

## Chapter 6 - Animal Reproduction

All Lectures Uploaded on YouTube:

<https://tinyurl.com/fkm10-biology>

The image consists of a purple rectangular background with several white text boxes overlaid. From top to bottom, the text reads: "Class 10 Biology", "All 11 Chapters", "All Lectures Playlist", and "Full Book". In the top right corner, the words "FEDERAL BOARD" are written in white. To the right of the text boxes is a photograph of a young woman with long dark hair, wearing a purple t-shirt, sitting and smiling. Next to her is a copy of the "Textbook of Biology Grade 10" by National Book Foundation at Federal Textbook Board Islamabad. The book cover features a blue background with illustrations of microorganisms and a heart.

Reproduction is the process by which new individuals are produced from existing ones. It is essential for the survival of a species, though not necessary for the survival of a single organism.

- Two types:
  1. Asexual reproduction
  2. Sexual reproduction

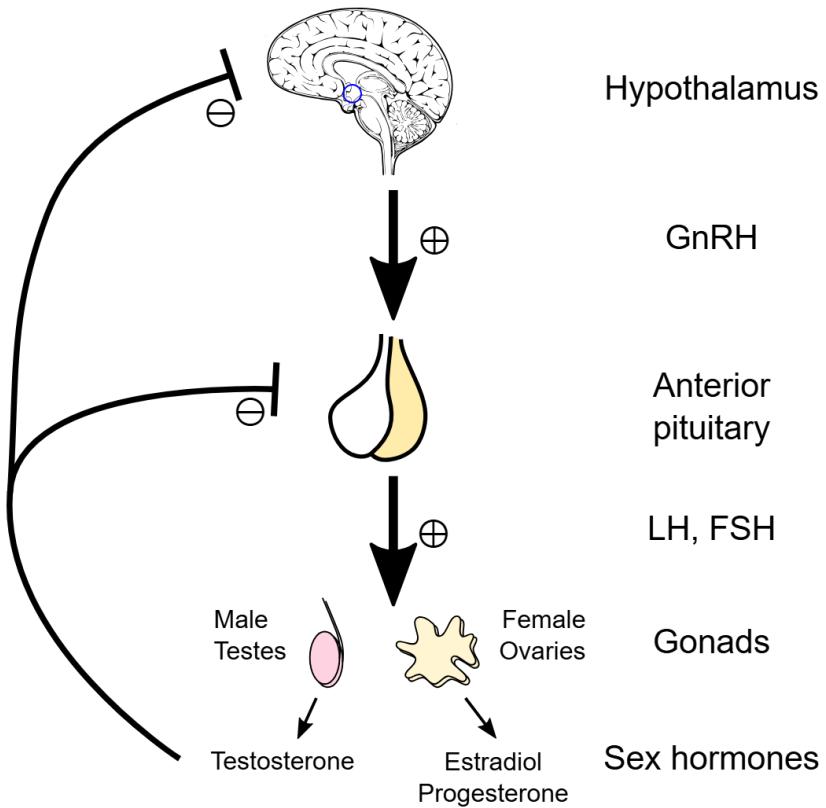
We will only focus on **animal reproduction**.

### 6.1. Role of Hormones in Male and Female Sexual Development

#### 6.1.1. Male Sexual Development

Main hormones:

- Testosterone
- Follicle Stimulating Hormone (FSH)



## 1) Testosterone

- Produced in the testes (under control of pituitary gland hormone).
- In females, the same hormone is called **Luteinizing Hormone (LH/ICSH)**.
- Functions:
  - Development of male reproductive organs during puberty.
  - Controls spermatogenesis and reproductive system maintenance.
  - Stimulates sperm development into mature sperms.
  - Promotes secondary sexual characteristics:
    - Beard and body hair growth
    - Deepening of voice
    - Increased muscle mass

## 2) Follicle Stimulating Hormone (FSH)

- Produced by anterior pituitary gland.
- Stimulates testes cells for sperm development and regulates sperm production.
- Acts at a different stage from testosterone:
  - **Testosterone** → final maturation of sperm
  - **FSH** → initiation and regulation of early sperm development

### 6.1.2. Female Sexual Development

#### Main hormones:

- Estrogen
- Follicle Stimulating Hormone (FSH)
- Luteinizing Hormone (LH)
- Progesterone

#### 1) Estrogen

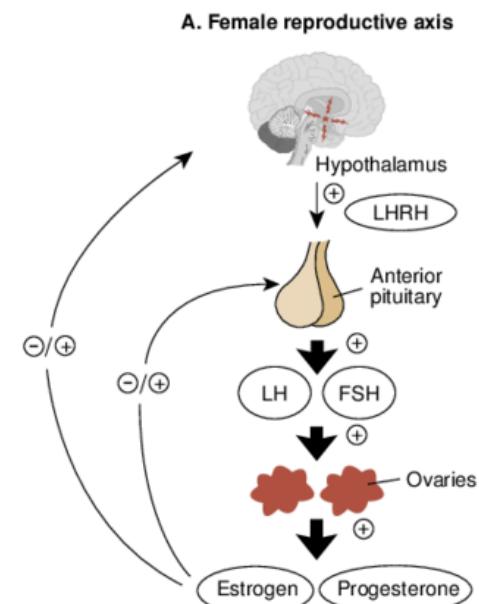
- Produced by ovarian follicles under FSH influence.
- Functions:
  - Development of female reproductive organs (uterus, fallopian tubes, etc.)
  - Secondary sexual characteristics during puberty.

#### 2) Follicle Stimulating Hormone (FSH)

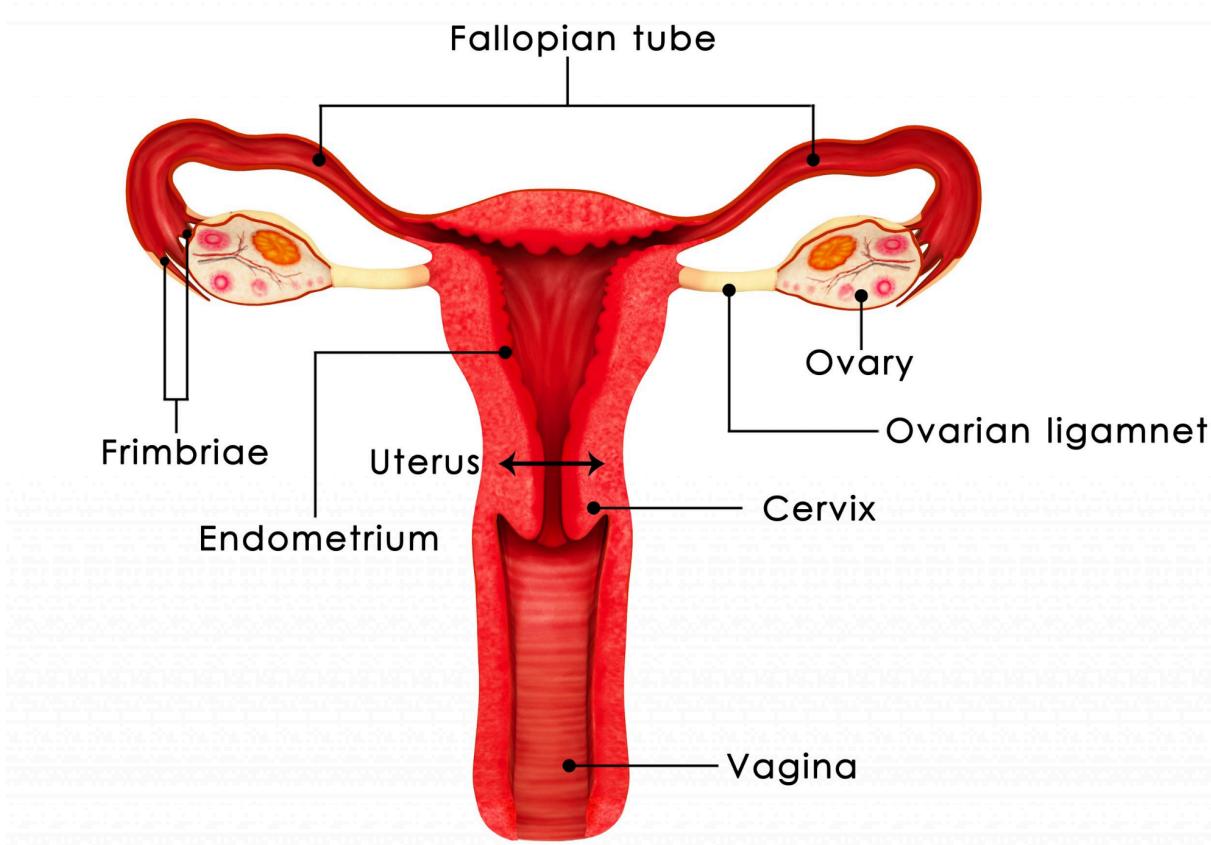
- Produced by anterior pituitary gland.
- Stimulates growth of ovarian follicles.
- Promotes **oogenesis** (egg formation).
- Helps in estrogen production and prepares body for ovulation.

#### 3) Luteinizing Hormone (LH)

- Produced when high estrogen levels inhibit FSH secretion.
- Causes rupture of mature follicle → ovulation.
- After ovulation:
  - The follicle becomes **Corpus Luteum**



- Corpus luteum produces progesterone



#### 4) Progesterone

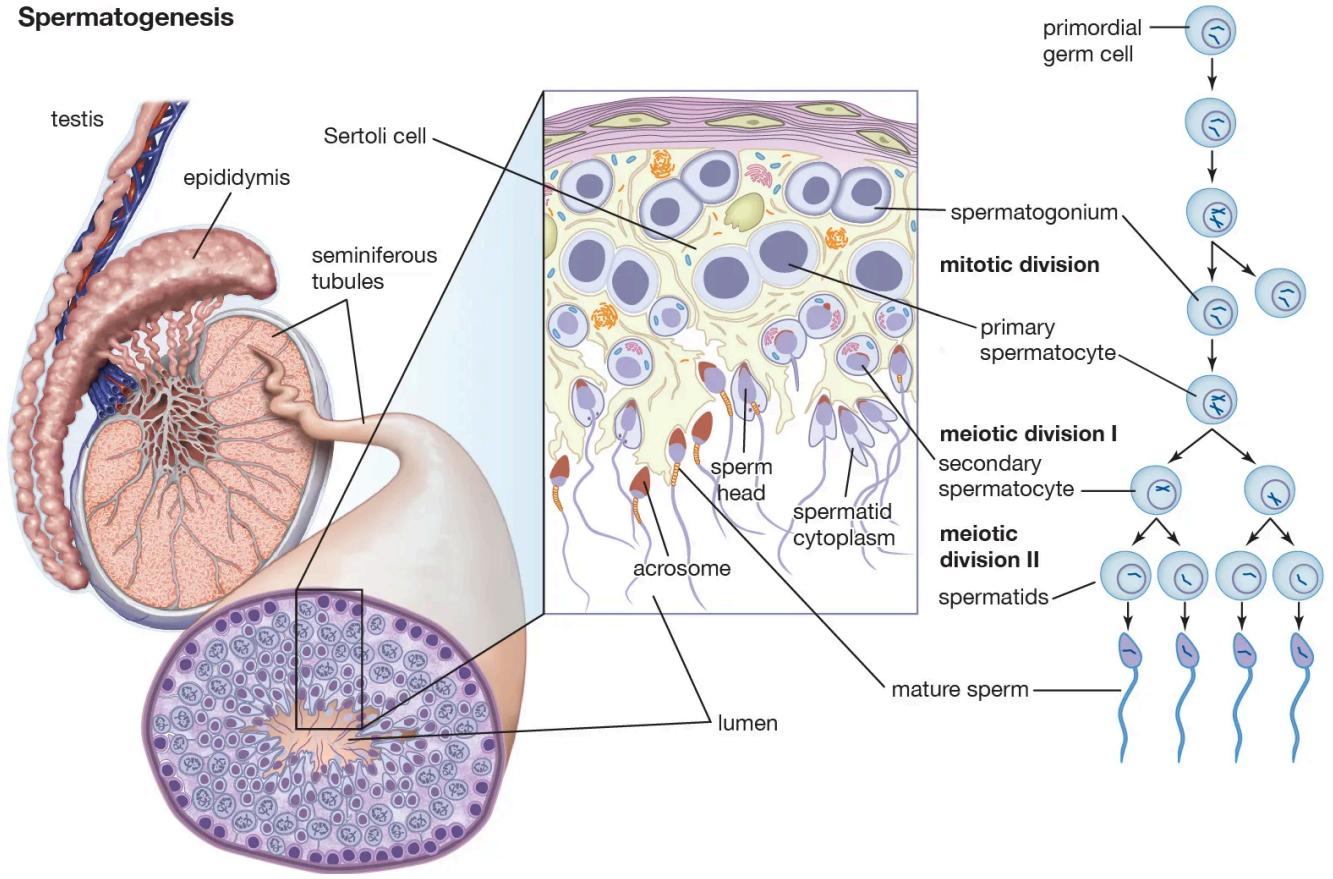
- Produced by **Corpus Luteum**.
- Functions:
  - Prepares uterus lining for embryo implantation.
  - Maintains pregnancy.
  - High levels inhibit the release of more eggs.

## 6.2. Gametogenesis and Fertilisation

### 6.2.1. Gametogenesis

- Process of gamete (sperm/egg) formation through **meiosis**.
- Reduces chromosome number by half (haploid).
- Ensures **genetic variation** through crossing over and independent assortment.

## Spermatogenesis



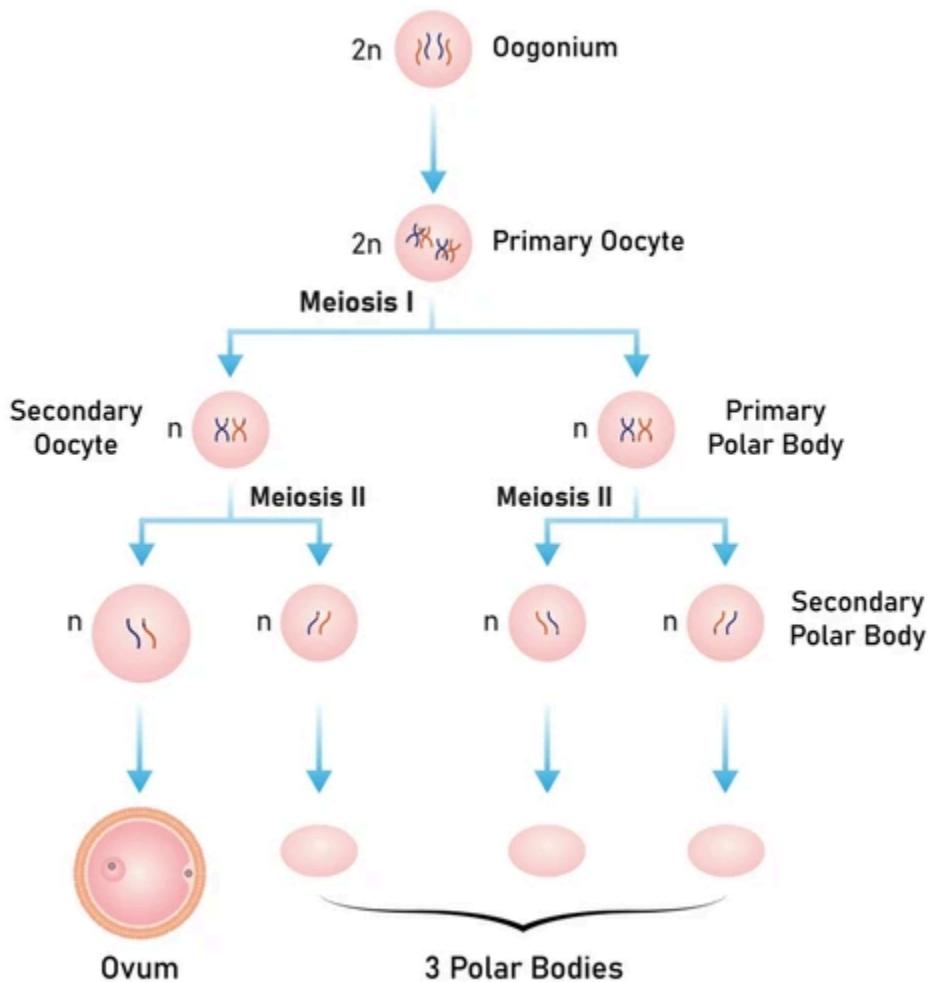
## In males → Spermatogenesis

- Location: Testes
- Continuous process after puberty
- Steps:
  1. **Spermatogonia (2n)** → divide by mitosis → primary spermatocytes
  2. **Primary spermatocyte (2n)** → meiosis I → two secondary spermatocytes (n)
  3. **Secondary spermatocyte (n)** → meiosis II → four spermatids (n)
  4. **Spermatids** → differentiate into mature spermatozoa (spermogenesis)
  5. **Formation of sperm** from spermatids

## In females → Oogenesis

- Location: Ovaries
- Cyclic process (occurs once per reproductive cycle).
- Begins before birth:

- Oogonia ( $2n$ ) → primary oocytes (arrested in prophase I until puberty).
- At puberty:
  - Meiosis I resumes → forms secondary oocyte + polar body.
  - Secondary oocyte arrested in metaphase II until fertilization.
  - Meiosis II completes only if sperm enters.
  - Results: 1 ovum + 3 polar bodies (which degenerate).



## 6.2.2. Fertilization

- **Definition:** Union of sperm (male gamete) and egg (female gamete) which forms a **zygote**.
- Restores diploid chromosome number (46 in humans).
- Each parent contributes **23 chromosomes**.

**Types:**

**1. Internal Fertilization**

- Inside the female body.
- Fewer offspring, higher survival.
- Parental care is common.
- Found in: mammals, birds, reptiles.

**2. External Fertilization**

- Outside the female body (in water).
- Many offspring, lower survival.
- Little/no parental care.
- Found in: fish, amphibians, aquatic invertebrates.

**Modes of Development after Fertilisation:**

- **Viviparous** – young develop completely inside the mother (mammals).
- **Oviparous** – eggs laid outside the body (birds, reptiles, amphibians).
- **Ovoviparous** – eggs hatch inside the mother, young are released alive (sharks, rays).

Sl. No.	External fertilization	Internal fertilization
1	Fusion of gametes occurs outside the body of an organism.	Fusion of gametes occurs inside the body of an organism.
2	Large number of both male and female gametes are released into the surrounding medium (e.g., water) in order to enhance chances of syngamy.	The number of sperms produced are very large and number of eggs produced are less.
3	Chances of fertilization is less.	Chances of fertilization is more.
3	The offsprings are extremely vulnerable to predators, threatening their survival.	The offsprings are well protected comparatively.
4	Examples: Bony fishes, frogs and majority of algae.	Examples: Birds, mammals, etc.

## 6.3. Mechanism of Reproduction in Animals

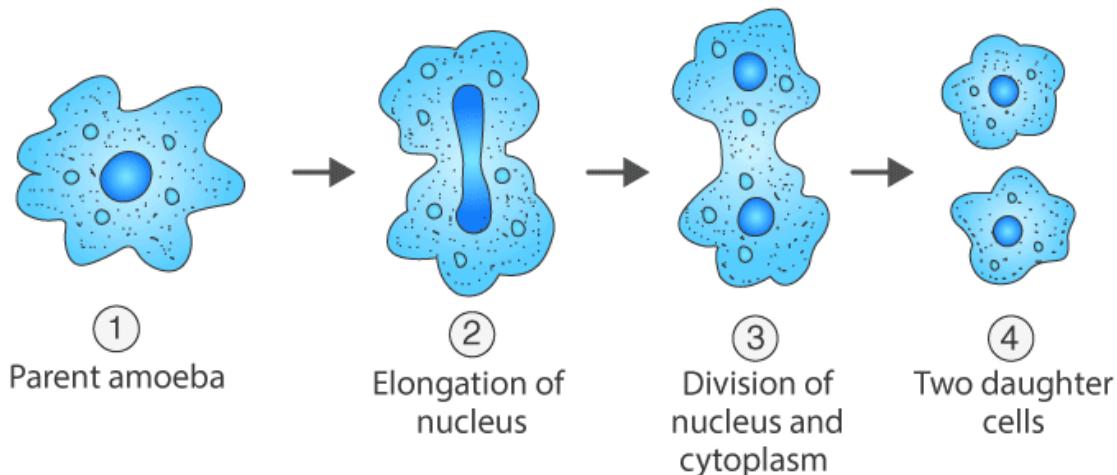
### 6.3.1. Asexual Reproduction

- Single parent → identical offspring (clones).
- No gametes involved.
- Common in invertebrates and unicellular organisms.
- Examples: budding, fragmentation, regeneration, and binary fission.
- **Advantage:** Rapid population increase; useful when mates are not available.
- **Disadvantage:** Lack of genetic diversity → more vulnerable to diseases and environmental changes.

#### Types of Asexual Reproduction

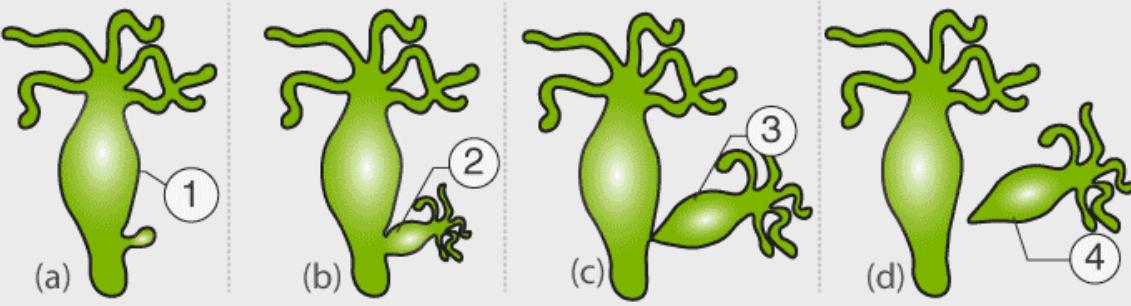
##### 1. Binary Fission

- The parent cell splits into **two equal daughter cells**.
- Common in protozoans like *Amoeba* and *Paramecium*.
- Process: Parent cell → nucleus divides (mitosis) → cytoplasm divides → 2 identical daughter cells.



##### 2. Budding

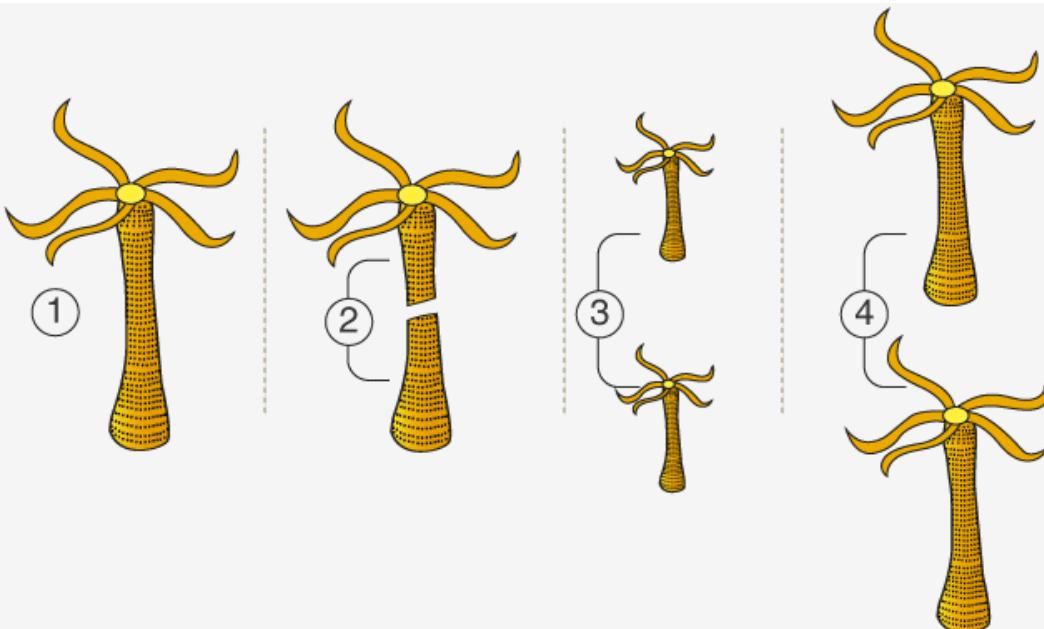
- A **small bud** forms on the parent body by mitosis.
  - i. The bud grows, develops, and detaches to become a new individual.
  - ii. Example: *Hydra*.



1 Parent Hydra | 2 Developing Bud | 3 New Bud | 4 New Hydra

### 3. Fragmentation and Regeneration

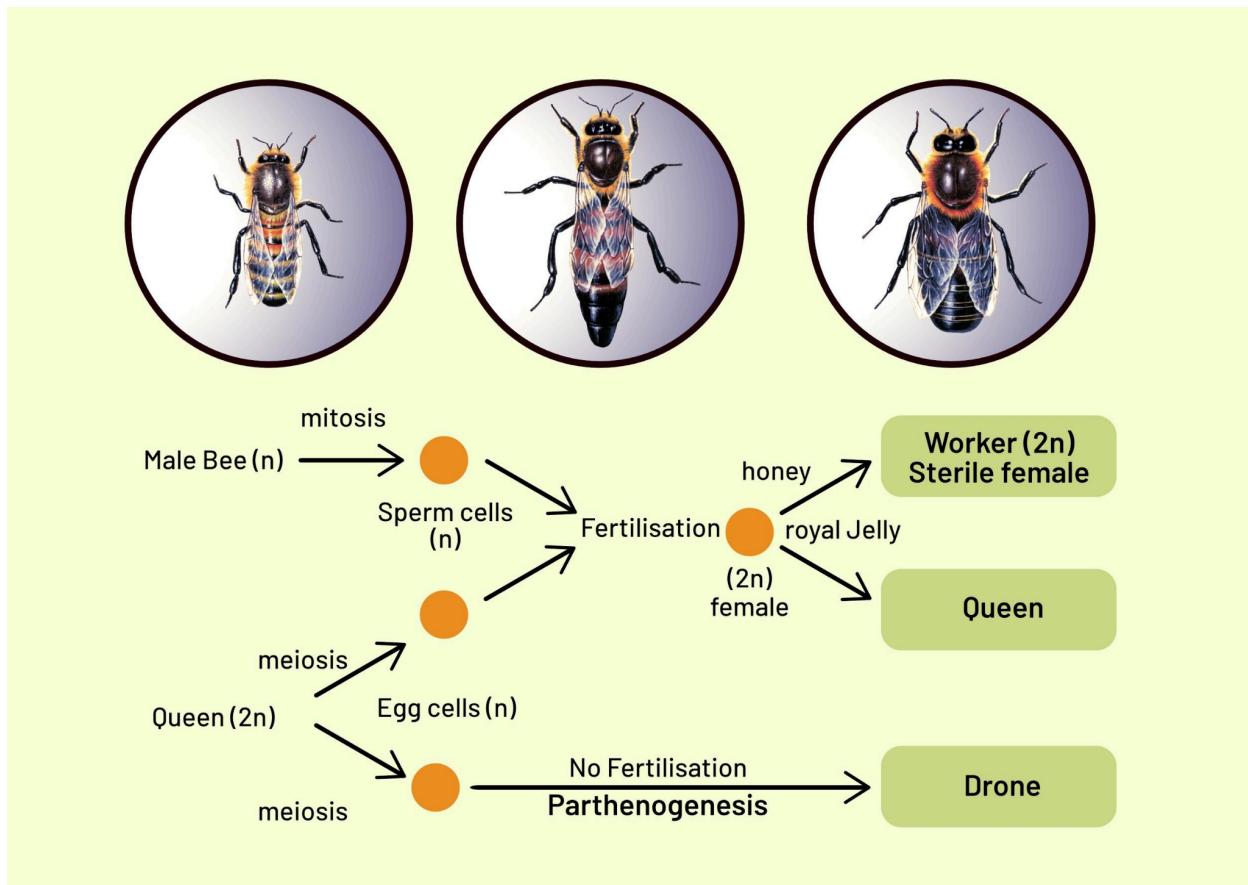
- iii. The parent body breaks into two or more fragments.
- iv. Each fragment regenerates into a complete individual.
- v. Example: Planaria, Starfish.



### 4. Parthenogenesis

- vi. Development of a new individual from an unfertilized egg.
- vii. Common in some insects (e.g., bees).

viii. Example: Queen bee ( $2n$ ) produces eggs → unfertilized eggs develop into drones (males).



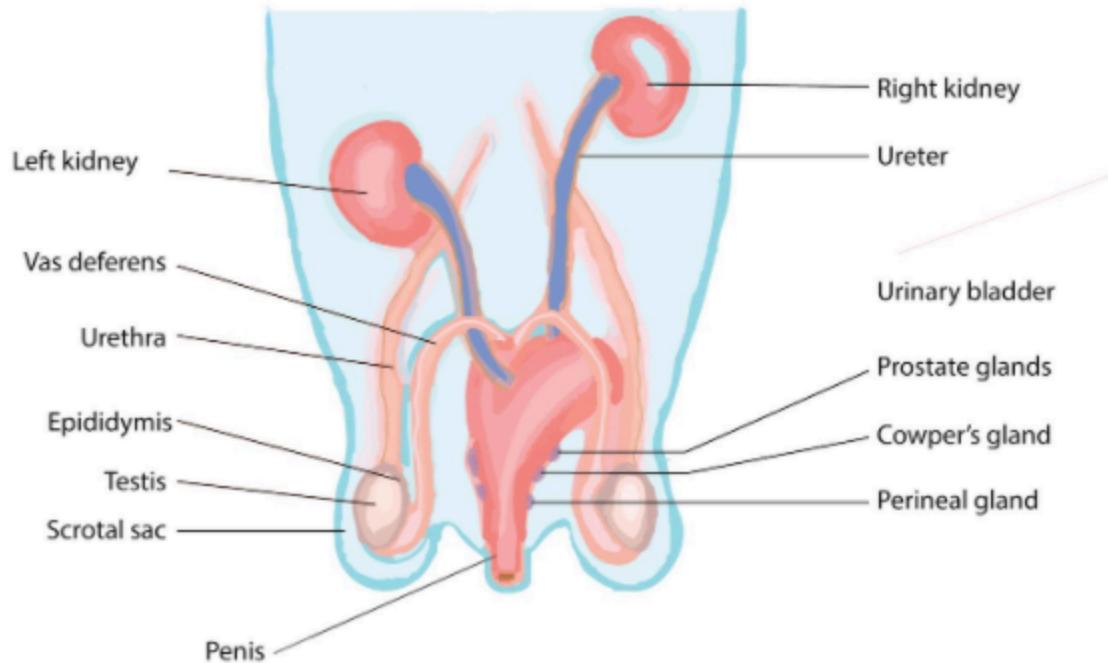
### 6.3.2. Sexual Reproduction in Animals

- Most animals are dioecious (separate male & female).
- Involves gametogenesis, fertilisation, and development.
- Studied in the rabbit (model organism).

#### 1. Male Reproductive System of Rabbit

- **Testes:** Produce sperm; located in the scrotum.
- **Epididymis:** Stores sperm.
- **Vas deferens:** Transports sperm to the urethra.
- **Urethra:** Passage for sperm & urine.
- **Glands:**
  - Seminal vesicles – add fluid (90% of semen).

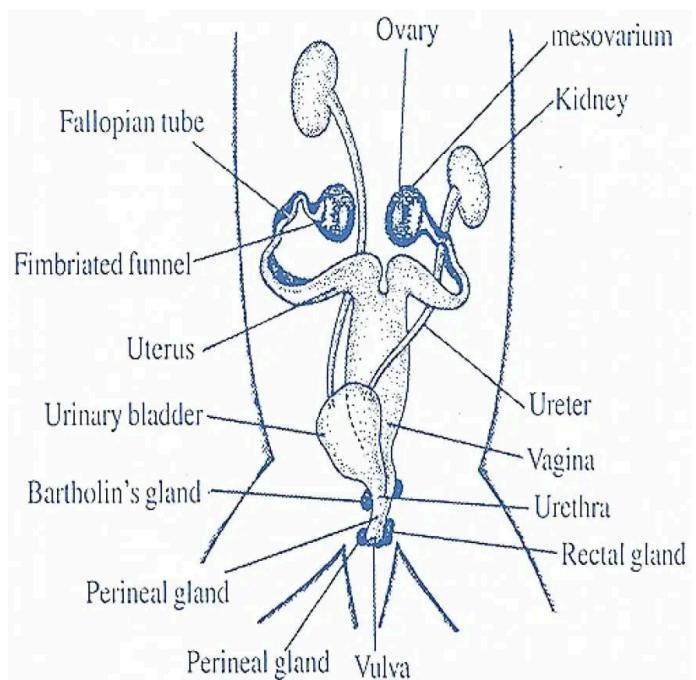
- Prostate gland – secretes alkaline fluid (neutralises acidity).
- Cowper's glands – lubricate ducts.



## Male reproductive system of Rabbit

### 2. Female Reproductive System of the Rabbit

- **Ovaries:** Produce eggs.
- **Fallopian tubes:** Site of fertilisation.
- **Uterus:** Divided into two uterine horns (where the embryo develops).
- **Cervix:** Separates the uterus from the birth canal (vagina).
- **Birth canal (vagina):** Receives sperm and delivers young.



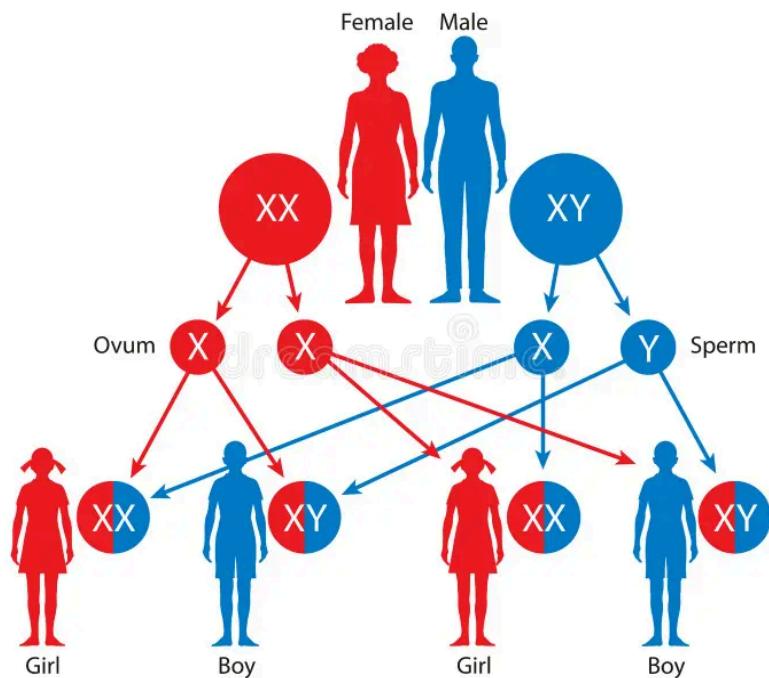
### 3. Fertilisation and Development in the Rabbit

- Fertilisation is internal (in the fallopian tubes).
- Female rabbits are induced ovulators → ovulation occurs after mating.
- Zygote forms → divides → travels to the uterus.
- Embryo implants in the uterine wall → develops internally.
- Pregnancy period: 30–32 days.
- Rabbits are viviparous (give birth to live young).
- Male rabbits may become sterile in summer due to reduced sperm count and motility.

## 6.4. Sex Determination in Humans

### 6.4.1. Chromosomal Basis

- Humans: 46 chromosomes (23 pairs).
- 22 pairs: autosomes; 1 pair: sex chromosomes.
- Female: XX (homogametic).
- Male: XY (heterogametic).



### **6.4.2. Role of Sperm and Egg**

- Mother contributes only the X chromosome.
- Father contributes the X or Y chromosome.
- Combination:
  - XX → Female
  - XY → Male
- Therefore, the sex of the child is determined by the father.

### **6.4.3. Probability**

The probability (chance) for a couple to have a son or a daughter during each pregnancy is 50% means there is an equal chance of a son or a daughter to be born. Since, the mechanism of sex determination in humans completely depends upon the father instead of mother, therefore, the male individual is called Sex determinator.

- Chance of a son or a daughter = 50% each.



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