

PRESS RELEASE

Source: Toyohashi University of Technology, Japan, Committee for Public Relations

Release Title: Phytoplankton *Dicrateria rotunda* synthesizes hydrocarbons equivalent to petroleum

Key points

- We discovered that *Dicrateria rotunda* (*D. rotunda*), a species of Haptophyte, can synthesize hydrocarbons equivalent to petroleum (saturated hydrocarbons with a carbon number ranging from 10 to 38). No organism capable of petroleum production has been previously reported.
- All of the eleven *Dicrateria* strains examined in this study, including ARC1 obtained during a science cruise in the Arctic Ocean, were found to be capable of synthesizing a series of saturated hydrocarbons. This has indicated that this capability of synthesis is common to the entire *Dicrateria* genus.
- The saturated hydrocarbon content of the *D. rotunda* ARC1 increased under dark and nitrogen-deficient conditions. Understanding the physiological function and synthesis pathways of these saturated hydrocarbons may contribute to the development of biofuels in the future.

Overview

Director-General Naomi Harada and colleagues from the Research Institute for Global Change at the Japan Agency for Marine-Earth Science and Technology, in collaboration with Assistant Professor Yuu Hirose from Toyohashi University of Technology and Specially Appointed Professor Kazuyoshi Murata from the National Institute for Physiological Sciences, discovered that the phytoplankton *Dicrateria rotunda* (*D. rotunda*) can synthesize a series of saturated hydrocarbons with a carbon number ranging from 10 to 38*.

A phytoplankton community was collected from seawater of the Chukchi Sea during a science cruise of the research vessel “Mirai” in the Arctic Ocean in 2013, from which we isolated and cultured the Arctic strain of *D. rotunda*, ARC1. ARC1 contained a series of saturated hydrocarbons with a carbon number ranging from 10 to 38, which are categorized as petrol (carbon number 10 to 15), diesel oils (carbon number 16 to 20), and fuel oils (carbon number 21 or higher). Moreover, we examined ten additional strains of *Dicrateria* stored in culture collections, all of which were found to be similarly capable of hydrocarbon synthesis, indicating that this was common to the entire *Dicrateria* genus. This study is the first to report on an organism with the capability to synthesize hydrocarbons equivalent to petroleum.

The capability of the ARC1 strain to synthesize saturated hydrocarbons was shown to increase depending on the environmental conditions, and the findings of this study are expected to contribute to the development of biofuels in the future.

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Reference

Naomi Harada, Yuu Hirose, Song Chihong, Hirofumi Kurita, Miyako Sato, Jonaotaro Onodera, Kazuyoshi Murata, Fumihiro Itoh (2021) "A novel characteristic of a phytoplankton as a potential source of straight-chain alkanes" *Sci. Rep.* **11**, 14190, 10.1038/s41598-021-93204-w.

Supplemental information

*Saturated hydrocarbons: Organic compounds composed of carbon and hydrogen. Saturated hydrocarbon with the smallest mass number is methane (CH₄), which has a carbon number of one.

Further information

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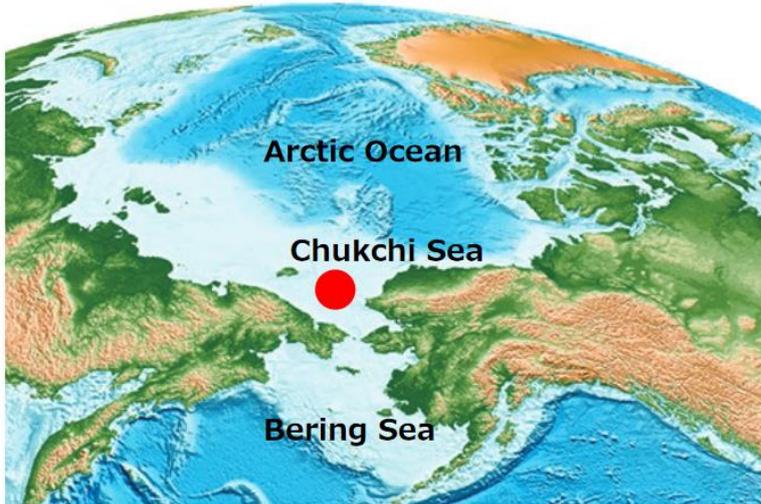
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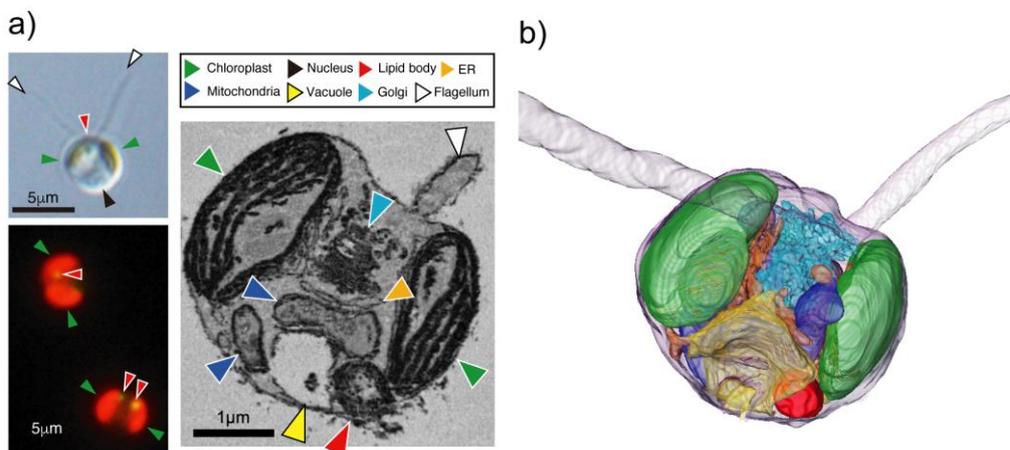
Figure1:



Title: Sampling site of the Arctic strain ARC1 of *D. rotunda* in the Arctic Ocean (the Chukchi Sea)

Caption: Sampling site of the Arctic strain ARC1 of *D. rotunda* in the Arctic Ocean (the Chukchi Sea) The red circle indicates 70° 0.06' N, 168° 44.96' W.

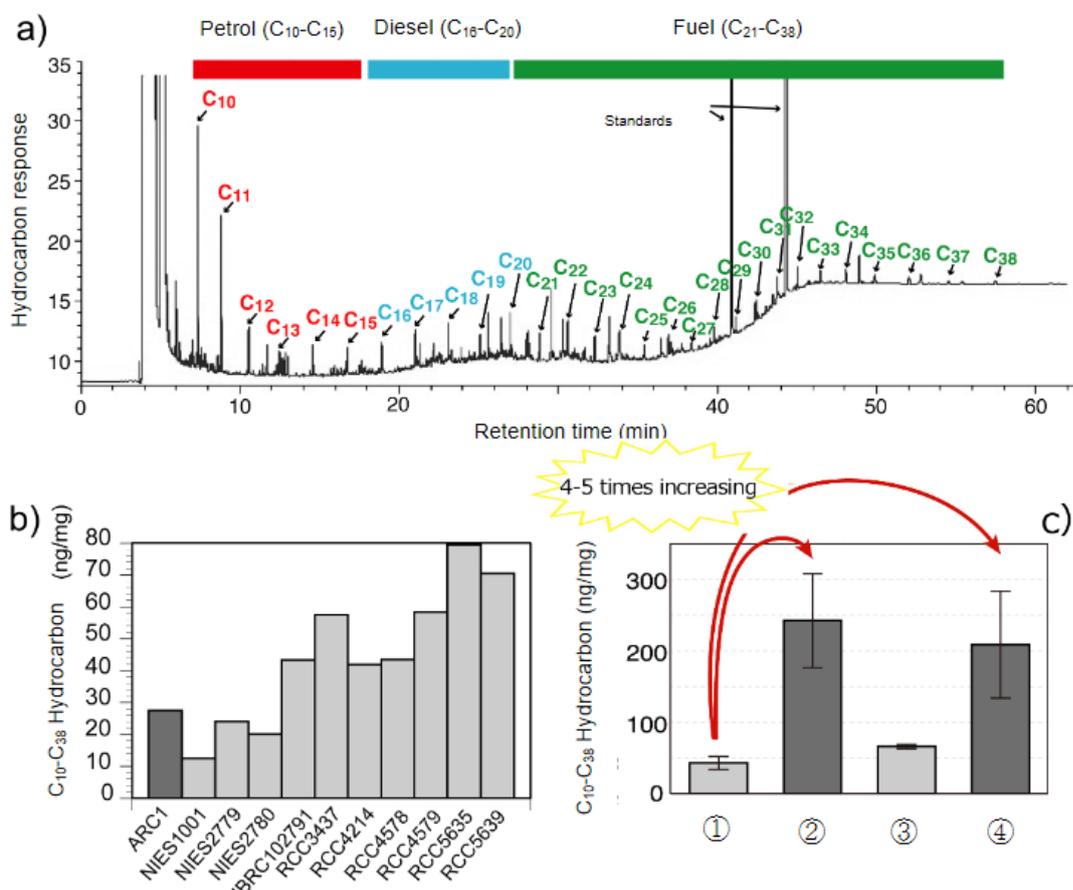
Figure2:



Title: Photographs of the Arctic strain ARC1 of *D. rotunda*

Caption: a) Photographs of the Arctic strain ARC1 of *D. rotunda* captured by bright field microscopy (upper left), fluorescence microscopy (lower left), and electron microscopy (right). b) A 3D structure of ARC1 cell reconstructed from multiple electron microscope images.

Figure3:



Title: Data of saturated hydrocarbon

Caption: a) Gas chromatogram of hydrocarbons extracted from the Arctic strain ARC1 of *D. rotunda*. b) Amount of C₁₀-C₃₈ saturated hydrocarbons in 11 strains of *D. rotunda*. c) Amount of C₁₀-C₃₈ saturated hydrocarbons in the ARC1 strain cultured under different conditions. *Error bars (standard deviation)

Keywords: Hydrocarbons, Phytoplankton, Petroleum, Carbon compounds, Organic carbon