Linking photosynthesis to respiration

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As part of an international collaboration, a team of French researchers has revealed new aspects of the cellular mechanisms underlying the amazing photosynthesizing capabilities of the tiny single-cell marine organisms known as diatoms.

In seeking to find the reasons why these organisms dominate the marine phytoplankton community, the scientists have discovered an unexpected interaction between photosynthesis and respiration in diatoms. This bioenergetic process gives us a better understanding of how diatoms convert light energy into organic materials with such efficiency, and could open up new and promising developments in biotechnology. These results, with contributions from the CEA, the CNRS, Inra, Inserm, the École Normale Supérieure, the Joseph Fourier, Paris-Sud and Pierre and Marie Curie Universities, and the commercial company Fermentalg, were published on the website of the journal *Nature* on July 13.

While photosynthesis on land is largely the domain of terrestrial vegetation, most of the photosynthesis occurring in the oceans is carried out by microscopic single-cell organisms known as phytoplankton. Diatoms, consisting of thousands of distinct marine species, dominate the phytoplanktons forming the first link in the marine food chain. They capture CO2 from the atmosphere, locking it away in the ocean depths and accounting for around 20 % of all the photosynthesis occurring on the planet. How is it that diatoms have come to dominate the phytoplankton community to such an extent?

As part of an international collaboration, researchers from the CEA, the

CNRS, Inra, Inserm, the École Normale Supérieure, the Joseph Fourier, Paris-Sud, and Pierre and Marie Curie Universities, and the commercial company Fermentalg have joined scientists from Belgium, Italy and the USA in decoding the characteristics of the photosynthesis process in diatoms at the molecular level.

Decoding the photosynthesis mechanism in diatoms

Both energy, in the form of the ATP molecule and reducing power, in the form of the NADPH molecule must be produced in a defined proportion in the chloroplast in order to fix CO2 by photosynthesis. In diatoms, the molecular mechanisms used to manage the ratio of ATP to NADPH require sustained exchanges between the chloroplast and the mitochondrion, the cellular organelle responsible for respiration. This process facilitates photosynthesis and has certainly contributed to the ecological success of diatoms in oceans across the world.

The discovery of this mechanism linking photosynthesis and respiration in diatoms opens the door to a wide range of possible biotechnology applications, including increased production of biomass for the manufacture of useful molecules, using light to trigger photosynthesis together with sources of carbon to feed respiration.

Provided by CEA

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