Comparison of morphology and surface characteristics of zoochlorella in various host organisms including protozoans and invertebrates

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Freshwater environments include many species of protozoans and invertebrates with intracellular symbiotic green algae (zoochlorella). To extract common features among zoochlorella in various host organisms, Japanese symbiotic strains of *Mayorella viridis* (amoeboid protozoa), *Stentor polymorphus* (ciliated protozoa), *Paramecium bursaria* (ciliated protozoa) and *Hydra viridis* (Cnidaria) were compared. Zoochlorella of *P. bursaria* and *M. viridis* isolated from their hosts were maintained and grown on C agar medium. Cell walls of the cultured zoochlorella (free-living state) were stained with Calcofluor white M2R, while those just isolated from their hosts (symbiotic state) showed a reduced staining intensity. All host organisms were observed with a transmission electron microscope. Cell walls of the zoochlorella in *P. bursaria* and *M. viridis* possessed a layer of fluffy structures, while those in *S. polymorphus* and *H. viridis* appeared smooth, suggesting a possible wide genetic variety of zoochlorella. All zoochlorella appear to have closely apposed peri-algal vacuole (PV) membranes that are derived from their host phagosome membranes. In all host cells, host's mitochondria were frequently observed to be firmly attached to the PV membrane, which was clearly demonstrated by electron tomography. These results suggest that various organisms might have acquired their zoochlorella by a common symbiotic mechanism.