

Evolution of multicellularity in *Chlamydomonas reinhardtii* in response to predation

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Abstract:

The transition from unicellular to multicellular life was one of a few major events in the history of life that created new opportunities for more complex biological systems to evolve. Thus far, studying the proximate and ultimate causes of the resulting increases in complexity has been a major challenge in evolutionary biology. Traditionally, questions related to the emergence of multicellularity have been addressed retrospectively, through comparative studies of extant unicellular and multicellular lineages. Experimental microbial evolution allows for prospective studies that observe evolution in real time. In this study, we report the *de novo* origin of simple multicellularity in response to predation. We subjected outcrossed populations of the unicellular green alga *Chlamydomonas reinhardtii* to selection by the filter-feeding predator *Paramecium tetraurelia*. Two of five experimental populations evolved multicellular structures not observed in any of the three unselected control populations. Colonies consist of 4-16 cells enclosed within the cell wall of the maternal cell, and cells are encased within a transparent extracellular matrix. The highly structured, spheroidal colonies that evolved in this experiment are reminiscent of volvocine algae such as *Eudorina elegans*. These algae represent a completely novel origin of multicellularity, as *C. reinhardtii* has never had multicellular ancestors.^{1,2}

References: (optional)

[1] Herron, M. D. & R. E. Michod. 2008. Evolution of complexity in the volvocine algae: transitions in individuality through Darwin's eye. *Evolution* 62:436-451.

[2] Leliaert, F., D. R. Smith, H. Moreau, M. D. Herron, H. Verbruggen, C. F. Delwiche, & O. De Clerck. 2012. Phylogeny and molecular evolution of the green algae. *Critical Reviews in Plant Sciences* 31:1-46.