

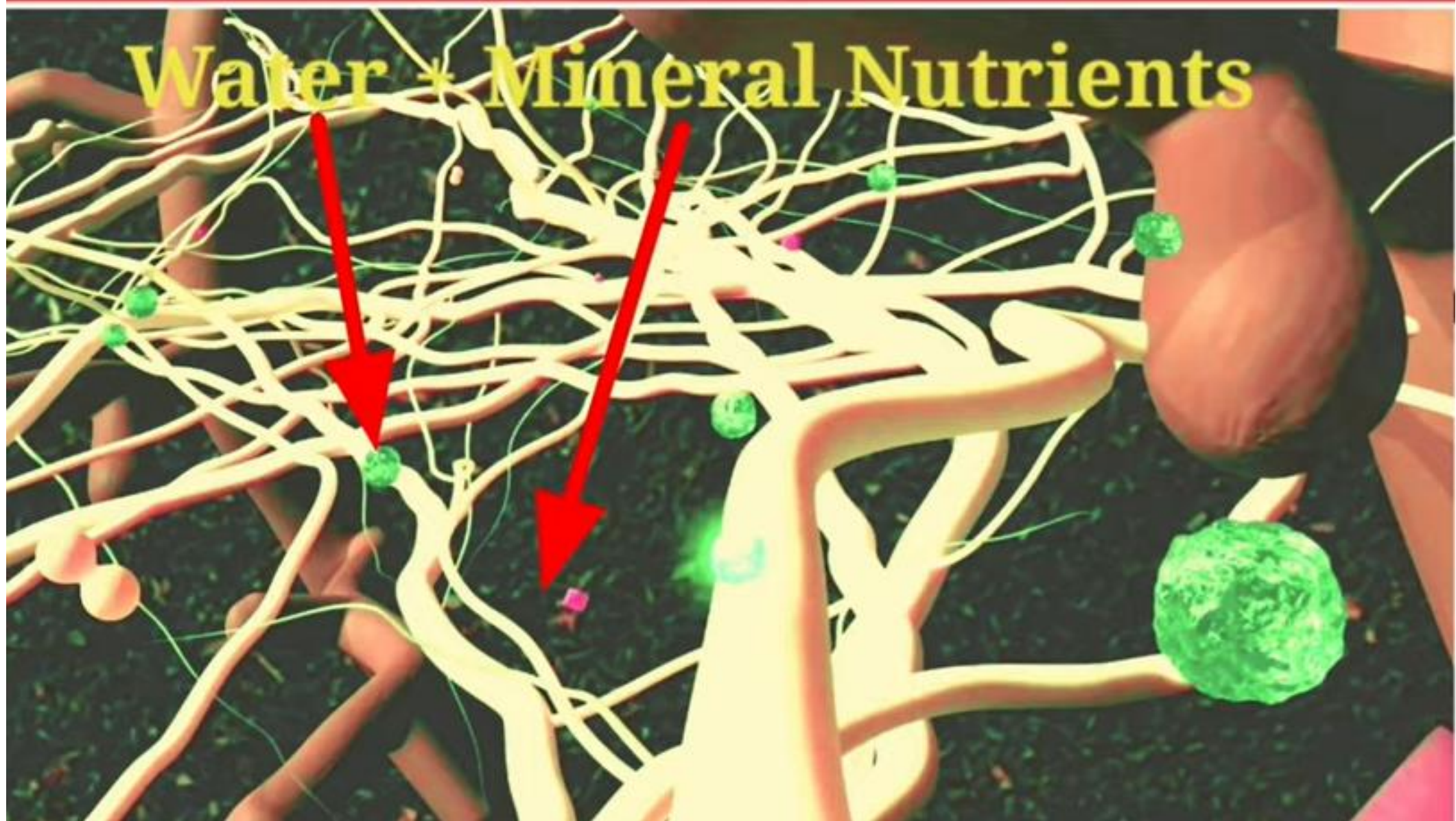
# Mycorrhiza

B.Sc. Botany Semester I

# Mycorrhiza

- The term 'mycorrhiza' was coined by German forest pathologist A. B. Frank in 1885.
- Mycorrhiza is a symbiotic association between fungus (*myco-*) and roots (*rhizo-*) of higher plants.
- Both the partners benefit each other (mutualistic!).
- More than 95% of plant species have mycorrhizal associations

# Mycorrhiza

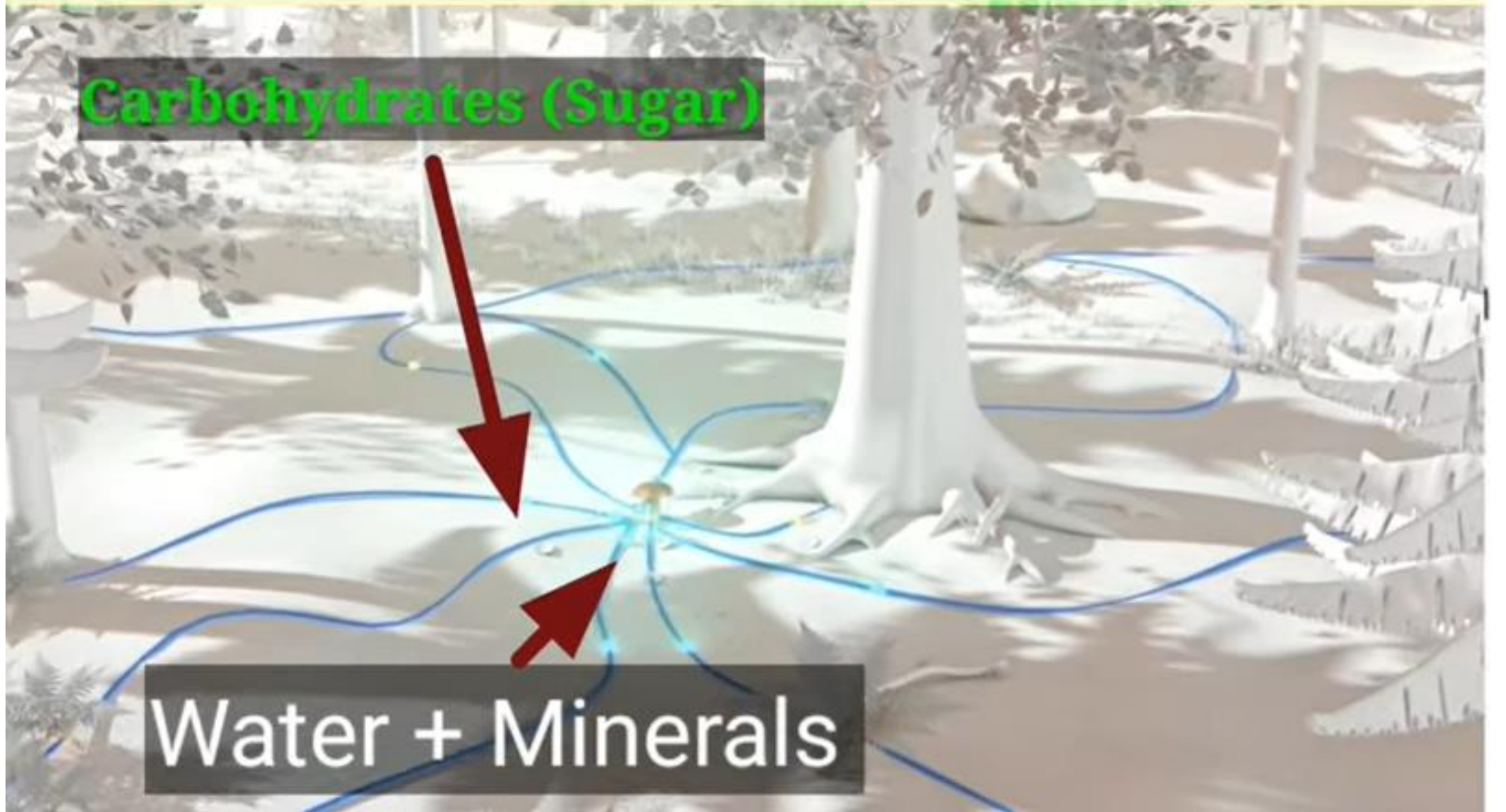




# Mycorrhiza

Carbohydrates (Sugar)

Water + Minerals



# Mycorrhiza

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# Types of mycorrhiza

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- Endomycorrhiza
- Ectomycorrhiza
- Ectoendomycorrhiza
- Ericoid mycorrhiza
- Arbutoid mycorrhiza
- Monotropoid mycorrhiza
- Orchid mycorrhiza



## Types of mycorrhizae :

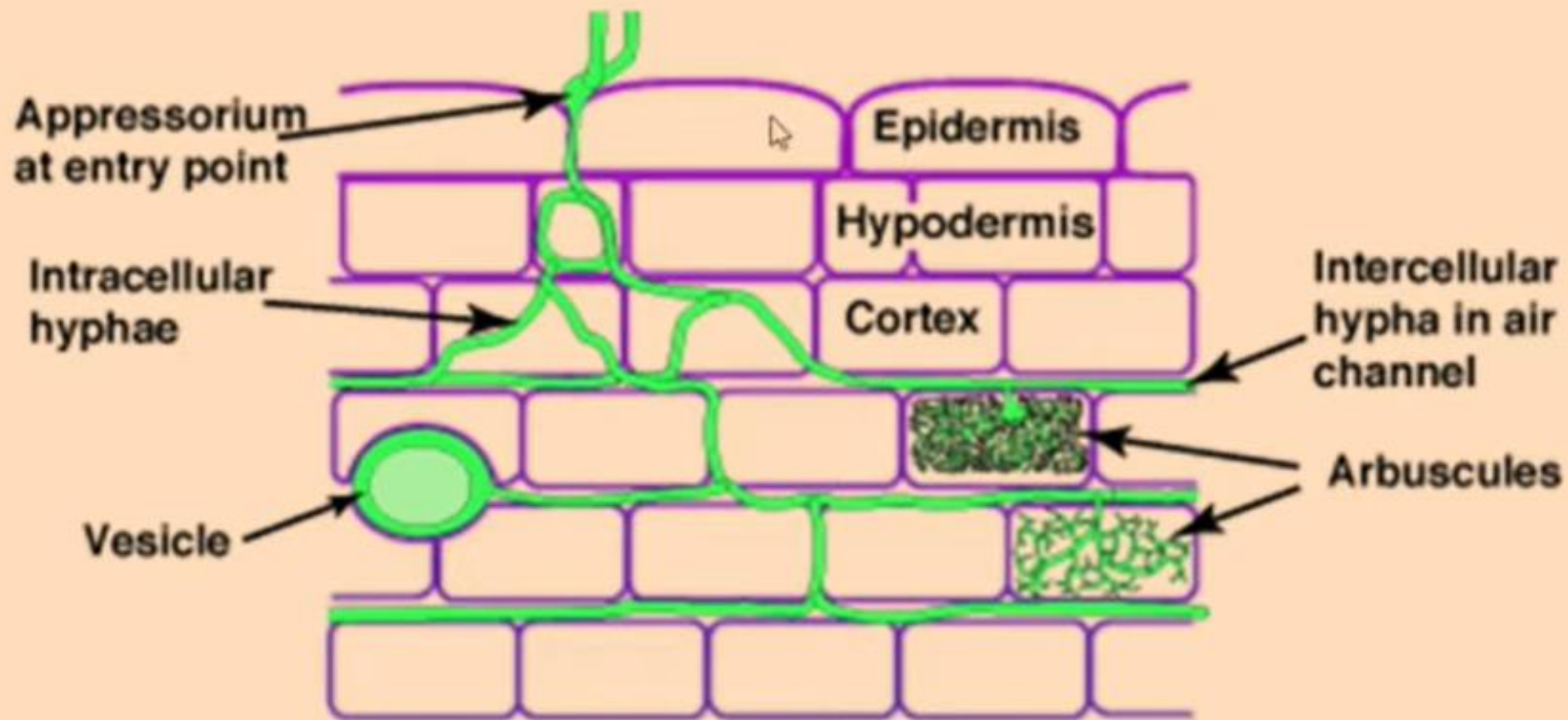
- On the basis of morphological and anatomical features, mycorrhizae are divided into the three types.
  1. Endomycorrhizae
  2. Ectomycorrhizae
  3. Ectendomycorrhizae
  
- Endomycorrhizae further classified in to five types.
  1. VAM fungi (vesicular arbuscular mycorrhizae)
  2. Orchidoid mycorrhizae
  3. Monotropoid mycorrhizae
  4. Ericoid Mycorrhizae
  5. Arbutoid mycorrhizae

## Endomycorrhiza (earlier VAM, now AM)

- More than 90% of vascular plants of the world flora form endomycorrhiza.
- This mycorrhiza was earlier named as Vesicular Arbuscular Mycorrhiza (VAM). Vesicles and arbuscules are the modified mycelial structures produced by the fungal partner inside the root cells.
- Vesicles serve as storage organs while arbuscules function as absorptive organs (similar to haustoria) through which fungal partner derive nutrients from root cells.



- Later, all endomycorrhiza were not found to produce vesicles, and therefore, VAM was renamed as Arbuscular Mycorrhiza (AM).
- Some common fungi that can produce endomycorrhiza are *Glomus*, *Gigaspora* and *Acaulospora*.



# Ectomycorrhiza

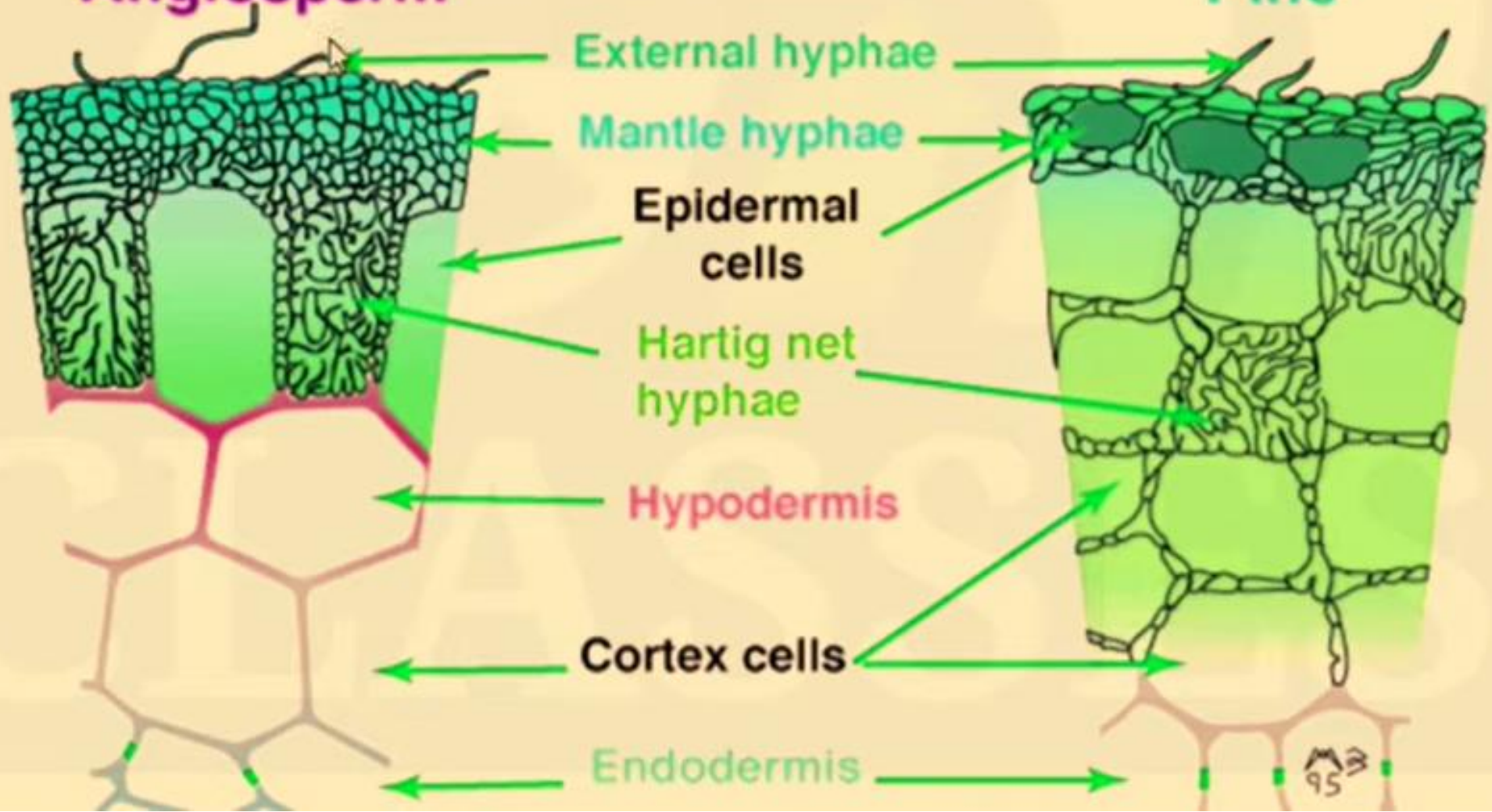
- Only 5% of vascular plants develop ectomycorrhiza in the plants belonging to the families Pinaceae, Fagaceae, and Betulaceae.
- In this type of mycorrhizal association fungi remain outside the root surface, fungal mycelia form a compact and multi-layered covering on the root surface known as mantle that prevents direct contact of root tissue with rhizosphere.



- These fungi also form a network of mycelia in root cortex known as Hartig net.
- These fungi remain in the intercellular space and never enter the root cells.
- Some common fungi that can produce ectomycorrhiza are *Boletus edulis*, *Russula* sp., *Rhizopogon* sp., *Pisolithus* sp. etc.

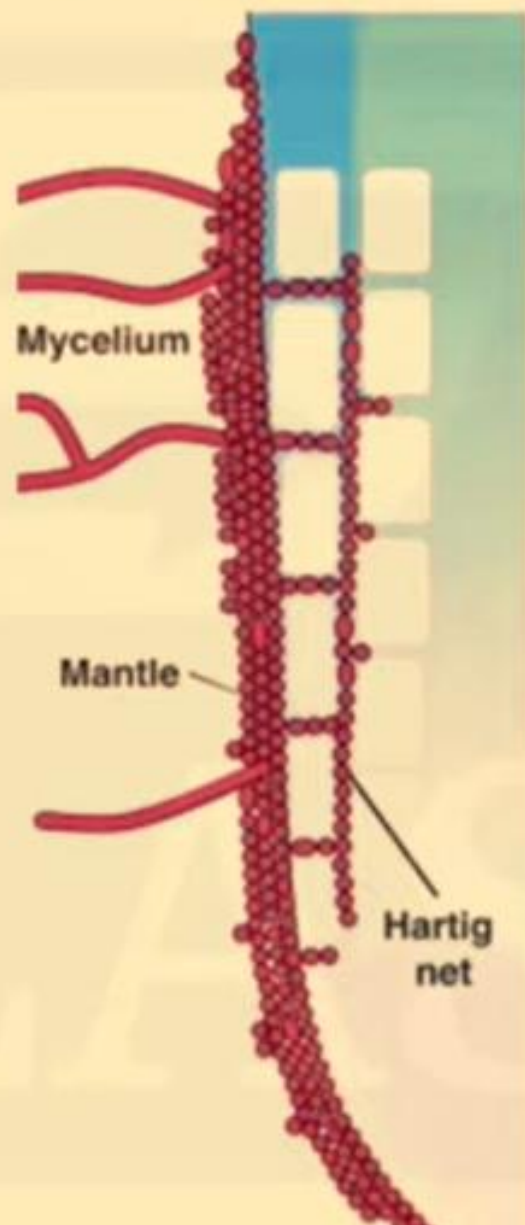
# Angiosperm

# Pine

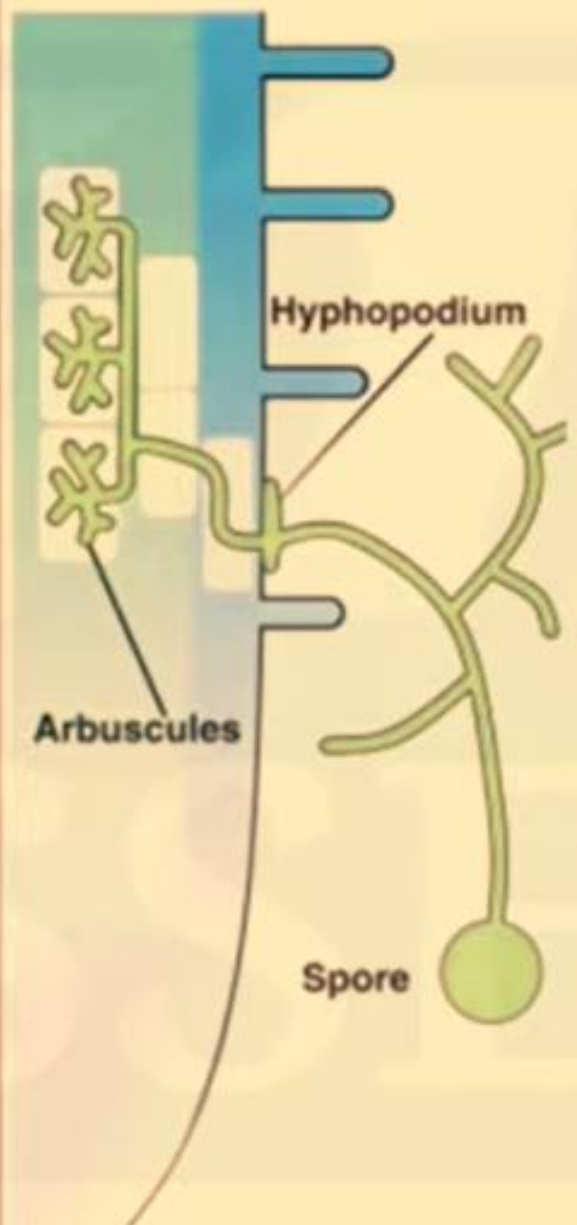


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### Ectomycorrhiza



### Arbuscular mycorrhiza (AM or Endomycorrhiza)





# Difference between endo- and ectomycorrhiza

Attribute	Endomycorrhiza	Ectomycorrhiza
Occurrence	More common (90%)	Less common (4%)
Penetration	Fungal hyphae penetrate cortical cells of root (inter- and intracellular)	Fungal hyphae don't penetrate root cells (intercellular or extracellular)
Fungal structures formed	Vesicle and arbuscle	Hyphal sheath or mantle (covering root tip) and Hartig net (in root cortex)
Fungi belong to	Glomeromycota	Basidiomycota, Ascomycota and Zygomycota
Plants involved	Most vascular plants including orchid, shrub, foliage plants, trees	Mostly woody plants (birch, eucalyptus, oak, pine)
Culturability	Can't be cultured on artificial media	Can be cultured
Morphological changes in root	Does not cause morphological changes in root	Cause morphological changes in root

## Orchidoid Mycorrhizae :

- Fungi belongs to basidiomycotina and colonize only member of family orchidaceae. This association is probably pseudomycorrhizal but play an important role in establishment of orchid seedlings.

## Ericoid Mycorrhizae :

- Fungal members are usually basidiomycetous and Ascomycotina. This is found in roots of plants belonging to order ericales. Rootlets are covered by a loosely woven mesh of dark brown septate hyphae from which branches penetrate the cortical cells.

## Monotropoid Mycorrhizae :

- The fungi belong to basidiomycotina, colonizing achlorophyllous members of angiosperms belonging to family monotropaceae. Fungal sheath present.

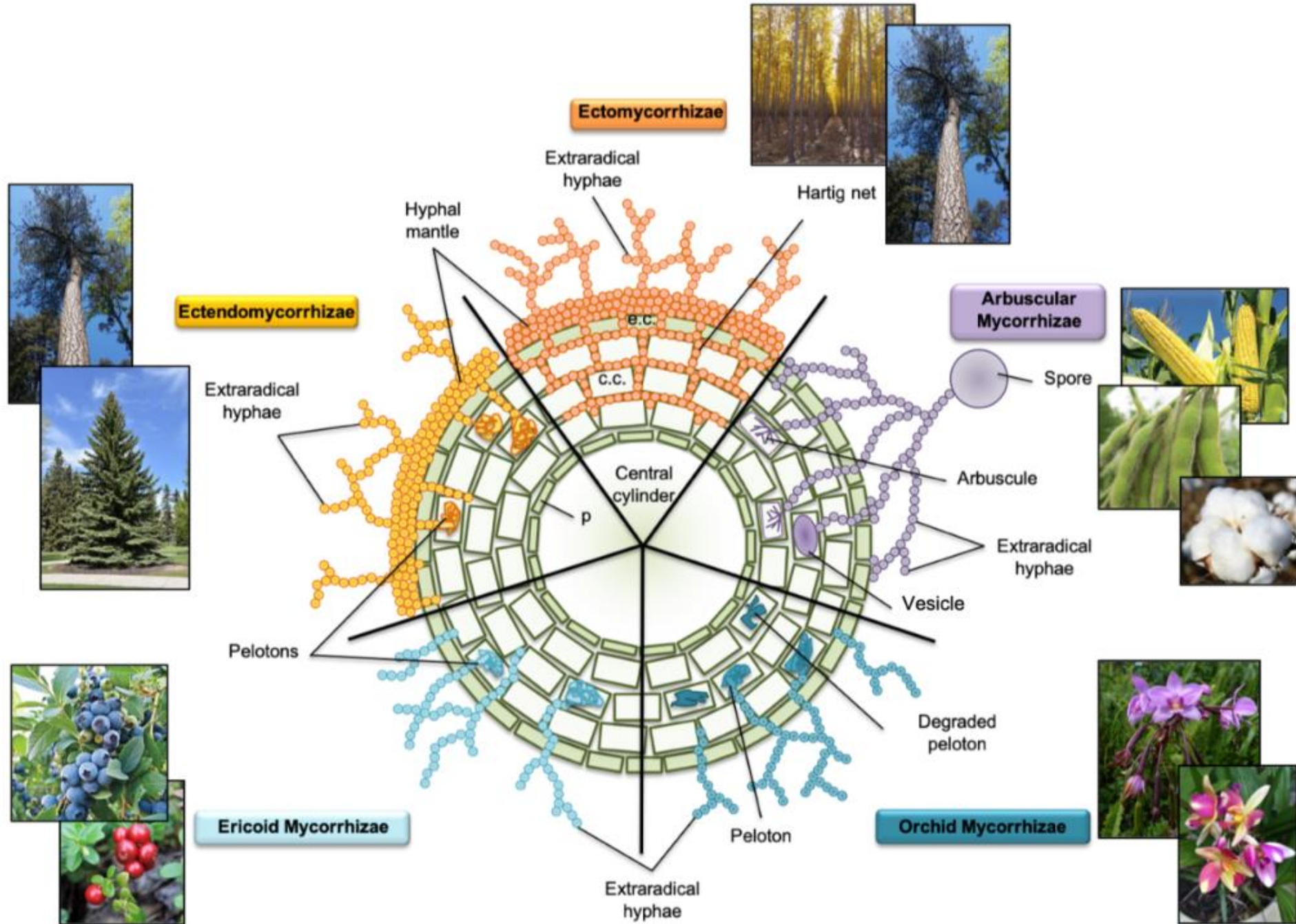
## Arbutoid Mycorrhizae :

- Arbutoid mycorrhizal associations are variants of ectomycorrhizae found in certain plants in the ericaceae characterized by hyphae coils in epidermal cells.
- A major difference between the arbutoid and ectomycorrhizal association is that the hyphae of the former actually penetrate the outer cortical cells and fill them with coils.



## Applications of Mycorrhizae :

- Increase nutrient uptake of plant from soil.
  - P nutrition and other elements: N, K, Ca, Mg, Zn, Cu, S, B, Mo, Fe, Mn, Cl
- Increase diversity of plant.
- Produce uniform seedling.
- Significant role in nutrient recycling.
- More tolerant to adverse soil chemical constraints which limit crop production.
- Increase plant resistance to diseases and drought.
- Stimulate the growth of beneficial microorganisms.
- Improve soil structure.
  - Stable soil aggregate – hyphal polysaccharides bind and aggregate soil particles.
  
- Increases absorption of phosphate by crops.
- uptake of zinc also increases.
- Increases uptake of water from soil.
- Increases uptake of sulphur from the soil
- Increases the concentration of cytokinins and chloroplast in plants.
- They protect plants during stress condition.





Grown with Mycorrhizae



Grown without Mycorrhizae



Grown without Mycorrhizae

Grown with Mycorrhizae





**THANK YOU**