Marine Bacteria with a Hybrid Engine

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Bernhard Fuchs and his culture of Congegribacter (Source MPI/ D. Todd)

What was considered a breakthrough in the automobile industry almost five years ago is in fact a million year old success story of nature - the ability to use a mix of different energy sources.

Some organisms like plants and green algae depend on light and carbon dioxide, while others like animals and fungi need complex nutrition (proteins and carbohydrates). And some even may use a mix of energy. They are able to compensate for low food supply by turning on their photoreceptors.

This ability (photoheterotrophy) seems to be widespread among marine bacteria. Max Planck researchers and their colleagues from Germany and the USA analysed the genome of a novel marine bacterium and found the genes coding for the usage of light energy.

Photoheterotrophs are quite abundant and account for up to 10% of the marine plankton. Recently Max Planck marine microbiologists took a closer look at the genome of one of the common bacteria found in coastal regions worldwide. Eight years ago they isolated a species named „Congregibacter litoralis KT71“ from the waters near Helgoland, an island in the German bight. Growth experiments showed that KT71 is heterotrophic and depends on carbon sources like sugars and small peptides. After they obtained and analysed the genome data from the Craig Venter Institute in the USA, the researchers were quite surprised to find all the genes for bacterial photosynthesis. KT71 was unlike other photosynthetic bacteria not pigmented and therefore the big question was: „Is KT71 really mediating photosynthesis?“ Their colleagues at the laboratory of the German Collection of Microorganisms and Cell Cultures (DSMZ) could show that KT71 grows better with light, when nutrients were depleted. The scientists assume that KT71 switches from carbon burning to photovoltaic mode, depending on the environmental conditions. During periods of starvation KT71 can also rely on internal storage compounds. Interestingly, in culture KT71 often forms aggregates and prefers low oxygen concentrations for growth.

Genetic fingerprints from a novel group of bacteriochlorophyll a containing Gammaproteobacteria were found five years ago. Now it is clear that Congregibacter litoralis KT71 is the first member of this group of photoheterotrophic marine bacteria which can be cultivated in the laboratories.

„KT71 is perfectly adapted to the fast environmental changes in the German bight and should be regarded as a typical representative of the marine bacteria in the Helgoland waters, “ says Rudolf Amann, Director of the Max Planck Institute in Bremen, Germany. His staff scientist Bernhard Fuchs agrees: „ If a strategy proves to be successful in one place, it will dominate. These kinds of bacteria are common in the global coastal shelf areas“.

After all, the researchers were quite lucky. Without the generous funding through the private Gordon and Betty Moore Foundation the sequencing of KT71 would not have been possible.

Citation: Bernhard M. Fuchs, Stefan Spring, Hanno Teeling, Christian Quast, Jörg Wulf, Martha Schattenhofer, Shi Yan, Steve Ferriera, Justin Johnson, Frank Oliver Glöckner and Rudolf Amann. *PNAS*, February 2007 "Characterization of a marine gammaproteobacterium capable of aerobic anoxygenic photosynthesis"

Source: by Manfred Schloesser, Max Planck Institute for Marine Microbiology