

Evolution of multicellularity in cyanobacteria: molecular genetic and genomic approaches

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Multicellularity is one of major innovation in organismic evolution, which lead to morphological and functional diversification. When and how organisms evolved multicellularity is one of key questions in an understanding of the biological history.

Cyanobacteria form a morphologically diverse group among prokaryotes. Especially in filamentous cyanobacteria, vegetative cells can mature in four developmental directions (vegetative cells, heterocysts, akinetes and hormogonia) in response to environmental growth conditions. Therefore they provide an interesting experimental system to study mechanisms and evolution of prokaryotic development. Here we performed molecular genetic study of the model filamentous cyanobacterium *Nostoc punctiforme* ATCC29133 to identify genes that control hormogonia formation. We further investigate evolution of the cell differentiation in cyanobacteria, by integrating molecular-phylogenetic and genomic analyses.

Recent advance in next-generation sequencing technology allows us to study taxonomically diverse organisms on genome basis. Multidisciplinary approaches using genomic, physiological, and ecological data together with geologic information would shed light on the early history of life on earth.

Keywords: multicellularity, evolution, cyanobacteria, genome, molecular biology, fossil