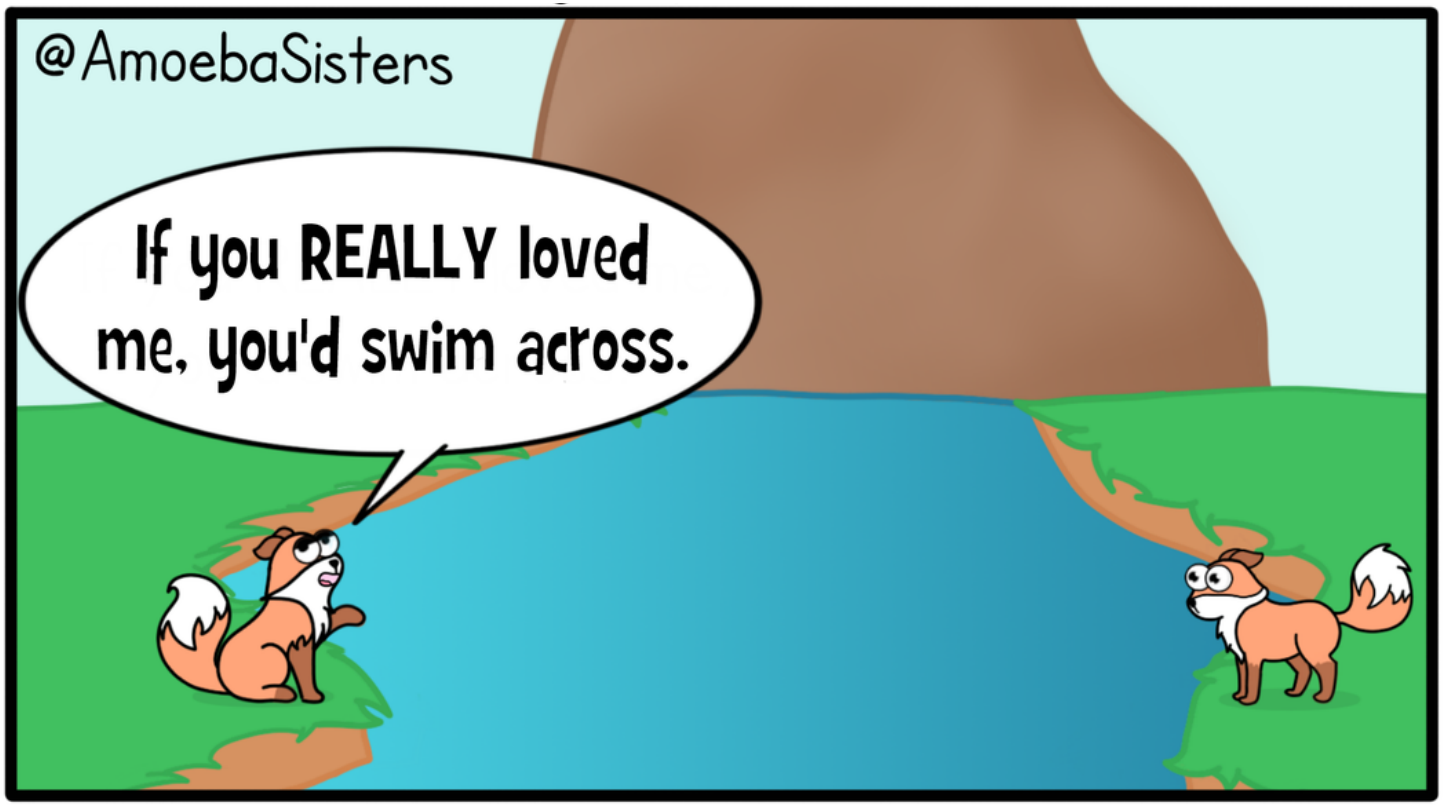
04 – EVOLUTION

4.2 Reproductive Isolation Mechanisms



Defining Species

4.2.1 Different criteria are used to define a species depending on the mode of reproduction.

4.2.2 A species that reproduces **sexually** can be defined by the ability of its members to actually or potentially interbreed to **produce fertile offspring**.

4.2.3 Other criteria used to define a species include:

- morphological similarity
- biochemical similarity
- sharing a common gene pools

Criteria	Description
Morphology	Organisms are classified based on similarities in shape and anatomy.
Biochemistry	Organisms are classified based on similarities in the chemical composition of cells and tissues as well as similarities in the metabolic processes that occur in cells.
Genetic composition	Organisms are classified based on similarities in DNA nucleotide sequences in genomes.

Reproductive Isolation

4.2.4 Reproductive isolating mechanisms act to maintain distinct species.

Define:

☑ Describe pre-zygotic (prevention of zygote formation) mechanisms including:

- temporal isolation
- behavioural isolation
- mechanical isolation
- gamete isolation.

☑ Describe post-zygotic (prevention of fertile hybrids) mechanisms including:

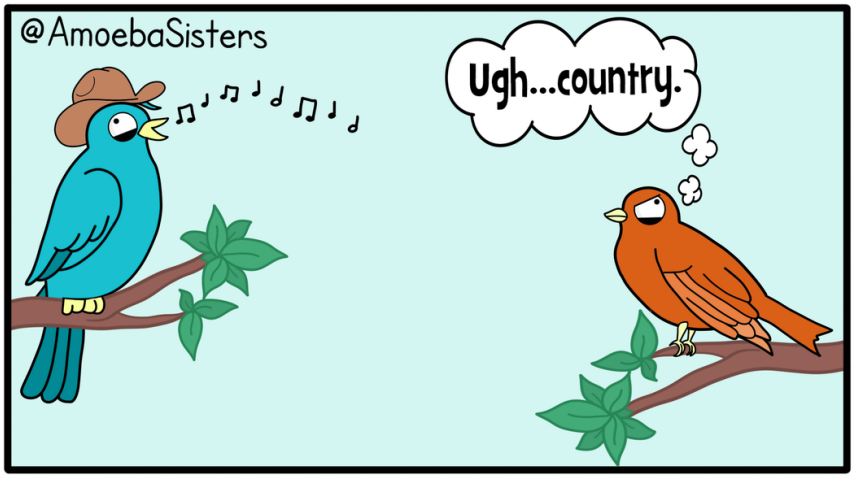
- hybrid inviability
- hybrid sterility.

Pre-Zygotic Isolation

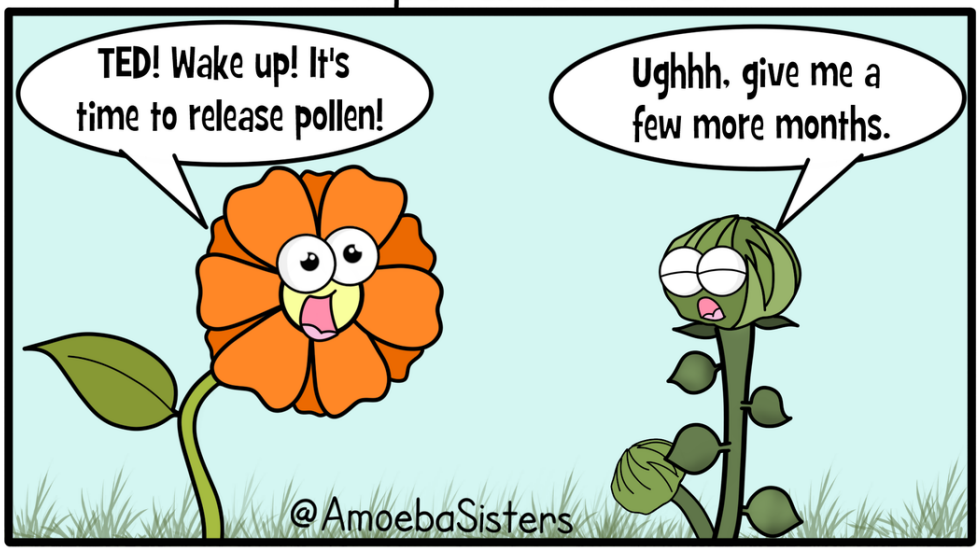
Mechanism	Description
Ecological isolation	This occurs when species occupy different habitats (or niches) within a geographical area. Organisms are prevented from mating as they do not share a habitat or breeding ground.
Temporal isolation	This occurs when species inhabit the same geographical area but are sexually mature at different times of the year and will not mate for this reason.
Mechanical isolation	This occurs in animals where differences in the shape of genitalia prevent mating between members of different species.
Behavioural isolation	This occurs when animals exhibit species-specific courtship patterns which fail to impress members of different species.
Gametic isolation	This occurs when a species produces gametes that are incompatible with those of a different species. Fertilisation is unsuccessful when gametes cannot fuse and form a zygote.

Pre-zygotic Isolating Mechanisms		Example	
Temporal	Occurs when two species mate at different times of year	Frogs live in same pond but breed during different seasons (summer vs spring)	
Ecological	Occurs when two species occupy different habitats	Lions and tigers can potentially interbreed, but usually occupy different habitats	
Behavioural	Occurs when two species have different courtship behaviours	Certain groups of birds will only respond to species-specific mating calls	
Mechanical	Occurs when physical differences prevent copulation / pollination	Certain breeds of dog are morphologically incapable of mating due to size	

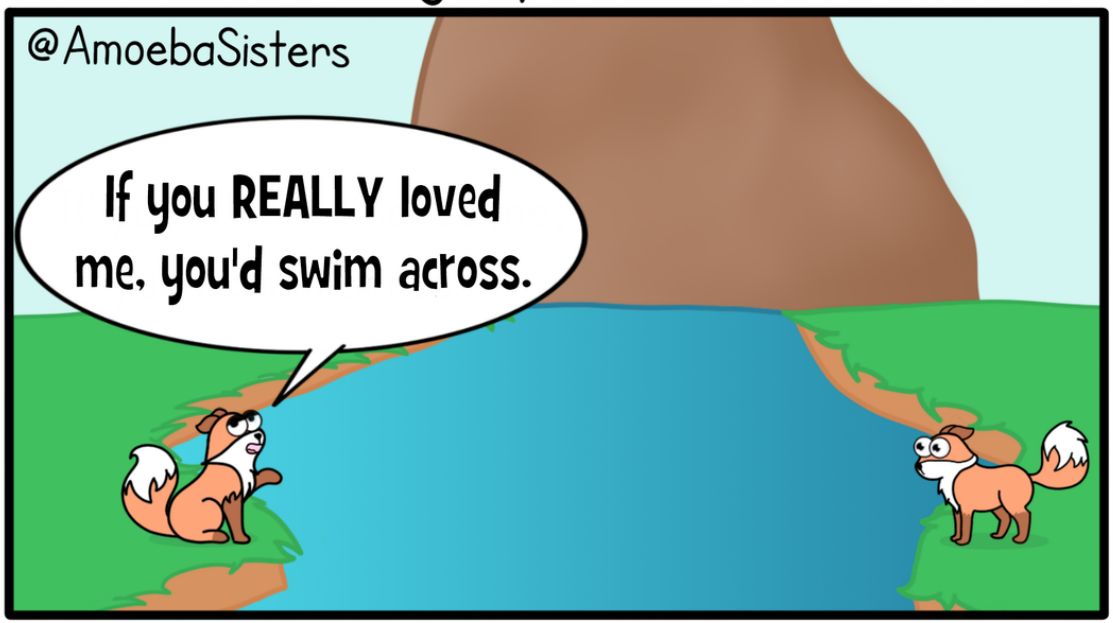
Behavioral Isolation



Temporal Isolation

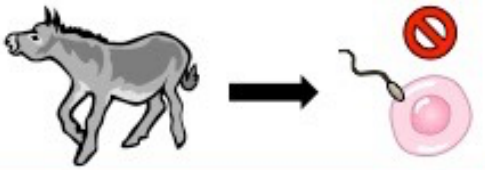


Geographic Isolation



Post-Zygotic Isolation

Mechanism	Description
Hybrid unviability	A hybrid offspring is formed but is unhealthy and is unlikely to live long enough to produce offspring.
Hybrid sterility	A hybrid offspring reaches sexual maturity but is sterile (infertile) because meiosis fails to produce gametes. Differences in chromosome number and structure prevent successful pairing of homologous chromosomes during meiosis.

Post-zygotic Isolating Mechanisms		Examples	
Hybrid Inviability	Hybrids are produced but fail to develop to reproductive maturity	Certain types of frogs form hybrid tadpoles that die before they can become a frog	
Hybrid Infertility	Hybrids fail to produce functional gametes (sterility)	Mules are sterile hybrids resulting from mating between a horse and a donkey	
Hybrid Breakdown	F_1 hybrids are fertile, but F_2 generation fails to develop properly	The offspring of hybrid copepods have less potential for survival or reproduction	

The offspring of a female horse and a male donkey is called a mule (Figure 4.15).

Figure 4.15: Male donkey and a female horse (parents) with mule (offspring).