



CHAPTER 46: ANIMAL REPRODUCTION

AP Biology 2013

1

BOTH ASEXUAL AND SEXUAL REPRODUCTION OCCUR IN THE ANIMAL KINGDOM

- Asexual methods:

- Binary fission - separation of a parent into two individuals about the same size
- Budding - new individuals arise from outgrowths of existing one
- Fragmentation - breaking of the body into several pieces some which develop into complete adults (accompanied by regeneration)



Fig. 46.2

- Parthenogenesis - processes in which an egg develops without being fertilized
- Animals may reproduce exclusively asexually or sexually, or they can alternate between the two.

2

SEXUAL REPRODUCTIVE PATTERNS

- Sexual reproduction presents a special problem for certain organisms that seldom encounter a mate
- One solution is hermaphroditism when each individual has both male and female reproductive systems
- Another solution is sequential hermaphroditism when an individual reverses its sex during its lifetime



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Costs? Benefits?

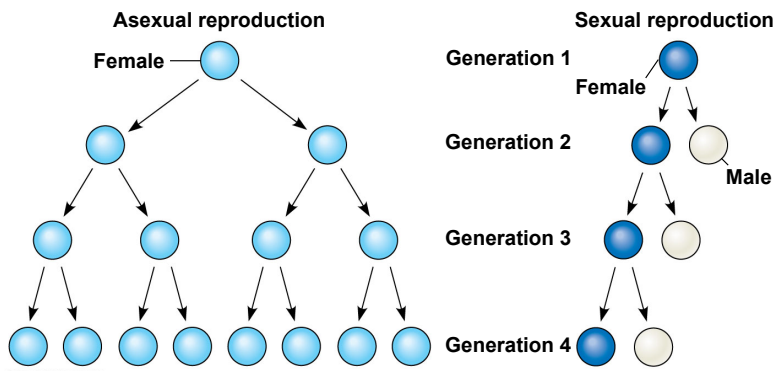


Fig. 46.3

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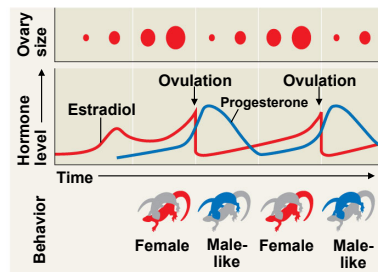
VERTEBRATE REPRODUCTION

Fig. 46.3

- Some fish, amphibians, and lizards reproduce by a complex form of parthenogenesis that involves the doubling of chromosomes after meiosis
- For some animals, finding a sexual partner is challenging and one solution is hermaphroditism
- Some species exhibit sex reversals



(a) *A. uniparens* females



(b) The sexual behavior of *A. uniparens* is correlated with the cycle of ovulation.

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FERTILIZATION

- Union of sperm and egg
- External fertilization - eggs shed by the female are fertilized by sperm in the external environment
- Internal fertilization - sperm are deposited in or near the female reproductive tract and fertilization occurs within the tract
- Either require critical timing mediated by environmental cues, pheromones, and/or courtship behavior
- Internal fertilization requires important behavioral interactions between male and female animals and requires compatible copulatory organs



Fig. 46.6

6

SURVIVAL

- All species produce more offspring than the environment can handle
- Embryos of terrestrial animals develop in eggs that can withstand harsh environments
- Instead of secreting a shell around the embryo, many animals retain the embryo which develops inside the female
- Parental care differs



Fig. 46.7

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GAMETE PRODUCTION

- Least complex systems of gamete production do not even contain gonads (organs that produce gametes) but gametes form from undifferentiated tissue
- Most complex contain many sets of accessory tubes and glands that carry, nourish, and protect the gametes and developing embryos
- Some animals with simple body plans have highly complex reproductive systems
- Most insects have separate sexes with complex reproductive systems
- Cloaca - common opening of digestive, excretory, and reproductive systems that is common in non-mammalian vertebrates

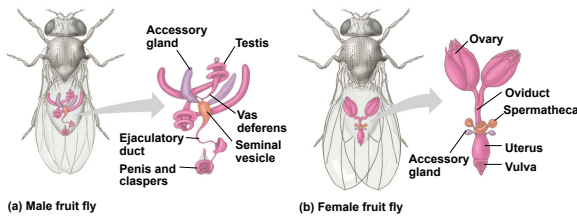


Fig. 46.8

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REPRODUCTIVE ORGANS

- Female
 - Ovary enclosed by tough protective capsule containing many follicles
 - Follicle - consists of one egg cell surrounded by one or more layers of follicle cells
 - Ovulation - expelling an egg cell from a follicle
 - Remaining solid follicular mass (corpus luteum) secretes hormones if a pregnancy occurs
 - Cilia in the fallopian tube carry the egg to the uterus
 - Mammary glands are not part of the reproductive system
 - They are important for reproduction as sacs of epithelial tissue that secrete milk

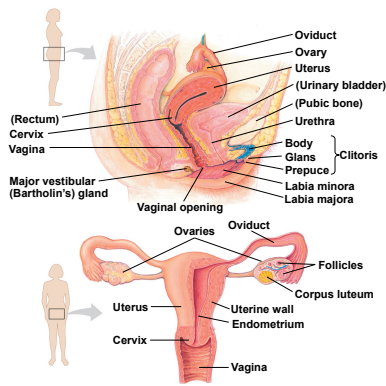


Fig. 46.10

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REPRODUCTIVE ORGANS

• Male

- Testes consist of highly coiled tubes surrounded by layers of connective tissue (seminiferous tubules - where sperm forms)
- Production of sperm cannot occur at body temperature so testes are held outside the abdominal cavity in the scrotum
- The sperm pass through more coiled tubes called the epididymis.
- During copulation sperm are propelled through the vas deferens and urethra
- Accessory glands:
 - Prostate - secretes directly into the urethra
 - Bulbourethral gland - secretes mucus that neutralizes acidic urine

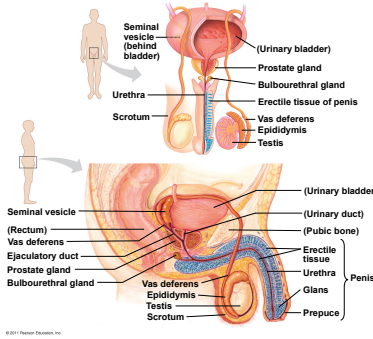


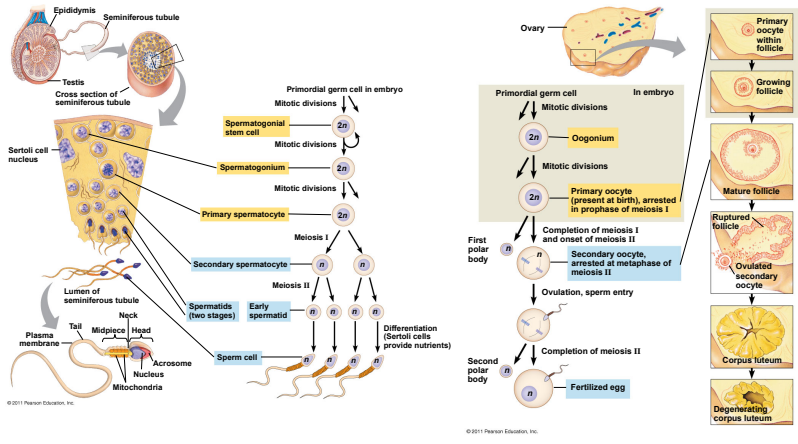
Fig. 46.11

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GAMETOGENESIS

- Oogenesis - development of mature ova
- Spermatogenesis - development of mature sperm

Figs. 46.12 & 46.13



11

FEMALE REPRODUCTIVE CYCLES

- Estrous cycles - endometrium is reabsorbed by the uterus and sexual receptivity is limited to a "heat" period
- Menstrual cycles (primates) - endometrium is shed from the uterus in a bleeding event called menstruation and sexual receptivity is not limited to specific timeframe
- Human cycle involves the uterus and ovaries
- Hormones in the hypothalamus (GnRH) and anterior pituitary gland (FSH and LH) orchestrate the cycle

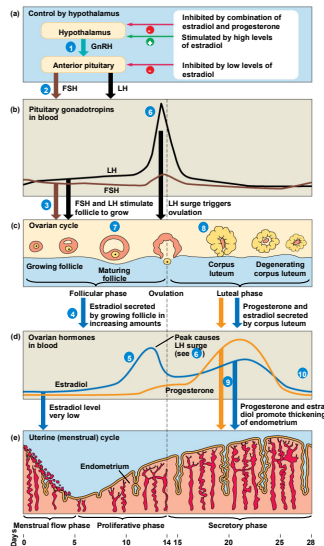


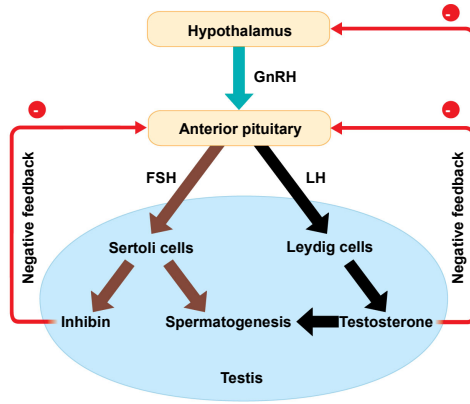
Fig. 46.13

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MALE HORMONAL CONTROLS

Fig. 46.14

- Testosterone and other androgens are responsible for primary and secondary sex characteristics
- Hormonal secretions are controlled by the hypothalamus and pituitary glands



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PLACENTAL MAMMALS

- Gestation - condition of carrying one or more embryos in the uterus
- Fertilization occurs in the oviduct
- After fertilization, the zygote undergoes cleavage and develops into a blastocyst before implantation in the endometrium.

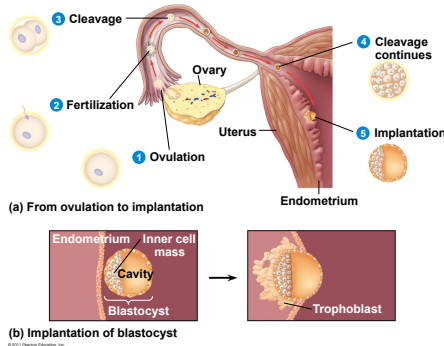


Fig. 46.15

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HUMAN GESTATION

- 1st trimester
 - Embryo obtains nutrients from the endometrium until the outer layer of blastocyst interacts with the endometrium to form the placenta
 - Main period of organogenesis
- 2nd trimester - growth, mother will feel movements
- 3rd trimester - continued growth

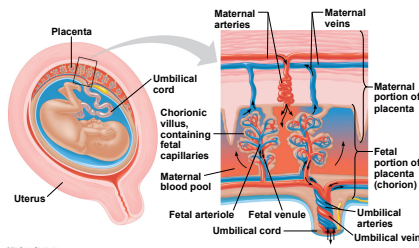
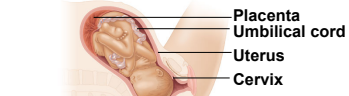
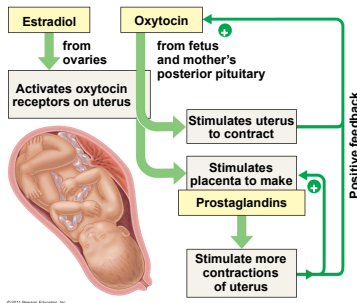


Fig. 46.16 & 46.17

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LABOR AND BIRTH

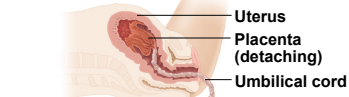
Figs. 46.18 & 46.19



1 Dilation of the cervix



2 Expulsion: delivery of the infant



3 Delivery of the placenta

- Complex interplay of regulators and hormones induces labor
- Birth happens after a long series of uterine contractions

CONTRACEPTION

- Prevent release of mature eggs and sperm from gonads
- Prevent fertilization by keeping sperm and eggs apart
- Prevent implantation of embryo

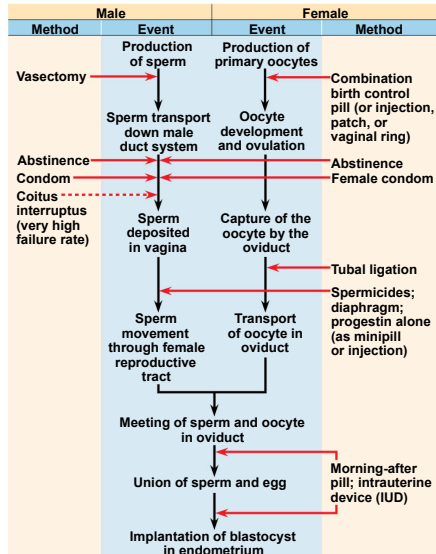


Fig. 46.20

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REPRODUCTIVE TECHNOLOGY

- Amniocentesis and chorionic villus sampling
- Invasive techniques where amniotic fluid or fetal cells are obtained
- Noninvasive procedures
 - Ultrasound
- *In vitro* fertilization

