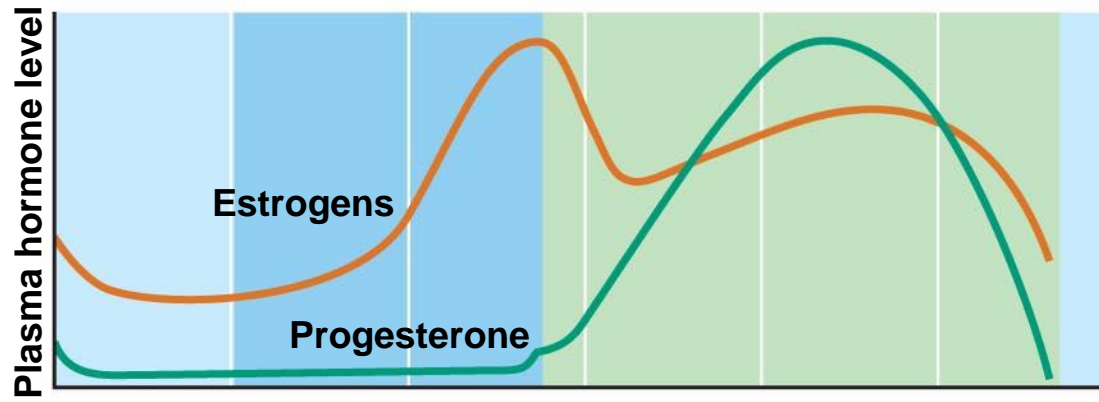


**(a) Fluctuation of gonadotropin levels:** Fluctuating levels of pituitary gonadotropins (FSH and LH) in the blood regulate the events of the ovarian cycle.

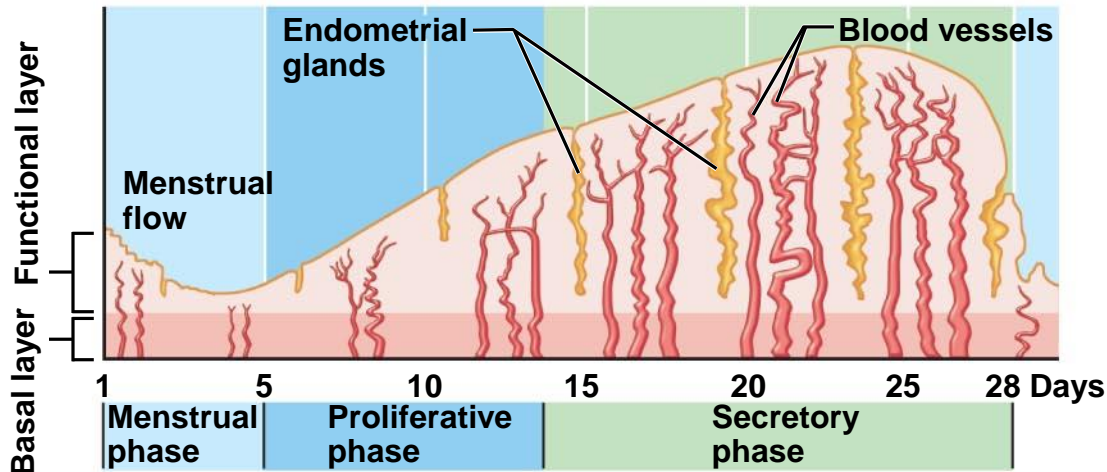


(b) Ovarian cycle: Structural changes in the ovarian follicles during the ovarian cycle are correlated with (d) changes in the endometrium of the uterus during the uterine cycle.

Figure 16.12b



(c) Fluctuation of ovarian hormone levels: Fluctuating levels of ovarian hormones (estrogens and progesterone) cause the endometrial changes of the uterine cycle. The high estrogen levels are also responsible for the LH/FSH surge in (a).



- (d) The three phases of the uterine cycle:
- **Menstrual:** Shedding of the functional layer of the endometrium.
  - **Proliferative:** Rebuilding of the functional layer of the endometrium.
  - **Secretory:** Begins immediately after ovulation. Enrichment of the blood supply and glandular secretion of nutrients prepare the endometrium to receive an embryo.

The menstrual and proliferative phases occur before ovulation, and together correspond to the follicular phase of the ovarian cycle. The secretory phase corresponds in time to the luteal phase of the ovarian cycle.

Figure 16.12d

# Hormone Production by the Ovaries

- **Estrogens**

- Produced by follicle cells
- Cause **female secondary sex characteristics**
  - Enlargement of accessory organs of the female reproductive system
  - Development of breasts
  - Appearance of axillary and pubic hair
  - Increase in fat beneath the skin, particularly in hips and breasts
  - Widening and lightening of the pelvis
  - Onset of **menses** (menstrual cycle)

# Hormone Production by the Ovaries

## ➡ Progesterone

- ➡ Produced by the corpus luteum
- ➡ Production continues until LH diminishes in the blood
- ➡ Does not contribute to the appearance of secondary sex characteristics
- ➡ Other major effects
  - ➡ Helps maintain pregnancy
  - ➡ Prepare the breasts for milk production



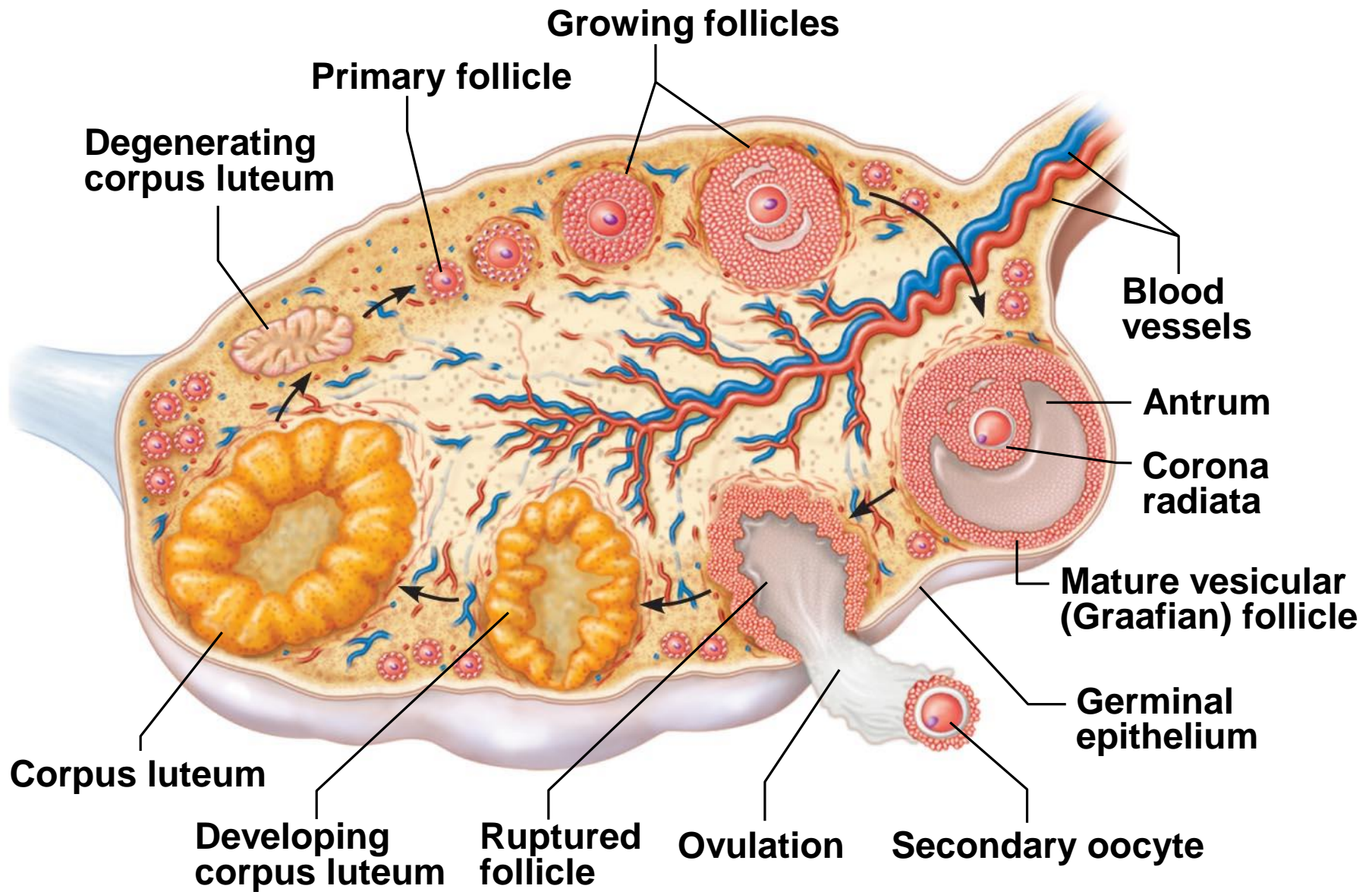


Figure 16.7

Workbook Page 330 #18

# Mammary Glands

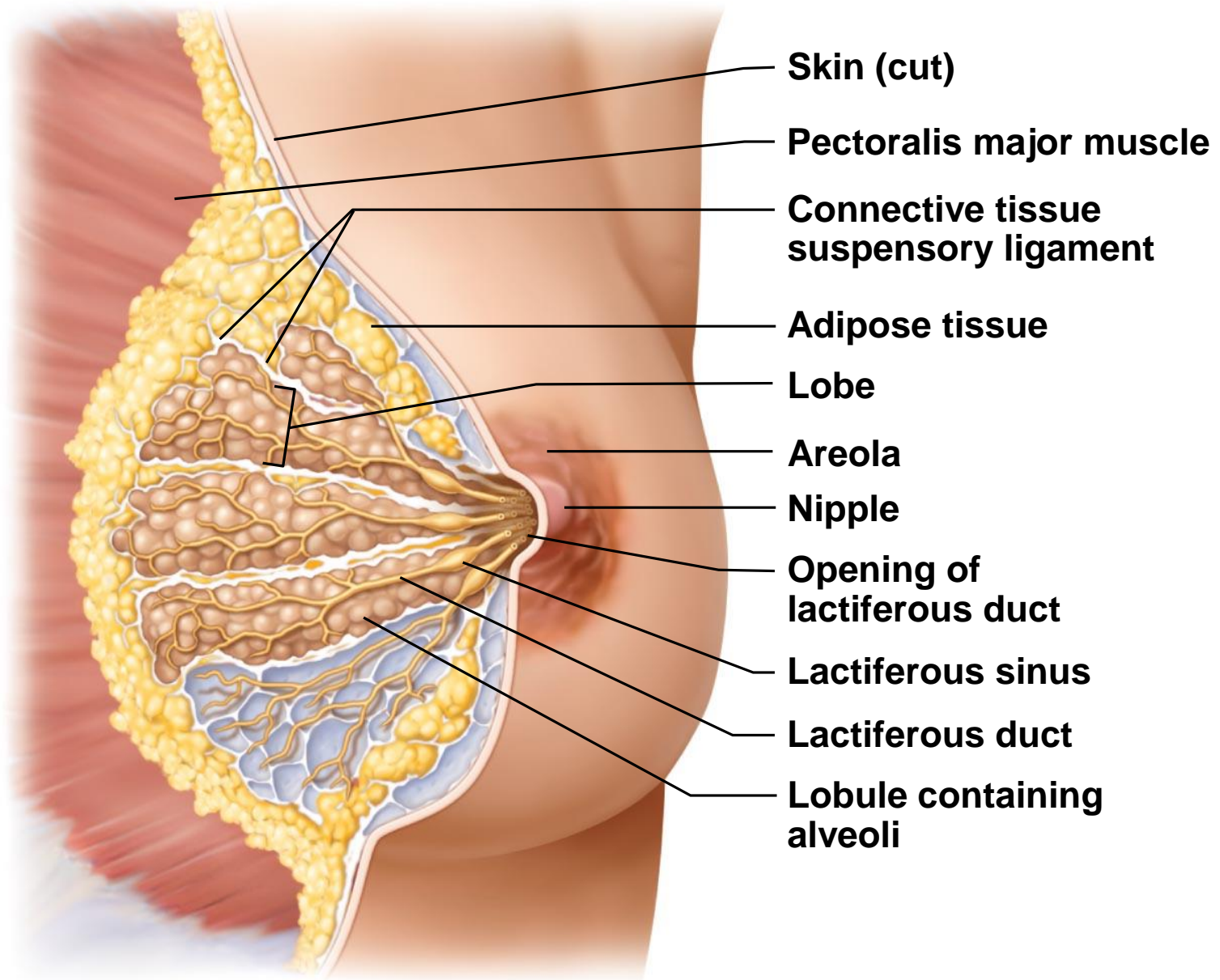
- Present in both sexes, but only function in females
  - Modified sweat glands
- **Function is to produce milk**
- Stimulated by sex hormones (mostly **estrogens**) to increase in size

# Anatomy of Mammary Glands (1 of 2)

- **Areola** — central pigmented area
- **Nipple** — protruding central area of areola
- **Lobes** — internal structures that radiate around nipple

# Anatomy of Mammary Glands (2 of 2)

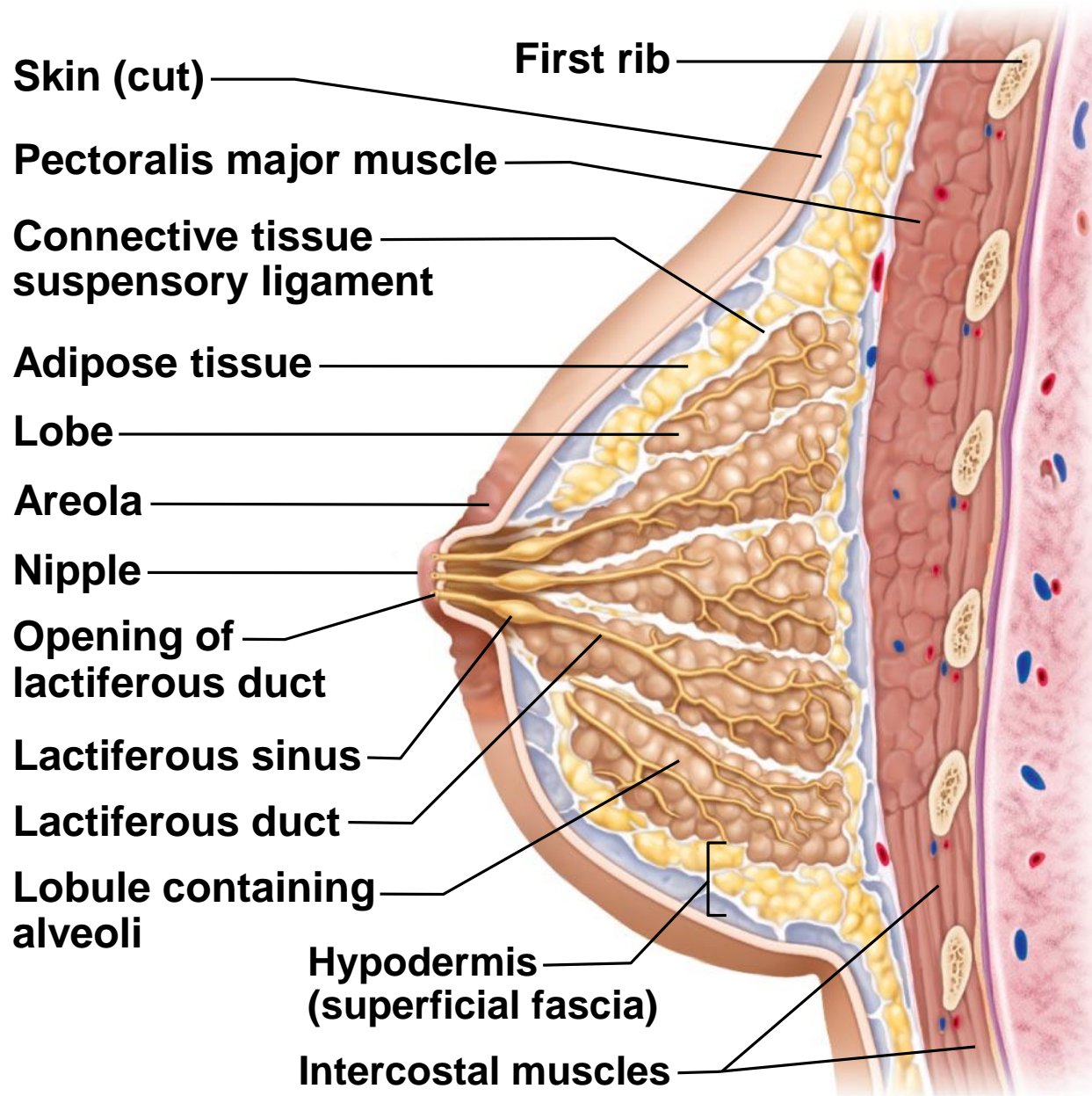
- **Lobules** — located within each lobe and contain clusters of alveolar glands
- **Alveolar glands** — produce milk when a woman is lactating (producing milk)
- **Lactiferous ducts** — connect alveolar glands to nipple



**(a)**

**Figure 16.13a**





(b)

Figure 16.13b

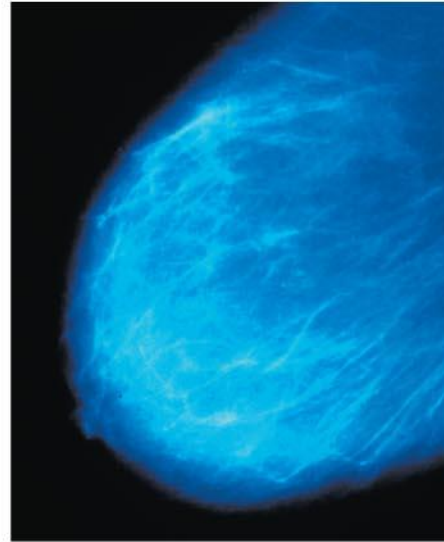
# Mammography

- X-ray examination that detects breast cancers too small to feel
- Recommended every 2 years for women between 40 and 49 years old and yearly thereafter
  - if there exists a family predisposition, consultation with a physician is recommended to modify analytical regimen

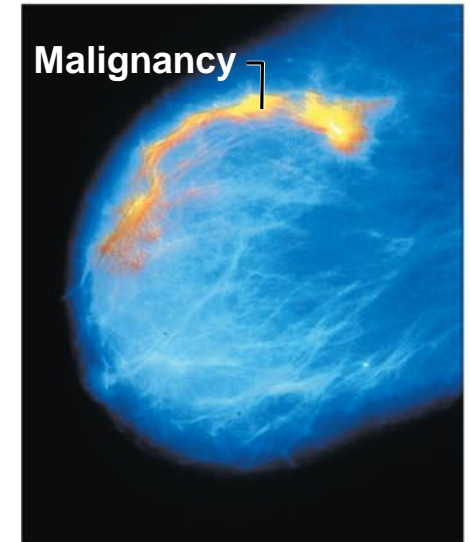




**(a) Mammogram procedure**



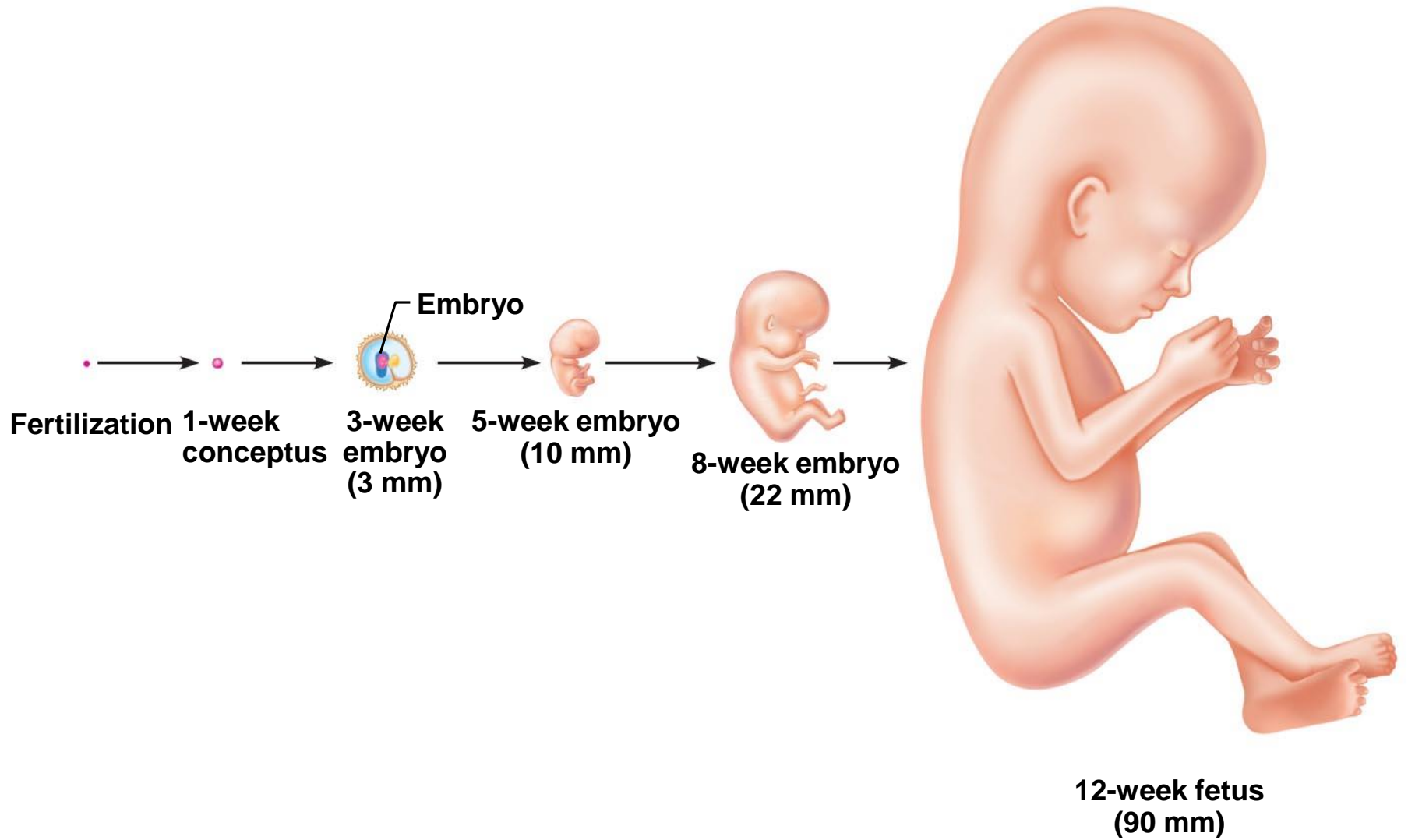
**(b) Film of normal breast**



**(c) Film of breast with tumor**

# Introduction to Pregnancy and Development

- **Pregnancy** — time from fertilization until infant is born
- **Conceptus** — developing offspring
  - **Embryo** — period of time from fertilization until week 8
  - **Fetus** — week 9 until birth
- **Gestation period** — from date of last period until birth (approximately 280 days)



**Figure 16.15**

# Accomplishing Fertilization

- The **oocyte** is viable for **12 to 24 hours** after ovulation
- **Sperm** are viable for **24 to 48 hours** after ejaculation
- For fertilization to occur, sexual intercourse must occur no more than **2 days** before ovulation and no later than **24 hours** after
- Sperm cells must make their way to the **uterine tube** for fertilization to be possible

# Accomplishing Fertilization

- When sperm reach the oocyte, enzymes break down the follicle cells of the **corona radiata** around the oocyte
- Once a path is cleared, sperm undergo an ***acrosomal reaction*** (acrosomal membranes break down and enzymes digest holes in the oocyte membrane)
- Membrane receptors on an oocyte pull in the head of the first sperm cell to make contact

# Mechanisms of Fertilization

- The membrane of the oocyte usually does not permit a second sperm head to enter
  - The initial penetration causes changes in oocyte membrane creating a barrier to additional sperm
  - If another should enter, it's called ***polyspermy*** and the zygote does not survive
- The oocyte then undergoes its **second meiotic division** to form the ovum and a polar body
- Fertilization occurs when the genetic material of a sperm combines with that of an oocyte to form a zygote

# Acrosomal Reaction

- <https://www.youtube.com/watch?v=41qQTEhoNjY>
- <https://www.youtube.com/watch?v=7G2rL5Cutd4>

# The Zygote

- **First cell** of a new individual
- The result of the fusion of DNA from sperm and egg
- The zygote begins rapid **mitotic** cell divisions
- The zygote stage is in the uterine tube, moving toward the uterus



# Cleavage

- Rapid series of **mitotic** divisions that begins with the zygote and ends with the blastocyst
- Zygote begins to divide **24** hours after fertilization
- **3** to **4** days after ovulation, the preembryo reaches the uterus and floats freely for 2 to 3 days
- Late blastocyst stage — embryo implants in endometrium (day **7** after ovulation)

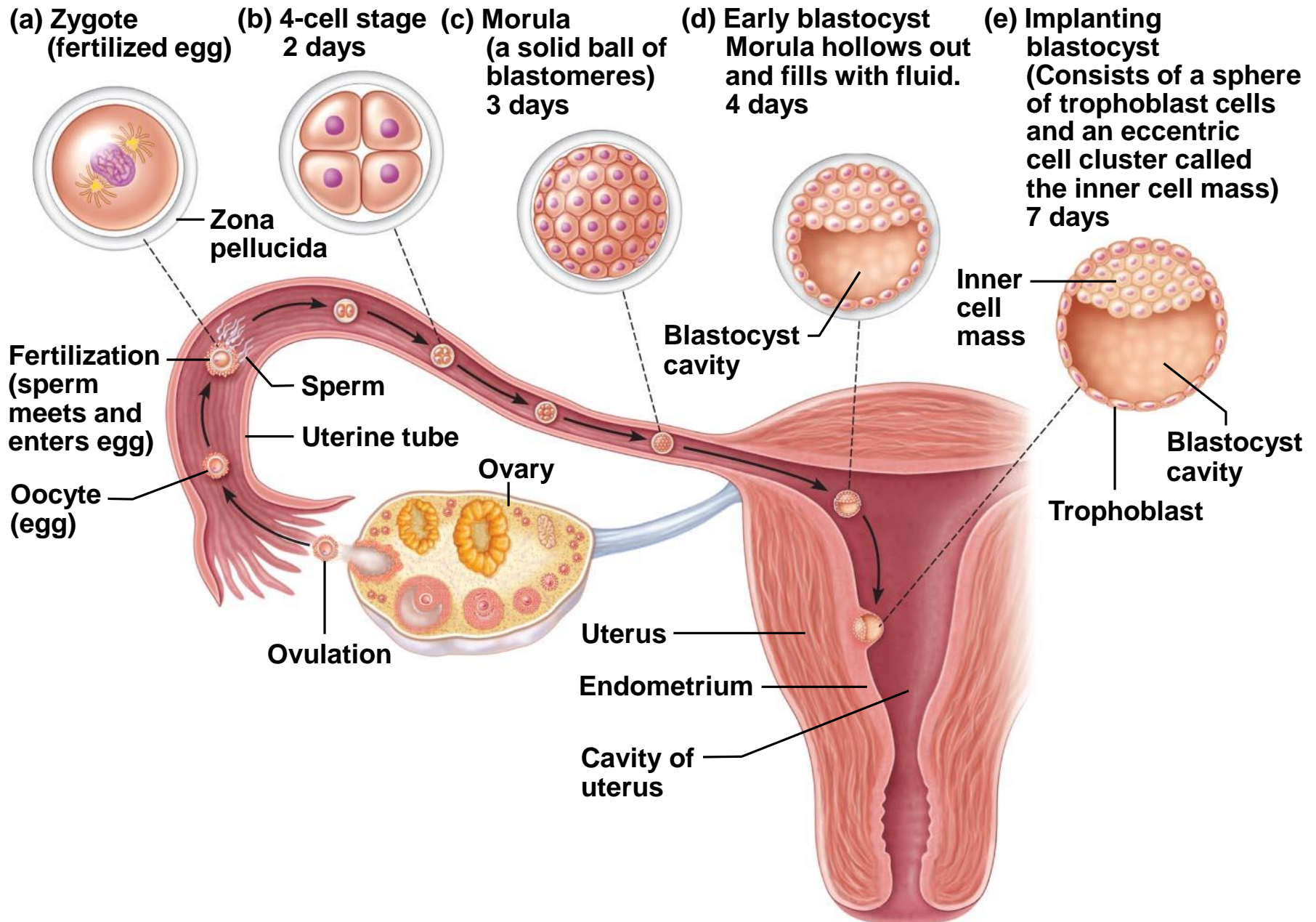


Figure 16.16

# Events of Embryonic and Fetal Development

- **Embryo** — period of time from fertilization until week **8**
  - **Morula** — 16-cell stage
  - **Blastocyst** (chorionic vesicle) — hollow, ball-like structure containing about 100 cells
- **Fetus** — week **9** until birth

\* **Biology 2 Workbook pg.**

**236 - 237**

# The Embryo

- The embryo first undergoes division without growth
- The embryo enters the uterus at the **16 - cell state** (called a **morula**) about **3** days after ovulation
- The embryo floats free in the uterus temporarily
- Uterine secretions are used for nourishment

# The Blastocyst (Chorionic Vesicle)

- **Blastocyst**
  - Ball-like circle of cells
- Begins at about the **100-cell stage**
- Secretes human chorionic gonadotropin (**hCG**) to induce the corpus luteum to continue producing hormones
- Functional areas of the blastocyst
  - **Trophoblast** — large fluid-filled sphere
  - **Inner cell mass** — cluster of cells to one side

# The Blastocyst (Chorionic Vesicle)

- Primary germ layers are eventually formed
  - **Ectoderm** — outside layer
  - **Mesoderm** — middle layer
  - **Endoderm** — inside layer
- The late blastocyst implants in the wall of the uterus (by day **14**)

# Derivatives of Germ Layers

- **Ectoderm**

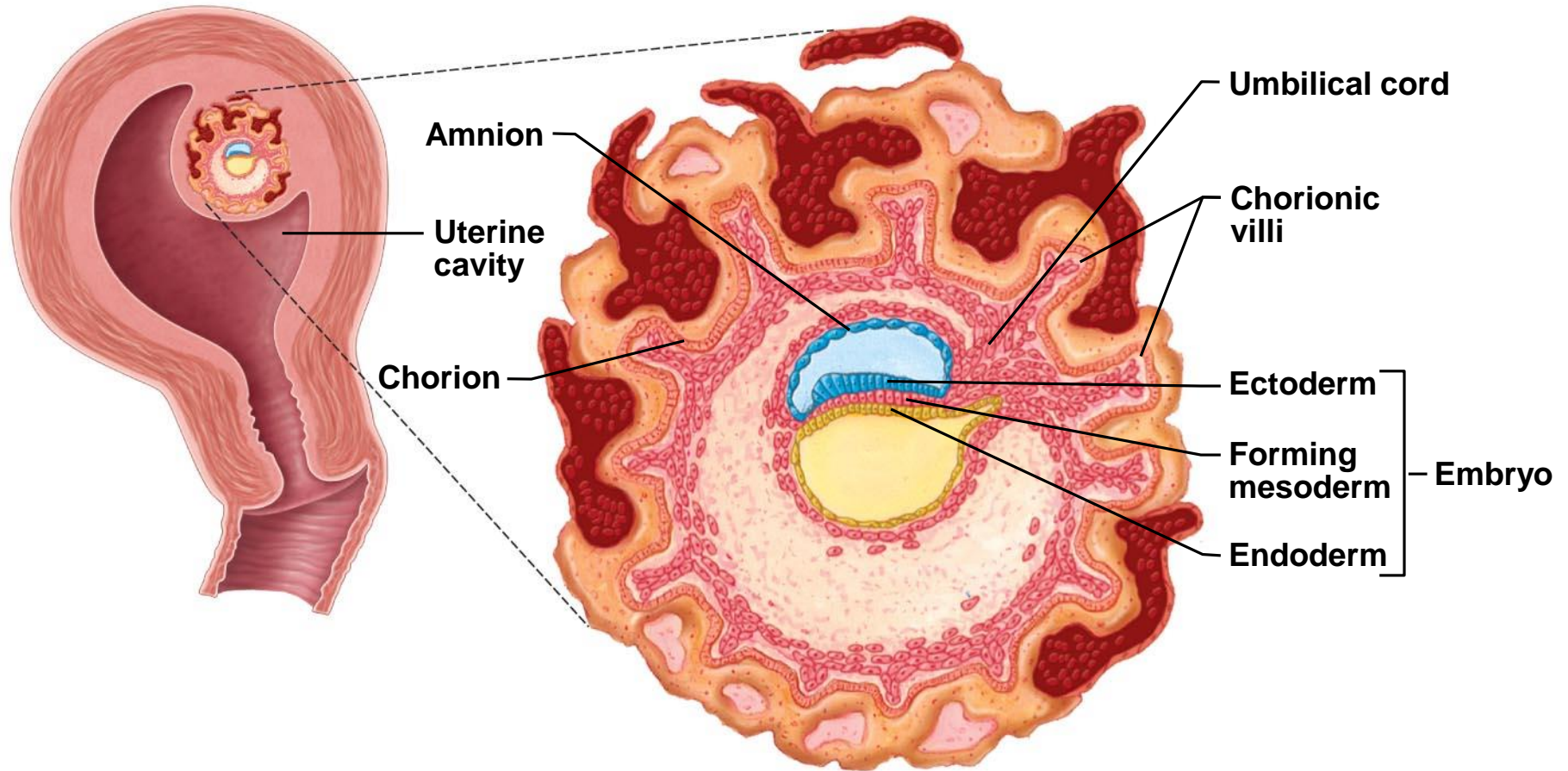
- Nervous system
- Epidermis of the skin

- **Endoderm**

- Mucosae
- Glands

- **Mesoderm**

- Everything else



**Figure 16.17**



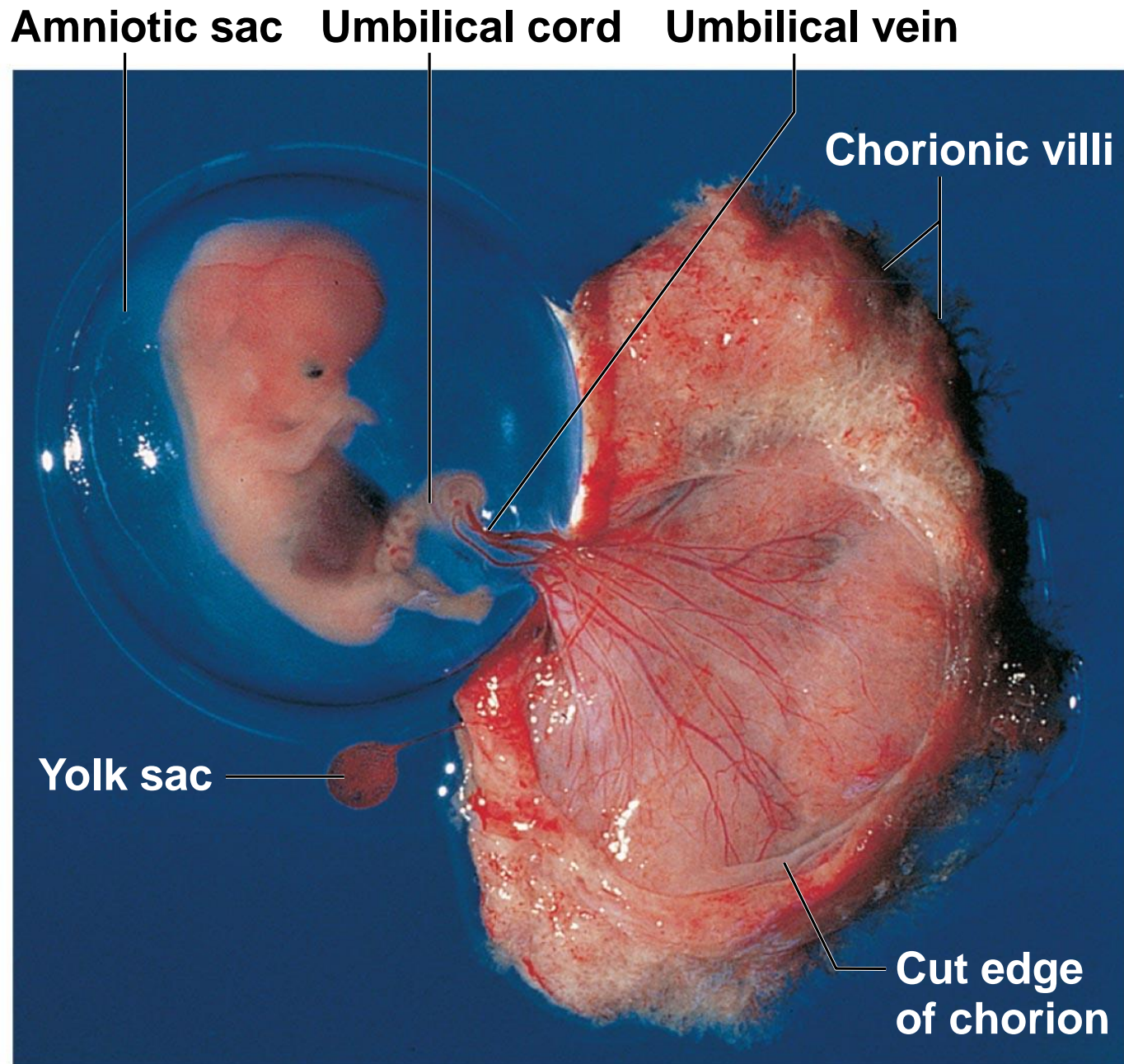


Figure 16.18

# Functions of the Placenta

- Forms a **barrier** between mother and embryo (blood is not exchanged)
- **Delivers nutrients and oxygen**
- **Removes waste** from embryonic blood
- Becomes an **endocrine organ** (produces hormones) and takes over for the corpus luteum (by end of second month) by producing
  - **Estrogen**
  - **Progesterone**
  - **Other hormones** that maintain pregnancy

# The Fetus (Beginning of the Ninth Week)

- All organ systems are formed by the end of the **eighth** week
- Activities of the fetus are growth and organ specialization
- This is a stage of tremendous growth and change in appearance



(a)



(b)

Figure 16.19a-b

# Development After Implantation

- **Chorionic villi** (projections of the blastocyst) develop
  - Cooperate with cells of the uterus to form the placenta
- **Amnion** — fluid-filled sac that surrounds the embryo
- **Umbilical cord**
  - Blood vessel-containing stalk of tissue
  - Attaches the embryo to the placenta

Workbook Page 334 #23

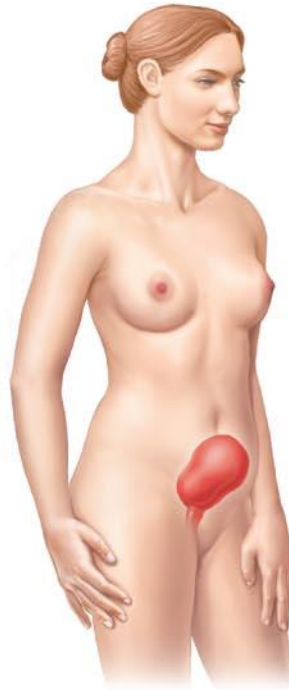
# Effects of Pregnancy on the Mother

- **Pregnancy** — period from conception until birth
- (1.) *Anatomical changes*
  - Enlargement of the uterus
  - Accentuated lumbar curvature (**lordosis**)
  - Relaxation of the pelvic ligaments and pubic symphysis due to production of **relaxin**





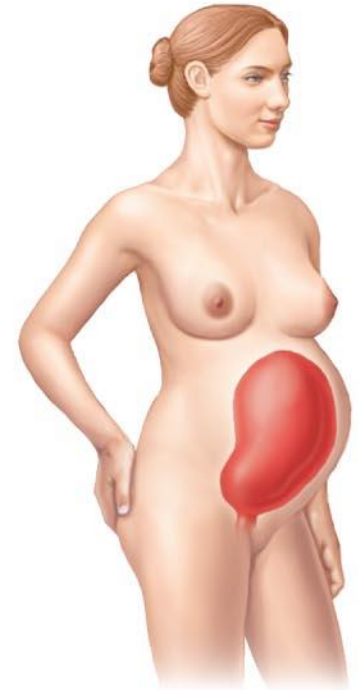
**(a) Before conception**  
(Uterus is the size of a fist and resides in the pelvis.)



**(b) 4 months**  
(Fundus of the uterus is halfway between the pubic symphysis and the umbilicus.)



**(c) 7 months**  
(Fundus is well above the umbilicus.)



**(d) 9 months**  
(Fundus reaches the xiphoid process.)



# Effects of Pregnancy on the Mother

- (2.) *Physiological changes*
  - (a) Gastrointestinal system
    - **Morning sickness** is common due to elevated progesterone and estrogens
    - **Heartburn** is common because of organ crowding by the fetus
    - **Constipation** is caused by declining motility of the digestive tract

# Effects of Pregnancy on the Mother

- (2.) *Physiological changes* (continued)
  - (b) Urinary system
    - Kidneys have additional burden and produce **more urine**
    - The uterus compresses the bladder, causing **stress incontinence**

# Effects of Pregnancy on the Mother

- (2.) *Physiological changes* (continued)
  - (c) Respiratory system
    - Nasal mucosa becomes **congested and swollen**
    - **Vital capacity and respiratory rate increase**
    - **Dyspnea** (difficult breathing) occurs during later stages of pregnancy

# Effects of Pregnancy on the Mother

- (2.) *Physiological changes* (continued)
  - (d) Cardiovascular system
    - **Blood volume increases** by 25 to 40 percent
    - **Blood pressure and pulse increase**
    - **Varicose veins** are common

Workbook Page 335 #28

# Childbirth (Parturition)

- **Labor** — the series of events that expel the infant from the uterus
  - Rhythmic, expulsive contractions
  - Operates by the positive feedback mechanism
- **False labor** — **Braxton Hicks contractions** are weak, irregular uterine contractions

# Childbirth (Parturition)

- Labor — the stages (in order)
  - *Initiation*
  - *Dilation*
  - *Expulsion*
  - *Placental*

# Childbirth (Parturition)

- **Initiation** of labor:
  - Estrogen levels rise
  - Uterine contractions begin
  - The placenta releases **prostaglandins**
  - **Oxytocin** produced by hypothalamus & released by the posterior pituitary
  - Combination of these hormones (oxytocin and prostaglandins) produces contractions



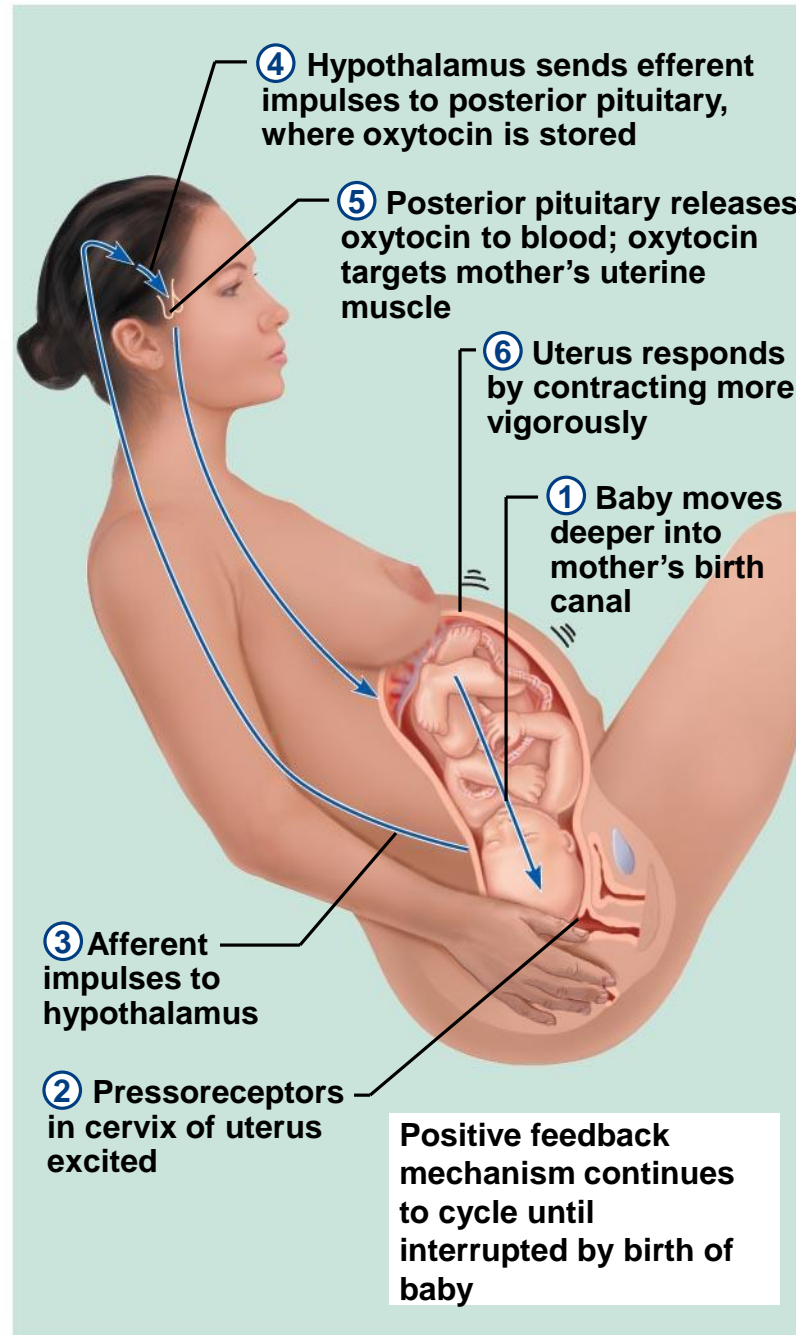
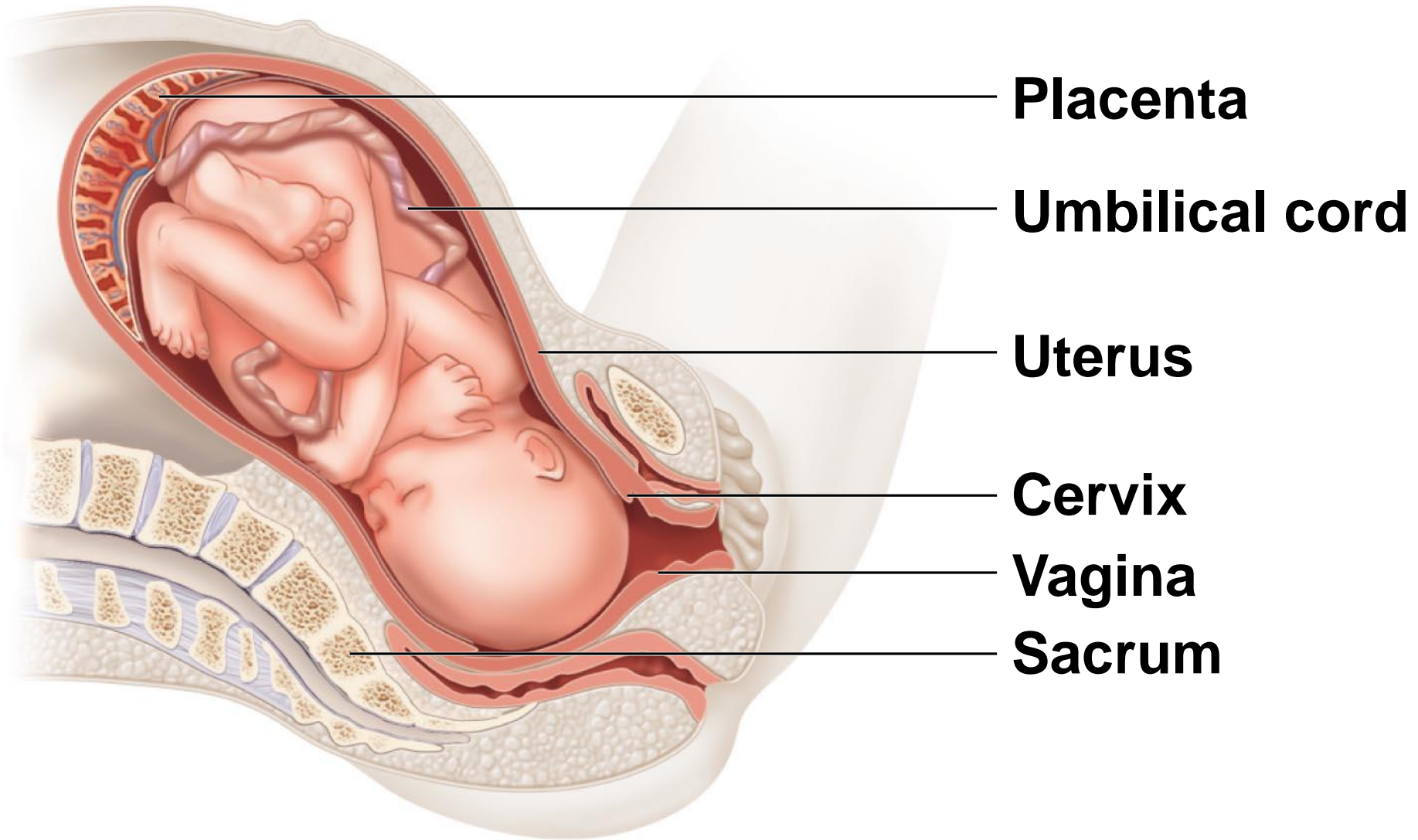


Figure 16.21

# Stages of Labor

- *Dilation*

- Cervix becomes dilated
- Full cervical dilation is 10 cm
- Uterine contractions begin and increase
- Cervix softens and **effaces** (thins)
- The amnion ruptures (“**breaking the water**”)
- Longest stage at **6** to **12** hours

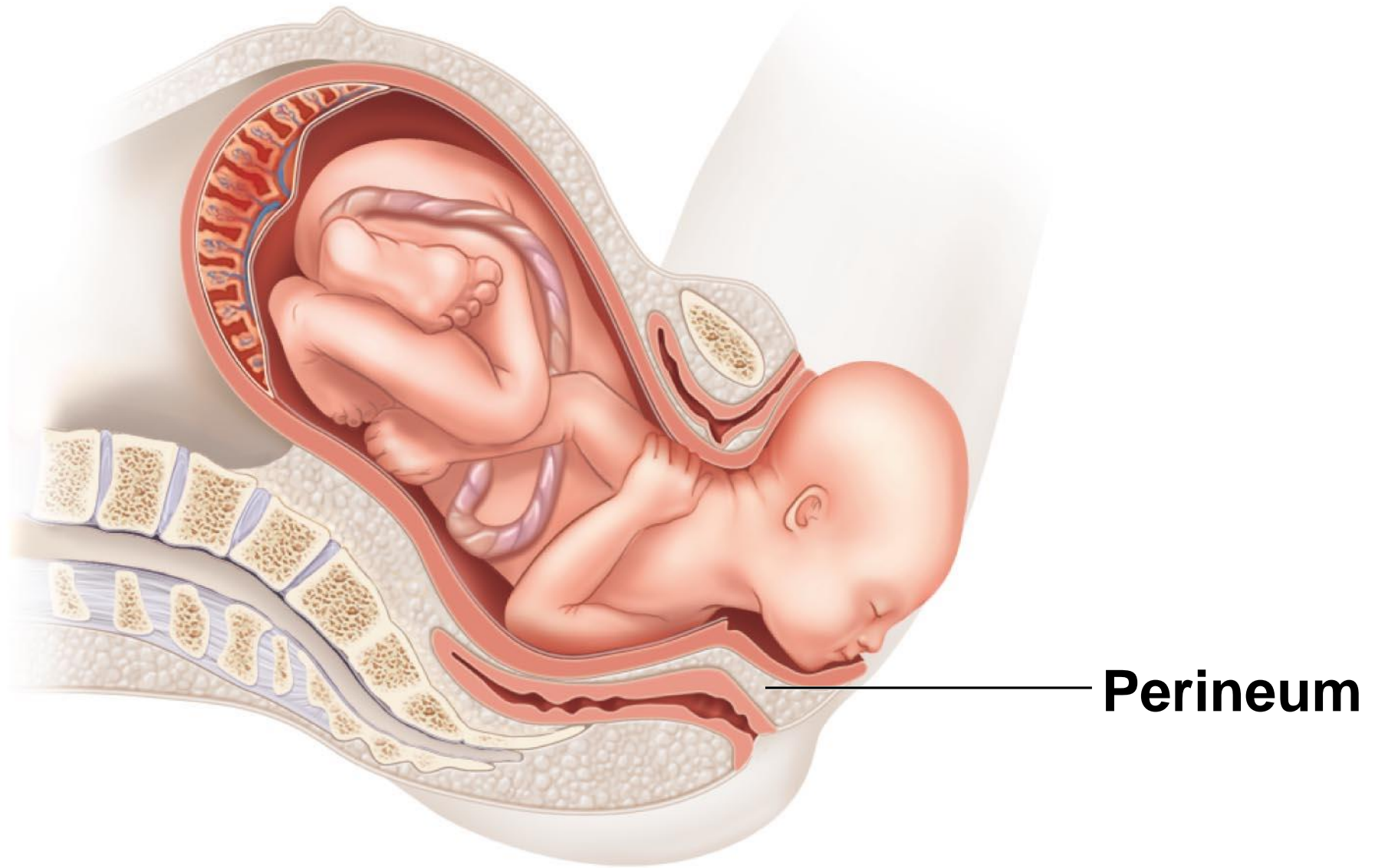


**(a) Dilation (of cervix)**

# Stages of Labor

- *Expulsion*

- Infant passes through the cervix and vagina
- Can last as long as **2** hours, but typically is **50 minutes** in the first birth and **20** minutes in subsequent births
- Normal delivery is head first (vertex position); **Breech** presentation is buttocks-first
- Orientation, among other factors, may dictate C – section



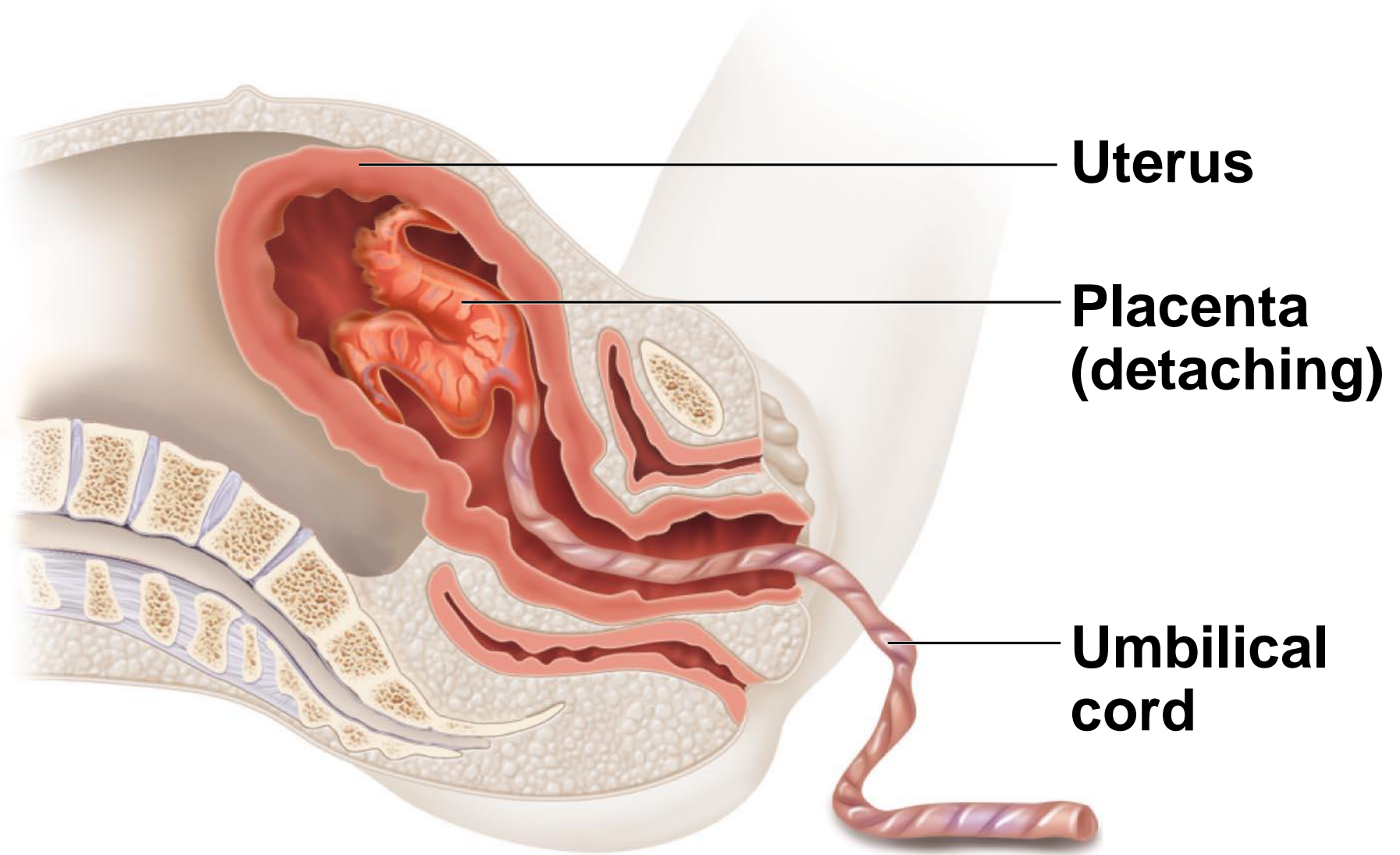
**(b) Expulsion (delivery of infant)**

# Stages of Labor

- *Placental stage*

- **Delivery of the placenta**
- Usually accomplished within 15 minutes after birth of infant
- **Afterbirth** — placenta and attached fetal membranes
- All placental fragments should be removed to avoid postpartum bleeding





**(c) Placental (delivery of the placenta)**

# Summative Videos

- <https://www.youtube.com/watch?v=3u251OXfsRU>
- <https://www.youtube.com/watch?v=92N7WPuoLZM>
- <https://www.youtube.com/watch?v=-DPY7gwxPhk>



# Developmental Aspects of the Reproductive System

- Gender is determined at fertilization
  - Males possess **XY** sex chromosomes
  - Females possess **XX** sex chromosomes
- Gonads do not begin to form until the eighth week
- **Testosterone** determines whether male or female structures will form

# Developmental Aspects of the Reproductive System

- Reproductive system organs do not function until puberty
- Puberty usually begins between ages 10 and 15

# Developmental Aspects of the Reproductive System

- Males

- Enlargement of testes and scrotum signals onset of puberty (often around age 13)

- Females

- Budding breasts signal puberty (often around age 11)
- **Menarche** — first menstrual period

# Developmental Aspects of the Reproductive System

- **Menopause** — a whole year has passed without menstruation
  - Ovaries stop functioning as endocrine organs
  - Childbearing ability ends
- There is no equivalent of menopause in males, but there is a steady decline in testosterone

# A Closer Look: Contraception

- **Contraception** — birth control
- **Birth control pill** — most-used contraceptive
  - Relatively constant supply of ovarian hormones from pill is similar to pregnancy
  - Ovarian follicles do not mature, ovulation ceases, menstrual flow is reduced

# A Closer Look: Contraception

- **Morning-after pill (MAP)**
  - Taken within 3 days of unprotected intercourse
  - Disrupts normal hormonal signals to the point that fertilization is prevented
- Other hormonal birth control devices cause cervical mucus to thicken
  - **Minepill** (tablet)
  - **Norplant** (rods placed under the skin)

# A Closer Look: Contraception

- **Intrauterine device (IUD)**

- Plastic or metal device inserted into uterus
- Prevents implantation of fertilized egg

- **Sterilization**

- **Tubal ligation** (females)—cut or cauterize uterine tubes
- **Vasectomy** (males)—cut or cauterize the ductus deferens

# A Closer Look: Contraception

- **Coitus interruptus** — withdrawal of penis prior to ejaculation
- **Rhythm** (fertility awareness) — avoid intercourse during period of ovulation or fertility
  - Record daily basal temperature (body temperature rises after ovulation)
  - Record changes in pattern of salivary mucus



# A Closer Look: Contraception

- **Barrier methods**
  - Diaphragms / Cervical caps / Condoms
  - Spermicidal foams / Gels / Sponges

# A Closer Look: Contraception

- Abortion — termination of pregnancy
- Miscarriage — spontaneous abortion is common and frequently occurs before a woman knows she is pregnant
- RU486 or “abortion pill” — induces miscarriage during first 7 weeks of pregnancy

