

Key for Quiz Questions #4
The Fungal Kingdom -- Fall 2006

Quiz Questions

1. (a) Summarize the main evidence for the existence of common mycorrhizal networks (CMNs). (5 pt)

- a. Direct observation of mycelial strands connecting two or more plants (in laboratory microcosms).
- b. Presence of the same mycobionts on the roots of two or more plants (in laboratory microcosms or in the field). Generally this has involved EcM, and has been done using morphotyping or molecular methods (e.g., RFLPs, sequencing, etc.).
- c. Radioactive tracer studies, mostly using ^{14}C or ^{32}P , in laboratory microcosms or in the field.
- d. Björkman's isolation studies with *Monotropa hypopitys*. Other studies have used trenching of small areas to achieve the same effect.
- e. Stable isotope studies, mostly using $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$, in laboratory microcosms or in the field.
- f. Plant growth/survival effects with and without mycorrhizal fungi in the system (as in the Grime *et al.* study described in lecture).

(b) Why do you think their existence has been so widely accepted (at least among those highly enlightened individuals who study mycorrhizas)? (1 pt)

- g. Acceptance of a reasonably large body of evidence from different types of studies and observations (even if each individual study has limitations).
- h. It's an appealing idea to many people and we often believe things that we are pre-disposed to believe.

(c) Summarize the main evidence against the existence of CMNs. (3 pt)

- i. There really isn't any specific evidence against their existence, other than the lack of effects seen in some studies. The biggest argument concerns whether C (primarily) is transferred from plant to plant; specifically whether the fungus transfers C received from donor plants to receiver plants and, if so, in physiologically/ecologically significant amounts. Rather than there being evidence against them, the issue is more a case of people simply ignoring the possibility that they exist and are important.

(d) Based on the readings for Week 6 and any other relevant information you have, do you believe in CMNs? Why or why not? (1 pt)

- j. Lots of responses possible. My feeling is that they certainly do exist and probably are important, but the importance has not yet been established, except in the case of the mycoheterotrophic plants. Whatever the response, some reasonable rationale must be provided for it.

2. *Outline the processes involved and the changes that might occur to an initially free-living Trebouxia colony/cell as it becomes involved in a lichen symbiosis and eventually its offspring “escape” as soredia. Specifically focus on the algal perspective. (15 pts)*

I was looking for the changes that occur during lichenization. Here's an outline of the basic processes.

Fungal hypha encounters algal cell, chemical communication between algae and fungus, hyphal encircles/encloses algal cell in fungal sheath (could include formation of a haustoria and penetration of algal cell wall, but not cell membrane), loss of motile zoospore phase, algal cell wall begins to leak carbohydrates to fungus (under influence of fungus, could go into details of urease control theory i.e. NH_3 released from urea degradation causes algal cell wall permeability to increase), algae lose a significant portion of the carbohydrates fixed (40%+), algal growth rate slows due to loss of carbohydrates, photosynthetic rate increases (with resultant changes in chloroplast and pyrenoid morphology), formation of lichen thallus occurs, algae proliferate and form algal layer, fungus continues to enclose algae, thallus increases in size, increased growth of algae in algal layer, eventually break through upper cortex to form soredia which escape.