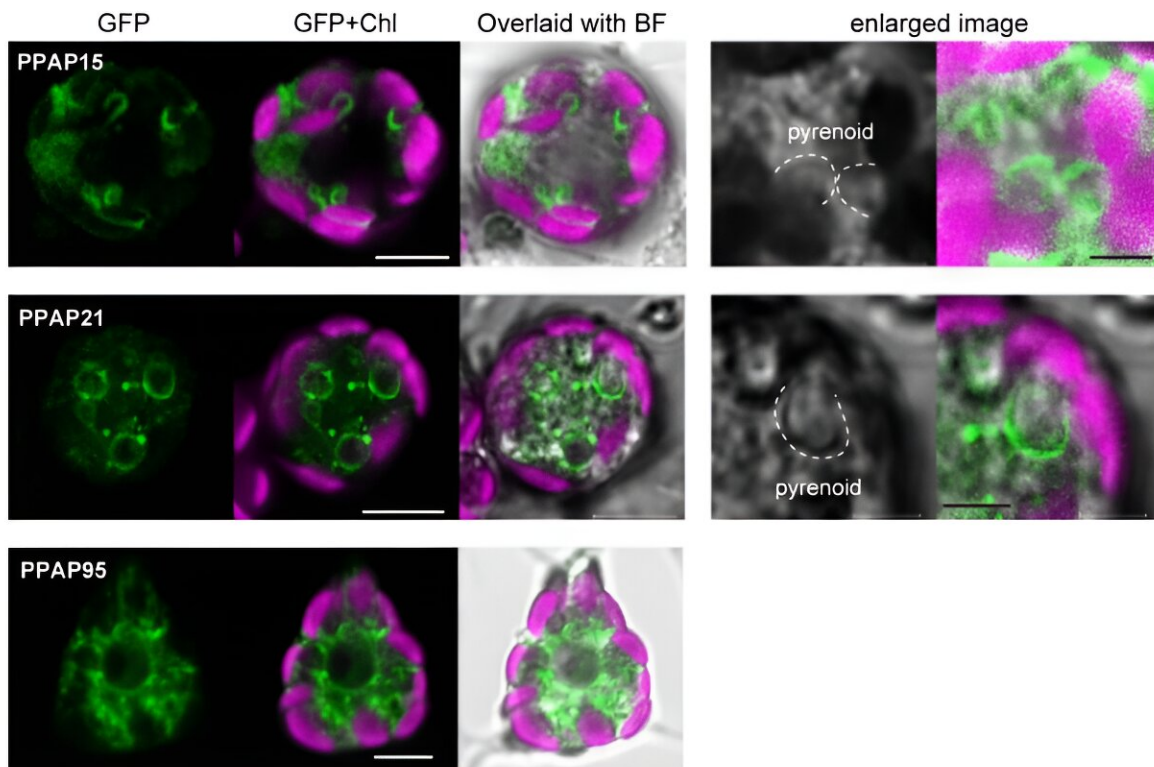


# New findings suggest convergent evolution of algal CO<sub>2</sub>-fixing organelles

February 29 2024



The GFP fusion proteins of PPAP15 (bifunctional dTDP-4-dehydrorhamnose 3,5- epimerase/dTDP-4-dehydrorhamnose reductase) and PPAP21 (beta-glucosidase) were observed in the cytoplasm and possibly capping vesicles outside the pyrenoid. PPAP95 ( $\alpha$ -carbonic anhydrase) seemed to be localized in the endoplasmic reticulum. Credit: *Proceedings of the National Academy of Sciences* (2024). DOI: 10.1073/pnas.2318542121

Researchers at the University of Tsukuba identified the proteins of a CO<sub>2</sub>-fixing organelle, namely, "pyrenoid," in the marine algal group Chlorarachniophyta and revealed various pyrenoid-associated proteins among algal groups, suggesting the independent evolution of pyrenoids in different algal groups.

Plants and [algae](#) fix carbon through photosynthesis, which converts CO<sub>2</sub> to [organic carbon](#). This [biological process](#) is catalyzed by the Rubisco enzyme, the most abundant protein on Earth. In many algae, Rubisco is densely packed into a microcompartment called the pyrenoid, which plays an important role in the CO<sub>2</sub> accumulation in [aquatic environments](#).

Notably, approximately one-third of global carbon fixation is estimated to occur within algal pyrenoids. Apart from Rubisco, the primary component of pyrenoids, the pyrenoid-associated proteins in most algae remain unclarified.

In a [new study](#) published in the *Proceedings of the National Academy of Sciences*, pyrenoid-associated proteins in a marine chlorarachniophyte alga were identified through a proteomic approach. Some of these proteins are apparently involved in pyrenoid construction and CO<sub>2</sub> concentration.

Interestingly, various pyrenoid-associated proteins have been reported among the algae studied to date, suggesting that CO<sub>2</sub>-fixing organelles evolved independently in each algal group. This is an example of convergent evolution at the molecular level.

Genetic engineering of plants using algal genes is underway to increase the photosynthetic performance. The pyrenoid-associated proteins reported herein are a potential basis for improving crop productivity in the future.

**More information:** Rena Moromizato et al, Pyrenoid proteomics reveals independent evolution of the CO<sub>2</sub> -concentrating organelle in chlorarachniophytes, *Proceedings of the National Academy of Sciences* (2024). [DOI: 10.1073/pnas.2318542121](https://doi.org/10.1073/pnas.2318542121)

Provided by University of Tsukuba

Citation: New findings suggest convergent evolution of algal CO<sub>2</sub>-fixing organelles (2024, February 29) retrieved 27 April 2024 from <https://phys.org/news/2024-02-convergent-evolution-algal-co8322-organelles.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.