

## CHAPTER 1: INTRODUCTION

### 1. Reproduction

Reproduction is a fundamental biological process by which living organisms generate new individuals of the same species through the transmission of genetic material, ensuring the continuity of life and the survival of the species.

#### 1.1. Gonads and gametes :

- **Gonads** are paired sex glands responsible for the production of gametes (sex cells).
  - **Testes** in males produce **spermatozoa (sperm)**.
  - **Ovaries** in females produce **ova (eggs)**.

#### 1.2. Gametogenesis : ( production of gametes)

- **Spermatogenesis**: Formation of sperm in the testes.
- **Oogenesis**: Formation of ova in the ovaries.

#### 1.3. Fertilization and early development :

Fertilization is the biological process by which a **male gamete (sperm)** fuses with a **female gamete (ovum)** to form a diploid **zygote**, initiating embryonic development.

### 2. Modes of Reproduction

#### 2.1 Sexual Reproduction

Sexual reproduction is a biological process in which two gametes, a **male gamete (sperm)** and a **female gamete (ovum)**, produced by two parents, fuse during fertilization to form a **zygote**, leading to the development of a new organism with **genetic variation**.

##### ➤ Internal Fertilization

Internal fertilization is a reproductive process in which the fusion of the male and female gametes occurs **inside the female reproductive tract**, providing greater protection to the developing zygote.

##### ➤ External Fertilization

External fertilization is a reproductive process in which the fusion of male and female gametes occurs **outside the body of the female**, usually in an **aquatic environment**.

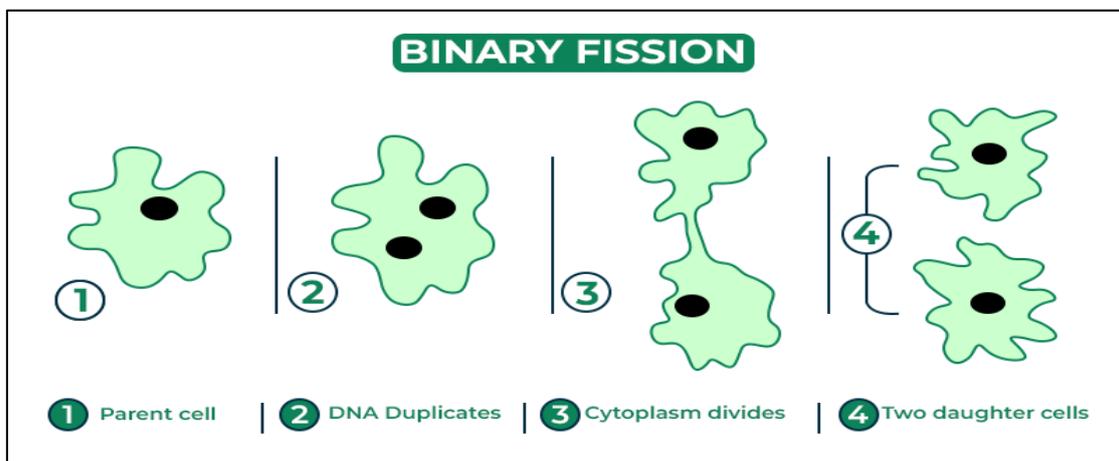
**examples:** Fish, Amphibians.....

### 1.2.2 Asexual Reproduction

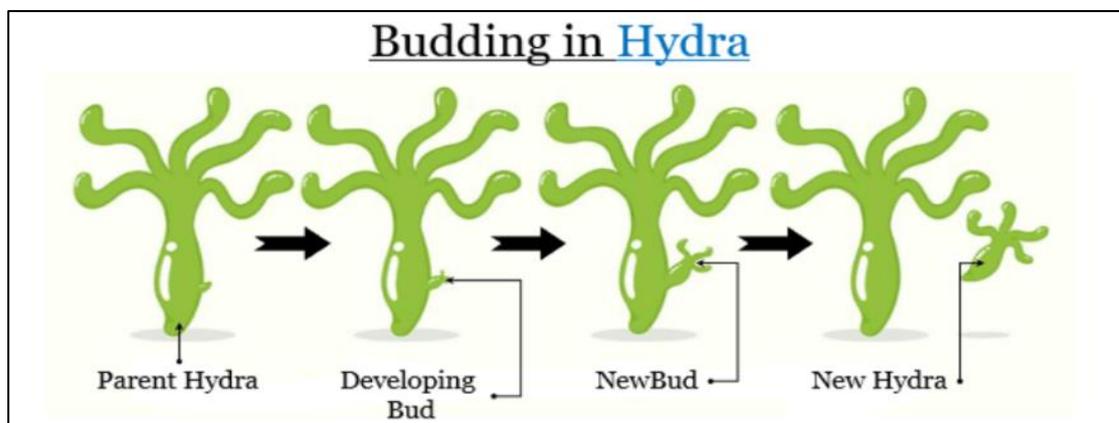
Involves only **one parent** and does **not require gamete fusion**. Genetically identical offspring are produced.

#### ➤ Types of Asexual Reproduction

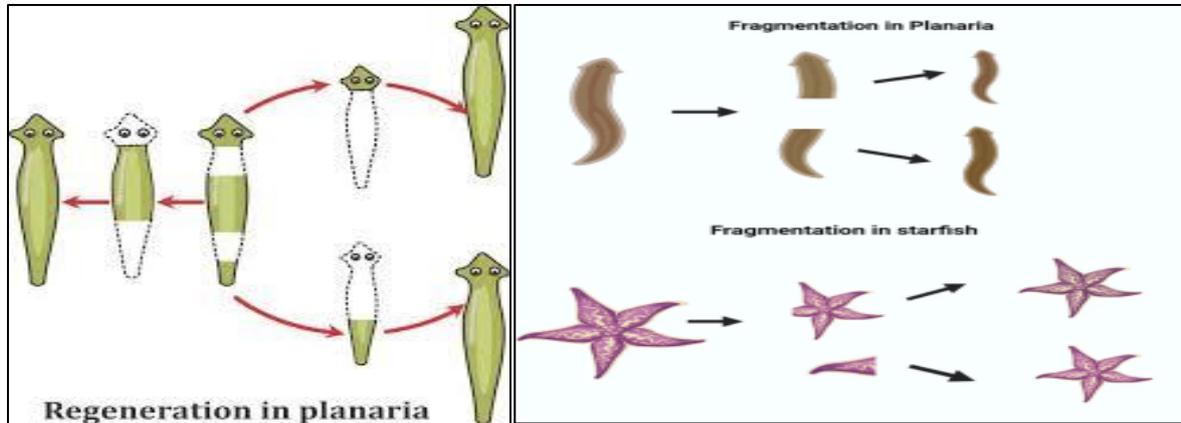
- **Fission:** The organism divides into two equal parts, each becoming a new individual.  
**Example: Amoeba, Bacteria, Paramecium (fig.1)**



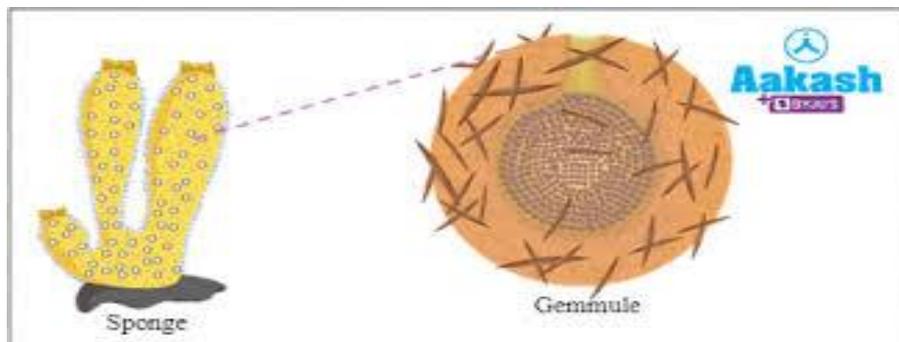
- **Budding:** A new individual grows from an outgrowth or bud on the parent's body.  
**Example: Hydra, Yeast, Coral (fig.2)**



- **Fragmentation and Regeneration:** The body breaks into parts, and each part regenerates into a complete organism. **Example: Planaria (flatworm), Starfish, Spirogyra (algae)** (fig. 3)



**Gemmules:** In sponges, protective structures called **gemmules** form from migrating cells within the sponge's body. The purpose of these gemmules is to **help the sponge survive harsh conditions**, such as drought or extreme temperatures. These cells are protected inside a tough outer covering until environmental conditions improve

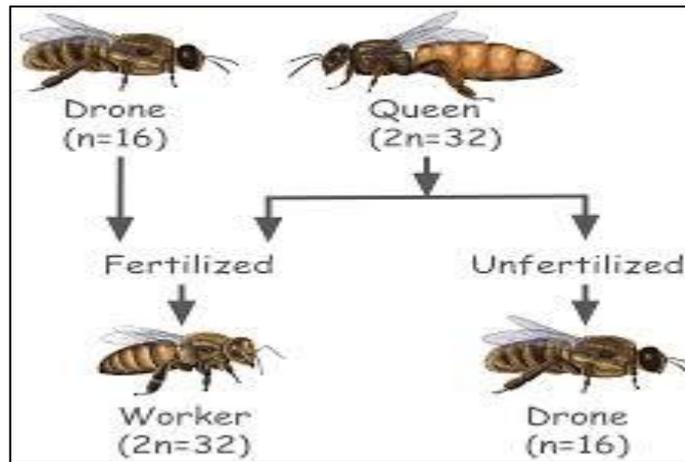


- **Parthenogenesis:**

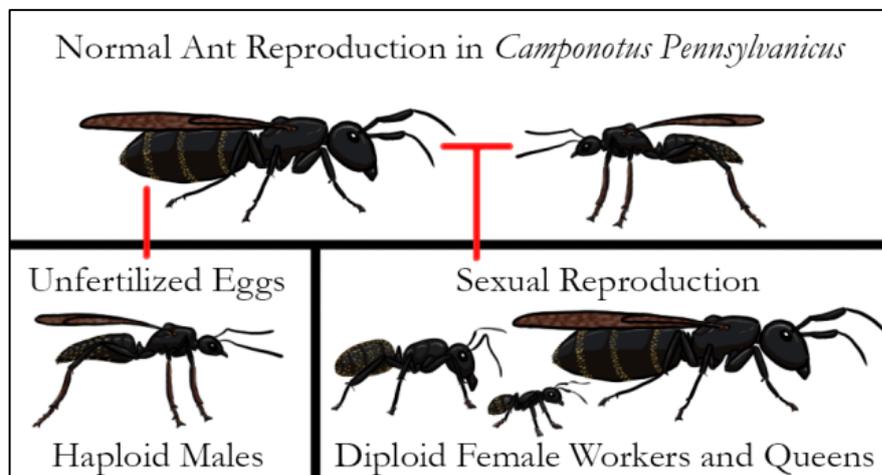
**Parthenogenesis:** This is a type of **asexual reproduction** where an **unfertilized egg develops into a new organism**. No male gamete (sperm) is involved.

**Examples:**

**Honeybees:** Drones (male bees) develop from unfertilized eggs.



**Ants:** Some male ants develop from unfertilized eggs.



## 2. Reproductive Systems

- **Dioecious:**
  - Male and female reproductive organs are on separate individuals.
  - **Example:** Humans, Most mammals, Birds
- **Hermaphroditism:**
  - Both male and female reproductive systems are present in one individual.
  - **Example:** Earthworms, Snails
  - **Sequential Hermaphroditism:** Sex changes during the life of an individual.
    - **Protogynous (female first):** Starts as female, later becomes male.

- **Example:** Some reef fishes, like wrasses (harem defense by males)
- **Protandrous (male first):** Starts as male, later becomes female.
  - **Example:** Clownfish (produces large numbers of offspring)

#### 4. Embryology

Embryology is the study of **the processes and regulation of prenatal development**, starting from **fertilization in the fallopian tube** and continuing until **birth**. It examines how the zygote divides, differentiates, and develops into a fully formed organism.

#### 5. Development

**Development** is the process of **physical and functional growth** of an organism, starting from **fertilization** and continuing through **all stages of life up to adulthood**. It includes cell division, tissue formation, organ development, and functional maturation.

##### 3.1 Types of development

- **Direct Development:** Organism develops into an adult without major changes. Example: Humans, lizards.
- **Indirect Development:** is when an organism passes through a **larval stage** before becoming an adult. During this process, it undergoes **metamorphosis**, meaning the body changes form significantly from the larva to the adult stage. Examples: Frogs, butterflies.

##### ➤ Modes of reproduction :

- **Viviparous:** Live birth after internal development (e.g., mammals, some sharks).
- **Oviparous:** Egg-laying; development occurs outside the body (e.g., birds, lizards).
- **Ovoviviparous:** Eggs hatch inside the parent (e.g., boas, vipers).

#### 4. Human Development

Human development spans both **prenatal** and **postnatal** stages.

##### 4.1 Prenatal Development

Divided into three main stages:

**1. Preimplantation (Weeks 1–2)** is the first stage of **human embryonic development**, from **fertilization to implantation in the uterus**.

- **Fertilization:** Formation of zygote.

**2. Embryonic Period (Weeks 3–8)** is the stage when the **basic body plan and major organs develop**.

**2.1. Gastrulation:** Formation of three germ layers — **ectoderm, mesoderm, and endoderm**.

**2.2. Neurulation:** Development of the **neural tube**, which becomes the brain and spinal cord.

**2.3. Organogenesis:** Formation of **major organs and systems** (heart, limbs, eyes, ears).

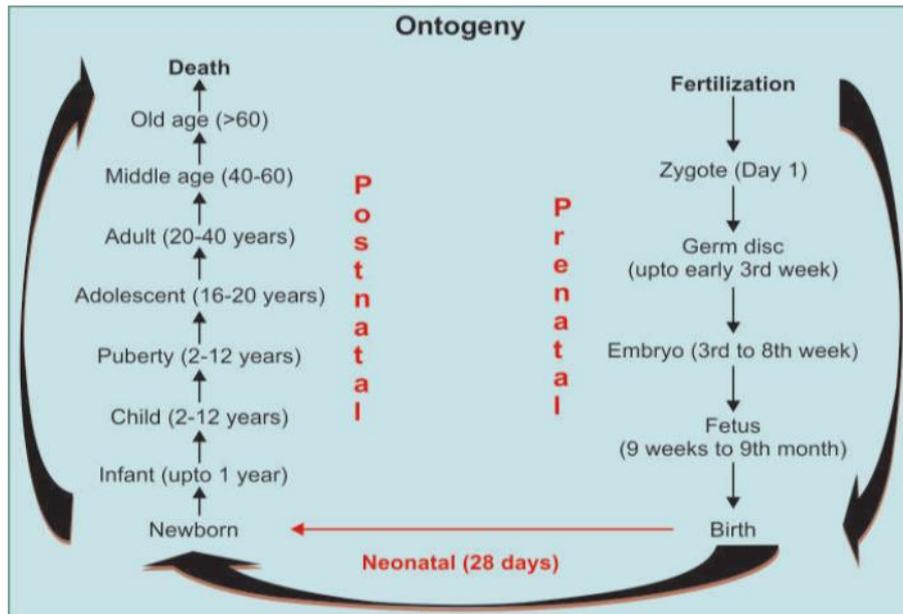
**3. Fetal Period (Week 9 to Birth)** is the stage when the **organs and body systems mature and grow**.

#### **4. 4.2 Postnatal Development**

Divided into several stages:

1. **Neonatal Period** (Birth to 28 days): Adaptation to external life.
2. **Infancy** (1 month – 1 year): Rapid growth and development.
3. **Childhood** (2–12 years): Continued growth and skill development.
4. **Puberty** (12–16 years): Onset of secondary sex characteristics.
5. **Adolescence** (17–20 years): Sexual and physical maturation.
6. **Adulthood** (21–40 years): Full physical maturity.
7. **Middle Age** (40–60 years): Gradual aging processes begin.
8. **Old Age** (60+ years): Decline in physical and reproductive functions.

**5. Ontogeny:** is the study of the **complete life cycle of an individual organism**, from **fertilization to death**. It includes processes such as **cell division, cell differentiation, growth, development, and aging (fig . )**



**Fig. 1:** Ontogeny/life cycle of a human