

Reproduction Notes

Mrs. Laux

AP Biology

I. Asexual Reproduction

→ a single parent endows its offspring with a set of genes identical to its own (except for mutations)

A. Forms

1. Budding

a. a part of the parent's body grows and separates from the rest of the body

2. Fragmentation

a. the parent's body may break into several pieces: each piece can develop into a new animal

3. Parthenogenesis

a. an unfertilized egg develops into an adult

II. Sexual Reproduction

→ offspring are produced by the fusion of two types of gametes [egg (ovum) and sperm]

A. Fertilization

→ when sperm and egg fuse, a fertilized egg, or zygote, forms

1. External

a. mating partners typically release eggs and sperm into the water simultaneously

2. Internal

a. the male delivers sperm into the female's body

3. Hermaphroditism

a. a single individual produces both eggs and sperm

III. Human Male Reproductive System

A. Parts

1. testes

a. produce sperm and testosterone (interstitial cells)

b. housed in the scrotum

i. cooling unit, maintains sperm below body temp

ii. if testes don't descend into sac, seminiferous tubules degenerate and male becomes sterile

iii. treated surgically or hormonally

iv. connected to pelvic cavity by inguinal canals

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- a. can get an inguinal hernia
- c. contain seminiferous tubules
 - i. spermatogenesis takes place here
- d. Sertoli cells
 - i. large cells, produce fluid that nourishes sperm cells
- 2. series of conducting ducts
 - a. vas deferens (sperm ducts), ejaculatory duct, urethra
 - i. transport sperm from testes out of the body
- 3. accessory glands
 - a. seminal vesicles secrete nutritive fluid
 - i. fructose -give sperm nourishment and energy
 - ii. prostaglandins-stimulate contractions of uterus, help sperm move up female reproductive tract
 - b. prostate gland
 - i. secretes alkaline fluid
 - a. neutralizes acidic environment of vagina
 - b. gives sperm motility
 - c. bulbourethral glands
 - i. secrete mucous
 - a. lubricates penis for penetration into vagina
- 4. penis
 - a. organ of copulation
 - b. long shaft; end enlarges to form expanded tip, the glans
 - c. glans covered with prepuce or foreskin
 - i. circumcision-removal of prepuce
- 5. semen
 - a. 3.5 mL per ejaculation, 200 million sperm

B. Spermatogenesis

- 1. spermatogonia divide by mitosis
- 2. some differentiate and become primary spermatocytes
- 3. undergo meiosis
- 4. first meiotic division produces 2 secondary spermatocytes
- 5. second meiotic division, each secondary spermatocyte yields 2 spermatids

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6. each spermatid differentiates to form a mature sperm
7. sperm has a head which contains a nucleus and a cap, or acrosome, with enzymes

C. Sperm

1. complete their maturation in epididymus and vas deferens
2. during ejaculation
 - a. sperm pass from vas deferens to ejaculatory duct to urethra in penis
 - b. each ejaculate of semen contains 400 million sperm
 - c. suspended in secretions of
 - i. seminal vesicles
 - ii. prostate gland
 - iii. bulbourethral glands-release mucous secretion

D. Penis

1. consists of:
 - a. 3 columns of erectile tissue
 - i. 2 cavernous bodies plus
 - ii. 1 spongy body-surrounds urethra
 - a. engorgement with blood causes penis to become erect- more blood flows in than out
 - b. no bone in human penis, though some mammals have penis bones

E. Endocrine regulation of male reproduction

1. involves
 - a. hypothalamus
 - i. secretes gonadotropin-releasing hormone (GnRH)
 - ii. stimulates anterior pituitary gland
 - b. pituitary gland
 - i. secretes gonadotropic hormones
 - a. FSH (follicle-stimulating hormone)
 - b. LH (luteinizing hormone)-also called interstitial cell stimulating hormone (ICSH)
 - ii. FSH, LH, and testosterone directly or indirectly stimulate sperm production

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iii. LH stimulates the interstitial cells of testes to produce testosterone

c. testes

i. produce testosterone (androgen-principal male sex hormone)

a. responsible for establishing and maintaining male primary sex characteristics and secondary sex characteristics

IV. Human Female Reproductive System

A. Parts

1. ovaries

a. produce oocytes

b. steroid hormones

i. estrogens

ii. progesterone

2. oviducts (uterine tubes or fallopian tubes)

a. allow passage of egg from ovary to uterus due to peristalsis and beating of cilia

3. uterus (womb) pear-shaped

a. incubates the developing embryo

b. epithelial lining called endometrium

c. lower part is the cervix-extends into vagina

4. vagina

a. lower part of birth canal

b. site of penis insertion during sexual intercourse (coitus)

5. vulva

a. external genitalia

i. labia majora

ii. labia minora

iii. clitoris-erectile tissue, becomes engorged with blood; sensitive to touch, pressure, and temperature; center of sexual sensation

iv. mons pubis-fatty tissue; covered with coarse pubic hair

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v. hymen-thin ring of tissue; forms border around entrance to vagina

6. breasts

a. mammary glands for nursing newborn-lactation

i. first few days produce colostrum-contains protein and lactose; little fat

ii. stimulated by Prolactin

iii. milk released by oxytocin

b. consist of 15 to 20 lobes of glandular tissue

c. gland cells arranged in alveoli

B. Oogenesis

1. takes place in the ovaries

2. oogonia differentiate into primary oocytes

3. primary oocyte and cluster of cells surrounding it make up follicle

4. as follicle grows, primary oocyte undergoes first meiotic division

5. gives rise to secondary oocyte (gets all of the cytoplasm) and a polar body

6. after second meiotic division have oocyte and 3 polar bodies (disintegrate)

7. after ovulation (release of secondary oocyte from ovary), secondary oocyte enters oviduct, where fertilization may take place

8. part of follicle remaining in ovary develops into corpus luteum

C. Endocrine regulation of female reproductive system

1. involves

a. hypothalamus

b. pituitary

c. ovaries

D. Menstrual cycle

1. marked by menstrual bleeding at beginning-day 1

2. ovulation-day 14

3. total cycle-28 days

4. events coordinated by gonadotropic and ovarian hormones

5. preovulatory phase

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- a. GnRH from hypothalamus stimulates anterior pituitary to secrete FSH
 - i. stimulates follicle development
 - ii. developing follicles release estrogens
 - a. stimulate development of endometrium
 - b. signal anterior pituitary to secrete LH
 - c. LH stimulates ovulation
6. postovulatory phase
 - a. LH promotes development of corpus luteum
 - i. secretes progesterone, estrogens
 - a. stimulate final preparation of uterus for possible pregnancy
 - b. estrogens inhibit secretion of GnRH, FSH, and LH
7. if secondary oocyte is fertilized
 - a. development begins and tiny embryo implants in uterus
 - b. membranes around embryo secrete
 - i. human chorionic gonadotropin (hCG)-you are pregnant!
 - a. maintains corpus luteum
8. if fertilization does not occur
 - a. corpus luteum degenerates
 - b. concentrations of estrogens/progesterone in blood fall
 - c. endometrium is shed-menstruation occurs
9. estrogens responsible for:
 - a. secondary female sex characteristics
10. PMS -premenstrual syndrome
 - a. condition experienced by some women
 - b. begins several hours to ten days before menstruation
 - c. ends a few hours after onset of menstruation
 - d. symptoms include: fatigue, anxiety, depression, irritability, headache, edema, skin eruptions
 - e. cause-unknown

IV. Sexual stimulation

A. Physiological responses

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1. vasocongestion-a condition in which the spongy tissue of the penis and clitoris expands with blood during sexual arousal

2. increased muscle tension

B. Phases of sexual response

1. sexual excitement

2. plateau

3. orgasm

4. resolution

V. Fertilization

→fusion of secondary oocyte and sperm to form a zygote

→fertilization + establishment of pregnancy = conception

VI. Parturition

A. the birth process

1. hormones

a. oxytocin

b. prostaglandins

B. Labor-3 stages

1. ~12 hours, fetus moves to cervix, cervix dilates to max or 10 cm and becomes effaced (flattened); amnion ruptures-releases 1 L of amniotic fluid

2. ~20 minutes to 1 hour; fetus is delivered-passes through cervix and vagina; uterine and abdominal wall contractions by mother

3. ~10 to 15 minutes, placenta and fetal membranes = (afterbirth) are expelled

VII. Contraception=against conception

A. Hormonal methods

1. oral contraceptives-by mouth, "the pill"

a. combo progestin and synthetic estrogen; natural hormones destroyed by liver almost immediately; synthetic absorbed and metabolized slowly

b. pills for 21 days; placebos for 7 days

c. 99.7% effective

d. prevent ovulation

e. trick pituitary into thinking you are pregnant

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2. Depo-Provera-DMPA -injectable progestin
 - a. prevents ovulation
 - b. injected intramuscularly every 3 months
 3. implantation of progestin-Norplant
 - a. inserted under skin of arm
 - b. inhibits ovulation, thickens cervical mucus
 - c. effective for 5 years
 4. morning-after pills
 - a. post-coital
 - b. change endometrium so embryo cannot implant in uterine wall
 - c. taken up to 72 hours after intercourse; 75% effective
- B. Intrauterine devices (IUDs)**
1. small plastic loop or coil, inserted into uterus
 2. up to 10 years
 3. 99% effective
 4. inflames wall of uterus?
 5. interferes with embryo implantation
 6. body produces WBCs to object and these attack fertilized ovum
- C. Condoms**
1. mechanical method of birth control
 2. only contraceptive device sold for men
 3. provides barrier that contains semen; sperm cannot enter female tract
 4. some protection against AIDS and STDs
- D. Contraceptive diaphragm**
1. mechanically blocks passage of sperm from vagina into cervix
 2. covered with spermicidal jelly or cream or foams
 3. inserted prior to sexual intercourse (coitus, copulation)
- E. Sterilization**
1. Vasectomy-male
 - a. vas deferens are cut and tied
 - b. sperm made at slower rate; phagocytized in testes by WBCs
 - c. semen amount still roughly the same-sperm account for little of volume

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d. can reverse about 70% of time; other 30% produce antibodies against own sperm and are sterile

2. Tubal ligation-female

a. cut and tie oviducts

F. Emergency contraception-see morning after pills

1. rape

2. unprotected intercourse

VIII. Abortions-termination of pregnancy; results in death of embryo or fetus

A. Spontaneous-miscarriage

1. no intervention

2. embryos frequently abnormal

B. Therapeutic

1. intervention

a. to protect mother's health

b. grossly abnormal embryo

2. suction method (less than 12 weeks) or

3. drugs interrupt pregnancy-methotrexate, RU-486 (mifepristone)

4. more than 12 weeks-D and E (dilation and evacuation); forceps and suction

C. Birth control-most controversial

IX. Sexually transmitted diseases (STDs) or venereal diseases (VD)

→most prevalent communicable disease, next to cold, in the world

A. Chlamydia-caused by a bacterium

1. causes pelvic inflammatory disease (PID)

B. Gonorrhea-bacterium

C. Syphilis-spirochete bacterium

D. Genital herpes-herpes simplex type 2 virus

E. Pelvic inflammatory disease (PID)-caused by A or B

F. AIDS-HIV

G. Yeast infections-fungus

H. Trichomoniasis-protozoan

I. Genital warts-human papilloma virus (HPV)