

# TOPIC: TYPES OF REPRODUCTION

## Key Knowledge:

- Biological advantages and disadvantages of asexual reproduction
- Binary fission in prokaryotic cells (U1: AoS2)
- Biological advantages of sexual reproduction in terms of genetic diversity of offspring

## REPRODUCTION

Reproduction involves the formation of new life from a progenitor source. It can involve the production of new cells or entirely new organisms. There are two main mechanisms by which reproduction can occur:

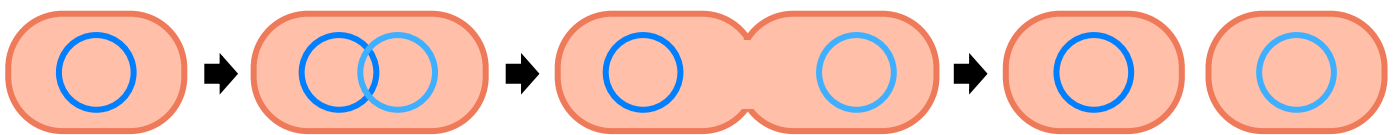
ASEXUAL REPRODUCTION	SEXUAL REPRODUCTION
Only involves a single parent	Involves two parents
Offspring are genetically identical (clones)	There is genetic variation in the offspring
Lower energy cost to parent (no need for a mate)	Higher energy cost to parent (need to find mate)

## ASEXUAL REPRODUCTION

Asexual reproduction involves the formation of offspring that are **genetically identical** to the parent. The mechanism by which reproduction occurs is dependent on the type of organism involved. Examples of asexual reproduction techniques include: binary fission (bacteria), fragmentation or budding (eukaryotes), vegetative propagation or spore formation (plants) and parthenogenesis (certain animal species).

### 1. BINARY FISSION

Binary fission is a rapid method of asexual reproduction employed by prokaryotic cells. The circular DNA is first copied in response to a replication signal and then the two DNA loops attach to the membrane. The membrane elongates and pinches off (cytokinesis), forming two cells with identical DNA molecules. Certain eukaryotic organisms (e.g. *Planaria* and *amoeba*) may also reproduce asexually via a fission-like process.



### 2. BUDDING

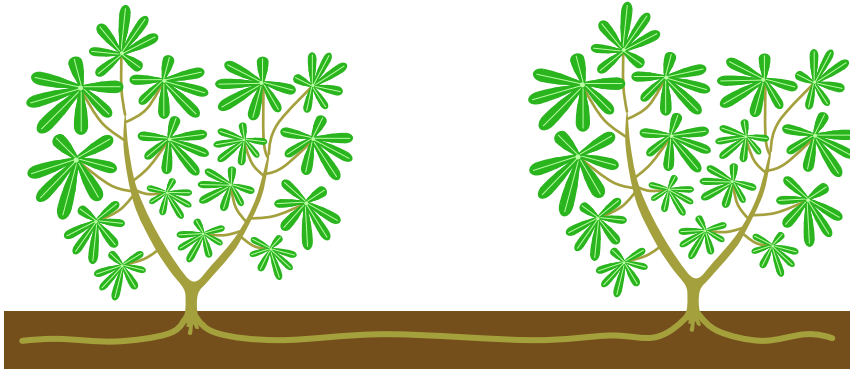
Budding involves the growth of cells on a parent organism, which eventually separate from the parent to form an autonomous organism. This method of cloning occurs in species of *Hydra*, but is also common to many species of yeast (fungi).

### 3. FRAGMENTATION

Fragmentation involves the growth of a new organism from a separated portion of a parental organism. From the fragment, the offspring will develop to be morphologically identical to the parent. Fragmentation is common to starfish, as well as certain species of annelid worms.

## 4. VEGETATIVE PROPAGATION

Plants have the capacity for vegetative propagation, whereby sections of a plant can be induced to grow independently. This is because all plants possess meristematic tissue which is totipotent (undifferentiated). Virtually all types of roots and shoots are capable of vegetative propagation.

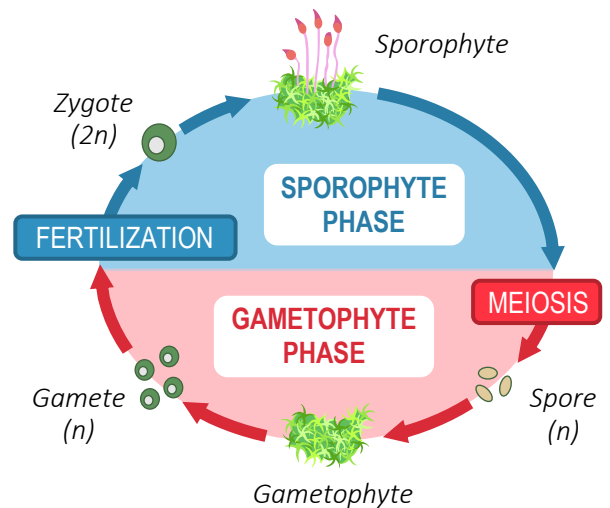


*Some plants can form horizontal stems called runners (or stolons) that grow roots and form clones.*

*The largest organism on Earth is a clonal colony of aspen with an interconnecting root system that covers approximately 43.6 ha.*

## 5. SPORE FORMATION

Some plant species form spores via an alternating cycle of generations. A diploid plant will form a haploid spore (via meiosis) that will then germinate to form a haploid plant. As the offspring was produced from a sole parent, it represents an asexual reproduction cycle. The haploid plant then produces gametes (via mitosis) which can fuse with another haploid gamete to form a diploid offspring. As this offspring was produced from two parents, it will represent a sexual reproduction cycle. Spore formation is common in non-flowering plants (e.g. ferns, mosses), as well as certain types of fungi, algae and protozoans.



## 6. PARTHENOGENESIS

Parthenogenesis is a form of asexual reproduction in which an offspring develops from an unfertilised gamete. While there are different mechanisms by which this can occur, it usually involves the production of a diploid egg cell by the female parent. This process occurs in certain species of insects, fish and reptiles.

## SEXUAL REPRODUCTION

Sexual reproduction involves the formation of offspring that are **genetically distinct** to the parents. Sexual reproduction requires the formation of specialised sex cells (called gametes), which form via meiosis.

In most organisms, the gametes produced by an organism defines its sex – males produce smaller gametes (sperm) which combine with the larger gametes (ova) produced by females. The gametes contain half the genetic information of the parent (i.e. haploid), such that when they are combined they will form a diploid offspring that is a genetic amalgamation of both parents.

The fusion of two gametes is called **fertilisation** and can occur internally (via copulation) or externally (via mass spawning). External fertilisation incurs less of a survival cost to the parents, but the offspring are susceptible to the environment while they are developing. Sexual reproduction is a common propagation technique in most eukaryotic organisms as it promotes genetic variation and biodiversity.