Trends in Microbiology | Microbe of the Month

Crocosphaera watsonii

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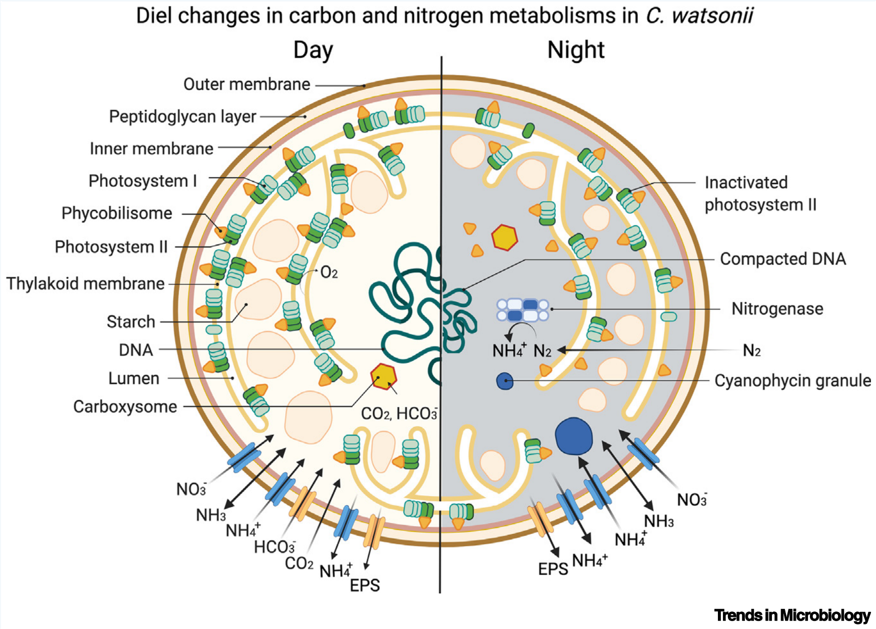
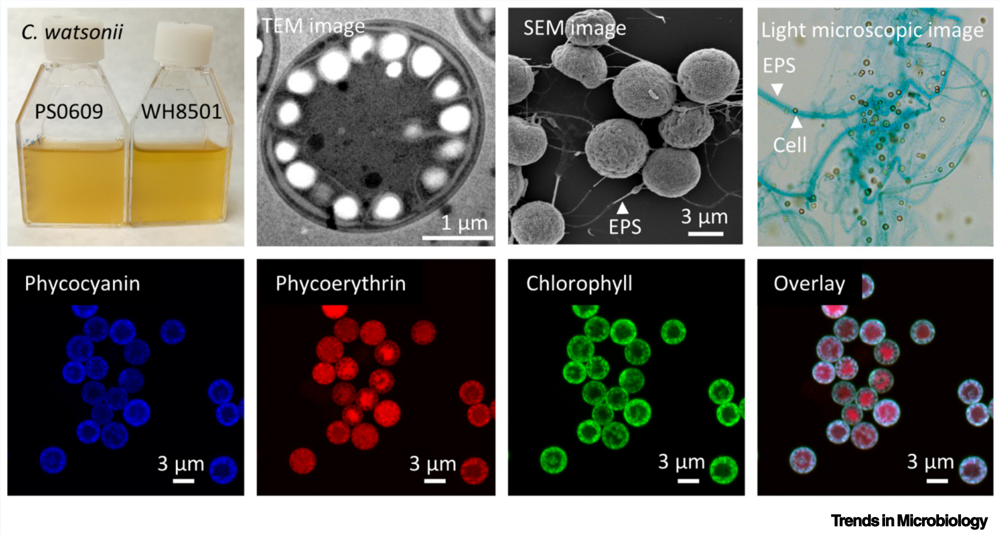


Crocosphaera watsonii is a marine unicellular cyanobacterium that fixes carbon during the day and nitrogen during the night. They are abundant in tropical and subtropical oceans, providing both bioavailable carbon and nitrogen to the ecosystem, altering local and possibly global biogeochemical cycling. The temporal segregation of nitrogen fixation from oxygenic photosynthesis helps to protect nitrogenase, the oxygen-sensitive enzyme responsible for nitrogen fixation. The diel rhythm of carbon and nitrogen fixations fluctuates the cellular carbon to nitrogen ratio. Although *C. watsonii* can reduce nitrogen gas into organic compounds, they also compete with other cells for extracellular combined nitrogen, such as ammonium, nitrate, and urea. *C. watsonii* exists as single individual cells or as multiple cells bound by extracellular polymeric substances (EPS). Even under nitrogen-fixing conditions, only a fraction of the cellular population in colonies fixes nitrogen. This intercellular functional heterogeneity is predicted to lower overall energy consumption during nitrogen fixation. Their metabolic activities are highly sensitive to temperature, constraining their niche to warm waters.



KEY FACTS:

The first described *C. watsonii* was originally isolated as *Synechocystis* sp. strain WH8501, by S. Watson and F. Valois in 1984 from tropical Atlantic Ocean waters (28°S, 43°W). Most strains of *C. watsonii* remain uncultured and the isolates grow slowly and are difficult to maintain in axenic laboratory culture. Isolates of *C. watsonii* can be physiologically classified into two groups: a small-cell type (about 3 µm in diameter) and a large-cell type (about 6 µm), the latter of which produces up to about ten times more EPS than that of the small-cell type. The cells contain a number of thylakoid membranes arranged in sinuous parallel clusters. The physiology of *C. watsonii* has been studied mainly based on strains WH8501, WH0003, and PS0609.

The whole genome was read for six strains (WH8501, WH8502, WH0401, WH0003, WH0005, and WH0402) and reported in 323–1343 contigs. The first sequenced *C. watsonii* genome was that of the type material (*C. watsonii* WH8501) by the Joint Genome Institute. It has a larger genome (6.2 Mb) than other reported strains (4.5–5.8 Mb). However, low genomic diversity has been reported among strains so far. Genetic engineering of *C. watsonii* has not been achieved.

As a native to oligotrophic areas of the ocean, *C. watsonii* is economical in dealing with essential rare elements in its enzymatic machinery. A proteomic study showed that the intracellular iron was recycled between metalloproteins involved in nitrogen fixation and photosynthesis, lowering the total cellular iron requirement by ~40%. *C. watsonii* operates a unique disassembly of the photosystem II complex during the night period.

TAXONOMY AND CLASSIFICATION:
KINGDOM: Bacteria
PHYLUM: Cyanobacteria
CLASS: Cyanophyceae
ORDER: Chroococcales
FAMILY: Aphanothecaceae
GENUS: *Crocosphaera*
SPECIES: *watsonii*

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Declaration of interests

No interests are declared.

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