1. REPRODUCTION IN ORGANISMS

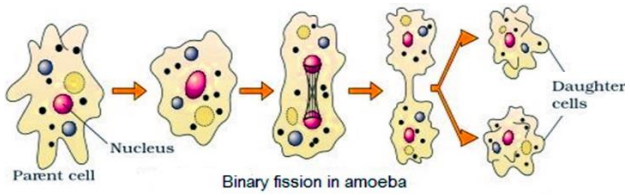
ASEXUAL REPRODUCTION

- It is seen in unicellular organisms, simple plants & animals.
- The offspring are identical to one another and to their parent. Such morphologically and genetically similar individuals are known as **clone**.

Types of asexual reproduction

a. Fission: In this, the parent cell divides **(cell division)** into two or more individuals. E.g. Protists and Monerans. Fission is 2 types:

- **Binary fission:** It is the division of parent cell into two individuals. E.g., *Amoeba, Paramecium*.
- **Multiple fission:** It is the division of parent cell into many individuals. E.g. *Plasmodium*, *Amoeba*.



Under unfavourable condition, *Amoeba* withdraws its pseudopodia and secretes a 3-layered hard covering (cyst) around itself. It is called **encystation.** Under favourable conditions, encysted *Amoeba* undergoes multiple fission to give many minute amoeba or pseudopodiospores. The cyst wall bursts out and spores are liberated to grow up into many amoebae. This is called **sporulation.**

b. Budding: In this, a bud appears and grows in the parent body. After maturation, it is detached from parent body to form new individual. E.g. *Hydra*, Sponge, Yeast etc.

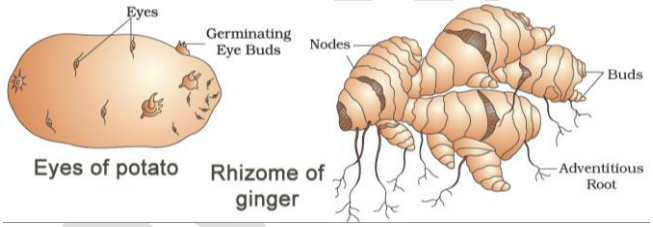
c. Fragmentation: In this, the body breaks into distinct pieces (fragments) and each fragment grows into an adult capable of producing offspring. E.g. *Hydra*.

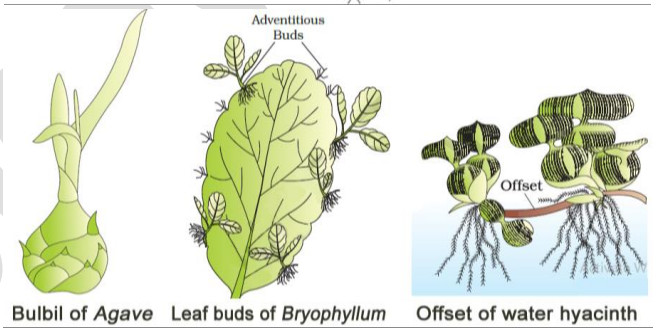
d. Vegetative propagation: It is the production of offspring from **vegetative propagules** in plants.

Vegetative propagules are units of vegetative propagation.

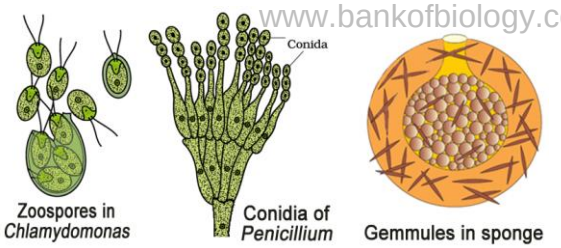
Examples for vegetative propagules:

- **Buds ('eyes')** of the potato tuber.
- **Rhizomes** of banana & ginger.
  Buds & Rhizomes arise from the **nodes** of modified stems. The nodes come in contact with damp soil or water and produce roots and new plants.
- **Adventitious buds** of *Bryophyllum*. They arise from the notches at margins of leaves.
- **Bulbil** of *Agave*.
- **Offset** of water hyacinth.
- **Runner, sucker, tuber, bulb etc.**





Other asexual reproductive structures: E.g. **zoospores** (microscopic motile structures in some algae and protists), **conidia** (*Penicillium*) and **gemmules** (*sponge*).



Asexual reproduction is the common method in simple organisms like algae and fungi. During adverse conditions, they can shift to sexual method.

SEXUAL REPRODUCTION

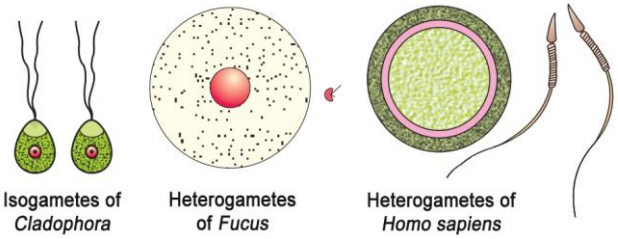
Gametogenesis

It is the formation of male and female gametes.

Gametes (haploid cells) are 2 types:

a. Homogametes (isogametes): Similar gametes. They cannot categorize into male & female gametes. E.g. Some algae like ***Cladophora***.

b. Heterogametes: The male and female gametes are distinct types. Male gamete is called **antherozoid (sperm)** and female gamete is called **egg** (**ovum)**. E.g. ***Fucus*** (an alga), Human beings etc.



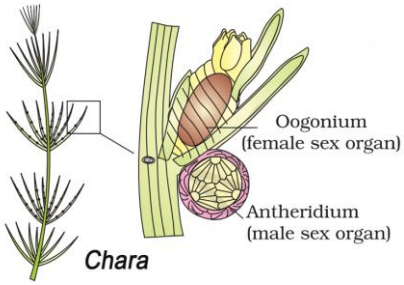
Sexuality (bisexual or unisexual) in organisms:

a. Bisexual: Male & female reproductive structures present in the same individual.

Bisexual plants: E.g. *Hibiscus, Pisum.*

In flowering plants, male flower is **staminate** (bears stamens) and female flower is **pistillate** (bears pistils).

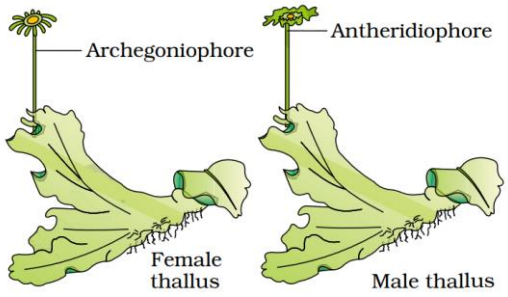
If male & female flowers are present on same plant, it is called **monoecious**. E.g. Cucurbits, coconuts, *Chara.*



Bisexual animals (hermaphrodites): E.g. Earthworms, leech, sponge, tapeworm, etc.

b. Unisexual: Male and female reproductive structures are present on different individuals.

If male & female flowers are present on different plants, it is called **dioecious**. E.g. papaya, date palm, *Marchantia.*



Unisexual animals: E.g. Cockroach, higher animals etc.

Fungi may be **homothallic** (bisexual) or **heterothallic** (unisexual).

Cell division during gamete formation:

- Many monerans, fungi, algae & bryophytes have **haploid** parental body. They produce haploid gametes by **mitosis.**
- Pteridophytes, gymnosperms, angiosperms & animals have **diploid** parental body. They produce haploid gametes by **meiosis** of **meiocytes** (gamete mother cell).

Name of organism	Chromosome number	
	In meiocytes (2n)	In gametes (n)
Human being	46	23
Housefly	12	6
Rat	42	21
Dog	78	39
Cat	38	19
Fruit fly	8	4
Ophioglossum	1260	630
Apple	34	17
Rice	24	12
Maize	20	10
Potato	48	24
Butterfly	380	190
Onion	16	8

Fertilisation (syngamy)

- It is the fusion of gametes to form a diploid **zygote**.
- In rotifers, honeybees, some lizards, birds (turkey) etc., female gamete develops to new organisms without fertilisation. This is called **parthenogenesis.**

Types of fertilization:

a. External fertilisation: Syngamy occurs in the external medium (water), i.e. zygote is formed outside the body. E.g. most aquatic organisms (many algae, bony fishes etc.) and amphibians.

Such organisms show synchrony between the sexes and release large number of gametes into the surrounding medium to ensure syngamy.

Disadvantage: The offspring are extremely vulnerable to predators threatening their survival up to adulthood.

b. Internal fertilisation: Syngamy occurs inside the body of the organism. E.g. terrestrial organisms, belonging to fungi, animals (reptiles, birds, mammals) & plants (bryophytes, pteridophytes, gymnosperms & angiosperms).

In this, non-motile egg is formed inside the female body to where motile male gamete reaches and fuses.

In seed plants, the non-motile male gametes are carried to female gamete by pollen tubes.