

Synthesis, Targeting and Sorting

7. (26 pts) The cells lining the digestive system of cnidarians (hydra, jellyfish, corals and their relatives) directly ingest and then internally digest unicellular prey. Curiously, some cnidaria (or coelenterata as they used to be called) have evolved mechanisms for forming a commensal relationship with the single cell alga, *Chlorella* (ingesting but not digesting them). Speculate *how* such a relationship might work at the cellular level, consider the following, slightly edited Abstract of research presented at an annual meeting of the American Society for Cell Biology, and answer the following questions.

Endosymbiont Perturbation of Phagosome Digestion. Thomas C. Hohman, Paul L. McNeil, and Leonard Muscatine. Department of Biology, UCLA, Los Angeles California.

Unicellular *Chlorella* are capable of living with the digestive cells of the fresh water colenterate *Hydra viridis*. These symbiotic algae are phagocytized by hydra digestive cells but avoid host digestion and persist at constant numbers within host cells. In contrast, heat-killed symbionts are rapidly degraded and do not persist within host cells. Acid phosphatase activity could not be detected in phagosomes containing live symbionts, whereas this enzyme was found in over 50% of the vacuoles containing heat-killed symbionts one hour after phagocytosis. Darkness and DCMU [an herbicide], both of which inhibit photosynthesis and hence the release of photosynthetic products, also abolish persistence. Neither of these latter treatments affected symbiont viability. Symbiotic algae are not only recognized by digestive cells as particles not to be attacked, they are also selected for transport within host cells from the apical site of ingestion to a basal position of permanent residence. This process too is disrupted by DCMU and darkness. Algal persistence and transport may both, therefore, be signaled by the release of photosynthetic products.

A. (8 pts) What is the usual fate of material that enters a cell, say a macrophage, by phagocytosis? Describe these events with the aid of a diagram.

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B. (10 pts) Based on the Abstract how might *Chlorella* escape the usual fate of phagocytized material? Your hypothesis must be as specific and as detailed as possible.

C. (6 Pts) Briefly discuss at least 1 critical test of your hypothesis and indicate clearly how the results would prove or disprove it.