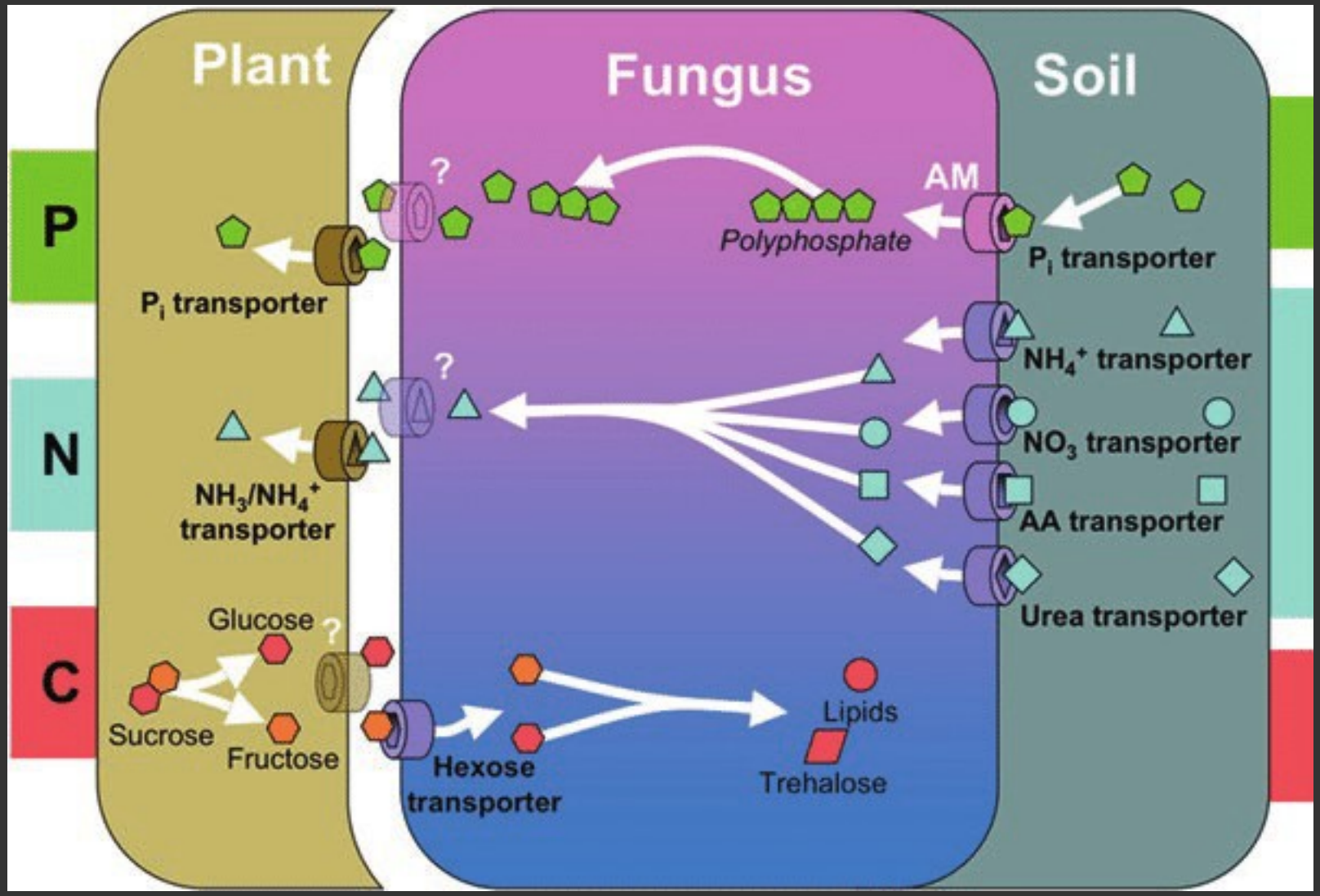
Symbioses: Mycorrhizae

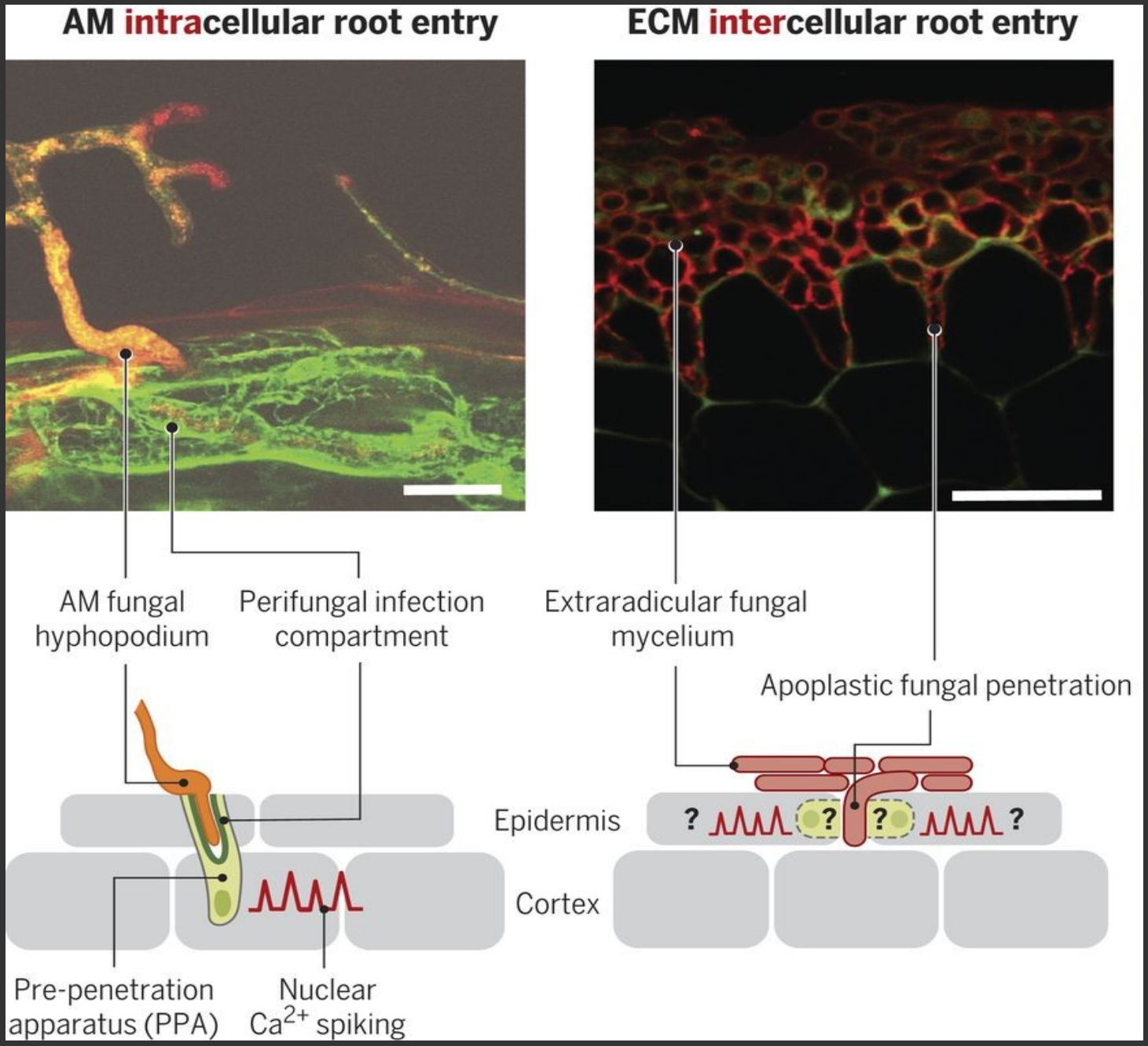
Topics (just the very basics):

- Fungus + root
- AMF vs ECM vs Ericoid
- Diversity
- Evolution of ECM and mycoheterotrophs

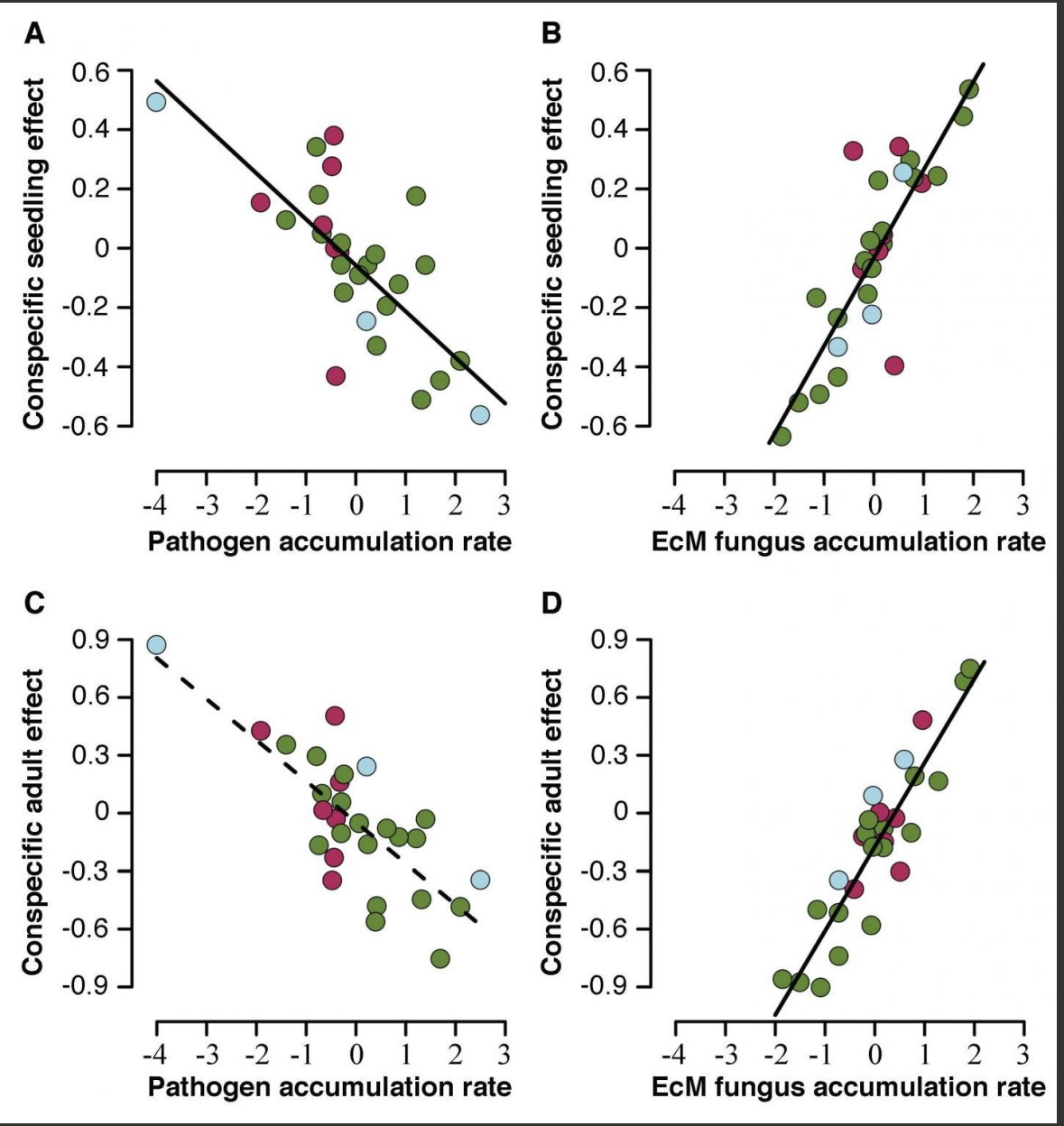
Specialized relationship between host plant and mutualistic fungus
Can't grow these fungi without host (biotrophic)
Many of the ECM fungi have lost previous C-aquisition methods



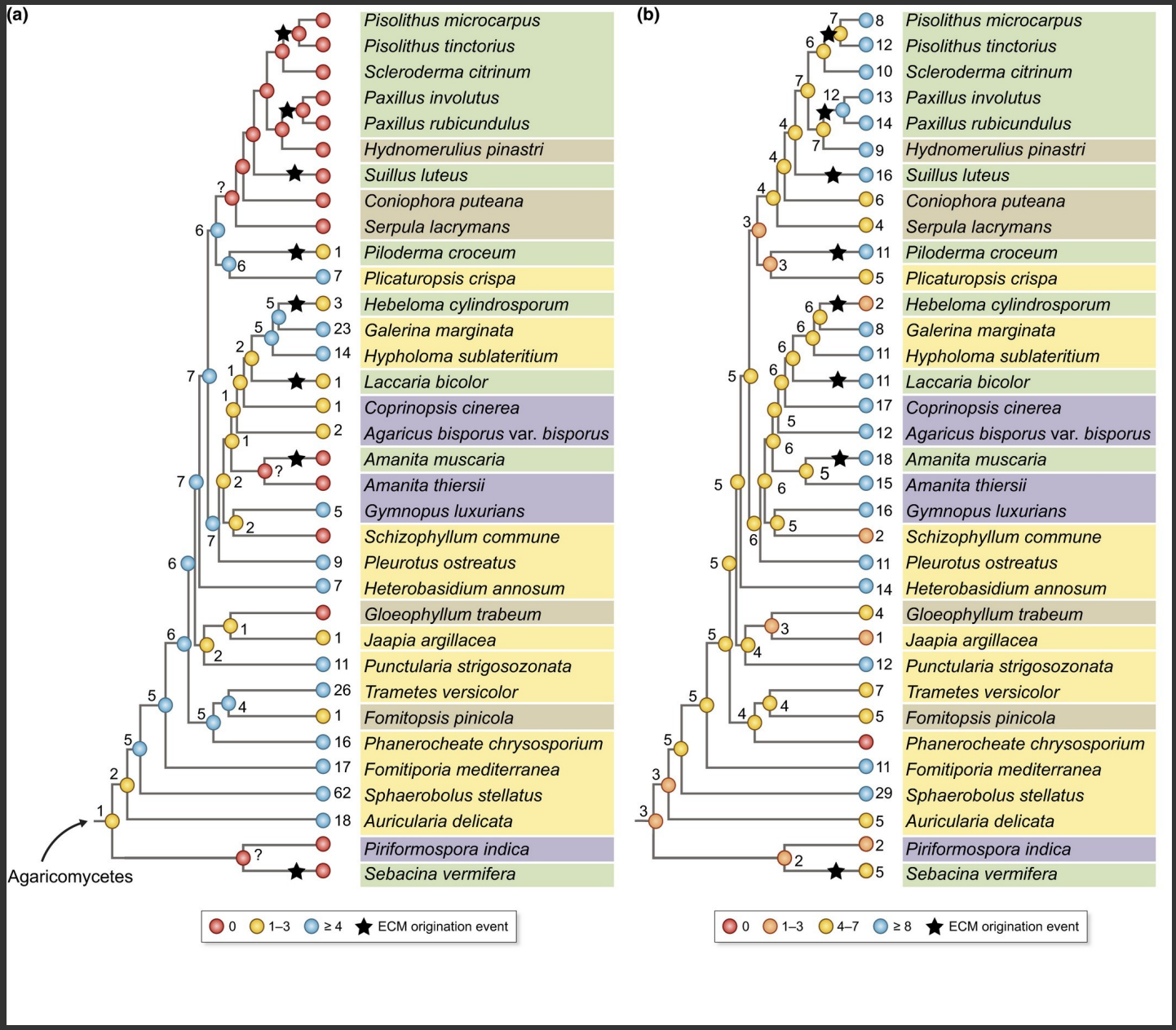
Arbuscular vs Ectomycorrhizal



Even without enhanced N and P aquisition, plants benefit from ECM via reduced pathogens



Multiple origins of ECM and co-option of saprotrophic genes to facilitate nutrient liberation and transfer (to plants)

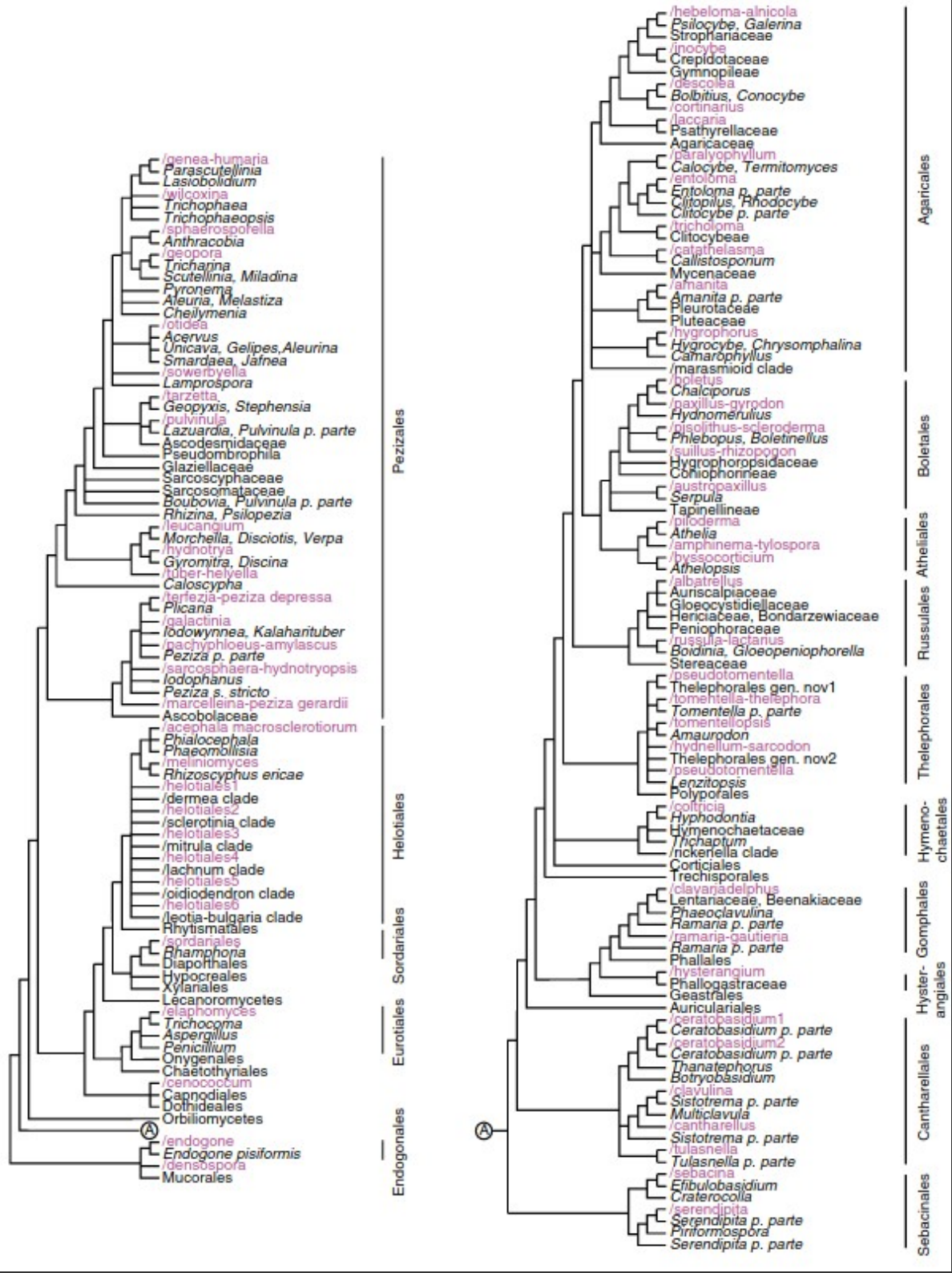


Green = ECM; Numbers are gene copy number for retained saprotrophic peroxidases (left) and laccases (right).

Tell-tale sign of ECM roots

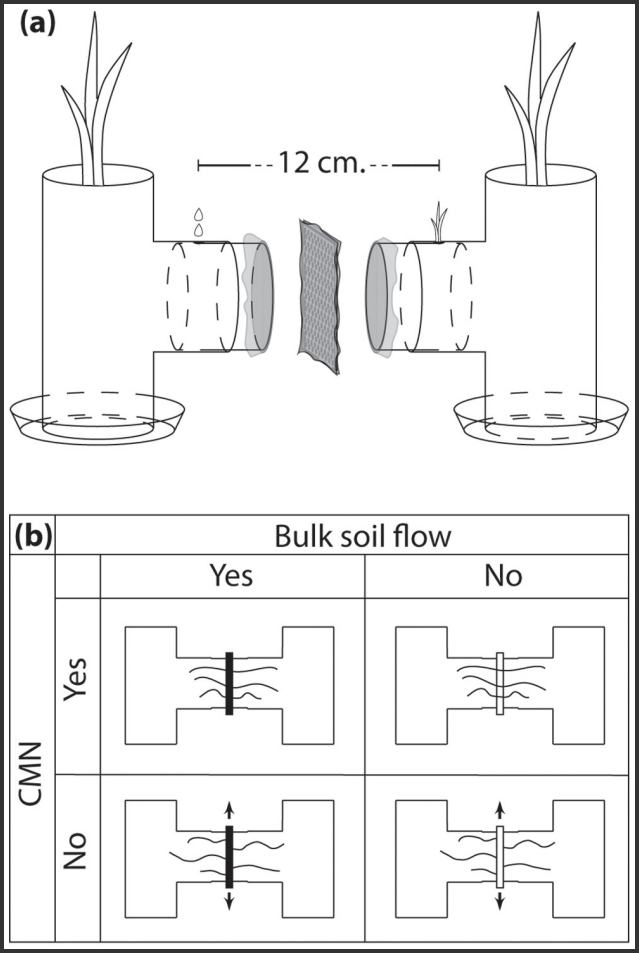
Only 2% of plant species have ECM associations. But some very dominant plants are among them. (e.g., the entire Taiga belt)

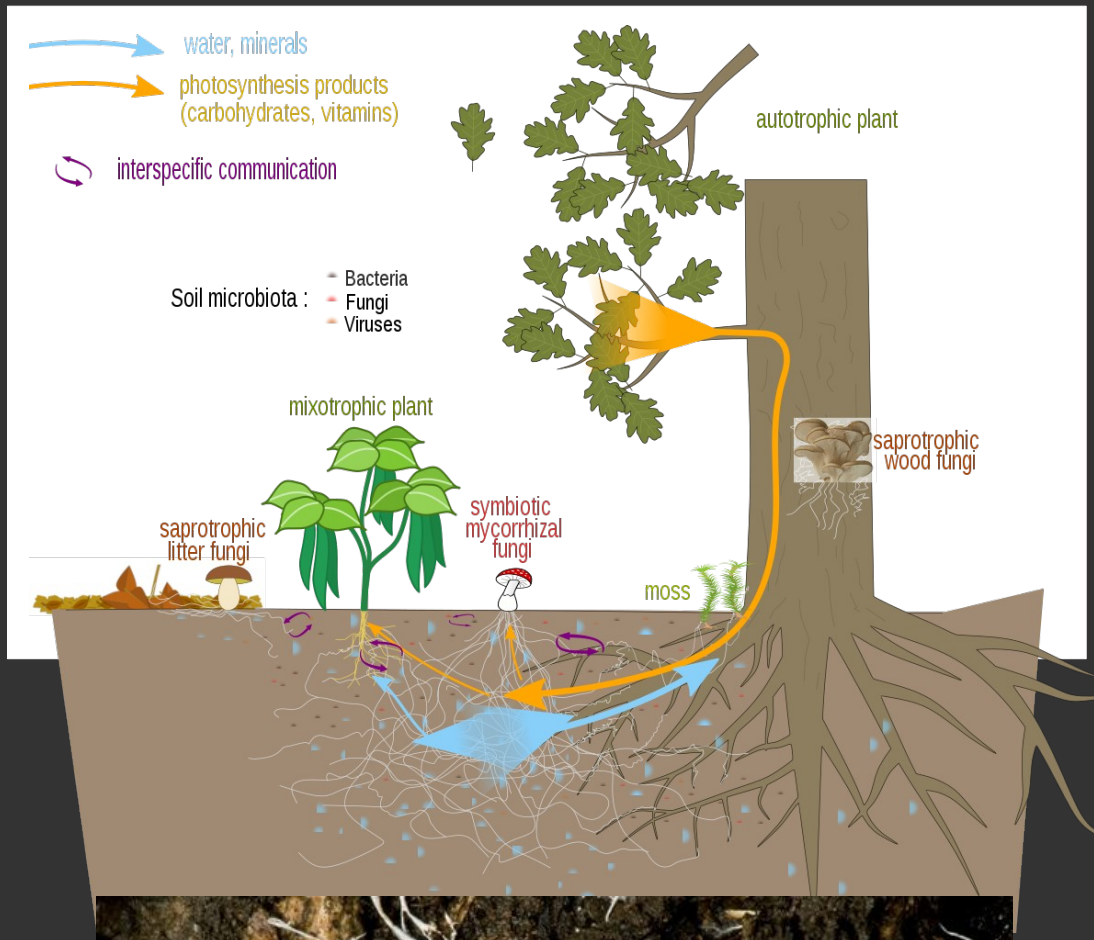
Purple = ECM clades present



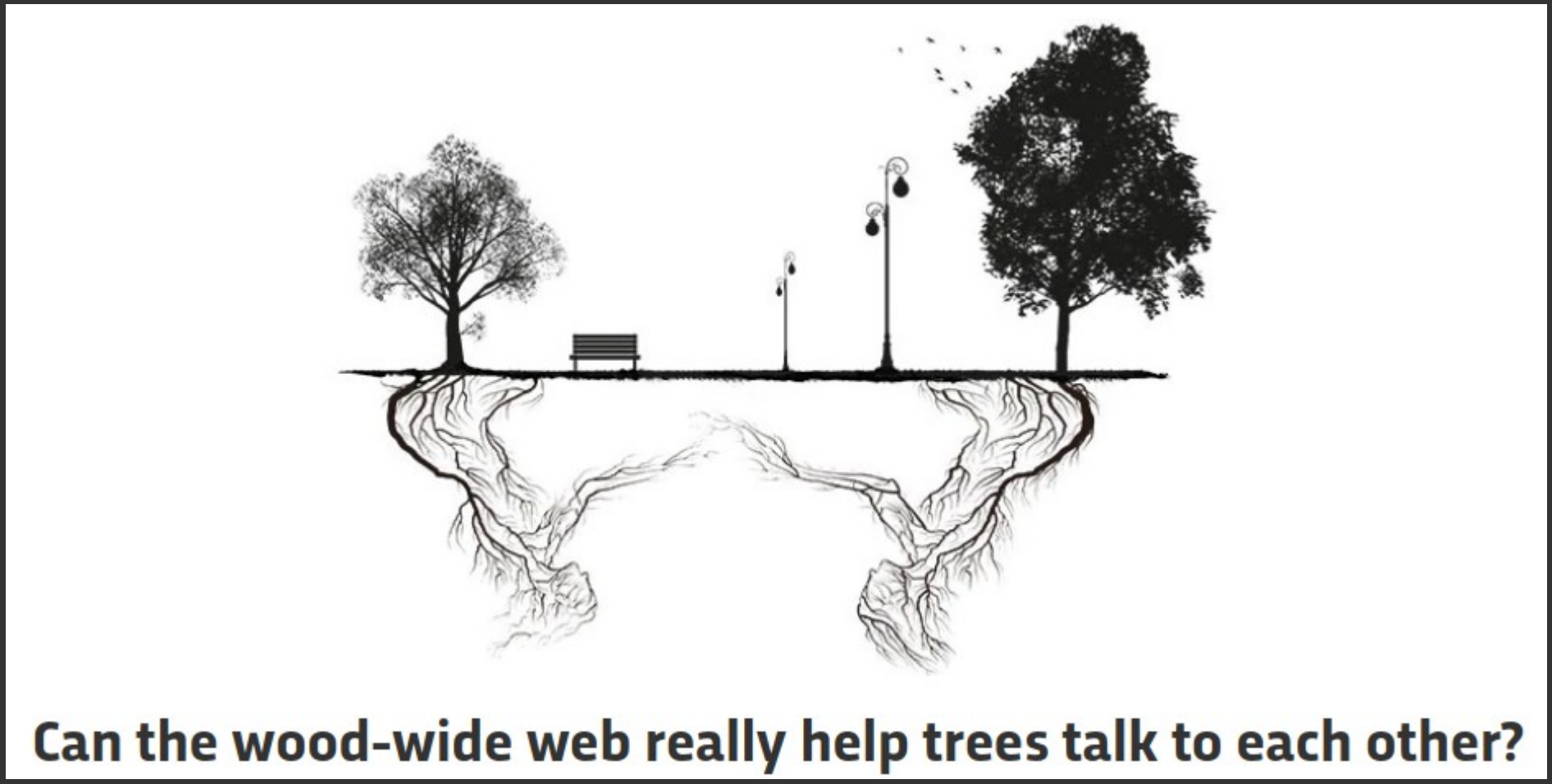
These trees are dependent on ECM fungi

Mycorrhizal networks (the internet of the forest)





ECM fungi can transport lots of things between plants, including sugars, defense compounds, or even poisons.



Can the wood-wide web really help trees talk to each other?

Well, it's complicated.
It isn't like Avatar.

What's in it for the fungus?

Annals of Botany **104**: 1255–1261, 2009
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BOTANICAL BRIEFING

Myco-heterotrophy: when fungi host plants

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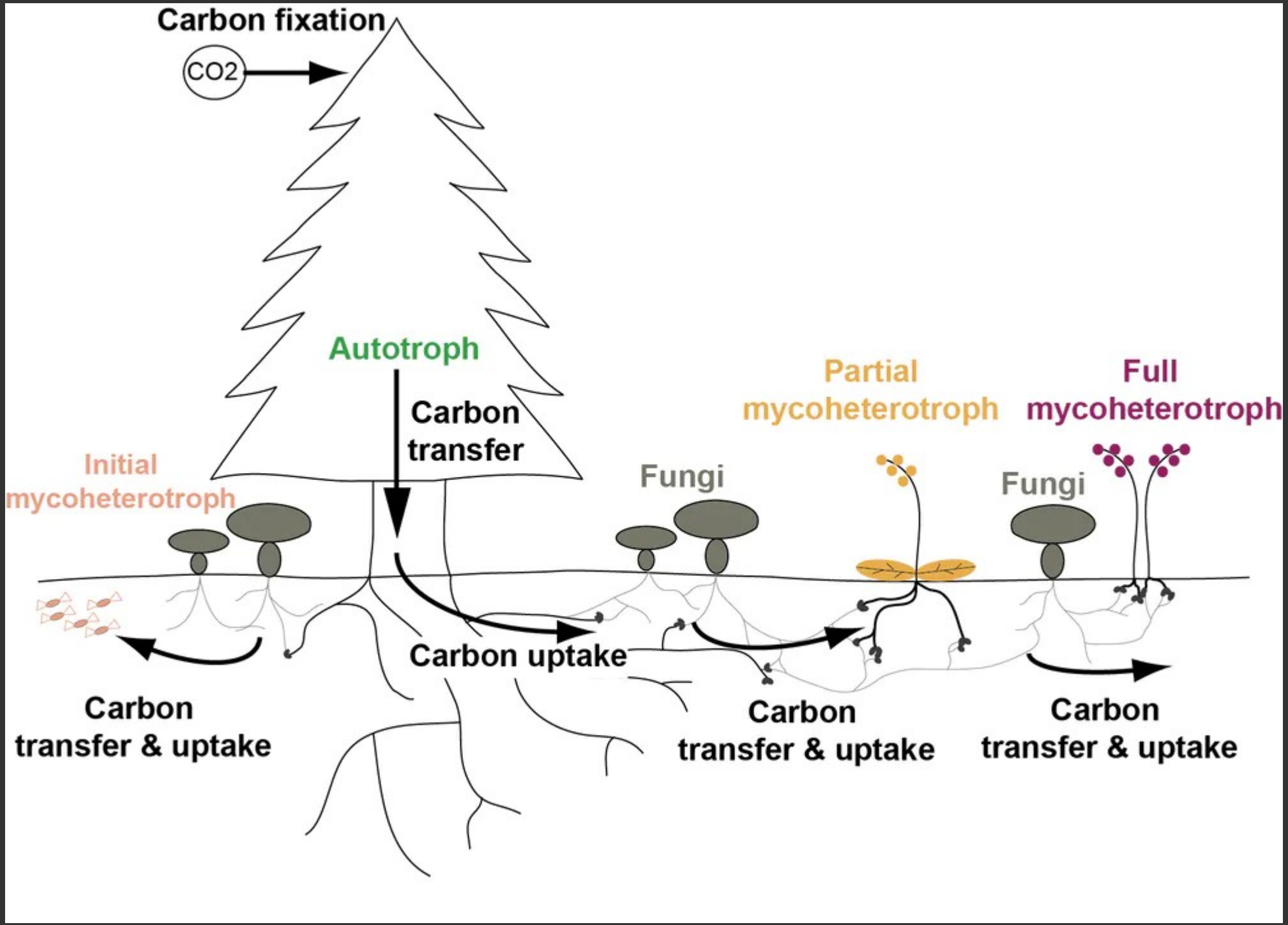

Carbon fixation
CO2
Autotroph
Carbon transfer
Initial mycoheterotroph
Fungi
Partial mycoheterotroph
Fungi
Full mycoheterotroph
Carbon uptake
Carbon transfer & uptake
Carbon transfer & uptake
Carbon transfer & uptake

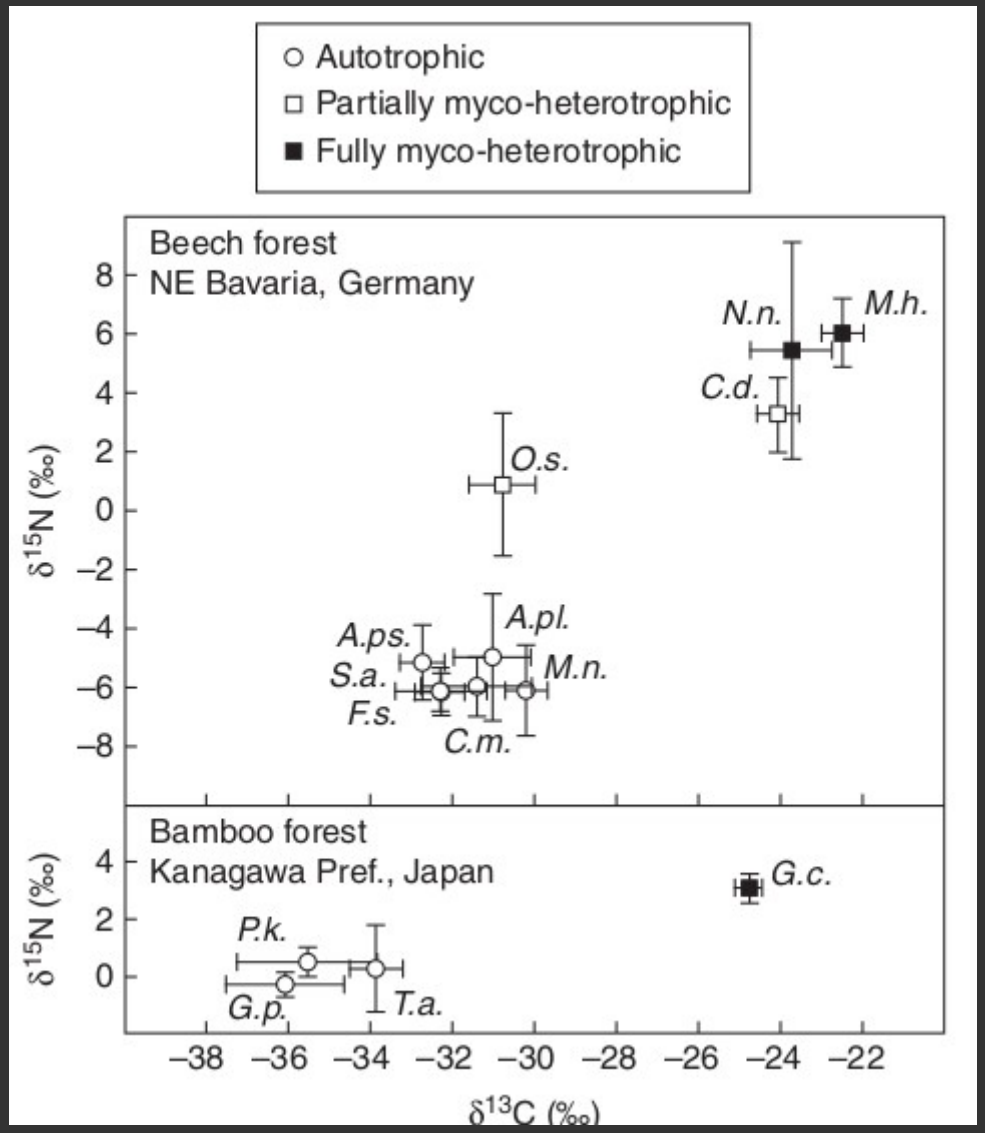
"Common" Utah mycoheterotrophs

Monotropa uniflora

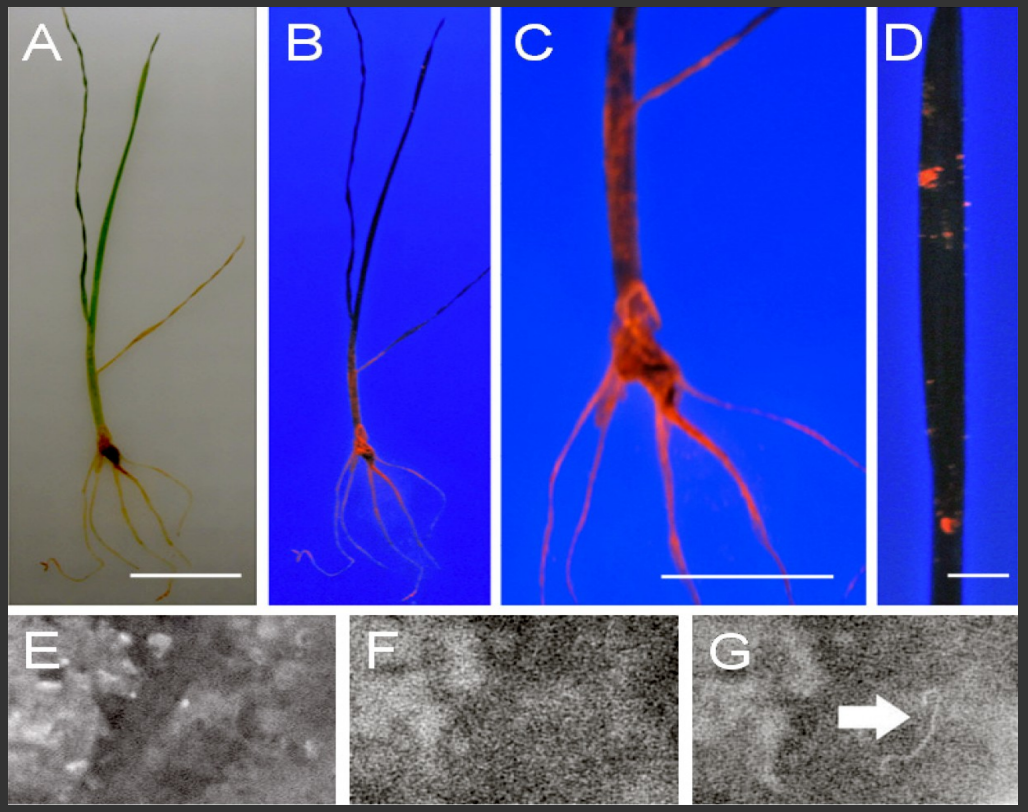
Pterospora andromeda

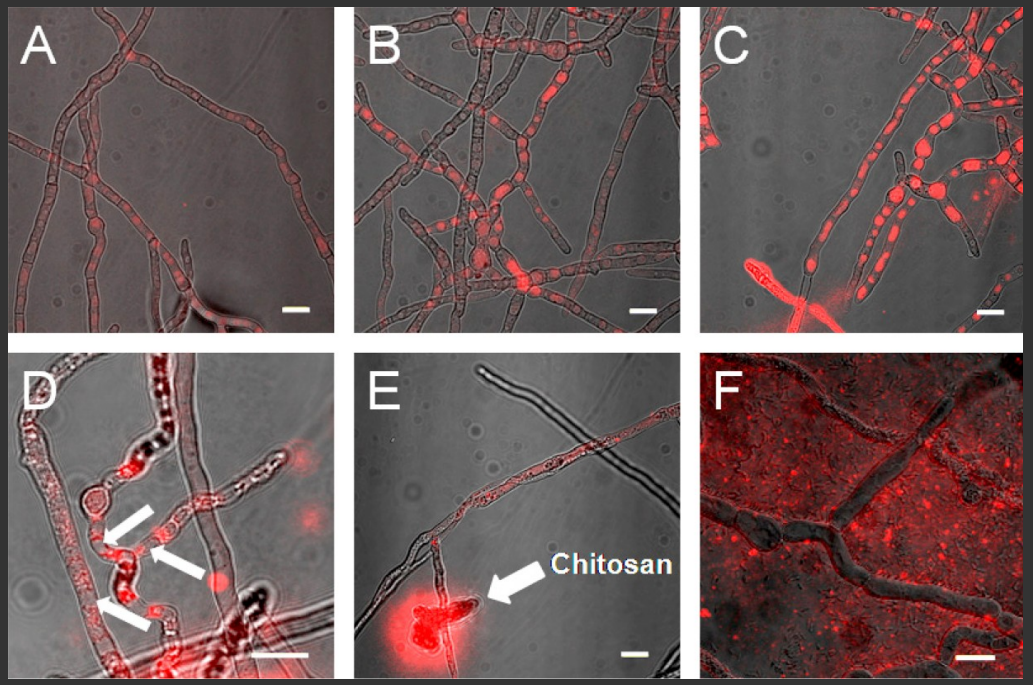
Monotropa hypopitys

Isotope tracing and quantum dots help us follow and source the nitrogen and carbon.



Merckx et al., 2009





Whiteside et al., 2010

Assignments

1. Keep working on your lab assignments

Use this time to catch up on things!