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NATURE

Microalgae with super-powers ?

Microalgae are highly diverse microorganisms with a strong biotechnology potential, which could play an increasingly important role in our lives, particularly in food, health, cosmetics and energy… Let's have a look!

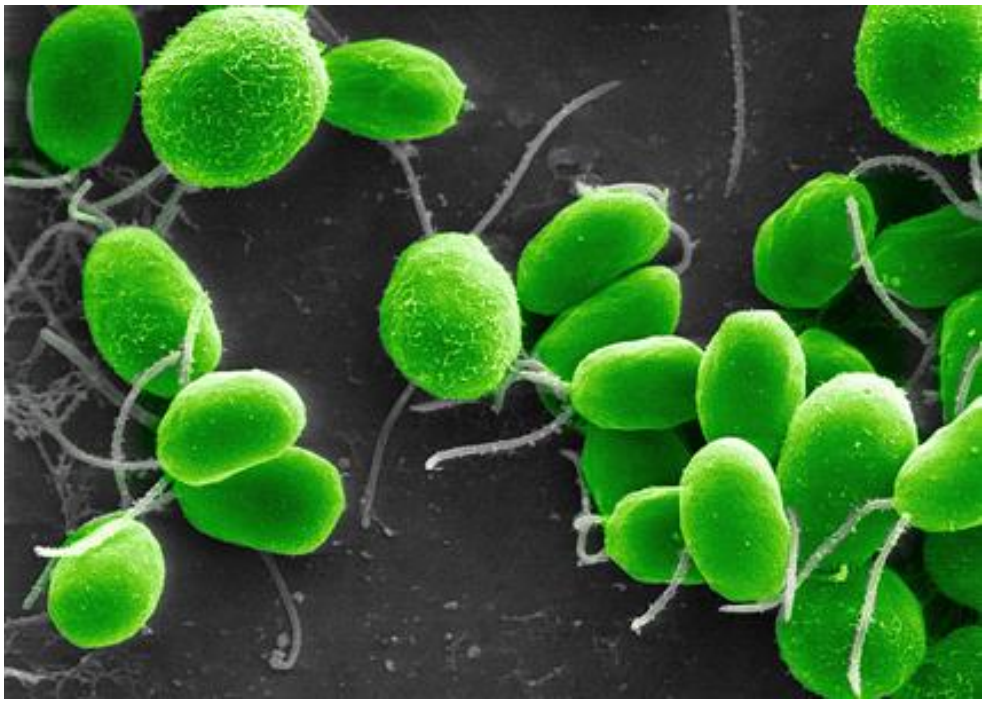
First of all, let's clarify the term "microalgae". It designates microscopic algae, invisible to the naked eye, unlike those you may encounter in the sea - macroalgae. For the most part, these microalgae live in a pelagic aquatic environment, meaning that they can be found in open water, from the bottom to the surface. However, they can also grow on soils, rocks or trees. Even more surprising, some microalgae can survive and colonize extreme environments! For example, the alga *Dunaliella salina* has the particular ability to grow in extremely salty environments: moreover it is responsible for the pink color of the salt marshes of Camargue. But then, what is the common point between all microalgae? It is their main source of energy: light. Like plants, most algae have chloroplasts. They are organelles capable of transforming light energy into chemical energy and then into carbon ! Known as photosynthesis, it is responsible for the microalgae's autotrophy (ability to produce organic molecules by themselves in the presence of inorganic or mineral elements).

They also have the particularity of being an important source of micronutrients: their vitamin content is sometimes higher than plants. They are also a primary source of (polyunsaturated fatty acids such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) - essential for the development of the nervous system. Some microalgae, such as *Dunaliella salina*, have a high content of beta-carotene, an orange-coloured compound, providing antioxidant properties. Microalgae are therefore used in the cosmetics industry but also as food supplements.

Now a little riddle: what is round, green, and moving?

It is *Chlamydomonas reinhardtii*, the star of microalgae ! This green freshwater microalgae, whose body is actually a single cell and has two flagella allowing it to move and reproduce. It can be grown in a laboratory in a solid or liquid in a laboratory in a solid or liquid medium, in light or dark (in the presence of nutrients). In addition, it has a generation time of only a few hours. All these properties make it an ideal model for future biotechnology applications.

In medicine, researchers have recently produced cancer molecules by transfection of chlamydomonas cells. In industry, some experiments focus on algoculture. To do this, microalgae are grown in photobioreactors



or illuminated open basins. The interest of these large-scale crops is that microalgae have the particularity of using CO_2 in the air to produce oxygen and multiply. In addition to cleaning up the atmosphere, they also produce compounds of interest, such as lipids, which can be used for biofuels.

Currently, bioethanol and biodiesel are produced from plants such as beets, soybeans and sugarcane. However, there is very few arable land so it is impossible to grow plants for both biofuels and food.

Chlamydomonas reinhardtii could therefore make it possible to produce the fatty acids that composes the biofuels but also those oils present in our food. Indeed, C. reinhardtii is capable of producing intracellular lipid droplets under stress conditions, such as nitrogen deficiency. However, its low fat yield does not make it competitive with current means of production. Synthetic biology could improve its production performance or the quantity of oil stored, thanks to efficient molecular tools.

If you've been following us from the beginning, you certainly know that this is the goal of our palm oil project!

Sterna-Sarah Chichportich et Pauline Morin

Team iGEM Sorbonne Université 2019