

## Animal Reproduction and Development

- ❑ **Sexual reproduction** is the creation of offspring by the fusion of haploid gametes to form a zygote.
  - ❑ The female gamete is the ovum.
  - ❑ The male gamete is the spermatozoon.
- ❑ **Asexual reproduction** is reproduction in which all genes come from one parent; there is no fusion of egg and sperm.
  - ❑ Asexual reproduction can only occur by **binary fission**, which is the separation of a parent into two or more individuals of about the same size.
- ❑ **Budding** is another form of asexual reproduction, in which new individuals bud off of the parent.
  - ❑ Budding occurs in yeast cells.
- ❑ **Fragmentation** is a form of asexual reproduction in which an individual breaks into several pieces, all of which then form complete adults.
  - ❑ Regeneration, the re-growth of body parts, is a necessary part of fragmentation.
- ❑ **Parthenogenesis** is the process in which an egg develops without being fertilized. Adults produced by this process are often haploid, and eggs are formed without meiosis (seen in bees, wasps, ants, fishes, amphibians, lizards – pg. 976 in text).
- ❑ **Hermaphroditism** exists when each individual has both male and female reproductive systems.

- ❑ Most must mate with another member of the same species

### Mechanisms of Sexual Reproduction

**Fertilization** is the union of sperm and egg.

***External fertilization*** occurs when eggs are shed by the female and fertilized by the male outside the female's body.

***Internal fertilization*** occurs when sperm are deposited in the female reproductive tract and fertilization occurs within the tract.

**Gonads** are the organs that produce gametes in most animals.

### Mammalian Reproduction

The male's external reproductive organs are the **scrotum** and **penis**.

The internal organs include:

Gonads (**testes**) – which produce gametes and hormones

Accessory glands – which secrete necessary fluids

Ducts – which carry sperm and glandular secretions

The testes are made up of many highly coiled tubules surrounded by connective tissue.

The tubules are **seminiferous tubules**, the sites of sperm production.

In between the tubules are **Leydig cells**, which produce testosterone and other androgens.

- ❑ The testes are held in the scrotum, which is located outside the lower abdominal pelvic cavity.
- ❑ The sperm passes from the seminiferous tubules into the **epididymis**, a highly coiled tubular structure.
  - ❑ It takes about 20 days for the sperm to pass through the 6m long tubules of each epididymis.
  - ❑ During this passage, the sperm become motile and gain the ability to fertilize.
  - ❑ Sperm leaves the epididymis and travels through the muscular ducts of the **vas deferens**, which ultimately meets up with a duct from the **seminal vesicle** and forms an ejaculatory duct, which opens into the urethra.
    - ❑ The seminal vesicles, accessory glands, add secretions to the sperm, forming semen. About 60% of the total volume of semen comes from these accessory glands.
- ❑ The seminal vesicles, the **prostate gland**, and the **bulbourethral gland** all contribute secretions to the sperm to create semen. These secretions supply necessary nutrients and a medium for the sperm cells.'
- ❑ The penis is composed of three masses of spongy tissue derived from modified veins and capillaries.
- ❑ The female gonads are the two **ovaries**.
- ❑ Each ovary contains many microscopic **follicles**.
  - ❑ Follicles consist of one egg surrounded by one or more layers of follicle cells, which help to develop, nourish, and protect the egg cell.
  - ❑ All of the 400,000 follicles a woman has are formed before her birth. Of these, only several hundred will release egg cells during the woman's reproductive years.
  - ❑ One follicle matures and releases its egg cell during each menstrual cycle.
  - ❑ The follicle cells also produce **estrogens**, the female hormones.
- ❑ The egg cell is released into the **oviduct**, or **fallopian tube**, and cilia lining the fallopian tube move the egg down to the **uterus**.
  - ❑ The inner lining of the uterus is called the **endometrium**.
- ❑ At the base of the uterus is the **cervix**, which leads to the **vagina**, the canal through which a baby is born.
- ❑ **Spermatogenesis** is the production of mature sperm cells, and it occurs in the seminiferous tubules.
  - ❑ The cells that give rise to sperm are called **spermatogonia**.
  - ❑ They undergo meiosis and differentiation eventually to form mature, motile sperm.
  - ❑ The head of sperm cells is tipped with a special body, the **acrosome**, which secretes enzymes that help the sperm penetrate the egg.
- ❑ **Oogenesis** is the development of mature ova.
  - ❑ **Oogonia** are the cells that develop into ova; they multiply and begin meiosis, but they stop at prophase I of meiosis I.
  - ❑ These eggs are called **primary oocytes**, which are quiescent until puberty.
  - ❑ From puberty onward, follicle-stimulating hormone (FHS) periodically stimulates a follicle to grow and its egg cell to complete meiosis I and begin meiosis II.
  - ❑ This forms the **secondary oocyte**. Meiosis then stops again; the secondary oocyte, released during ovulation, does not continue meiosis II right away.
  - ❑ In humans, penetration of the egg cell by the sperm triggers the completion of meiosis, and only then is the oogenesis actually complete.

- ❑ Humans and other primates have **menstrual cycles** (shedding of lining), and other mammals have **estrous cycles** (reabsorption of lining).
  - ❑ Menstruation occurs when the endometrium is shed from the uterus through the cervix and the vagina.
- ❑ The term *menstrual cycle* refers specifically to the changes that occur in the uterus. By convention, the first day of menstruation is designated day 1 of the cycle.
  - ❑ The **menstrual flow phase** of the cycle is the phase during which menstrual bleeding occurs.
  - ❑ The **proliferative phase** of the cycle is that during which the endometrium begins to regenerate and thicken.
  - ❑ In the **secretory phase**, the endometrium continues to thicken, and if an embryo has not implanted in the lining by the end of this phase, menstrual flow occurs.
  - ❑ The **ovarian cycle** parallels the menstrual flow cycle, and begins with the follicular phase, in which several follicles begin to grow.
    - ❑ Only one continues to enlarge and mature, while the others disintegrate.
  - ❑ At the end of the follicular phase, ovulation occurs, during which the secondary oocyte is released from the ovary.
    - ❑ The follicular tissue that remains in the ovary after ovulation develops into the corpus luteum.
  - ❑ During the **luteal phase** of the ovarian cycle, endocrine cells in the corpus luteum secrete hormones.

### **The Stages of Early Embryonic Development**

- ❑ After fertilization, there are three successive stages in early development.
- 1) **Cleavage**, which is a period of rapid mitotic cell division, partitions the cytoplasm of the zygote into ***smaller cells*** called blastomeres, each of which has its own nucleus.
  - ❑ Continued cleavage leads to a ball of cells called a **morula**, and then a fluid-filled central cavity called the **blastocoel** forms within the morula to produce the **blastula**.
- 2) **Gastrulation** is a drastic rearrangement of the cells in the blastula.
  - ❑ In gastrulation, three (germ) cell layers are produced – the ectoderm (later forming the nervous system and outer layer of skin)
  - ❑ the endoderm (later develops to line the digestive tract),
  - ❑ and the mesoderm (later develops into most organs and tissues).
- 3) **Organogenesis** is the development of the three germ layers into the rudiments of organs.