Systemic 3[C]

Chapter 22: SEXUAL REPRODUCTION: SYSTEMS • BEHAVIOURS

Learning Objectives: Upon completion of this chapter, students should be able to:

- Differentiate between asexual and sexual reproduction.
- Describe sexual reproduction in vertebrates and flowering plants.
- Detail the structure and function of reproductive systems in humans (male and female).
- Explain the reproductive system and behaviours in other vertebrate animals.
- Describe the structure and function of reproductive systems in common flowering plants.
- Outline various reproductive behaviours in vertebrates (e.g., courtship, pairing, territoriality, seasonal breeding, migrations).
- Discuss examples of reproductive behaviours.
- Explain the process of pollination in plants, including wind pollination.

22.1 Asexual and Sexual Reproduction

- **Asexual Reproduction:**
  - **Definition:** Involves a single parent producing genetically identical offspring (clones) without the fusion of gametes.
  - **Advantages:** Rapid population growth, only one parent needed, efficient in stable environments.
  - **Disadvantages:** Lack of genetic variation, making populations vulnerable to environmental changes.
  - **Examples:** Binary fission (bacteria, amoeba), budding (yeast, *Hydra*), spore formation (fungi), vegetative propagation (plants).
- **Sexual Reproduction:**
  - **Definition:** Involves the fusion of two specialized reproductive cells (gametes – sperm and egg), usually from two different parents, to form a zygote. This results in genetically diverse offspring.
  - **Advantages:** Genetic variation (increases adaptability to changing environments), allows for evolution.
  - **Disadvantages:** Requires two parents, slower process, requires more energy.
  - **Basis:** Meiosis, which reduces the chromosome number by half to produce haploid gametes.

22.2 Reproductive Systems in Vertebrates: Human and Other Mammals

- **A. Male Reproductive System (Human/Mammalian):**
    - **Testes:** Paired organs located in the scrotum outside the body cavity (for cooler temperature necessary for sperm production). Produce sperm (male gametes) and testosterone (male sex hormone).
    - **Epididymis:** Coiled tube on the back of each testis where sperm mature and are stored.
    - **Vas Deferens (Sperm Duct):** Tube that transports sperm from the epididymis to the urethra.
    - **Seminal Vesicles, Prostate Gland, Bulbourethral Glands:** Accessory glands that produce seminal fluid, which nourishes sperm, provides a medium for transport, and helps neutralize the acidity of the female reproductive tract. Seminal fluid + sperm = semen.
    - **Urethra:** Tube that extends through the penis, carrying both urine and semen out of the body.
    - **Penis:** Male external reproductive organ, delivers sperm into the female reproductive tract.
    - **Functions:** Production of sperm and male hormones; delivery of sperm.
- **B. Female Reproductive System (Human/Mammalian):**
    - **Ovaries:** Paired organs located in the pelvic cavity. Produce eggs (ova, female gametes) and female sex hormones (estrogen and progesterone).
    - **Oviducts (Fallopian Tubes):** Tubes that extend from the ovaries to the uterus. Site of fertilization. Fimbriae (finger-like projections) sweep the egg into the oviduct. Cilia lining the oviduct move the egg towards the uterus.
    - **Uterus (Womb):** A muscular, pear-shaped organ where a fertilized egg implants and develops during pregnancy.
    - **Cervix:** The narrow, lower part of the uterus that opens into the vagina.
    - **Vagina:** A muscular tube connecting the cervix to the outside of the body; receives sperm during intercourse and serves as the birth canal.
    - **Functions:** Production of eggs and female hormones; reception of sperm; site of fertilization; development of fetus.

22.3 Reproductive Systems in Flowering Plants

- **Flower Structure:** The reproductive organ of flowering plants.
    - **Sepals:** Leaf-like structures that enclose and protect the bud.
    - **Petals:** Often brightly coloured and scented to attract pollinators.
    - **Stamen (Male Reproductive Part):**
        - **Anther:** Produces and contains pollen grains (male gametophytes).
        - **Filament:** Stalk that supports the anther.
    - **Pistil/Carpel (Female Reproductive Part):**
        - **Stigma:** Sticky receptive tip for pollen grains.
        - **Style:** Stalk connecting the stigma to the ovary.
        - **Ovary:** Contains ovules (which contain the female gametes/egg cells).
    - **Receptacle:** The part of the flower stalk where the parts of the flower are attached.

- **Common Flowers:**
  - **Bisexual (Hermaphroditic) Flowers:** Contain both male (stamen) and female (pistil/carpel) reproductive parts (e.g., hibiscus, lily, rose).
  - **Unisexual Flowers:** Contain either male or female reproductive parts.
    - **Monoecious Plants:** Have both male and female flowers on the same plant (e.g., corn, cucumber).
    - **Dioecious Plants:** Have male and female flowers on separate plants (e.g., papaya, holly).

22.4 Reproductive Behaviours in Vertebrates

These behaviours enhance the chances of successful reproduction and survival of offspring.

- **A. Courtship:**
  - **Definition:** Ritualized behaviours performed by individuals to attract a mate and prepare for mating.
  - **Examples:** Elaborate dances (birds of paradise), vocalizations (bird songs, frog calls), displays of strength or beauty, pheromone release.
  - **Functions:** Species recognition, assessment of mate quality, synchronization of reproductive cycles, reduction of aggression.
- **B. Pairing (Monogamy/Polygamy):**
  - **Monogamy:** A pair bond between one male and one female, often for a single breeding season or for life (e.g., swans, albatrosses). Often associated with significant parental care from both parents.
  - **Polygamy:** One individual mates with multiple partners.
    - **Polygyny:** One male mates with multiple females (e.g., lions, deer).
    - **Polyandry:** One female mates with multiple males (rare, e.g., jacanas).
- **C. Territoriality:**
  - **Definition:** The defence of a specific area (territory) by an individual or a group against intruders of the same species.
  - **Function:** Secures resources (food, shelter), mating opportunities, and nesting sites.
  - **Examples:** Birds singing to defend nesting territory, dogs marking territory with urine.
- **D. Seasonal Breeding:**
  - **Definition:** Reproduction occurs only during specific times of the year, often linked to favorable environmental conditions (e.g., abundance of food, suitable temperature).
  - **Regulation:** Often controlled by photoperiod (day length), temperature, and hormonal cycles.
  - **Examples:** Most wild mammals and birds breed in spring/summer.
- **E. Migrations:**
  - **Definition:** Regular, long-distance movements of animals from one region to another, often in response to seasonal changes in climate or food availability.
  - **Function (Reproductive context):** To reach breeding grounds that offer abundant food or safe nesting sites, or to escape harsh non-breeding conditions.
  - **Examples:** Wildebeest migration to find grazing lands, bird migrations to warmer climates for breeding or wintering.

22.5 Pollination in Plants

- **Definition:** The transfer of pollen grains from the anther (male part) to the stigma (female part) of a flower.
- **Importance:** A crucial step in sexual reproduction of flowering plants, leading to fertilization and seed formation.
- **Types of Pollination:**
    - **Self-pollination:** Pollen is transferred from the anther to the stigma of the *same flower* or to another flower on the *same plant*.
    - **Cross-pollination:** Pollen is transferred from the anther of one flower to the stigma of a flower on a *different plant of the same species*. Promotes genetic variation.
- **Agents of Pollination:**
    - **Wind Pollination (Anemophily):**
        - **Characteristics of Wind-pollinated Flowers:**
            - Small, inconspicuous, often dull-colored petals or no petals.
            - Lack nectar or scent.
            - Large, feathery, often external stigmas to catch airborne pollen.
            - Large amounts of light, smooth, non-sticky pollen produced.
            - Anthers often hang outside the flower to release pollen easily.
        - **Examples:** Grasses, maize (corn), wheat, most trees (oaks, pines).
    - **Insect Pollination (Entomophily):**
        - **Characteristics of Insect-pollinated Flowers:**
            - Large, brightly colored, often scented petals.
            - Produce nectar to attract insects.
            - Sticky or rough pollen, often produced in smaller quantities.
            - Anthers and stigmas often enclosed within the flower, positioned to touch the insect.
            - Sticky stigmas to hold onto pollen.
        - **Examples:** Roses, sunflowers, orchids, beans.
    - **Other Agents:** Water, birds, bats, other animals.