Toward the next biofuel: Secrets of Fistulifera solaris

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Biofuels are an attractive alternative to fossil fuels, but a key challenge in efforts to develop carbon-neutral, large-scale methods to produce biofuels is finding the right organism for the job. One emerging candidate is the microalga Fistulifera solaris. An international collaboration between scientists from Japan and France has revealed the genome of F. solaris and provided exciting hints at the roots of its ability to grow and produce oil at the same time.

Biofuels made from plant-produced oils are an attractive alternative to fossil fuels. However, the enormous amount of arable land needed for production and the competition between their uses as food/feed and fuel present obstacles to the production of biofuels from crops. These considerations have led to focus on microalgae as oil producers. Microalgae are tiny photosynthetic organisms found in both ocean water and freshwater. They grow quickly in liquid culture and can produce high levels of oils. In fact, the omega-3 fatty acids present in fish are actually produced by microalgae that are eaten by the fish. Institutions throughout the world have generated collections of wild microalgae in efforts to find species with desirable characteristics.

One such microalga is a species of diatom called *Fistulifera solaris*, which is emerging as a promising candidate for next-generation biofuel technology. Diatoms are microscopic algae that are major contributors to marine ecosystems; they are also the basis of diatomaceous earth, which is used by gardeners as a natural pest deterrent. Not only does *F. solaris* grow quickly and produce high levels of oils, it does both at the same

time, unlike other oil-producing microalgae that produce their highest amounts of oil at stages when they grow slowly, if at all. These characteristics make *F. solaris* an excellent candidate for batch culture to produce biomass from which oil for biofuels can be harvested.

F. solaris was originally isolated from samples taken at the junction of two rivers in Japan. A collaboration of scientists in Japan and France aimed to elucidate the molecular underpinnings of simultaneous growth and oil production by sequencing the genome of *F. solaris* and also cataloguing the transcriptome - providing a read-out of all genes expressed at a given time. Lead scientist Dr. Tsuyoshi Tanaka of the Division of Biotechnology and Life Science in the Institute of Engineering at Tokyo University of Agriculture and Technology, highlights the need for this information, saying "Biofuel production using photosynthetic organisms such as microalgae is one of the most promising approaches to generating sustainable energy. However, the molecular functions of organisms such as oleaginous microalgae remain unclear, thus hampering efforts to improve productivity". Tokyo University of Agriculture and Technology.

More information: The Plant Cell orcid.org/0000-0001-9504-1152

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