

# Mutualism, Commensalism, Amensalism

Chpt 15 & page 376

## Learning Objectives

Describe	widespread mutualism (mycorrhizae)
Describe	well-studied mutualism (swollen thorn acacia & ants)
Explain	why the benefits of a mutualism are environment dependent
Provide	examples of commensalism & amensalism

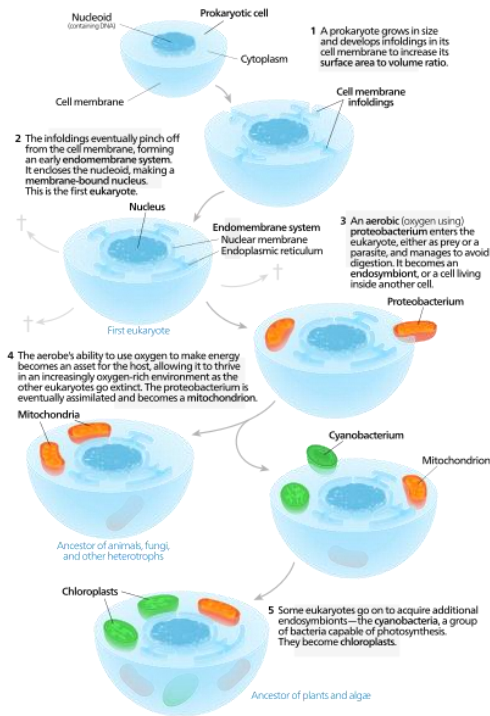
## How we classify interactions

Type of Interaction	Response	
	Species A	Species B
Neutral	0	0
Mutualism	+	+
Commensalism	+	0
Competition	—	—
Amensalism	—	0
Predation	+	—
Parasitism	+	—
Parasitoidism	+	—



## The first mutualism? organelles!

- *Lynn Margulis* (1966) - proposed that ancestors of eukaryotic cells were symbiotic relationship with prokaryotic cells
    - Rejected by 15 journals!
  - The "Endosymbiont Theory"
- "Life did not take over the globe by combat, but by networking"*



## The Endosymbiont Theory

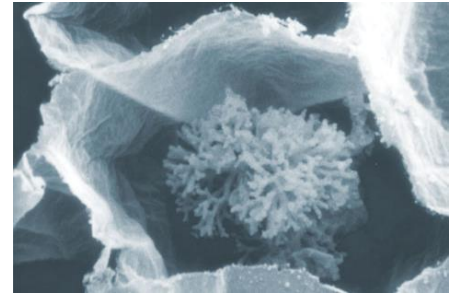
- Mitochondria (evolved first):  
descendants of aerobic, heterotrophic bacteria
- Chloroplasts (plastids):  
descendants of photosynthetic bacteria- probably cyanobacteria

## How to characterize mutualisms

1. The benefits received
  - Access to resources (including habitat), protection, reduced competition with a 3<sup>rd</sup> species, dispersal
2. The degree of dependency
  - **Obligate** (coral, lichen) versus **facultative** (pollinators & plants)
3. The degree of specificity
  - **Specialists** versus **generalists**
4. The duration of the intimacy
  - Free living, obligatory

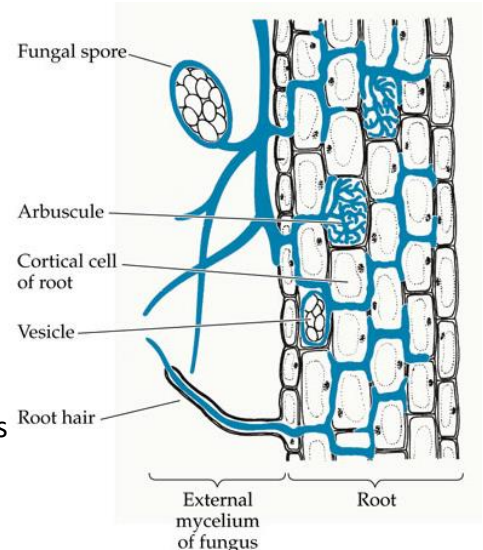
# Plants & fungi: mycorrhizae

- Major groups:
  - • Ectomycorrhizae (EM or ECM)
  - Endomycorrhizae
    - • Arbuscular mycorrhizae (AM or VAM)
    - Ericoid
    - Orchidaceous mycorrhizae
- Facilitate availability & uptake of nutrients (EM & AM)
- Facilitate water uptake (EM)
- Protect plants from pathogens (fungi & bacteria; EM & AM)
- For legumes: increase nodulation → more N uptake indirectly via *Rhizobia*
- *What do plants provide?*



## Arbuscular mycorrhizae (AM)

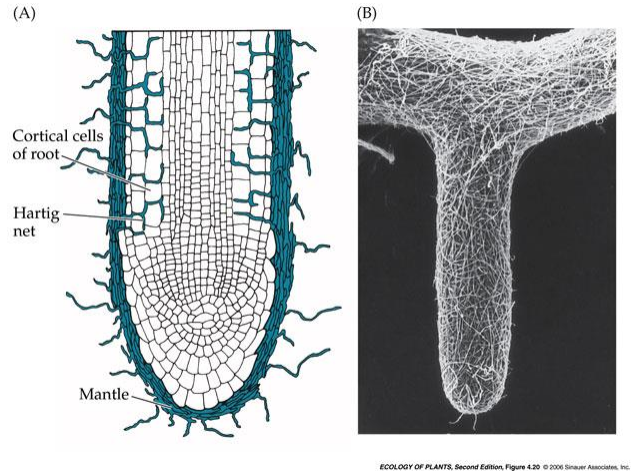
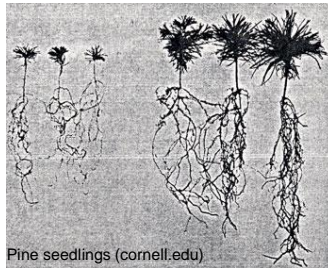
- Not highly specific
- Fungal hyphae grow in intercellular root spaces, but penetrate certain cells to form arbuscules and vesicles (depends on branching pattern)
- Most abundant when Phosphorus is limited and in warmer/drier climates
- Gymnosperms *except* the Pinaceae, most plant families except those that actively exclude fungi (Brassicaceae, Portulacaceae, Caryophyllaceae, Proteaceae)



ECOLOGY OF PLANTS, Second Edition

# Ectomycorrhizae

- Highly specific
- Hartig net grows in between root cells, the mantle densely ensheathes outside of root
- Less prolific than AM. Found mostly in woody plants: Dipterocarpaceae, Pinaceae, Fagaceae, Myrtaceae, Salicaceae, Betulaceae, Leguminosae

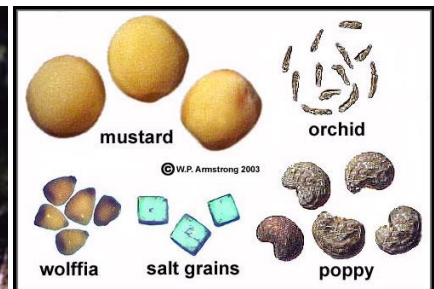


## Ericoid & Orchidaceous mycorrhizae

- Ericaceae (huckleberries, madrone, manzanitas, etc.) live in acidic, nutrient poor soils → obligate mutualism with fungi for nutrient uptake
- Orchids have world's smallest seeds!  
→ obligate symbioses with fungi
  - Provide C to developing seedling
- Parasitic orchids never provide C to fungi
  - Relationship not well understood



*Corallorhiza mertensiana*







## Swollen thorn acacias & ants

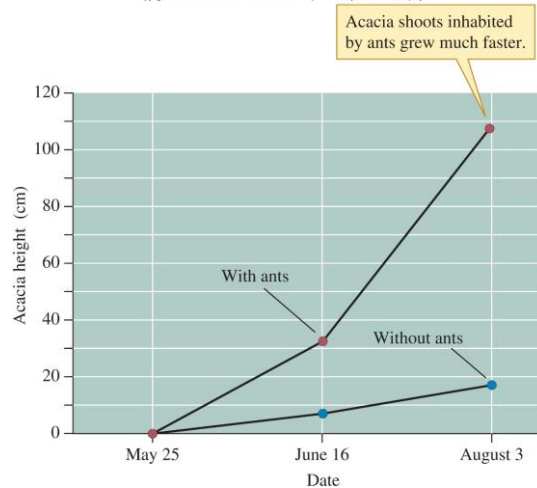


*Pseudomyrmex* spp. in Acacia thorn  
(Gregory Basco - deepgreenphotography.com)



## Swollen thorn acacias & ants

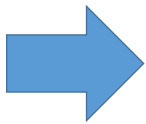
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[National Geographic video](#)

## Are mutualisms always beneficial?

- If resources abundant: are mutualisms favored?
- If resources limited: are mutualisms favored?



Degree of mutualism versus parasitism may depend on environment

## Commensalism (+/0)



What if the number of cattle egrets on the cow or moss on the tree increases?



## Amensalism (-/0)



Or, strongly asymmetrical  
competition  
e.g. banana slug/black tailed  
deer