

Phylogeny and evolution of a new parasitic lineage closely related to Apicomplexa

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Apicomplexa are obligatory intracellular parasites and cause some of the most debilitating diseases of humans (for example, the malaria parasite *Plasmodium*). Apart from several unique adaptations to their parasitic lifestyle (for example the apical complex), they possess a highly reduced non-photosynthetic plastid called the apicoplast. The apicoplast has lost many of its metabolic pathways, but still contains a small plastid genome and remains an essential organelle as it harbors pathways for heme, isoprenoid, fatty acid, and iron-sulfur cluster synthesis. Relatively recently, several new free-living lineages, collectively called chrompodellids, were discovered and were shown to be closely related to the Apicomplexa. The best studied of these new lineages are two photosynthetic algae called *Chromera velia* and *Vitrella brassicaformis* whose genomes were fully sequenced.

Piridium sociabile is a parasite of a marine gastropod (*Buccinum undatum*) that was described and classified as an apicomplexan parasite in 1936 and then more or less disappeared from scientific literature. Here, we present transcriptomic data from *Piridium sociabile*. Phylogenomic analyses show, with highest support, that it is actually a sister lineage to the photosynthetic chrompodellid *Vitrella brassicaformis* and therefore most likely represents a lineage that is closely related to Apicomplexa but acquired a parasitic lifestyle and lost photosynthesis independently. Analyses of the plastid genome and plastid targeted proteins have shown that its plastid is very similar to the apicoplast of Apicomplexa.