***DE NOVO* ORIGIN OF MULTICELLULARITY IN RESPONSE TO PREDATION.** M. D. Herron[1], J. C. Boswell[2], J. M. Borin[2], C. A. Knox[3], M. Boyd[3], W. C. Ratcliff[2], and F. Rosenzweig[2], [1]Georgia Institute of Technology, 310 Ferst Dr., Atlanta, GA 30332, xprinceps@gmail.com; [2] Georgia Institute of Technology, 310 Ferst Dr., Atlanta, GA 30332; [3]University of Montana, 32 Campus Dr. Missoula, MT 59812.

Introduction: 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.

Results and Discussion: 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 (**Fig. 1A, C, E**).

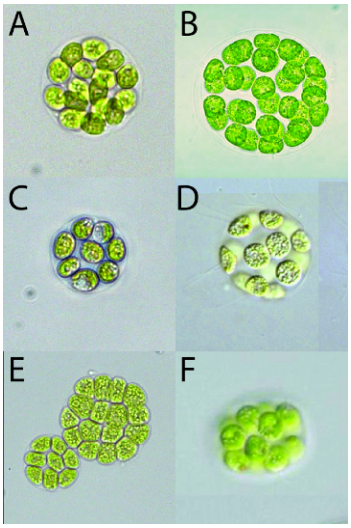

Fig. 1. Naturally occurring and experimentally evolved volvocine algae. A, C, E: multicellular structures from the *Paramecium* predation experiment. B: *Eudorina elegans*. D: *Volvulina steinii*. F: *Yamagishiella unicocca*.

The highly structured, spheroidal colonies that evolved in this experiment are reminiscent of volvocine algae such as *Eudorina elegans* (**Fig. 1B**). These algae represent a completely novel origin of multicellularity, as *C. reinhardtii* has never had multicellular ancestors.[1,2]

References: [1] Herron M. D. and Michod R. E. (2008) *Evolution, 62,* 436-451. [2] Leliaert F. et al. (2012) *Crit. Rev. Plant Sci., 31,* 1-46.