Article

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Genomic footprints of a cryptic plastid endosymbiosis in diatoms.

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Evaluations

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The authors reanalyzed the published data from two sequenced diatom genomes and found many nuclear genes that seemed to betray a green algal ancestry. This was surprising because most everyone would have suspected a red algal ancestry for nuclear genes in diatoms.

Diatoms are one of the world's most abundant forms of phytoplankton. It has, until now, been believed that their original photosynthetic plastid was of red algal origin, derived from a secondary endosymbiosis. However, this study is the first to find very large numbers (hundreds) of nuclear genes of green algal derivation. This is likely to cause quite a stir and new investigations to see what is behind the unexpectedly green signal in diatom nuclear genomes.

Competing interests: None declared

Cite this evaluation

Evaluated by:
William Martin
University of Duesseldorf, Germany
Plant Biology
23 Sep 2009

Rating 8
Must Read

This paper makes a highly significant and potentially controversial contribution to unraveling the complexities of early eukaryotic cell evolution and the central role that endosymbiosis has played.

The authors used 2 fully sequenced diatom genomes to conduct phylogenomic analysis of the plastid origins of nuclear genes. The diatom plastid is the result of secondary endosymbiosis and is of red algal origin. Thus, the expectation was that endosymbiont-derived nuclear genes in the diatoms would be of red algal origin. However, results of this study (hinted at in previous genome analysis of diatoms and other organisms thought to share lineage with the diatoms) show that a high proportion of the endosymbiosis-derived nuclear genes (roughly 16% of the total nuclear genome) have their origin in the green algal lineage. The authors interpret this result as providing evidence that deep in diatom evolutionary history, there was a green algal endosymbiont that donated many algal genes to the nucleus and that, subsequently, a red algal endosymbiont replaced the green, leading to the red-derived plastid found in contemporary diatoms. This interpretation supports a revised view of the genetic underpinnings of the remarkable success of chromalveolates (there are more than 100 thousand species of diatoms alone) as predominant primary producers in the oceans following the Permian extinction 250 million years ago.

Competing interests: None declared

Cite this evaluation

Evaluated by:
Robert Goodman
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Microbiology
21 Sep 2009

Rating 8
Must Read

This manuscript provides evidence that the evolution of ancestral algae into modern diatoms has involved at least two plastid endosymbioses, an early green algal endosymbiosis involving relatives of prasinophytes as well as the red algal endosymbiosis postulated previously.

Microalgae, such as diatoms, are breathtakingly beautiful, almost unimaginably diverse and of central importance to life. Diatoms alone account for 20% of the carbon fixation carried out on earth. The evolutionary history of microalgae has been debated for decades but whole genome sequencing now allows rigorous analyses that were not possible previously. One theme that comes out of these analyses is that endosymbiosis is an important and surprisingly frequent driver of evolution. Previous data indicated that the chloroplasts of diatoms are substantially of red algal origin. In this manuscript, the authors provide data from genome-wide analysis that reveal that, prior to the red algal endosymbiosis, there was a green algal endosymbiosis. This endosymbiosis involved a member of a group of green algae called prasinophytes and a substantial number of diatom genes have this endosymbiotic event as their origin. At least two separate endosymbiotic events have, thus, played an important role in diatom evolution. One looks forward to additional genomic sequencing and analyses that will further clarify the evolutionary history of microalgae.

Competing interests: None declared

Cite this evaluation

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Berl R Oakley
The Ohio State University, USA
Microbiology
20 Jul 2009

Rating 8
Must Read