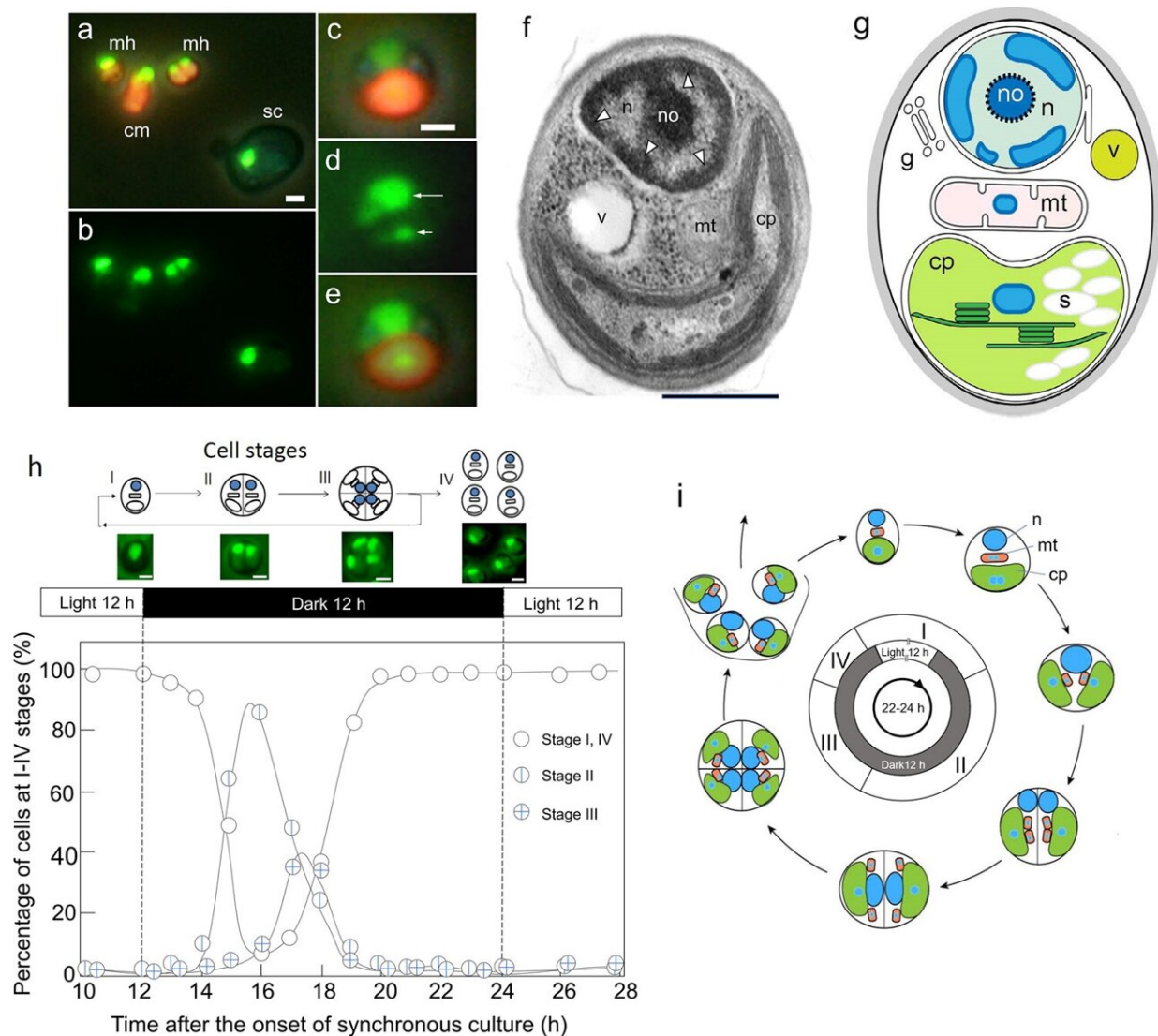


# New species of ultrasmall microalgae found in home aquarium could have multiple useful applications

January 27 2023



Morphological characteristics of *Medakamo hakoo*. a Fluorescence images

merged with a phase-contrast image of *M. hakoo* (mh), *Cyanidioschyzon merolae* (cm), and *Saccharomyces cerevisiae* (sc). SYBR Green signals appear green. Red signals are autofluorescence from the chlorophyll in chloroplasts. The scale bar indicates 1  $\mu\text{m}$ . b Image of the SYBR Green fluorescence only for the sample presented in panel a. c–e Highly magnified images of *M. hakoo*. c Phase-contrast and autofluorescence image. The scale bar indicates 1  $\mu\text{m}$ . d SYBR Green signals. Long and short arrows indicate the nuclear and chloroplast DNA, respectively. e Merged image of (c) and (d). f Transmission electron microscopy image of *M. hakoo*; no, n, v, mt and cp represent the nucleolus, nucleus, vacuole, mitochondrion, and chloroplast, respectively. Arrowheads indicate electron-dense structures. The scale bar indicates 500 nm. g Schematic image of the *M. hakoo* cell structure; no, n, g, mt, v, s, and cp indicate the nucleolus, nucleus, Golgi apparatus, mitochondrion, vacuole, starch, and chloroplast, respectively. h Synchronization culture of *M. hakoo*. The schematic diagram with images of SYBR Green fluorescence presents the following cell stages: single-cell stage (I), two-cells-combined stage (II), tetrad stage (III), and dissection stage (IV). The *M. hakoo* cells were treated with a 12-h light/12-h dark cycle. Totally, 4268 cells were counted. The counts at each time point are provided in Supplementary Data 6. The scale bars indicate 500 nm. i Schematic diagram of the *M. hakoo* lifecycle; n, mt, and cp indicate the nucleus, mitochondrion, and chloroplast, respectively. Credit: *Communications Biology* (2023). DOI: 10.1038/s42003-022-04367-9

A new species of microalgae was found in water from a home aquarium. While analyzing DNA samples taken from the algae, researchers from the University of Tokyo discovered a DNA sequence that didn't match any on record. This new species is the smallest known freshwater green algae, with inherent qualities that enable it to be cultured stably at a high density, meaning it could be effectively used to produce useful products for food and industry.

If you've picked up seaweed on the beach, waded through fronds in a stream or cleaned out a grimy, green fish tank, then you'll know what

[algae](#) is. These diverse aquatic organisms thrive on water, light and nutrients and come in all sorts of shapes, colors and sizes. Microalgae are an ultrasmall type of algae which are invisible to the human eye, but a vital part of the Earth's ecosystem, forming the basis for all aquatic food chains. They have attracted particular attention from researchers and businesses for their ability to capture [carbon dioxide](#), their use as a biofuel, as an alternative source of protein, and more. There are tens of thousands of types of microalgae, which continue to thrive in unexpected places.

"We were very surprised to discover a new species of microalgae in just a regular home aquarium," said Professor Sachihiko Matsunaga from the Graduate School of Frontier Sciences. "Alga were taken from the water and cultured one by one. The DNA of the alga was fluorescently stained and microscopically observed to find the one with the least amount of DNA per cell. We then sequenced the DNA of that alga and compared it to the DNA of other algae. The results did not match the DNA of any previously reported algae, indicating that it was a new species, and we named it Medakamo hakoo (M. hakoo)."

Microalgae are made up of relatively few genes, and this uncomplicated form makes them useful for researchers trying to identify what roles different genes play and how they could be used. Of the tens of thousands of known [microalgae](#), many remain uncharacterized. Thanks to this latest study, we now know that not only is this a [new species](#), but it also has the smallest known genome of any freshwater algae, as well as other useful qualities.

"M. hakoo contains only one mitochondrion (for producing energy) and one chloroplast (which contains chlorophyll and creates food through photosynthesis), whereas normal plant cells contain multiple mitochondria and chloroplasts. This indicates that it is a green alga with an extremely simple cell structure," explained Matsunaga.

"From our research, we have also speculated that it has an unprecedented DNA structure and a new gene regulatory system. Its [cell cycle](#) is also strongly synchronized with the day and night cycle, which is key to effective, stable bioproduction. Due to these inherent qualities and extremely [small size](#), *M. hakoo* can be effectively cultured at high cell density, making it possible to mass produce substances such as highly functional foods, cosmetics and bio-fuel at a low cost."

The researchers plan to continue to explore the potential applications for *M. hakoo*, both in the lab and the wider world. "Aquatic green algae are the originating organisms of today's land plants. Thanks to this research, we can better understand the minimum number of genes required for an organism to evolve and thrive in diverse environments, which we will continue to study," said Matsunaga. "In the future, I would like to find ways to collaborate and create useful substances from the mass cultivation of *M. hakoo*."

The research is published in the journal *Communications Biology*.

**More information:** Shoichi Kato et al, Genomic analysis of an ultrasmall freshwater green alga, *Medakamo hakoo*, *Communications Biology* (2023). [DOI: 10.1038/s42003-022-04367-9](https://doi.org/10.1038/s42003-022-04367-9)

Provided by University of Tokyo

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