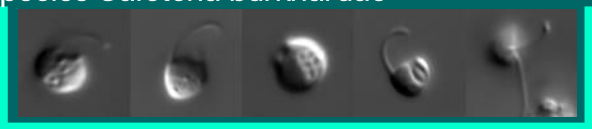
Characteristics

Genus *Cafeteria*

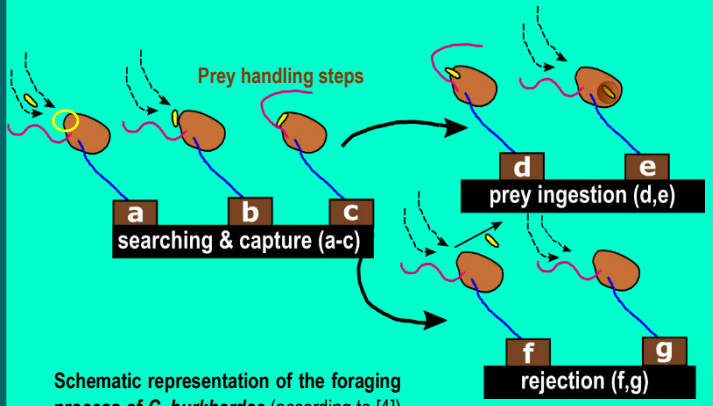
Cafeteria is a genus of unicellular flagellates within the stramenopiles, which are flagellates whose anterior flagellum is covered with additional hairs. There are 11 described species of *Cafeteria*, from the Atacama Desert in Chile to the deep sea up to 8300 m depth [1-3]. Main differences between species can be found at the molecular level.

Species *Cafeteria burkhardae*

according to [2]



Cafeteria burkhardae is a small (<5 µm) bacterivorous D-shaped protist. It is very easy to cultivate in the laboratory and has high growth rates (r-strategist). As with all *Cafeteria* species, bacteria are ingested by using the anterior flagellum. The small flagellate attaches to surfaces with the posterior flagellum.



Schematic representation of the foraging process of *C. burkhardae* (according to [4])

Objects shown:
Anterior flagellum (pink), posterior flagellum (blue),
place of intake (circle, yellow),
feeding stream (dashed curved arrows) and bacterium (yellow)

History

The two famous protozoologists, the Dane **Tom Fenchel** and the Northern Irishman **David Patterson**, found various new flagellates in their experiments near the Öresund in the 1980s. Sitting in a cafeteria, they had to come up with new names. One of these new flagellates looked like a coffee cup, which is why the choice to give it the generic name *Cafeteria* was an easy one. The two called this most original type of *Cafeteria* species *Cafeteria roenbergensis*, the so-called type species of the genus *Cafeteria*.

Since then, for over 50 years, this species has been kept alive in the laboratory in culture flasks in the CCAP collection. However, there was no associated DNA sequence from this species for a long time. And many flagellates that were thought to be *Cafeteria roenbergensis* by their appearance were sequenced and those sequences made available in public databases as *C. roenbergensis*. Finally, due to morphological and genetic differences, the genus *Cafeteria* was divided into new species in 2020.

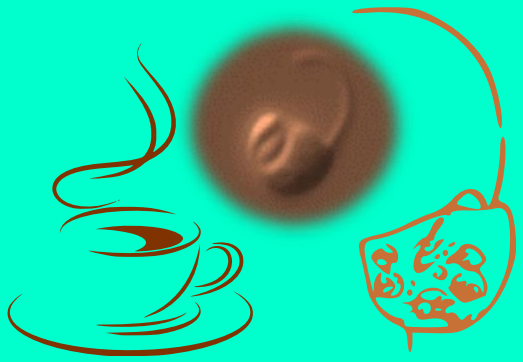
References and further reading

[1] Fenchel & Patterson, 1988. *Mar Microb Food Webs* 3, 9–19. doi: 10.1146/annurev.es.19.110188.000315
[2] Schoenle et al., 2020. *Eur J Protistol* 73, 125665. doi: 10.1016/j.ejop.2019.125665
[3] Schoenle et al., 2022. *Eur J Protistol* 85, 125905. doi: 10.1016/j.ejop.2022.125905
[4] Suzuki-Tellier et al., 2022. *Limnol Oceanogr*, 67: 1287-1298. doi: 10.1002/lno.12077
[5] Worden et al., 2015. *Science* 347, 1257594. doi: 10.1126/science.1257594
[6] Živaljić, et al. 2018. *Deep-Sea Res II*, 148, 251-259. doi: 10.1016/j.dsr2.2017.04.022

Authors on behalf of the DGP

Dr. Alexandra Schönle, Dr. Alexandra Jeuck & Prof. Dr. Hartmut Arndt
Institute of Zoology, University of Cologne
hartmut.arndt@uni-koeln.de

Protist of the Year 2024



from [1]

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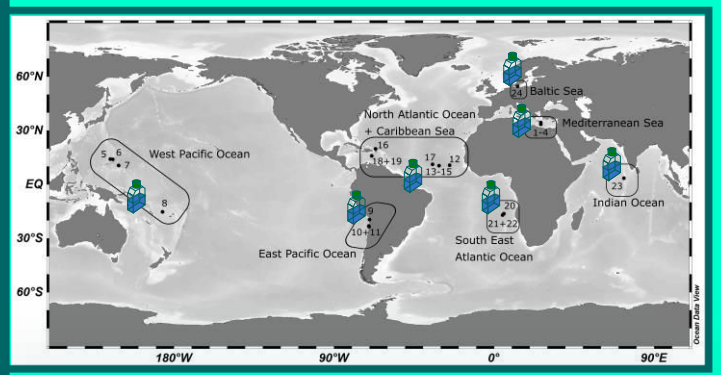
Distribution

The first described *Cafeteria burkhardae* was isolated from the North Atlantic Ocean at a depth of 5793 m. It has subsequently been repeatedly found in the sea, both in surface waters and in the deep sea, in the Atlantic as well as in the Pacific Ocean.

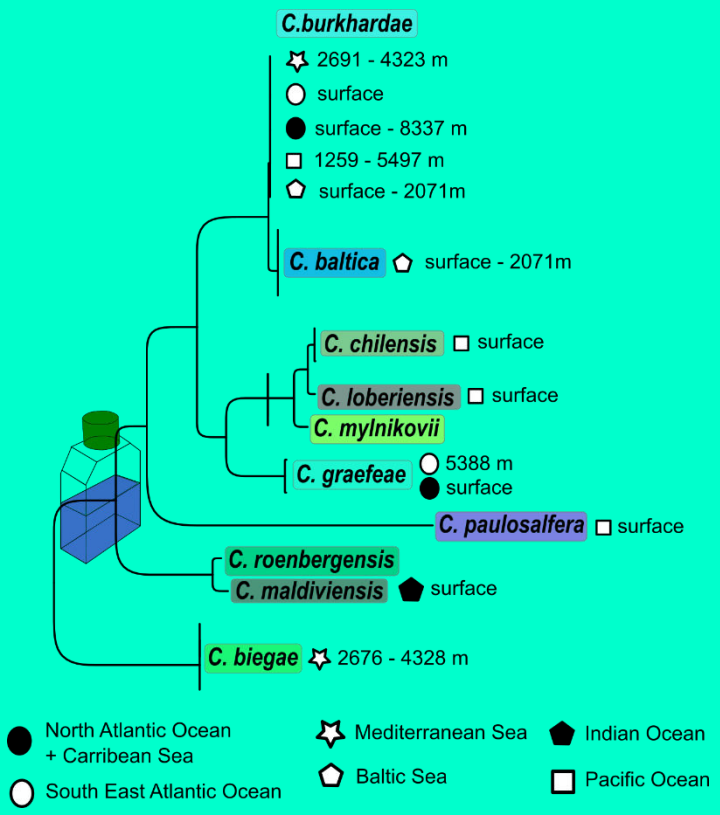
Fig. above, from left: Location of a *Cafeteria* species in the Atacama Desert, sampling gear for taking seawater samples and corer of a sediment sampling gear filled with deep-sea mud (from [3]).

It was even cultivated from deep-sea sediments at a depth of 8380 m, although during cultivation there was no high hydrostatic pressure that naturally prevails at such high depths.
In addition to *C. burkhardae*, six new *Cafeteria* species have also been described based on morphological and molecular characteristics from marine surface waters and the deep sea, including the Atlantic, Pacific, Mediterranean and Indian Ocean as well as the Baltic Sea.



Stations, where *Cafeteria* species were collected and isolated during various deep-sea expeditions (according to [2])

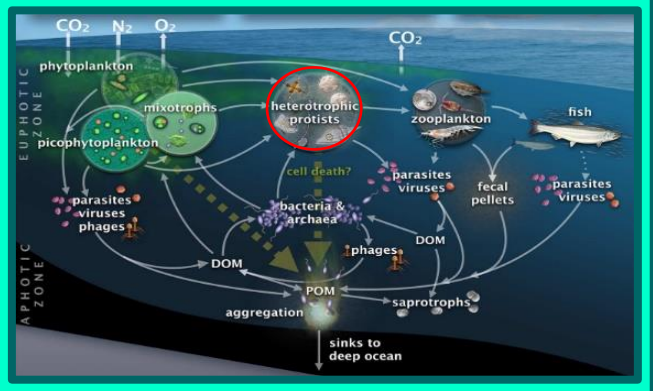
Phylogenetic tree



Phylogenetic tree analyses using cultured *Cafeteria species* have shown that *Cafeteria burkhardae* can be genetically detected at various global marine sampling sites (surface to deep sea), confirming their very wide distribution ([2]). A similarly large worldwide distribution is only known for very few protists. Other *Cafeteria* species (such as *C. biegae*) have not found to be as widespread. So it seems that some types of *Cafeteria* act more as a "global player" and some less.

Specifics

As heterotrophic protists, *Cafeteria* species play a crucial role in the microbial food-web as link to higher trophic levels and as remineralizers of nutrients in biogeochemical cycles.



Schematic overview of the marine food-web with the central position of heterotrophic protists (red circle) for the carbon cycle (aus [5]). POM is the abbreviation for particulate organic matter, while DOM stands for dissolved organic matter.

In addition, pressure experiments with *Cafeteria* strains isolated from surface waters and the deep sea show that several *Cafeteria* strains are capable of surviving up to 500 bar, which corresponds to the prevailing pressure at 5000 m depth [6].

In salinity experiments *C. burkhardae* shows a wide range of tolerance regarding different salt concentrations: from freshwater conditions to highly saline waters (150 ‰S). For comparison, the open sea has a salinity of 35 ‰S [3].