

Reproductive system

The organs associated with producing offspring

- Gonads produce gametes (sex cells) that fuse to make the offspring's first cell (the zygote)

	<u>Male</u>	<u>Female</u>
Gonad	testes	ovaries
Sex cell	sperm	egg or ova

√ The gonads also produce hormones that regulate reproduction

- Accessory reproductive organs assist in reproduction

√ Organs that conduct gametes

√ Glands that add secretions to gametes

Testes

The pair of male gonads that produce sperm and testosterone (male hormone)

- Located in the scrotum
- The immature sperm are formed in the seminiferous tubules of the testes from spermatogonia cells (requires testosterone from Sertoli cells and Leydig cells)

Figs 27.2, 27.4, and 27.5

The male reproductive system includes three tubular accessory organs that transport sperm to outside of the body and three accessory glands that secrete substances to activate, nourish, and protect the sperm

- The three tubular organs are the epididymis, the vas deferens, and the urethra
- The three glands are the prostate, the seminal vesicles, and the bulbourethral glands

Figs 27.2 and 27.4

### Epididymis

A coiled tube in scrotum where sperm mature

Figs 27.2 and 27.4

### Vas (ductus) deferens

Tubes that pass sperm (during sexual excitement) from the epididymis, through the prostate gland, to the urethra

Figs 27.2 and 27.4

### Urethra

Tube running from base of bladder to the tip of the penis

- Sperm enter the urethra at the prostate gland

Fig 27.2

### Semen

A mixture of sperm and fluids from accessory glands that males ejaculate

- Each ejaculation contains 2 – 5 ml semen and 120 – 750 million sperm
- The seminal fluids contain substances that activate, nourish, and protect the sperm

### Prostate gland

A single gland that surrounds the urethra near the bladder

- ✓ The prostate adds sperm-activating chemicals to the semen and also a buffer to neutralize acids in the urethra and vagina

Fig 27.2

### Seminal vesicles

A pair of glands that connect to the vas deferens in the prostate gland

- ✓ They add sperm nutrients to the semen

Fig 27.2

### Bulbourethral glands

A tiny pair of glands that connect to the urethra below the prostate gland

- ✓ They add to the semen mucus and a buffer

Fig 27.2

Penis

The organ that delivers sperm to the female reproductive system

- Erection = The filling of the penis' spongy tissue with blood during sexual excitement

Figs 27.2 and 27.7

Scrotum

A sac of skin that holds the testes

Fig 27.2

Hormonal regulation of the male reproductive system

- FSH = A pituitary hormone that causes the Sertoli cells of the testes' seminiferous tubules to produce sperm
- LH = A pituitary hormone that causes the testes to produce testosterone
- Testosterone = A steroid hormone produced in the testes
  - √ Causes the embryo to develop male reproductive organs
  - √ At puberty, causes maturation and enlargement of the male sex organs
  - √ Increases sex drive
  - √ Causes development of male secondary sex characteristics (Lowering of voice, facial hair, enlargement of bones and muscles, and (perhaps) aggressive behavior)

Figs 27.8 and 27.18; Tables 17.2 and 27.1

### Ovaries

The pair of female gonads that produce ova (eggs) and female hormones

- Follicles = Structures in the ovary that house eggs
    - √ There is only one egg per follicle
    - √ Every 28 days, one follicle matures and ejects its egg (ovulation)
  - Corpus luteum = The remains of the follicle after ovulation
    - √ The corpus luteum produces the steroid hormones estrogen and progesterone after ovulation
- Figs 27.9, 27.11, and 27.12; Table 17.2

The female reproductive system includes three accessory organs that conduct the egg, receive the sperm, and house the developing baby

- The fallopian tubes, the vagina, and the uterus

Fig 27.9

### Fallopian (uterine) tubes

Tubes that transport the egg from the ovary to the uterus; They also serve as the sight where the egg is fertilized

- Fimbriae = Waving projections at the tip of the fallopian tubes that sweep the freshly ovulated egg from the ovary to the inside of the fallopian tube
  - √ Fallopian tubes do **not** directly connect to ovary
- Cilia = Waving hair-like projections inside the fallopian tube that propel the egg to the uterus in 3 – 4 days

Figs 27.9 and 27.11

### Uterus

A hollow accessory organ that receives the fertilized egg and houses it throughout its development into a baby

- Endometrium = The inner lining of the uterine wall
  - √ The site of egg implantation
  - √ The lining sloughs off every 28 days if pregnancy does not occur (menstrual flow)
- Myometrium = The smooth muscle layer of the uterine wall
- Fundus = The rounded superior portion of the uterus
- Cervix = The narrow inferior portion of the uterus (protrudes into the vagina)

Figs 27.9 and 27.11

### Vagina (Birth canal)

A tube spanning from the cervix to the exterior of body

- The vagina receives sperm from the penis
- The vagina passes the infant out during childbirth and the menstrual flow during monthly cycles

Fig 27.9

### Vulva (female external genitalia)

The external structures at the vagina's opening

- Labia majora and labia minora = lip-like folds of skin
- The urethra exits the body just superiorly to the vagina
- Clitoris = A small protruding structure (just superior to the urethral exit) that corresponds to the penis in males

Figs 27.9 and 27.10

### The female reproductive cycle

The monthly changes in a woman's reproductive organs and fertility

- The average female reproductive cycle is 28 days in length
- The reproductive cycle is composed of two simultaneous cycles: The ovarian cycle (the monthly changes in the ovaries) and the uterine cycle (the monthly changes in the uterus)

### Ovarian cycle

The monthly changes in the ovaries

The pituitary hormones FSH and LH control the ovarian cycle

- Elevated FSH and LH at start of cycle (day 1) cause one follicle to mature each month
    - √ The maturing follicle releases estrogen
  - A sudden FSH/LH “spike” at midcycle (day 14) causes ovulation (release of an egg from the ovary)
  - After ovulation, the follicle becomes a corpus luteum (an endocrine gland that releases estrogen and progesterone)
    - √ The corpus luteum is sustained by LH
  - If no pregnancy occurred, falling LH levels cause the corpus luteum to degenerate by the end of the cycle (day 28)
    - √ As the corpus luteum degenerates, it releases less and less progesterone and estrogen
  - If pregnancy occurs, however, the corpus luteum persists and continues to release estrogen and progesterone beyond day 28
- Figs 27.11, 27.12, 27.13, and 27.15

The uterine cycle

The monthly changes in the uterus

- Each cycle involves a thickening of the endometrium (to provide a nutrient-rich location for the fertilized egg to implant)
- Day 1 – 5 (Menstruation): The previous thickened lining sloughs off and is discharged through the vagina as the menstrual flow

- Day 6 – 14 (Proliferative phase): Growth and thickening of a new endometrial lining

√ The growth of the new lining is caused by estrogen released from the maturing follicle in ovary

- Day 15 – 28 (Secretory phase): Increase in the stickiness of the new endometrial lining

√ The increased stickiness of the lining makes it able to bind the fertilized egg and also prevents menstruation (the detaching of the lining from the uterus wall)

√ The increase in lining stickiness is caused by progesterone released from the corpus luteum in the ovary

√ If fertilization does not occur, progesterone levels fall, causing less stickiness of the lining, which leads to menstruation (lining sloughing off) after day 28

[Figs 27.11, 27.13, and 27.15](#)



Hormone-based contraceptives:

- Birth control pills: Contain progesterone and estrogen at levels which mimic pregnancy. This halts ovulation.
- Norplant: Subcutaneous rods that release progesterone for several years
- Depo-Provera: A synthetic progesterone injection that halts ovulation for several months
- MAPs (morning-after pills): Large doses of progesterone and estrogen that prevent implantation of the fertilized egg
- RU486: A pill that, if taken within seven weeks of pregnancy, induces miscarriage of embryo

Mammary glands (breasts)

Structures that (in females) produce milk for offspring

- Breasts contain alveolar (milk producing) glands and adipose tissue
- Lactiferous and alveolar ducts = Passageways for milkflow to nipple
- Areola = The pigmented circle surrounding the nipple
- The pituitary hormones prolactin and oxytocin regulate lactation
  - ✓ Prolactin causes alveolar glands to make milk
  - ✓ Oxytocin causes ejection of milk

Figs 27.17 and 28.23

Fertilization

Sperm and egg combining to form a zygote (fertilized egg)

- The unfertilized egg is viable for 24 hours after ovulation
- Sperm are viable for 72 hours (3 days) after ejaculation
- Therefore, intercourse 72 hours before or 24 hours after ovulation can lead to fertilization

Fig 28.5

Embryo

The developing offspring from fertilization through eighth week of pregnancy

Figs 28.4, 28.5, and 28.15

Embryonic development major events:

- The embryo divides repeatedly while traveling to the uterus
  - √ Blastocyst = An early stage of the embryo, where it is a hollow ball of cells with a smaller clump of cells inside
    - Trophoblasts = The outer cells of the blastocyst (These cells will form the placenta)
    - Inner cell mass = The inner cells of the blastocyst (These cells will form the baby)
  - Implantation = When the blastocyst implants in the endometrium (on about day seven after ovulation)
    - √ The blastocyst releases hCG (an LH-like hormone) to sustain the corpus luteum
      - Estrogen and progesterone from the corpus luteum sustain pregnancy by preventing menstruation
  - The baby develops from the inner cell mass
    - √ Week four: Heart beating
    - √ Week eight: Foundations of all organ systems present
  - The placenta (the organ of nutrient, waste, and gas exchange between embryo and mother) develops from the trophoblast cells and maternal cells by week three
    - √ The placenta makes its own progesterone and estrogen
    - √ Umbilical cord = A tube connecting the embryo to the placenta for exchange of materials
    - √ Amnion = A fluid-filled sac that surrounds embryo

[Figs 28.4, 28.5, 28.6, 28.11, 28.12, and 28.15; Table 28.1](#)

Fetus

The developing baby from the ninth week to term (ready for birth stage) at around nine months (37 weeks)

- Fetal growth and development continue until term
  - √ Poor nutrition and use of alcohol, tobacco, or drugs can negatively affect growth and development
- Typical birth weight = 6 – 10 pounds

Fig 28.17

Changes in mother

- The uterus expands upward to accommodate fetal growth
  - √ The initial embryonic growth is in the pelvic cavity
  - √ As the uterus expands upward into the anterior abdominal cavity, abdominal organs are pressed superiorly, against the thoracic cavity
- The mother's skeletal system also changes
  - √ The placenta releases relaxin (a hormone that loosens pelvic ligaments for easier childbirth)
  - √ Lumbar vertebrae curvature increases to accommodate the extra weight
- The mother has increased activity of her excretory and respiratory systems due to the fetal metabolism
- The mother's blood volume, blood pressure, and pulse rate increase
- Breasts enlarge and prepare for lactation

Fig 28.18; Table 28.2

Parturition (or partum)  
Childbirth

Labor

The events that result in expelling the infant from the uterus

- The myometrium contracts in rhythmic waves, expelling the infant over several hours

√ Contractions are due to the pituitary hormone oxytocin

Stages of labor

(1) Dilation stage = Start of contractions to dilation of cervix (6 –12 hours)

- Dilation is caused by the baby's head pressing against the cervix
- Water breaking = Amniotic fluid escaping through the vagina when the amnion ruptures

(2) Expulsion stage = Full dilation to delivery of infant (1 hour on first birth, 20 minutes on subsequent births)

- Prolonged or difficult expulsion stage can lead to brain damage in fetus
- Cesarean section = Surgical delivery of an infant (through the abdomen) to avoid complications

(3) Placental stage = Delivery of the afterbirth (the placenta and membranes). Usually within 15 minutes of the infant's delivery

Fig 28.21