

Researchers reveal how ocean bacteria use light to grow

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Sunlight stimulates common ocean bacteria to use carbon dioxide for growth when high-quality organic carbon food sources are scarce, according to surprising research by an international team that includes a University of Otago researcher.

The team's new study suggests that these versatile [bacteria](#) may play a more significant role in the biogeochemistry of the oceans, and thus global climate processes, than previously thought. Their findings are published this week in the prestigious international journal *PNAS*.

The researchers, who include Otago marine scientist Dr Federico Baltar, investigated a [marine bacterium](#) called *Dokdonia* which contains a light-absorbing pigment named proteorhodopsin (PR).

Marine bacteria are the most abundant organisms in the ocean, accounting for up to 90% of its global biomass, and up to half are thought to be PR-containing.

Dr Baltar says this pigment's existence in ocean bacteria was first discovered by other researchers in 2000, revealing a whole new class of micro-organisms capable of harnessing sunlight in the ocean through means other than photosynthesis.

To tease out the mechanisms underlying how such bacteria were using light to grow, he and his co-authors analysed gene expression in *Dokdonia* in light and dark and nutrient rich and nutrient poor conditions.

"We discovered that light profoundly affects *Dokdonia*'s patterns of gene expression and metabolic activities, and that these responses are influenced by the availability of organic matter and its quality," Dr Baltar says.

The changes included that when they were exposed to light the bacteria switched to obtaining one-third of their cellular carbon from CO₂.

"These bacteria's ability to use both inorganic and [organic carbon](#) to grow makes them remarkably flexible micro-organisms that can quickly adapt to the highly variable conditions in their ocean environment," he says.

Dr Baltar says the findings are the microbial equivalent of discovering that kittens lie in the sun not because they enjoy the warmth, but because they are using light energy for sustenance until their next meal.

More information: Joakim Palovaara, Neelam Akram, Federico Baltar, Carina Bunse, Jeremy Forsberg, Carlos Pedrós-Alió, José M.

González, and Jarone Pinhassi. "Stimulation of growth by proteorhodopsin phototrophy involves regulation of central metabolic pathways in marine planktonic bacteria." *PNAS* 2014, [DOI: 10.1073/pnas.1402617111](https://doi.org/10.1073/pnas.1402617111)

Provided by University of Otago

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