Aakash + BYJU'S NOTES

Plant Kingdom

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Key Takeaway

1. Characteristics of plants
2. Classification of plants
3. Thallophyta
4. Algae
   - Structure
   - Habitat
   - Mode of nutrition
   - Reproduction
   - Life cycle
   - Classification

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Classification of Kingdom plantae

5

6 **Bryophytes**

- Structure
- Alternation of generation
- Fertilization
- Classification
- Reproduction

7 **Pteridophytes**

- Characteristics
- Alternation of generation
- Life cycle
- Classification
- Uses

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8 **Gymnosperms**

- Phases of life cycle
- Alternation of generation

9 **Angiosperms**

- Structure of flower
- Male gametophyte
- Female Gametophyte
- Fertilisation
- Life cycle
- Classification

Summary

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Characteristics of Plants

Characteristics of plants

Number of cells

- Plants are composed of several cells. Hence they are **multicellular**.

Type of cell

- Plant cells have a well defined nucleus and membrane bound cell organelles. Thus they are **eukaryotes**.

Cell wall

- Plants have a cell wall that provides structure to the cells and is composed of **cellulose**.

Mode of nutrition

- Presence of chloroplast enables them to prepare their own food by using sunlight through the process of photosynthesis. Thus, plants exhibit **photoautotrophic** mode of nutrition.

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Classification of Plants

- **Classification**- The process of grouping organisms according to the similarities and dissimilarities in their characteristics and placing them in the taxonomic hierarchy.
- **Importance of classification of plants:**
  - Difficult to study the characteristics of individual organisms
  - Classification makes researching about an organism easier

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Artificial Systems of Classification

- Plants are classified based on one or few morphological characteristics.
- In such systems, **evolutionary relationships** between organisms are not considered.
- This was based on vegetative characteristics.
- Some systems were based on the **androecium structure (given by Linnaeus)**.
- **They gave equal weightage to vegetative and sexual characters.**

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Natural System of Classification

- Organisms are classified based on - external as well as internal features.

Internal features include

Ultrastructure

- The highly **minute structures present within a cell** constitute ultrastructure. It requires a highly magnified microscope to view these structures.

Anatomy

- The study of the **internal structure** of an organism is known as anatomy.

Embryology

- The study associated with **embryo** and its **development** is called embryology.

Phytochemistry

- It deals with the analysis of **chemicals** obtained from plants.

- Classification based on such internal features was given by **George Bentham** and **Joseph Dalton Hooker.**

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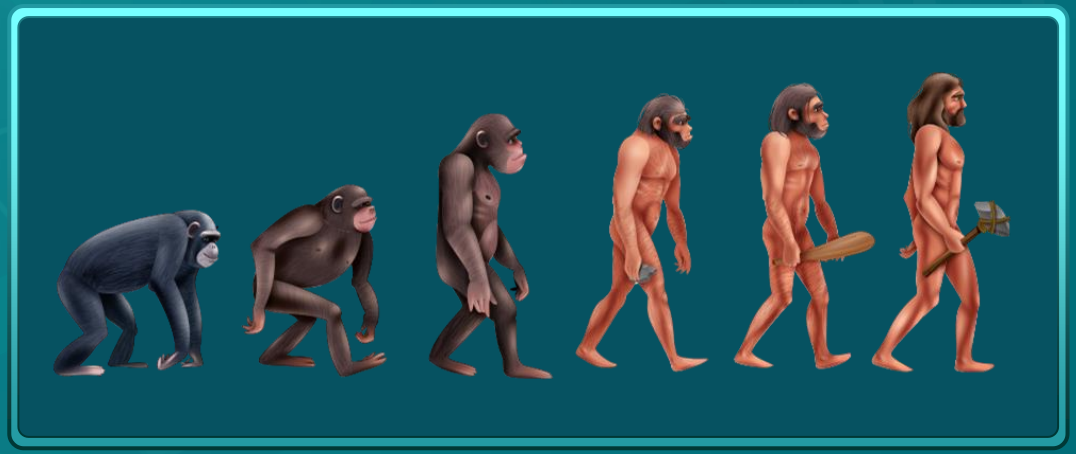
Phylogenetic System of Classification

- According to the theory of Charles Darwin, organisms experience a gradual change in their characteristics over successive generations.
- It is also to be noted that existing species originate from ancestors that looked quite different from them.
  - The organisms are classified based on **evolutionary relationships** between them.



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Phylogenetic System of Classification

Classified on the basis of

Fossil record

- The fossils help in understanding the characteristics of the **ancestors** of an organism.

Numerical taxonomy

- Classification of organisms based on a **numerical algorithm**. The character of the organism under the study is given numbers and codes. Using several mathematical tools the taxonomy is performed.

Cytotaxonomy

- It involves the classification of organisms based on the **chromosome** number, structure and behaviour.

Chemotaxonomy

- Classification of plants based on the **chemicals** they are composed of.

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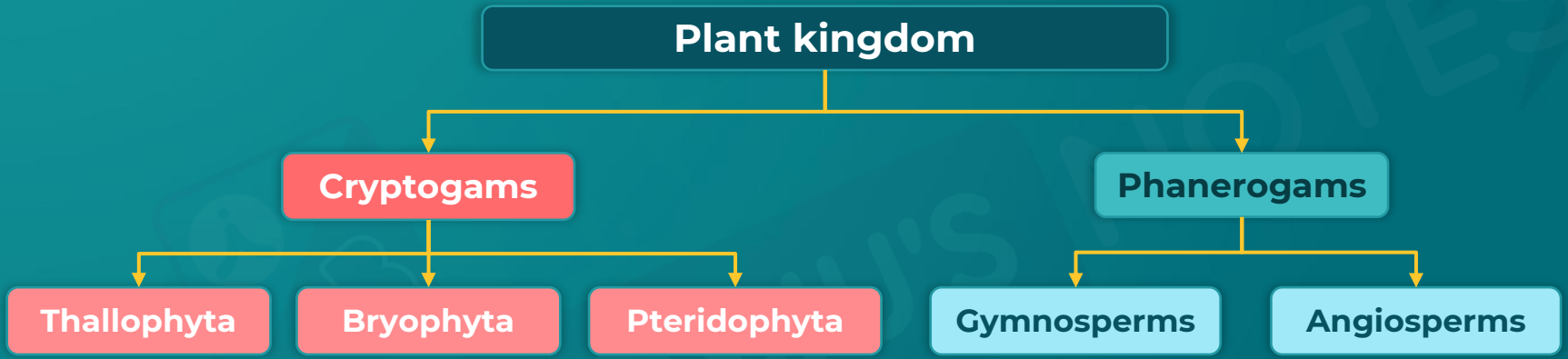
Current System of Plant Classification

- The present system of plant classification was proposed by **August W. Eicher**.
- This system of classification was based on **evolutionary relationships**.



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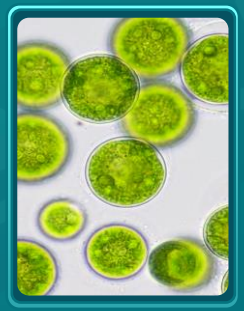
Thallophyta

- **Stephan Endlicher** called the bodies of plants without roots, stems and leaves as **thallus**. The group was called **thallophyta**.
- **Earlier classification**
  - Earlier, division Thallophyta included **fungi, algae** and **lichens** as none of these have a proper plant body.
- Current Classification
  - Fungi are now separated into **Kingdom Fungi**.
  - Since Lichens are a symbiotic association between fungi and algae, they were **not included in any Kingdom**.
  - So now, **thallophytes include only algae** and the term thallophyta is rarely used.

Fungi



Algae

Lichen

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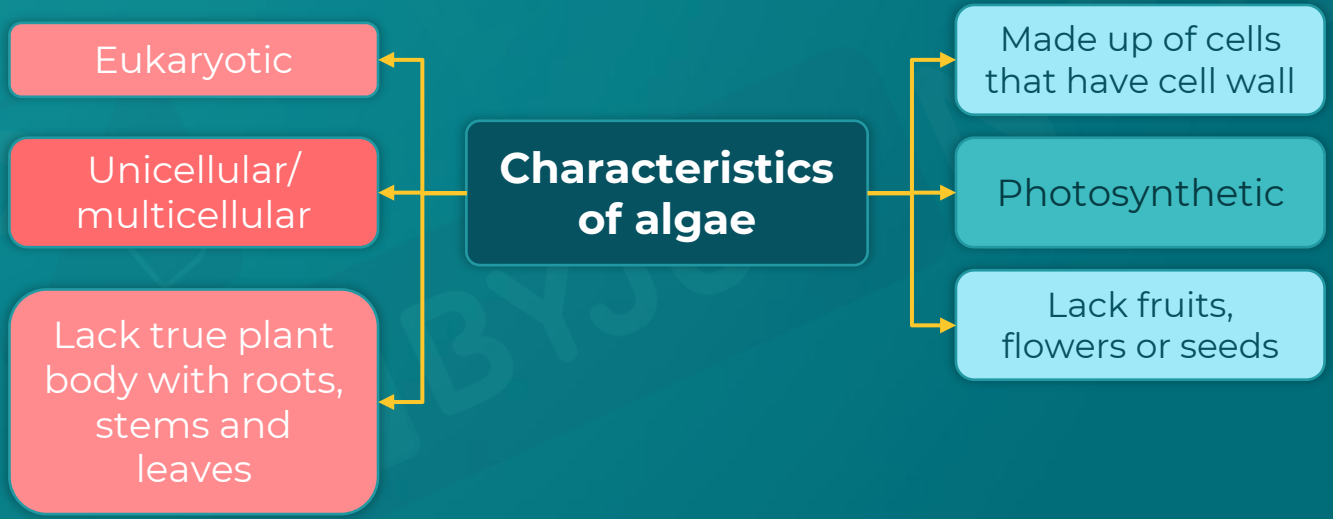
Algae

- The study of algae is called **phycology** or **algology**.
- **Mandayam O.P. Iyengar** is known as the father of **Indian phycology** or algology.



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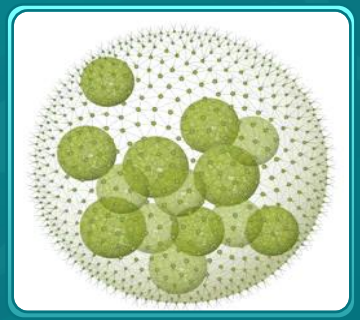
Algae : Structure

- Algae show great diversity in their **shapes** and **sizes**.
- Some of them are **microscopic** whereas some are **giants** reaching the height of 100 metres in length.

Plant body of algae can be

Unicellular (motile or non-motile)	Colonial	Multicellular	Filamentous
Unicellular	Colonial	Multicellular	Filamentous



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Algae : Habitat

- Predominantly **aquatic**
  - Marine
  - Freshwater
- **Moist surfaces** of soil, wood, stones and even snow
- Symbiotic relationship with fungi to form **lichens**

Moist surfaces of wood

On body of sloth

Marine habitat

Moist surfaces of stones

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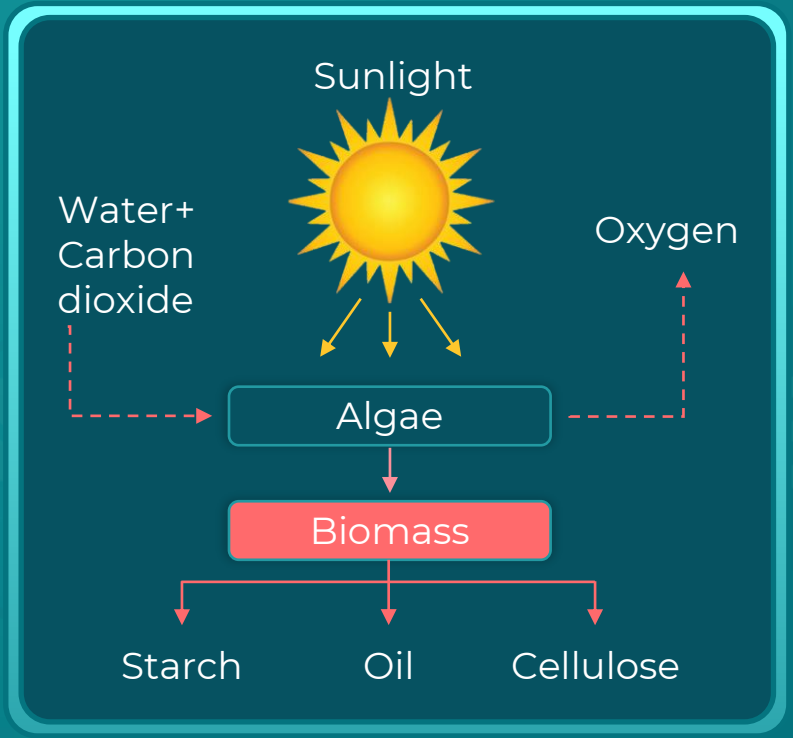
Algae : Mode of Nutrition



- Algae are **autotrophic** organisms performing photosynthesis.
- They belong to the phytoplankton group responsible for producing the majority of the oxygen on this planet.

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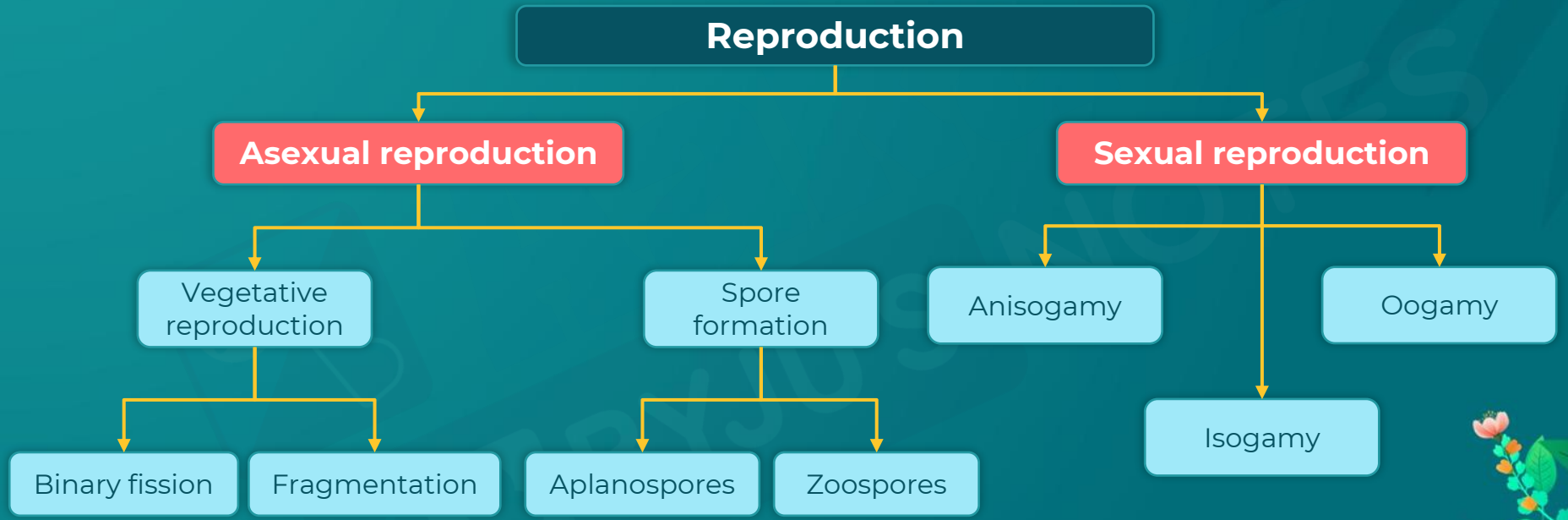
Algae : Reproduction



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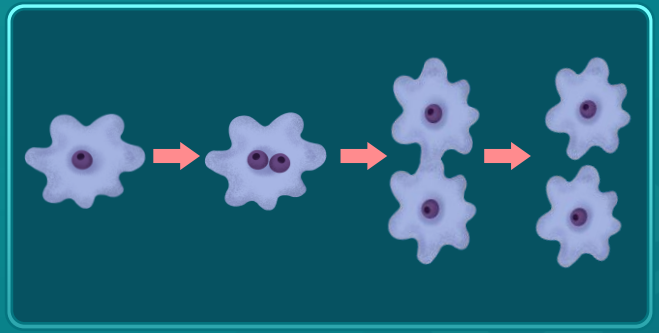
Algae : Asexual Reproduction

Vegetative reproduction

Binary fission

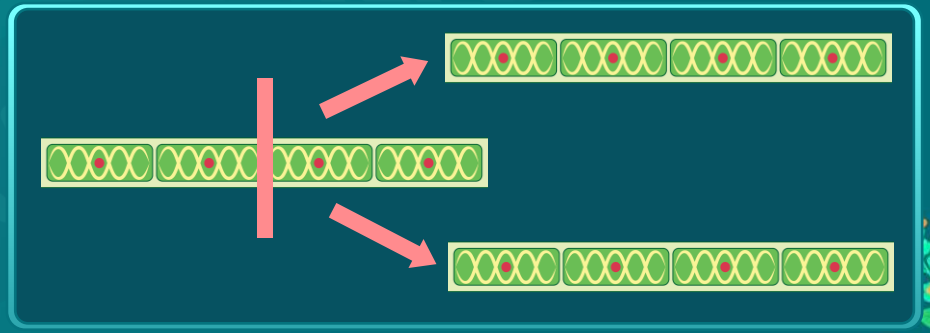
Division of a parent cell into **two daughter cells**



Exhibited by unicellular algae
e.g. *Chlamydomonas*

Fragmentation

Breaking up of the body of an organism into **fragments**, on maturation **each fragment grows into an individual organism**



Exhibited by filamentous algae
e.g. *Spirogyra*

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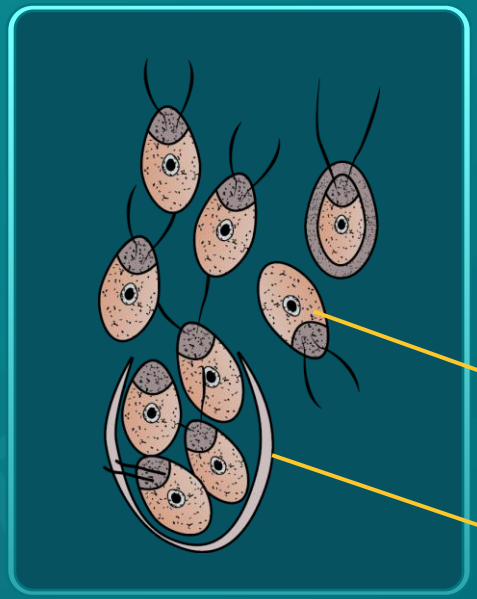
Algae : Asexual Reproduction

Spore formation

Aplanospores

Non motile asexual spores eg. *Ulothrix*.



Spore formation in *Chlamydomonas*

Zoospores

Flagellated **motile** spores that germinate to produce new algae E.g., *Chlamydomonas*.

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Algae : Sexual Reproduction

Sexual reproduction

Anisogamy

Both gametes are **dissimilar**.
E.g., *Eudorina*

Isogamy

Both gametes are **similar.**
E.g. motile - *Ulothrix*, non-motile - *Spirogyra*

Oogamy

Female gamete is **large** and **non-motile** and the male gamete is **small** and **motile**. Eg., *Volvox*, *Fucus*

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Phases of Algal Life Cycle

- In plants, both haploid and diploid cells can divide by mitosis.
- This ability leads to the formation of different plant bodies - **haploid** and **diploid**.
- **Sporophytic generation:**
  - **Sporophytic** generation is represented only by the one-celled **diploid** zygote formed by the fusion of haploid gametes.
  - There are **no free-living sporophytes**.
  - Meiosis in the zygote results in the formation of haploid spores.

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Phases of Algal Life Cycle

- **Gametophytic generation:**
  - The **haploid** spores divide mitotically and form the **gametophyte**.
  - The gametophyte forms haploid gametes.
- **Alternation of generations:**
  - Algae show an **alternation** between the gametophyte and sporophyte phases.
  - The dominant, photosynthetic phase in such plants is the free-living gametophyte.
  - This kind of life cycle is termed as **haplontic**. E.g., *Volvox*, *Spirogyra* and *Chlamydomonas*.

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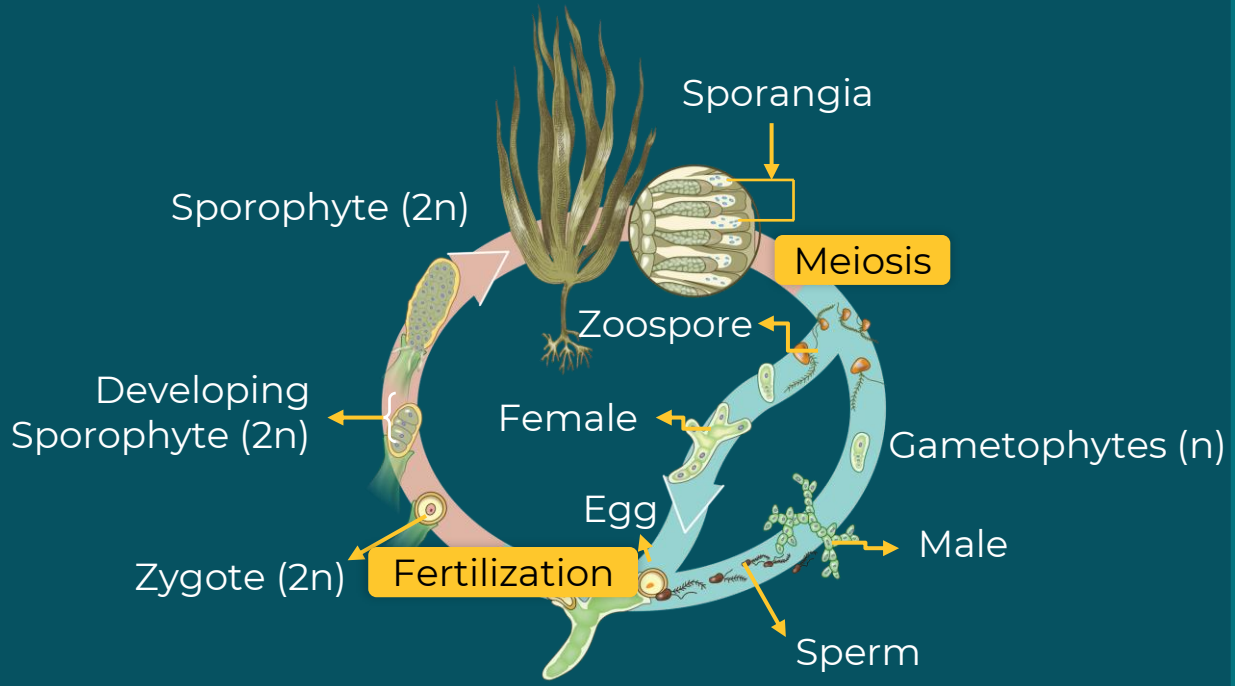
Phases of Algal Life Cycle



Key

- Haploid (n)
- Diploid (2n)

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Classification of Algae

Algae are classified **based on the pigments** they contain.

Laminaria

Fucus

Macrocystis

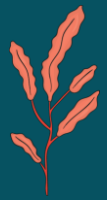
Sargassum

Padina

Daya

Porphyra

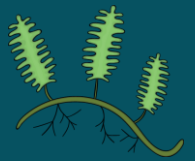
Acetabularia



Phyllophora

Cladophora

Ulva



Caulerpa

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Classification of Algae

Rhodophyceae

- Chlorophyll a
- Chlorophyll d
- Phycoerythrin

Red Algae
(Rhodophyceae)

Phaeophyceae

- Chlorophyll a
- Chlorophyll d
- Fucoxanthin

Brown Algae
(Phaeophyceae)

Chlorophyceae

- Chlorophyll a
- Chlorophyll b

Green Algae
(Chlorophyceae)

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Rhodophyceae

Habitat	Marine
Cell wall	Cellulose, pectin, polysulphate esters and phycocolloids
Pigments present	Chlorophyll a, Chlorophyll d, Phycoerythrin
Food stored	Floridean starch
Members	*Polysiphonia, Gracilaria, Gelidium, Chondrus, Pyropia*

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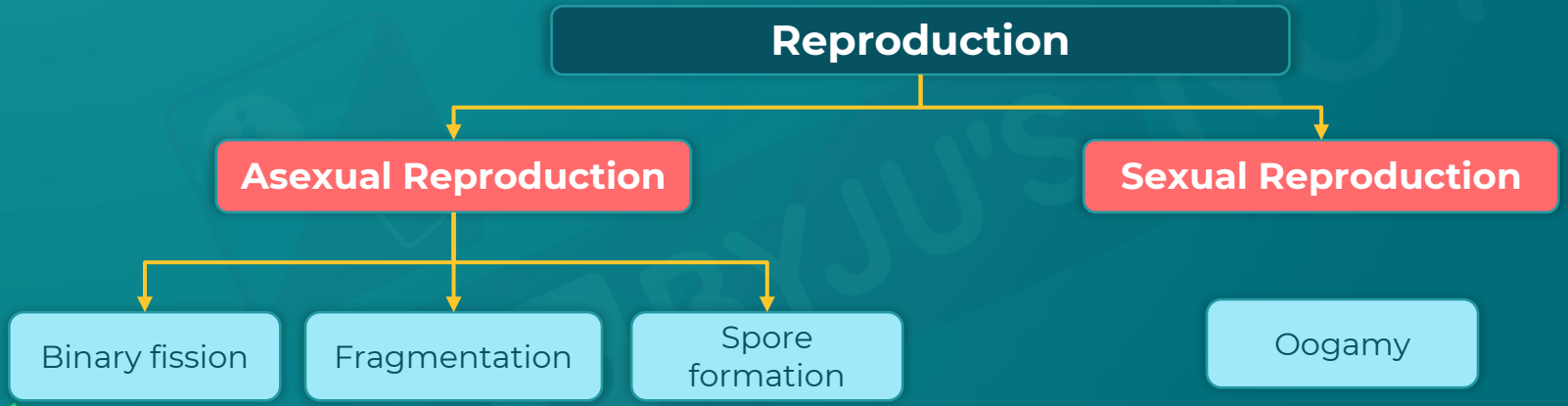
Rhodophyceae

- **Autotrophic mode of nutrition** is seen except in *Harveyella*, which is colourless and parasitic on other red algae.
- **Haplontic** life cycle is seen except in *Polysiphonia* (**haplo-diplontic**).



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Phaeophyceae

Habitat	Generally marine forms
Type of pigment present	Chlorophyll a & c, and fucoxanthin
Cell wall	Cellulose and algin
Stored food	Mannitol and laminarin
Members of Phaeophyceae	*Ectocarpus, Laminaria, Fucus, Sargassum, Dictyota*

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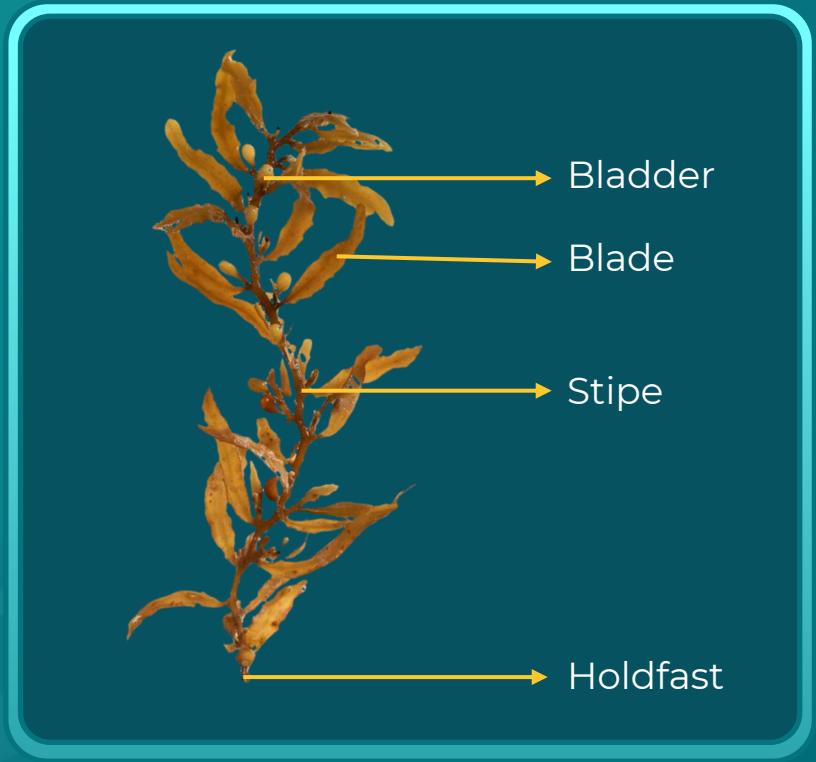
Phaeophyceae



Kelp

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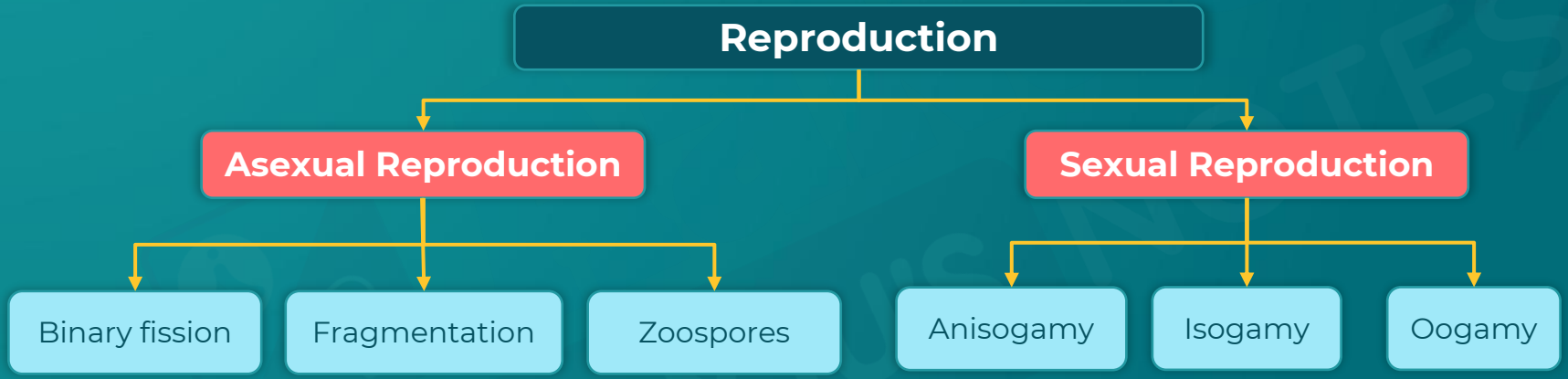
Phaeophyceae

- **Haplontic** life cycle is seen except in *Fucus* **(diplontic)** and in *Ectocarpus* and kelps **(haplo-diplontic)**.



- **Kelps** are giant brown algae forming underwater forests, where no vegetation can exist due to freezing temperatures.

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Chlorophyceae

Habitat	Mostly freshwater forms, very few marine forms
Type of pigment present	Chlorophyll a and b
Cell wall	Cellulose and pectose
Stored food	Starch
Members of chlorophyceae	*Chlamydomonas*, *Chlorella*, *Volvox*, *Spirogyra*, *Chara*

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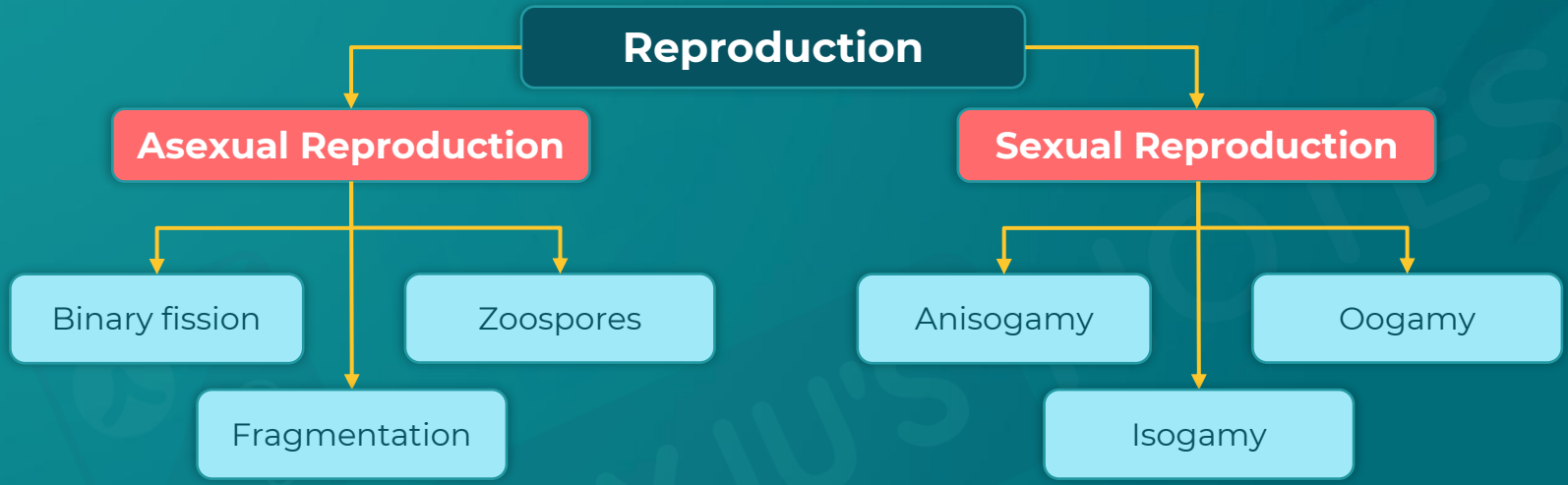
Chlorophyceae



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Chlorophyceae

Chloroplast diversity

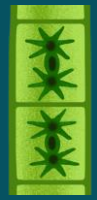

Cup shaped


Discoid


C-Shaped


Reticulate


Spiral


Stellate

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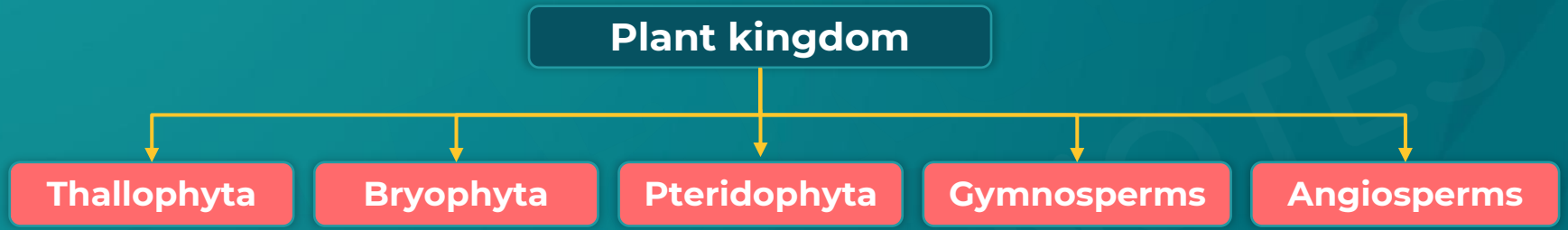
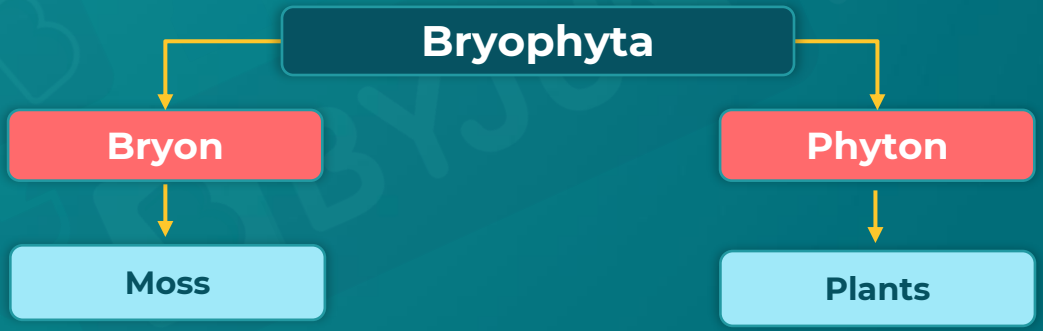
Classification of Kingdom Plantae





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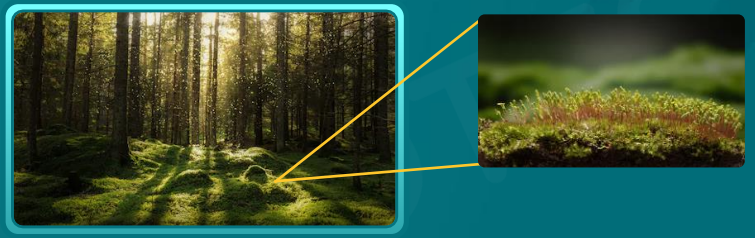
Bryophytes

- Bryophytes are **moss-like** plants which grow in moist, shaded areas and on hills.

Bryophytes growing in the cracks in pavements and on hilly areas

- They are short and grow as dense mats on the soil.



Bryophytes grow as a short, dense mat on the soil

- Why are bryophytes short?

As trees have xylem for the transport of water and phloem for the transport of nutrients like glucose, they are tall. However, bryophytes **do not have xylem and phloem**, therefore they are short.

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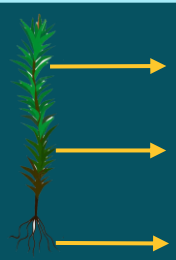
Bryophytes : Structure

- Plant-body is **undifferentiated** and is thallus-like.
- They do not have true roots, stem or leaves but may bear root-like, stem-like and leaf-like structures.
- The undifferentiated thallus can be **prostate or erect**.

Prostrate thallus		The thallus has a **downward position** and is **stretched** on the ground
Erect thallus		• The plant body is erect • Plant body is differentiated into **rhizoids**, **axis** and **leaf-like** structures. • The rhizoids **anchor** the plants to the substratum.

Characteristics of the prostate and erect thallus of bryophytes

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Alternation of Generation

Plants exhibit two phases in their life cycle:

- The sporophytic phase (2n)
- The gametophytic phase (n)

Gametophytic

- “Gameto” = Gamete producing;
  “Phyte” = plant
- The gametophyte exists independently.
- It is **haploid (n)**.

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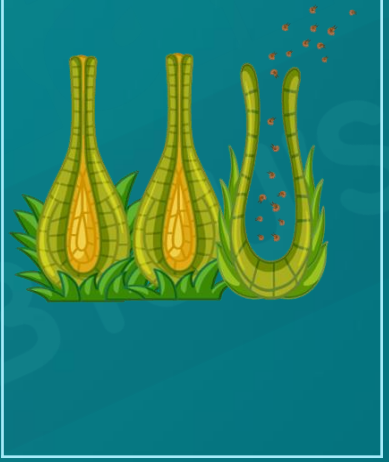
Alternation of Generation

The antheridium and archegonium of bryophytes

They produce biflagellate antherozoids.

Antheridium (male sex organ)



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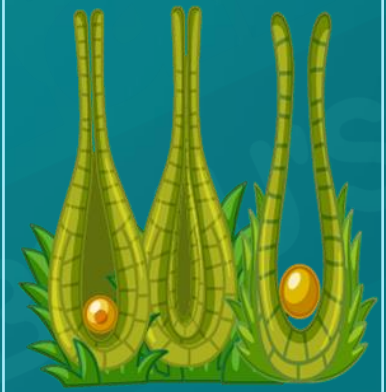
Alternation of Generation

The antheridium and archegonium of bryophytes

Archegonium (female sex organ)


Flask-shaped
and produces a single egg

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Fertilization in Bryophytes

- **Water is required** for the fertilization as the male and female gametes are brought together through the medium of water.
- Since they live on land but need water for fertilization, they are known as the **amphibians of the plant kingdom**.
- Zygote does not undergo reduction division.
- It produces a multicellular body called a **sporophyte**.
    - It is attached to the photosynthetic gametophyte and derives nourishment.
    - It is diploid (2n).

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Classification of Bryophytes

Bryophytes

- Liverworts

- Hornworts

Known so because of its horn – like sporophyte

- Mosses

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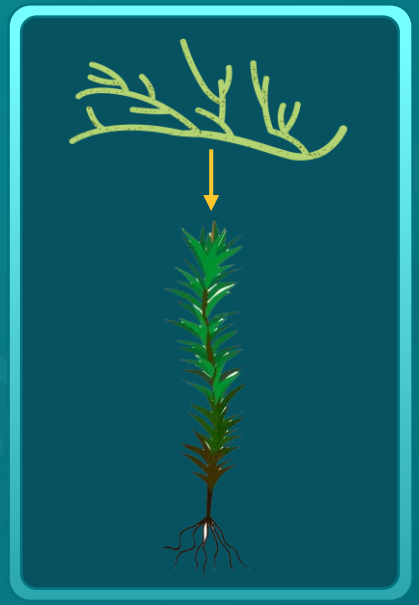
Classification of Bryophytes

a) Mosses:

- The predominant stage – gametophyte
  - consists of two stages

Protonema

Leafy stage



Stages of development of mosses

- First stage- Protonema is **creeping** and **branched**, filamentous
  - Develops directly from a spore
- Second stage- Leafy stage that develops from s econdary protonema as a lateral bud.
  - Plant body is attached to substratum by rhizoids

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Classification of Bryophytes

a) Mosses:

- Vegetative reproduction in mosses is by fragmentation and budding in the secondary protonema.
- In sexual reproduction, the sex organs antheridia and archegonia are produced at the apex of the leafy shoots.
- After fertilisation, the zygote develops into a sporophyte, consisting of a foot, seta and capsule.

- Common examples of mosses are *Funaria, Polytrichum* and *Sphagnum*.

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Classification of Bryophytes

b) Liverworts:

- There are two types of liverworts - thalloid liverworts and foliose liverworts.
  - Thalloid: e.g., *Marchantia*
  - The leafy ones have tiny leaf-like appendages along rows on the stem-like structures.

Thalloid

Foliose

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Reproduction in Liverworts and Mosses

Reproduction

Vegetative

Fragmentation in both liverworts and mosses

Asexual

- Liverworts: **Gemmae**
- Mosses: **Budding**

Sexual

Oogamy in both liverworts and mosses.

After fertilisation, the zygote develops into a sporophyte, consisting of a foot, seta and capsule.

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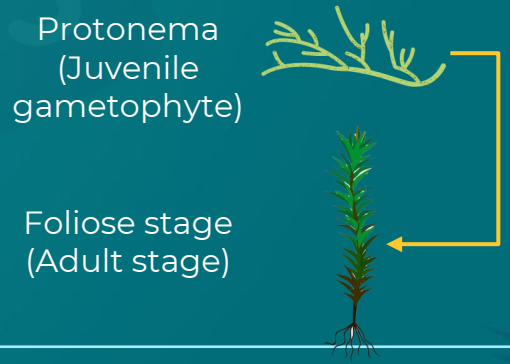
Asexual Reproduction in Liverworts and Mosses

The table below highlights the characteristics and differences between asexual reproduction in liverworts and mosses:

Asexual reproduction in liverworts	Asexual reproduction in mosses
• With the help of **gemma cups** • Gemma cups have green, multicellular **asexual buds** called **gemmae** • Gemmae germinate to form new organisms	• **Buds on protonema** develop into foliose stage
	

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Sexual Reproduction in Liverworts and Mosses

The table below highlights the characteristics and differences between sexual reproduction in liverworts and mosses:

Sexual reproduction in liverworts	Sexual reproduction in mosses
• Male and female sex organs are found on same or different thalli	• Male and female sex organs are found on the same plant at tips of leafy shoots
• Gametes produced by sex organs fuse and form into zygote that develops into sporophyte. • After meiosis, spores are produced within the capsule, which germinate to form free-living gametophytes.	• Gametes produced by sex organs fuse and form into zygote that develops sporophyte. Sporophyte produces spore by meiosis. • The sporophyte in mosses is more elaborate than that of liverworts.

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Importance of Bryophytes

Ecological

- Death and decay of mosses leads to soil formation
- Prevent soil erosion by reducing the impact of falling rain
- Food for herbaceous animals
- Packing material (peat moss)

Bryophytes are important for soil formation and are also a food source

Economical

- Peat - obtained from *Sphagnum*
- Uses of peat
  - Used as fuel and also in gardening
  - Due to high water holding capacity, used as packing material for trans-shipment of living material

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Characteristics of Pteridophytes

- **Habitat:**

Moist shady forests

Crevices of rocks

Bogs and marshes

Epiphytes on tree trunks

First terrestrial plants to possess vascular tissues – xylem and phloem.

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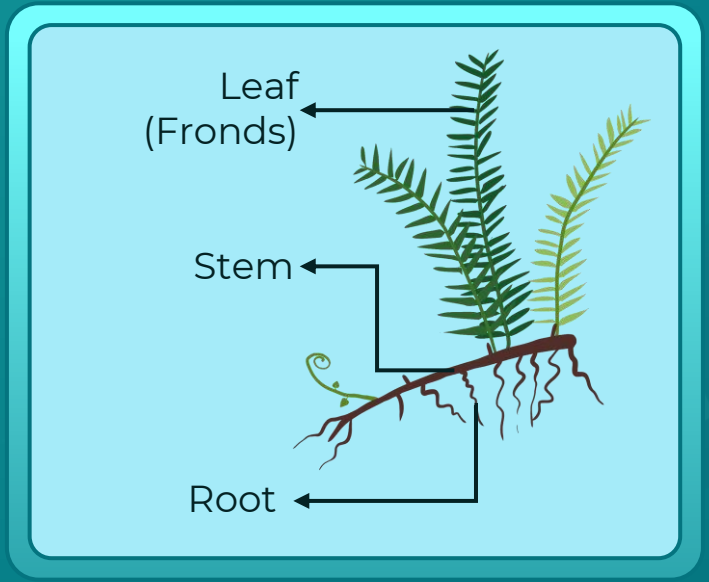
Characteristics of Pteridophytes

- **Parts of pteridophyte plant body**
  The main plant body - sporophyte.
- Differentiated plant body



Stem :

- Function:
  - **Supports** the leaves
  - Sometimes performs **photosynthesis**

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Characteristics of Pteridophytes

Roots:

- Develop from the rhizome and are **adventitious roots**.
- The roots help in **absorption** of water and nutrients.

Leaves :

- Leaves are also known as **fronds** and are green, feathery.
- New leaves or fronds typically expand by the unrolling of a tight spiral as they arise from the stem.

Sporophylls :

- Specialised fronds/leaves that help in **reproduction**.
- Leafy structures that bear the **spores** within the **sporangia**.
- In some pteridophytes, sporophylls aggregate into distinct compact structures known as called strobili or cones (Examples: *Selaginella, Equisetum*).
- Spores are haploid, unicellular structures that germinate to form thalloid gametophyte (prothallus).

- There are two types of fronds:

Microphyll	Megaphyll
Have only single unbranched vascular tissue	Have a branched vascular tissue
Are attached directly to the stem, no stalk	Usually have a stalk
Generally small	Larger in size
E.g. *Selaginella*	E.g. Ferns

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Alternation of generations in Pteridophytes

Two Generations of Pteridophyte Life Cycle

Gametophytic
- Gamete bearing
- Always haploid
- Mostly free living

Sporophytic
- Spore bearing
- Always diploid
- Independent
- Predominant stage

Alternation of Generation - 3 types

Life Cycle	Haploid : Diploid
Haplontic	
Diplontic	
Haplodiplontic	

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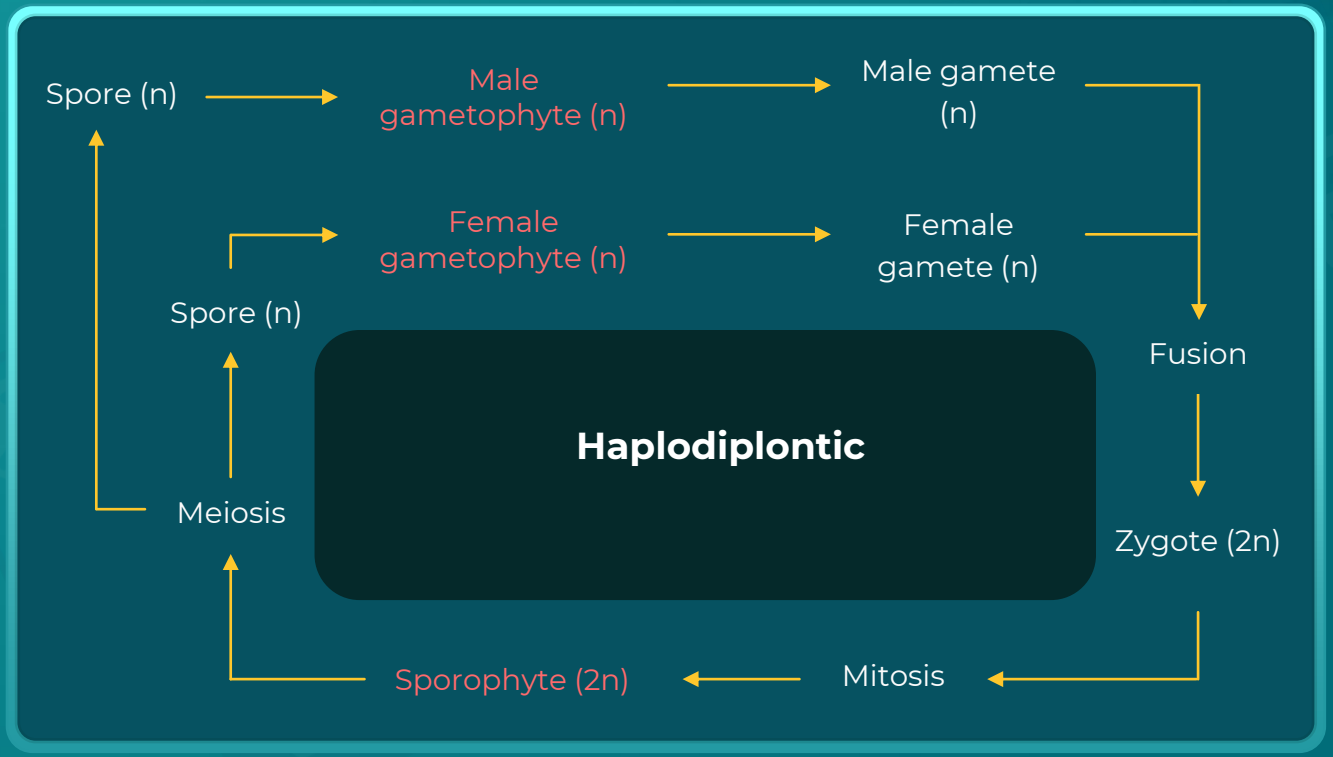
Alternation of generations in Pteridophytes



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Life Cycle of Pteridophytes

- The life cycle of pteridophytes comprises two phases - **Sporophytic** and **gametophytic**.

a. **Gametophyte phase/Prothallus**

- The sporophyte produces spores by meiosis which germinate to form the **gametophyte/prothallus**.
- **Characteristics:**
  - Mostly photosynthetic
  - Small, multicellular
  - Haploid
- It bears **sex organs**
  - **Male** sex organ - **antheridium**
  - **Female** sex organ – **archegonium**
- Gametes produced by sex organs fuse to form zygote.
- Zygote develops into multicellular well-differentiated sporophyte.

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Life Cycle of Pteridophytes

b. Sporophyte

- Has a well differentiated plant body with root, stem, and leaves.
- Leaves produce spores.
- **Characteristics:**
  - More dominant
  - Multicellular
  - Free-living
  - Diploid
- Based on the types of spore formation, there are two types of pteridophytes, **homosporous and heterosporous.**

Homosporous	Heterosporous
Same type of spore	Two types of spores
Small spores	Small microspores and large megaspores
Small spore- Bisexual gametophyte	Microspore- Male gametophyte Megaspore- Female gametophyte
Seen in majority of pteridophytes	Seen in *Selaginella* and *Salvinia*

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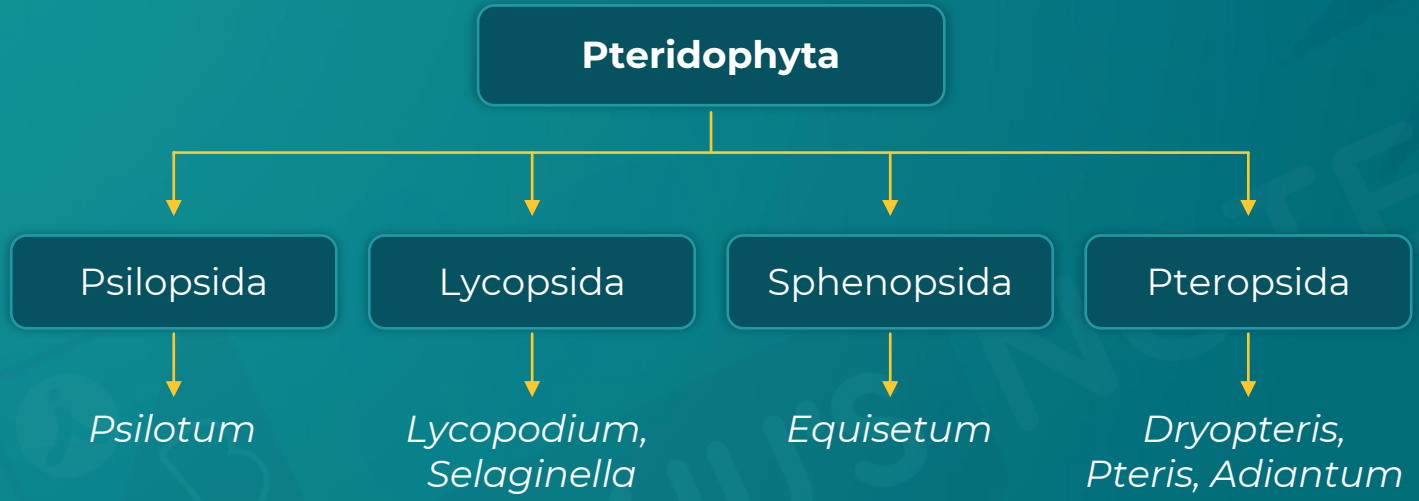
Classification of Pteridophytes



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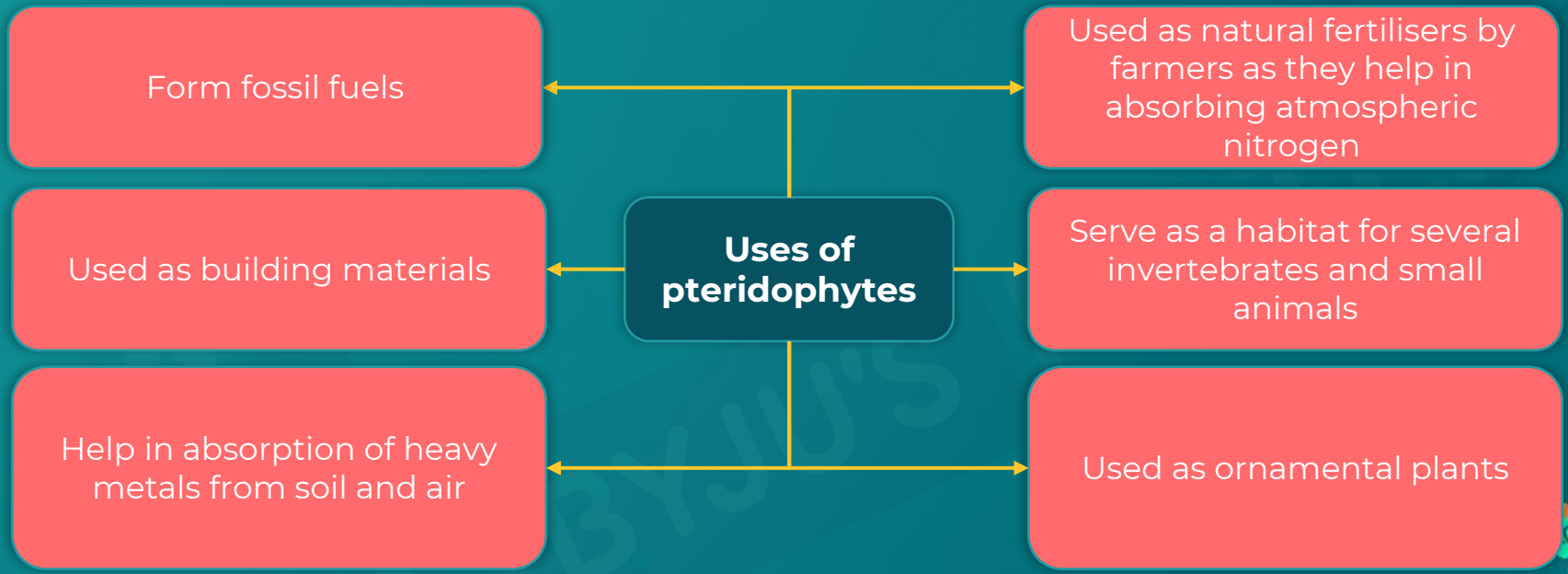
Uses of Pteridophytes



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Gymnosperms

- They are the first seeded plants.
- They are **vascular plants** and have xylem, which transports water and phloem, which transports food.
- They survive in dry and cold habitats.
- Differentiated plant body: well-defined roots, shoots and leaves.

Roots:

- **Taproot** system - The secondary roots arise from the central primary root.
- Form **symbiotic associations with fungi** and **cyanobacteria**.
    - Association with Fungi: **Mycorrhiza**
        - The fungus makes it easier to capture **minerals** such as organic nitrogen, phosphorus, iron and other nutrients available to the plants by solubilising it.
        - The fungal hyphae access and obtain **nutrients** beyond the root zone and deliver it to plants.
        - Plants, in turn, provide some of the **sugars** that it produces by photosynthesis.

Mycorrhiza

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Gymnosperms

- Association with nitrogen-fixing cyanobacteria: **Coralloid roots**
  - Cycads naturally grow in habitats with poor and inaccessible nutrients such as sand dunes, steep rocks.
  - The coralloid roots allow them to thrive in such challenging conditions.
  - Cyanobacteria like ***Nostoc*** are present in coralloid roots. It **fixes atmospheric nitrogen** to ammonia.

Coralloid roots

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Gymnosperms

Stem:

- **Erect Stem**
  - **Unbranched**
    - 
    - *Cycas*
  - **Branched**
    - 
    - *Pinus*

Leaves:

- **Leaves**
  - **Scaly**
  - **Foliage**
    - **Simple**
    - **Compound**
      - **Pinnately**
      - **Palmately**

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Gymnosperms

Characteristics of leaves

- **Scaly leaves**: Brown, thick, tough and needle-like
- **Foliage leaves**: Green, soft, pinnate and needle-like
- **Simple leaves:** The main leaf- undivided leaf
- **Compound leaves:** The main leaf divided into smaller leaflets

- Adaptations of leaf:

Adaptation of Leaves

Needle-like leaves	Thick cuticle	Sunken stomata	Evergreen
• Snow cannot sit on leaves • Reduced area = less water loss	• Waxy coating on leaves • Prevents water loss	Reduces water loss	Retains leaves for several years to capture sunlight throughout the year

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Gymnosperms

- Modification of leaf - **Sporophylls**
  - Sporophylls are modified leaves which play a role in **reproduction**.
  - Sporophylls usually aggregate to form **strobili**.
  - They contain sporangia which produce **spores**.

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Phases of Gymnosperm Life cycle:

Gametophytic
- Gamete bearing
- Always haploid

Sporophytic
- Spore bearing
- Always diploid
- Dominant stage

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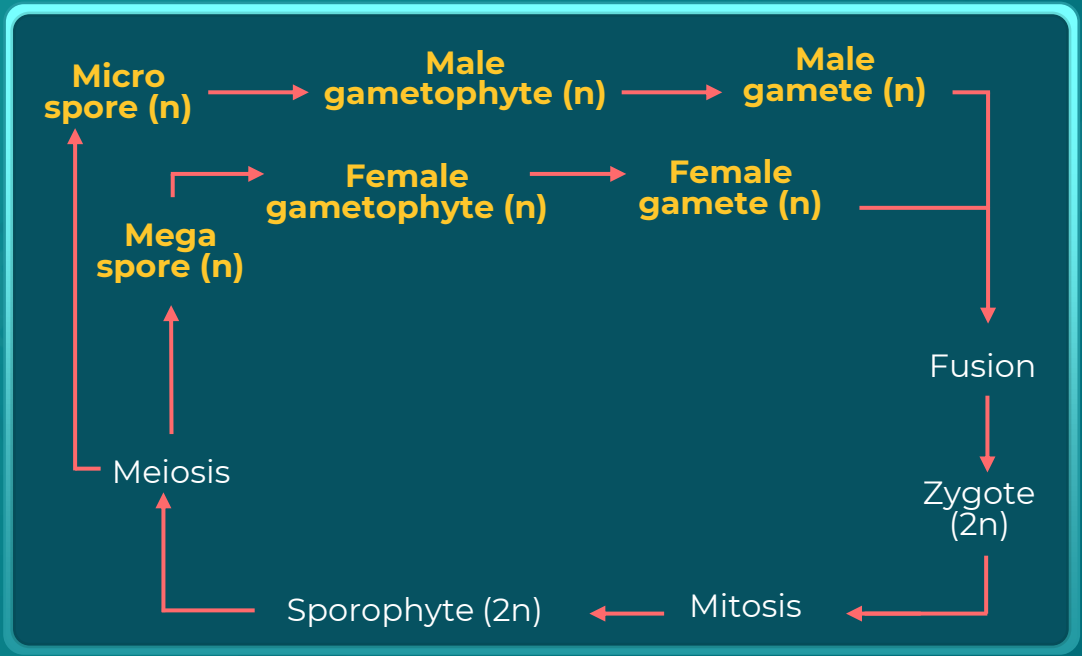
Heterospory

- Heterospory is a phenomenon in which **two types of spores** are formed.
- The male cones produce haploid **microspores** and the female cones produce haploid **megaspores**.



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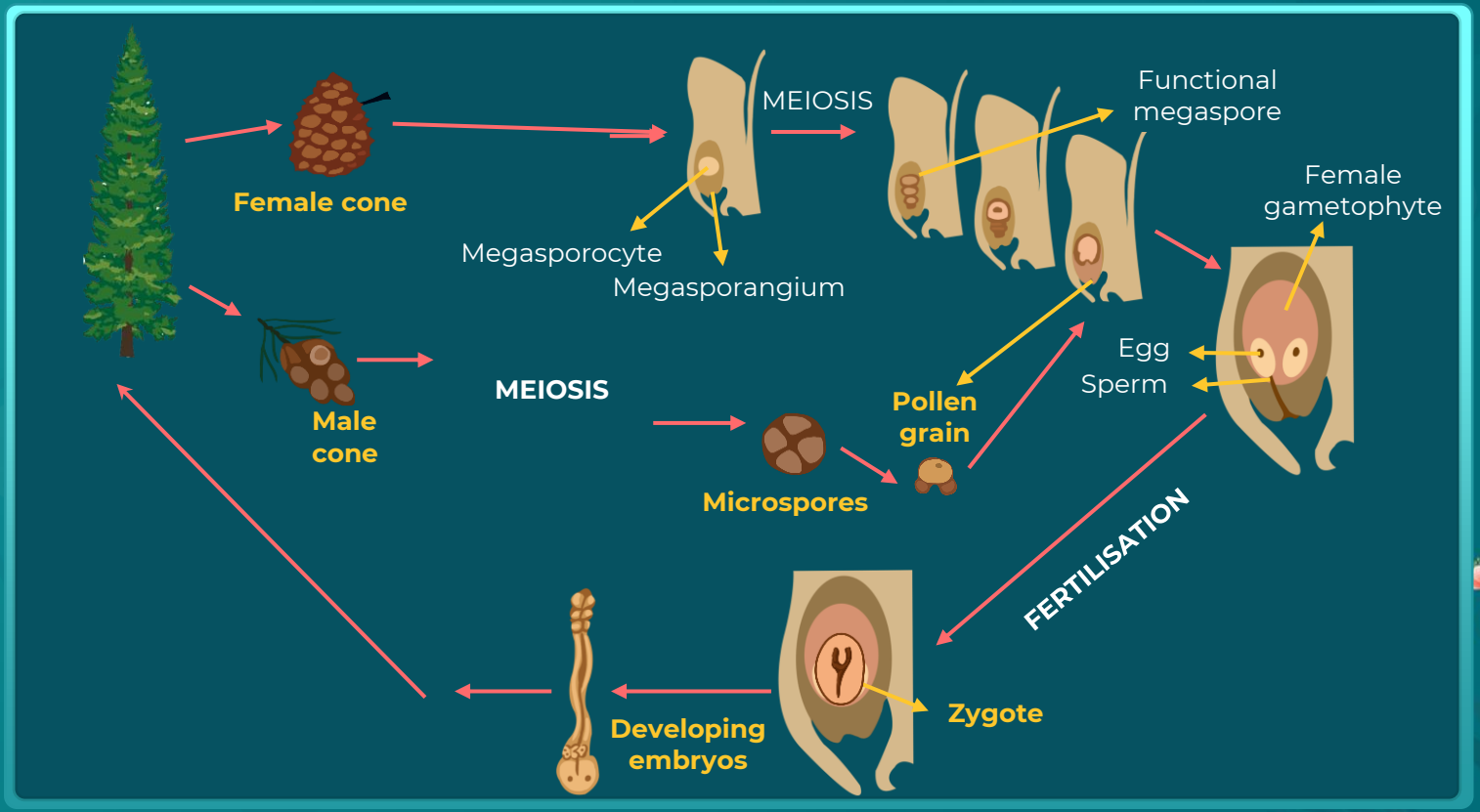
Alternation of Generations



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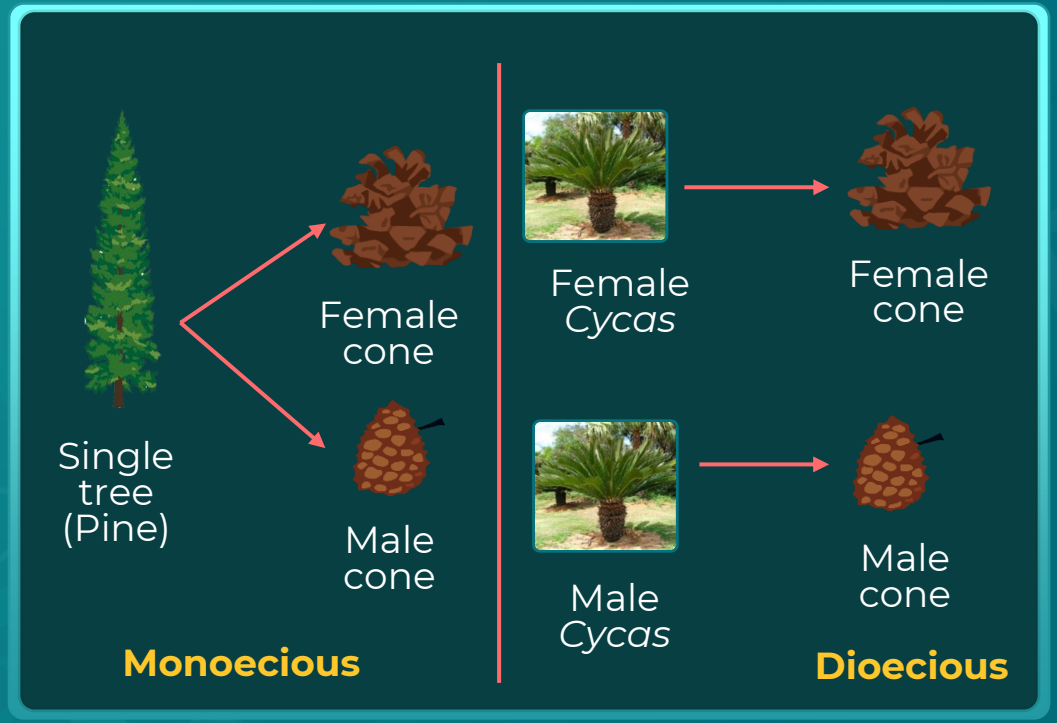
Gymnosperms



- **Monoecious** - Bisexual plants that have both male and female parts.
- **Dioecious** - Separate male and female plants that will produce only male or female cones

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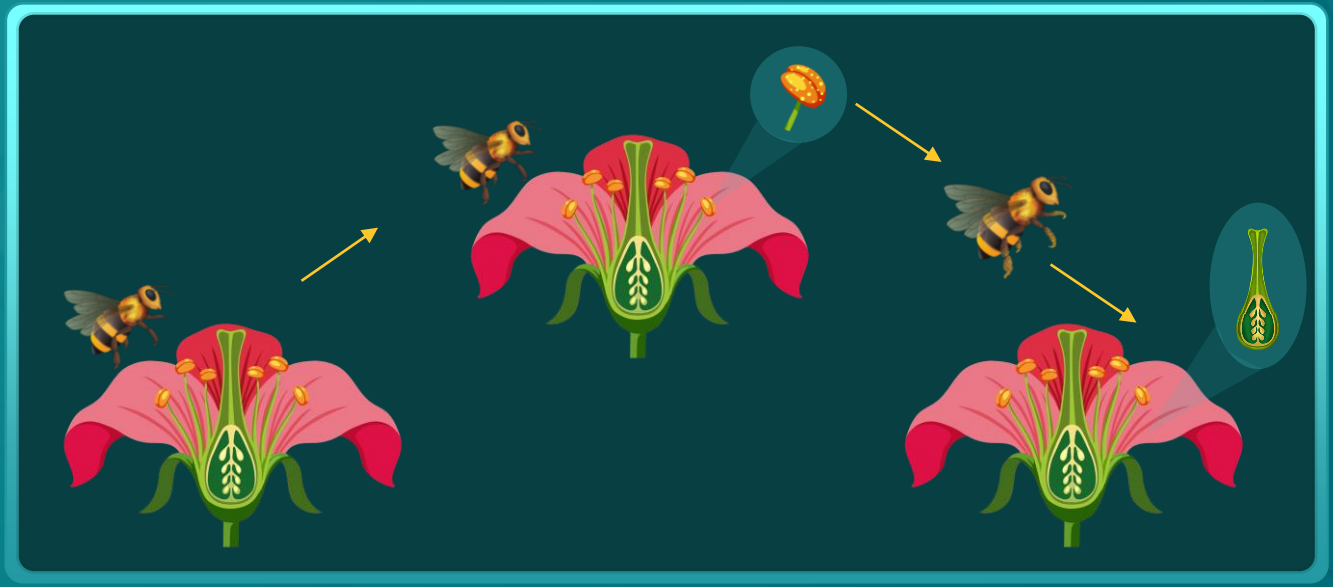
Angiosperms

- Includes all the **flowering, vascular, seed bearing** plants
- Seeds - enclosed within the fruit
- Flowers- attract insects which help in pollination
- **Pollination:** Process of transferring pollen grains from anther (male part of a flower) to stigma (female part of a flower)



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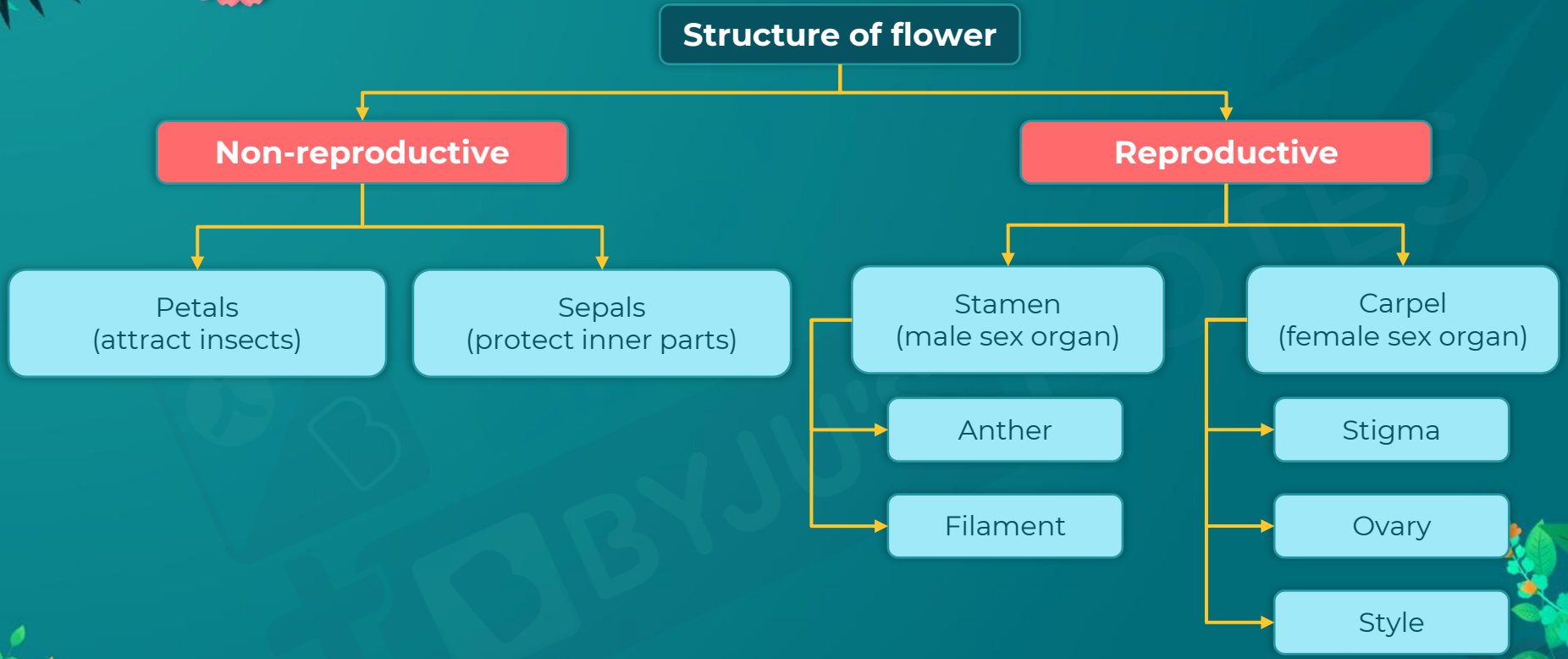
Angiosperms : Structure



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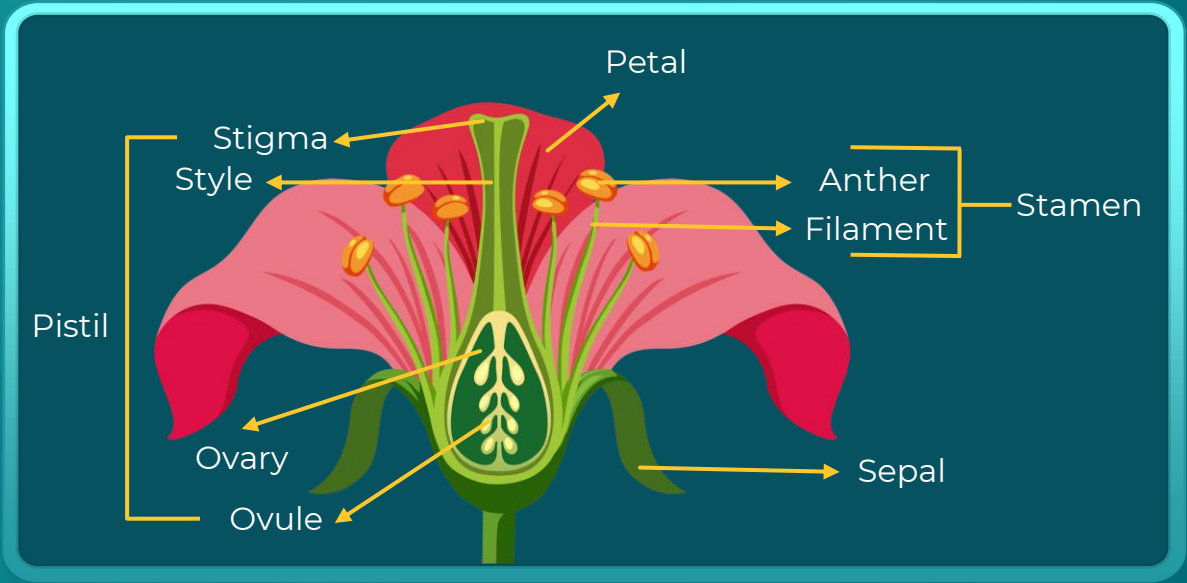
Angiospermic Flower: Parts



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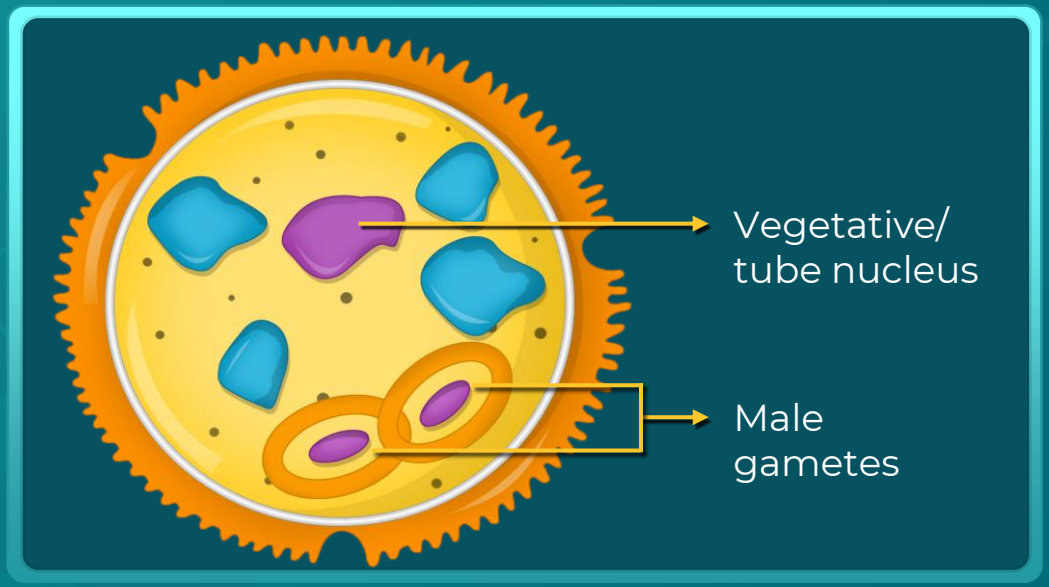
Angiosperms : Male Gametophyte

- **Pollen** is the male gametophyte as it bears the male gamete.
- Anther, when cut transversely, shows the presence of four lobes.
- Each pollen mother cell (diploid) in the anther undergoes meiosis to form **four haploid microspores**. These microspores mature into **pollen grains**.



Male gametophyte

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Angiosperms : Female Gametophyte

- **Embryo sac** is the female gametophyte.
- The **ovary** is the female reproductive part, inside which is the **ovule**.
- The ovule is the **megasporangium** of the angiosperms.
- Megasporangium consists of the **megaspore**.
- Generally, each ovule has a **megaspore mother cell** that undergoes **meiosis** to form **four haploid megaspores**.
- Three of them degenerate, and **one divides to form the embryo sac**.
- Each embryo-sac has a **three-celled egg apparatus (one egg cell** and **two synergids), three antipodal cells** and **two polar nuclei**.
- It develops into a **7-celled and 8-nucleate** state before the fertilisation.
- It consists of:
  - **Three cell egg apparatus-** One egg cell and two synergids
  - **Three antipodal cells**
  - **Two polar nuclei** that fuse together to form a diploid secondary nucleus

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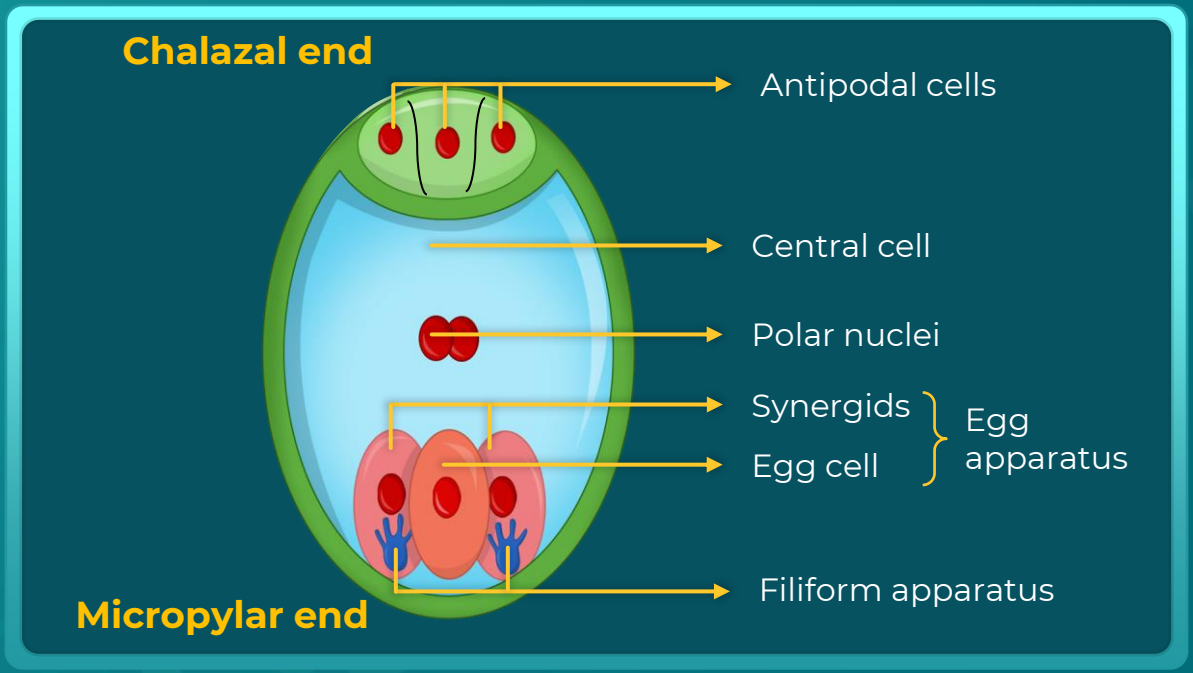
Angiosperms



Female Gametophyte

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Angiosperms: Fertilisation

- Process of **fusion** of the **male and female gametes**.
- The pollen grains are transferred from the anther to the stigma by the process of **pollination**.
- Once the pollen grains land on the stigma, the pollen tube starts forming.
- **Development of pollen tube**
  - Each pollen contains two cells- vegetative cell, generative cell
    - **Vegetative cell** produces a pollen tube
    - **Generative cell** divides to form two male gametes

Double fertilisation and triple fusion:

- One male gamete fuses with the egg cell and forms a **zygote.**
- The other male gamete fuses with the two polar nuclei to produce a triploid **Primary Endosperm Nucleus (PEN)**.

Post fertilization:

- The fruit is defined as a ripened ovary.
- Fertilised ovules develop into **seeds.**

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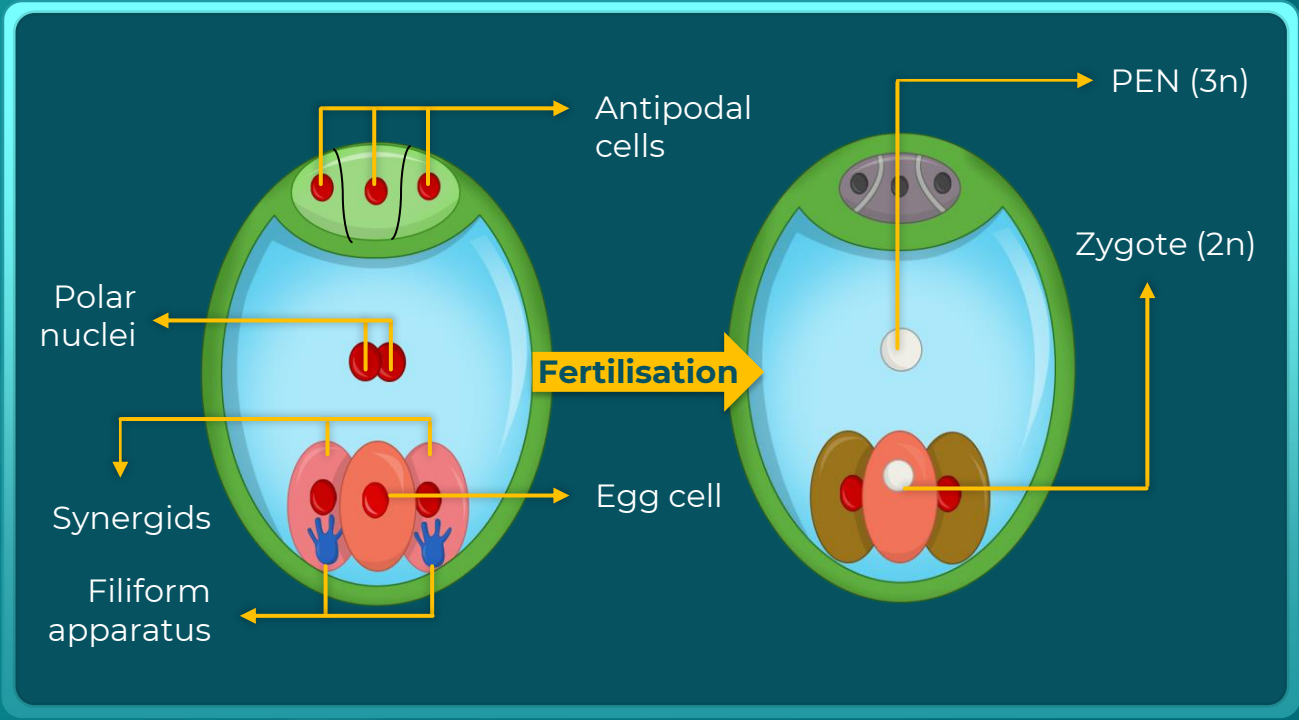
Angiosperms: Fertilisation



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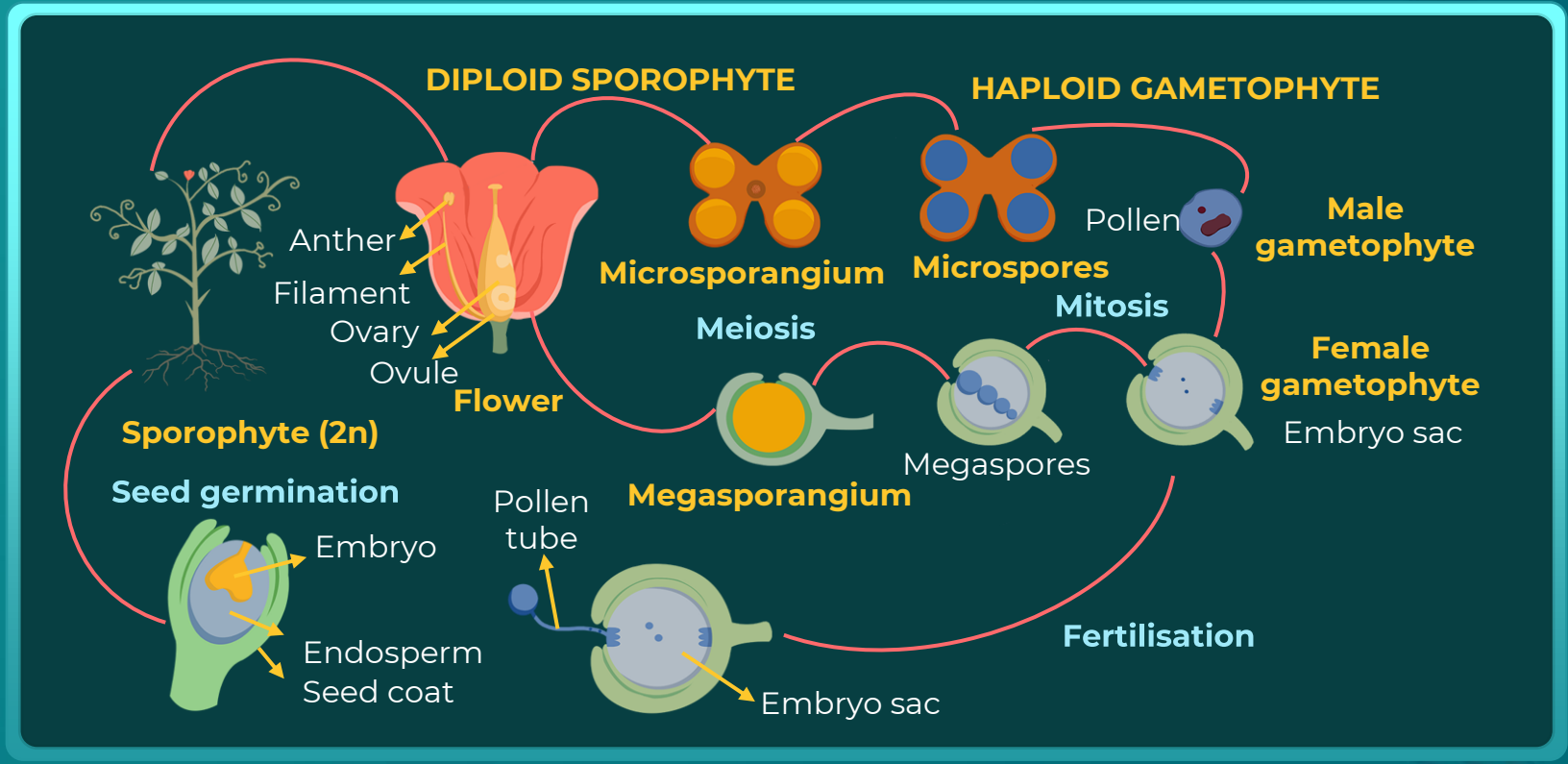
Life Cycle of Angiosperms



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Life Cycle of Angiosperms

Diplontic life cycle

- The **diploid sporophyte is the dominant phase** in their life cycle. Just like gymnosperms, angiosperms are also **heterosporous**.
- The gametes produced by female and male gametophytes fuse together and form the **zygote**.
- The zygote develops into an **embryo**.
- It shows the presence of small embryonic leaves called **cotyledons**.

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Classification on the Basis of Cotyledons

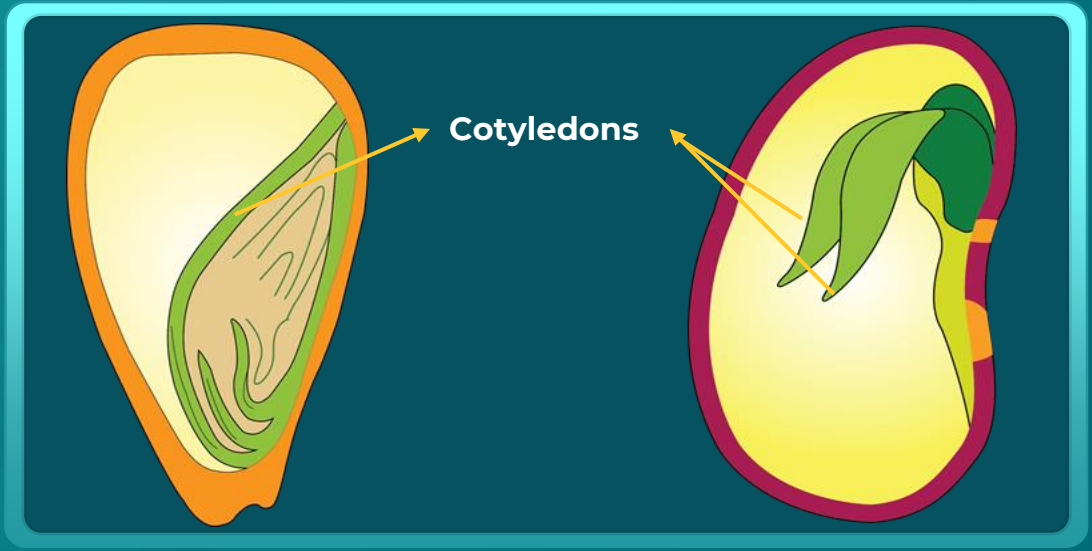
Seeds

Monocots

Dicots

One cotyledon

Two cotyledons



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Summary

- **Fossil record**- Dead remains of organisms are known as fossils. The fossils help in understanding the characteristics of the ancestors of an organism.
- **Numerical taxonomy**- Classification of organisms based on a numerical algorithm. The character of the organism under the study is given numbers and codes. Using several mathematical tools, the taxonomy is performed.
- **Cytotaxonomy**- It involves the classification of organisms based on the chromosome number, structure and behavior.
- **Chemotaxonomy**- Classification of plants based on the chemicals they are composed of.

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Summary

- **Thallophyta** includes plants which have a body which is not differentiated into roots, stems and leaves. Such a plant body is known as **thallus**.
- **Algae** are unicellular/multicellular eukaryotic organisms having a cell wall. They are photosynthetic and their plant body is an undifferentiated thallus.
- **Phytoplankton** are microscopic marine algae which are responsible for producing majority of the oxygen on this planet.
- **Alternation of generations** is the type of life cycle where the organisms alternate between the haploid gametophytic phase and the diploid sporophytic phase.
- **Haplontic life cycle** is one where the haploid phase of the organism is more significant and long-lasting than the diploid phase.
- **Haplo-diplontic life cycle** is one where both the haploid phase and the diploid phase are equally significant.
- **Diplontic life cycle** is one where the diploid phase of the organism is more significant and long-lasting than the haploid phase.

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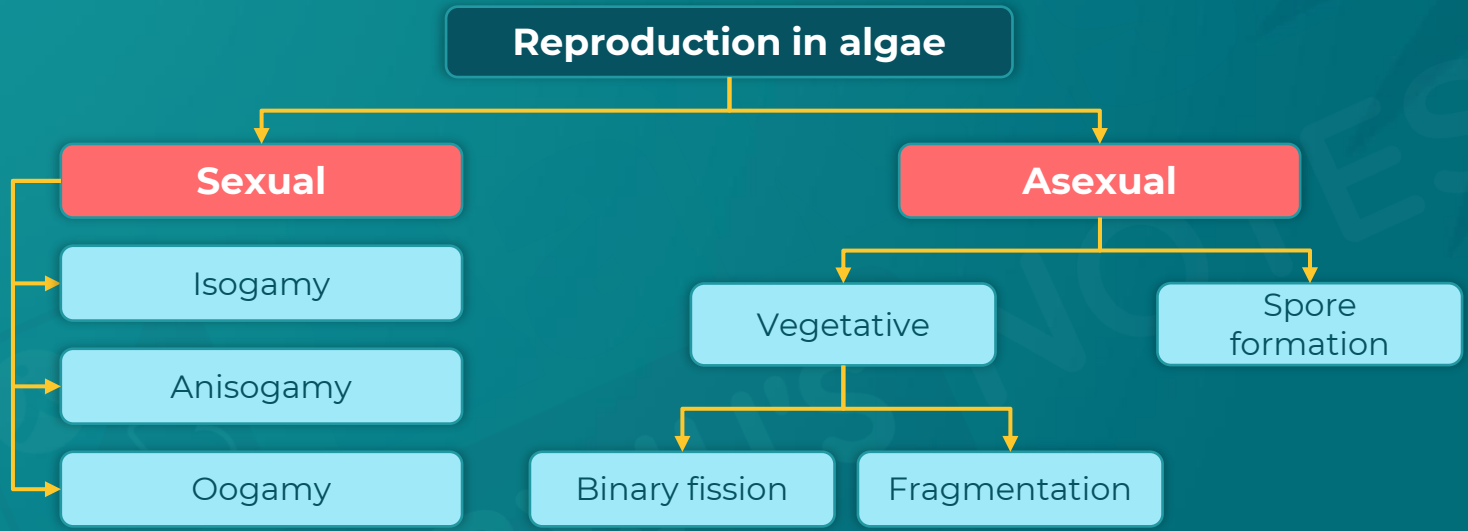
Summary



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Summary

Classification of algae:

Rhodophyceae	Phaeophyceae	Chlorophyceae
Red algae	Brown algae	Green algae
Chlorophyll a, Chlorophyll d, Phycoerythrin	Chlorophyll a, Chlorophyll c and Fucoxanthin	Chlorophyll a, Chlorophyll b
Mainly marine	Exclusively marine	Mainly freshwater
Mainly multicellular	Exclusively multicellular	Mainly unicellular
Food storage: Floridean starch	Food storage: Laminarin or mannitol	Food storage: Starch
Cell wall has cellulose and sulphated phycocolloids	Cell wall has cellulose and algin	Cell wall is made of cellulose
Eg: *Chondrus, Gelidium, Gracilaria*	Eg: *Fucus*, Kelp, *Laminaria*	Eg: *Chlorella, Chlamydomonas, Spirogyra*

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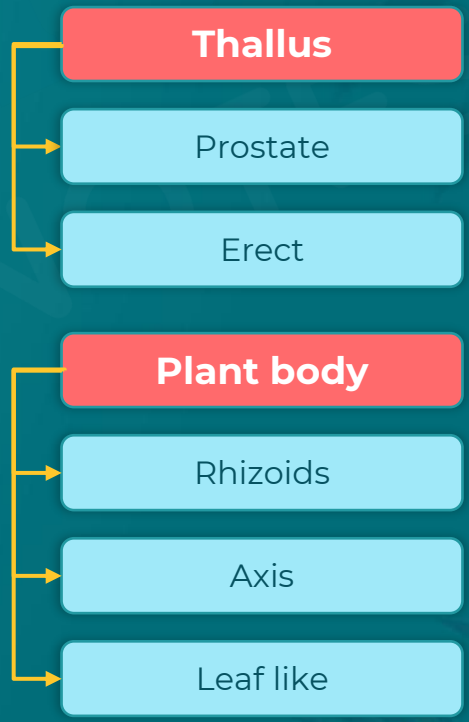
Summary

Bryophytes

- **Bryophytes** are moss-like plants which grow in moist, shaded areas and on hills.
- **Thallus** is the undifferentiated plant body of the bryophytes.
- **Prostate thallus** has a downward position and is stretched on the ground.
- **Erect thallus** is one where the plant body stands erect and upright.
- **Plant body** consists of:
  - **Rhizoids** - Root-like structures for anchorage
  - **Axis**
  - **Leaf-like structures**



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Summary

Bryophytes

- **Alternation of generation**
  - **Gametophytic phase** is haploid and independent
    - **Antheridium** is the male sex organ.
    - **Antherozoids** are flagellate male gametes.
    - **Archegonium** is the female sex organ.
    - **Egg cell** is the female gamete.
- **Fertilization** is bryophytes occurs only in water (hence called amphibians of the plant kingdom).
- **Sporophytic phase** is diploid.
- **Spores** are haploid cells formed by meiosis from the diploid spore mother cells.

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Summary

Bryophytes

- **Hornworts** have a horn-like sporophyte.
- **Mosses**
  - **Protonema** is the juvenile gametophyte phase.
  - **Foliose stage** is the adult stage.
- **Liverworts**
  - **Thalloid liverworts** have an undifferentiated thallus.
  - **Foliose liverworts** have a differentiated thallus.
- **Reproduction**
  - **Fragmentation** is a type of a reproduction wherein the parent cell splits into two fragments and each fragment develops into two new organisms.

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Summary

Pteridophytes

- **Pteridophytes** are the first land plants which have the vascular tissues - xylem and phloem.
- **Differentiation of the plant body**.
- **Rhizome**- is the stem of the pteridophytes.
- **Adventitious roots**.
- Leaves/Fronds
  - **Microphyll**- They are attached to the rhizome directly and have an unbranched vascular system.
  - **Megaphyll**- They are attached to the rhizome with the help of a stalk and have branched vascular tissues.
  - **Structure**-
    - **Rachis** is the stalk within the blade.
    - **Pinna** are the small leaflets that grow along the rachis.
    - **Costa** is the midrib of each pina.
    - **Stipe** is the stalk below the leaf blade.
- **Sporophylls** are specialised fronds/leaves that help in reproduction.

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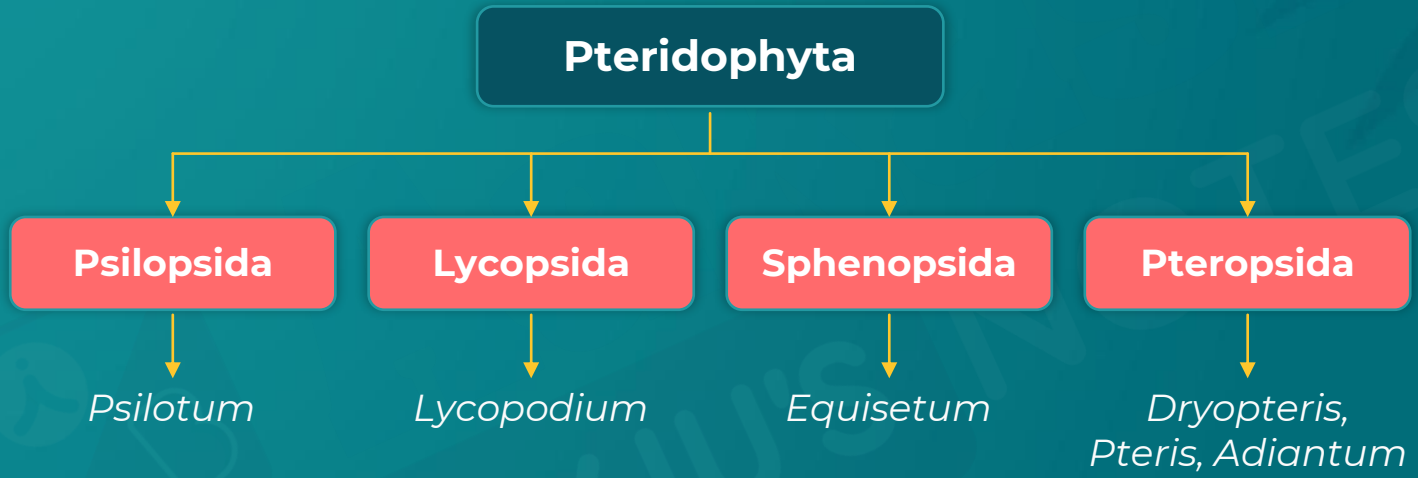
Summary



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Summary

Seed bearing plants

Gymnosperms

Gymnos = Naked
+
Sperma = Seed
Gymnosperms = Naked seeds

Angiosperms

Angeion = Vessels
+
Sperma = Seed
Angiosperms = Covered seeds

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Summary

Life cycle : Alternation of generation in angiosperms

Gametophyte
- **Gamete** bearing
- Always h**aploid**

Sporophyte
- **Spore** bearing
- Always d**iploid**
- **Dominant** stage

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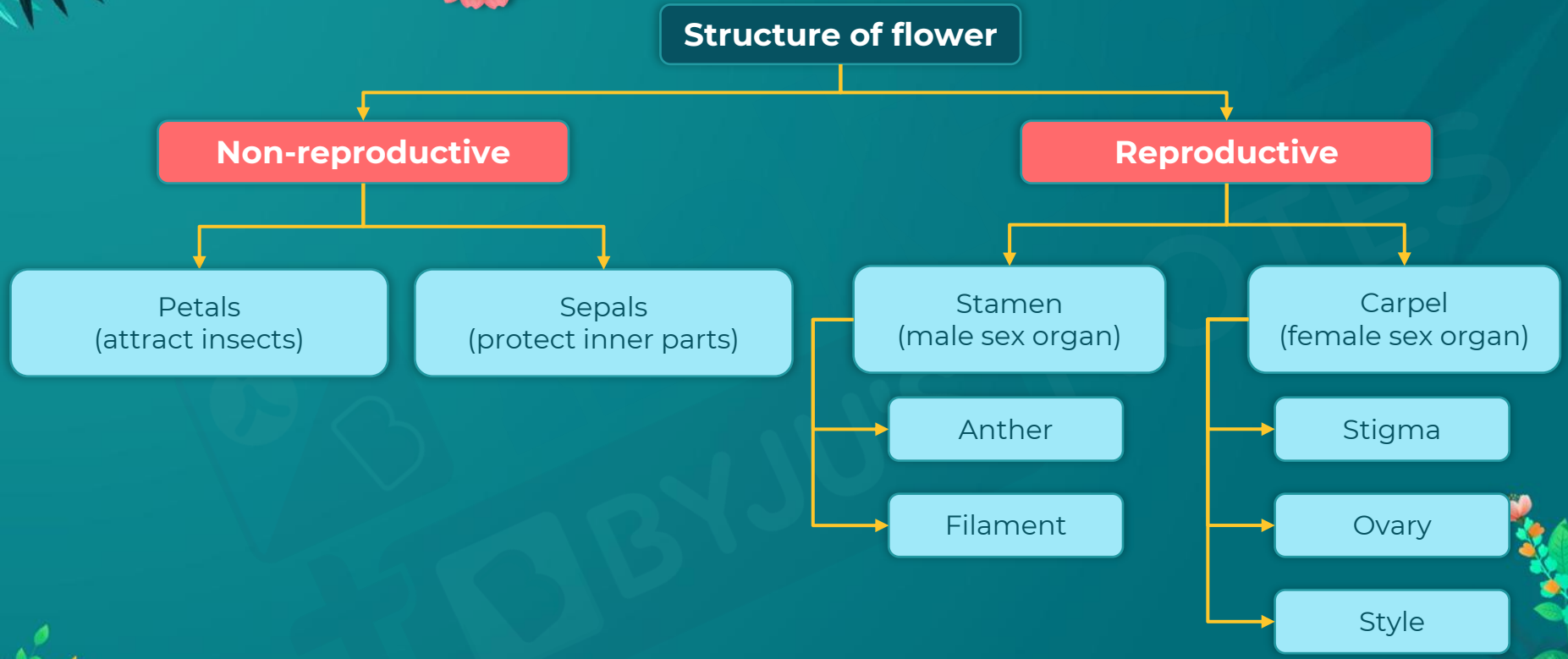
Summary



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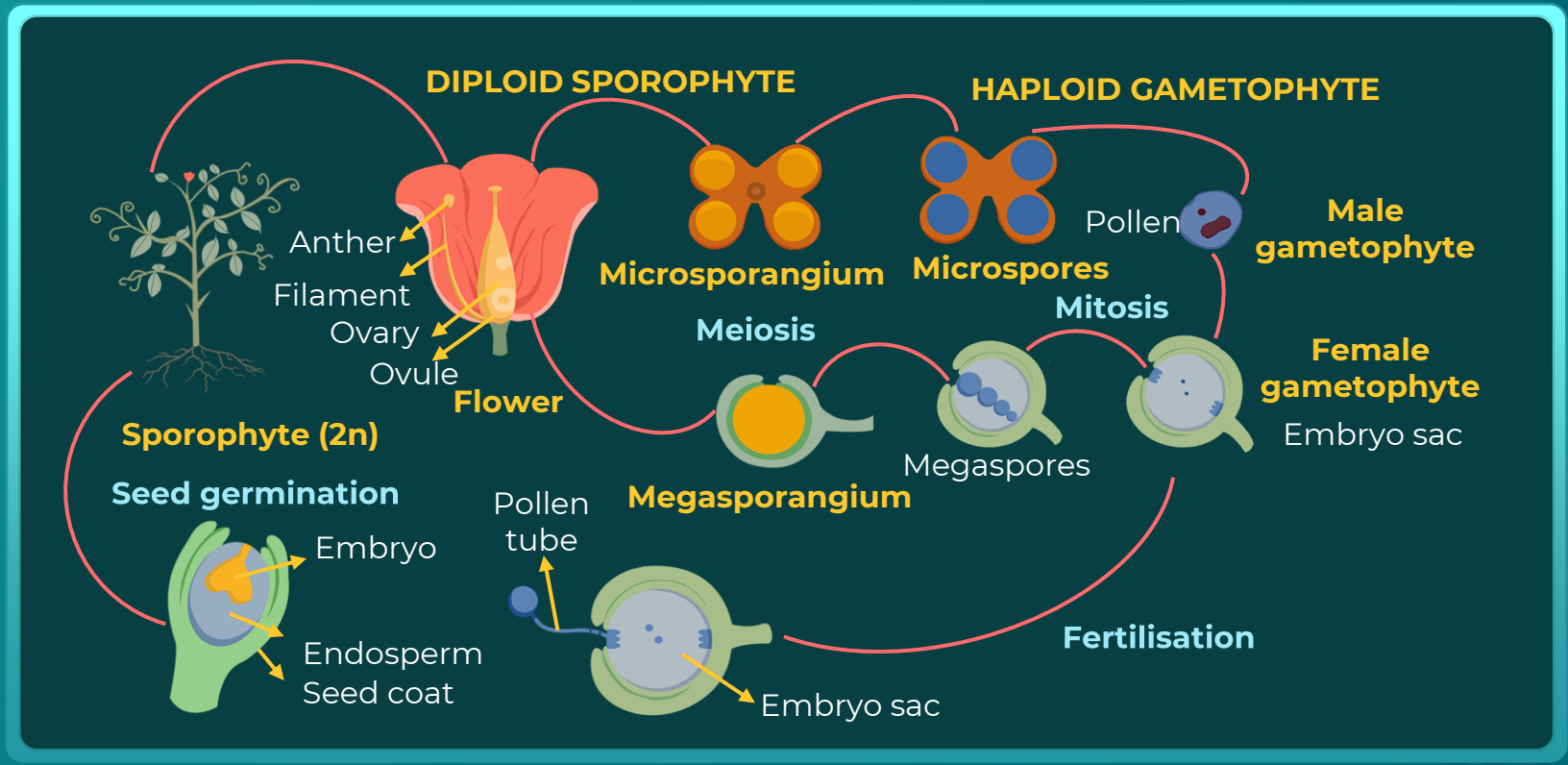
Summary

Life cycle of angiosperms



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