Microalgae Cell Culture System Delivers Increased Transfection Efficiency

A matrix-mediated cell culture system

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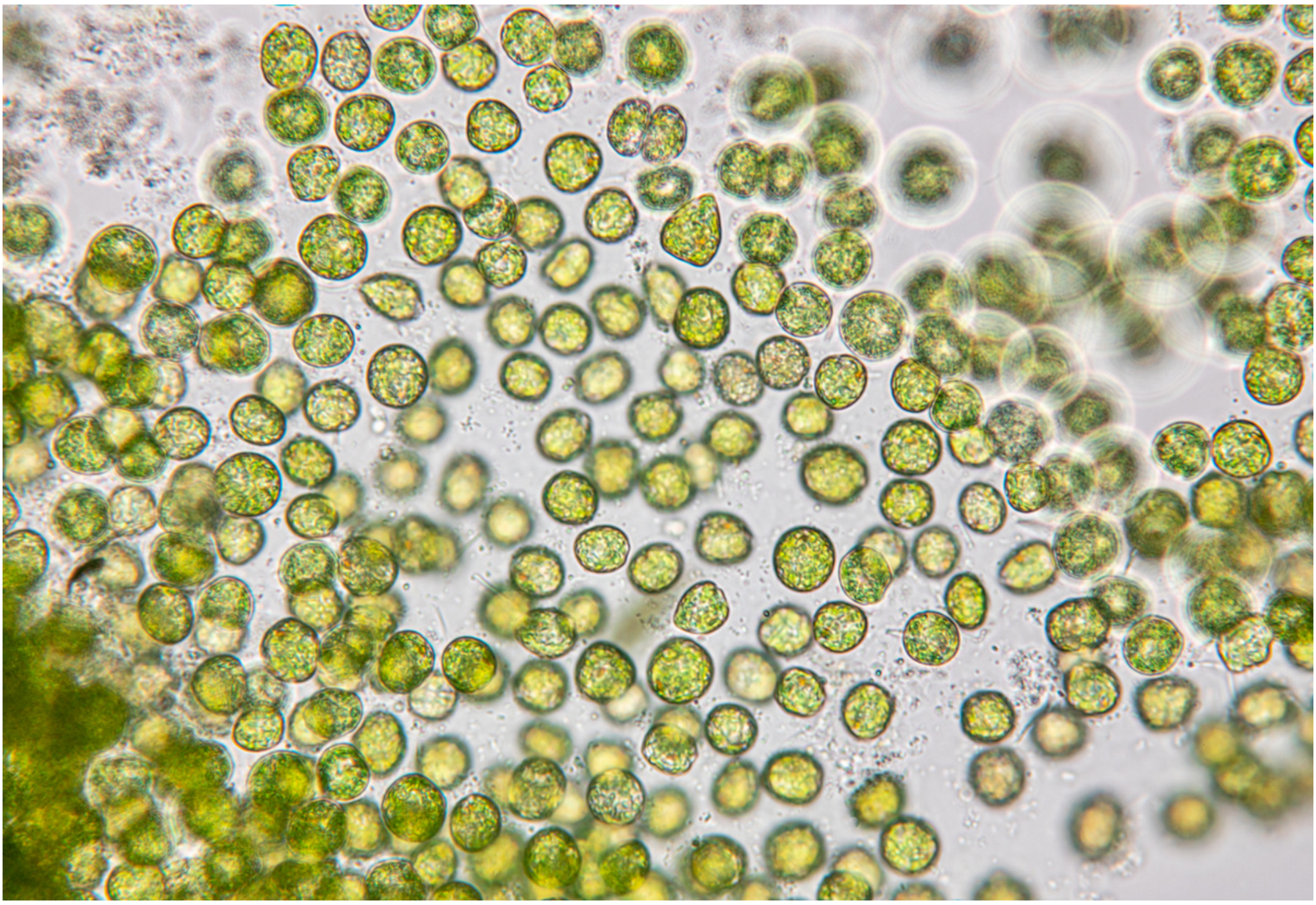

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Background

Microalgae are good candidates for heterologous protein production and have several added advantages over traditional platforms such as plant cell cultures.

Firstly, like cultured plant cells, many species of microalgae can be grown in the dark by utilising a carbon source for energy requirements. This means they can successfully be cultivated in industrial bioreactors. Unlike plant cultures, however, microalgae require relatively simple and affordable media for production. They can also be preserved cryogenically indefinitely. This is an important advantage, as algal isolates that have been identified to have industrial application can be evolutionarily halted via cryogenesis, ensuring a high degree of consistency and low batch variation in terms of heterologous protein production, among other possible applications.

An additional advantage is that microalgae are naturally single-celled and need not be synthetically manipulated first to grow in this state. As such, microalgae have several associated advantages over synthetic plant cell cultures. These include not requiring complex plant hormones for culturing, and most importantly, they can be screened for industrial applicability *a priori.* This is due to the fact that a single microalgal cell possesses the biochemical and genomic potential of the entire species so that numerous species can be screened simultaneously for a specific trait, such as industrial applicability. It is also easier to culture algal cells.

However, a drawback of using microalgae cell cultures is that microalgae have low transfection efficiency in culture, partly due to the small size of algal cells and thus reduced contact between the algal cells and *Agrobacterium spp.* in culture.

In response to this problem, researchers at the University of Cape Town (UCT) have designed a matrix-mediated algal cell culture system, Algal Cell Pack (ACP), which also increases the transfection efficiency of the microalgae.

Technology Overview

1. A microalgae cell culture system with a porous matrix, cell culture and a vector for a heterologous polypeptide.
2. A cell culture system and method of screening a microalgae species for its ability to be transfected by a vector using the cell culture system.
3. A cell culture system and method of screening a population of different microalgae species to identify a microalgae species that has the ability to be transfected with a vector using the cell culture system.

4. A method of producing a heterologous polypeptide using the cell culture system.
5. A method of harvesting endogenous compounds from microalgal cells.

Benefits

The ACP allows specifically for microalgae to be placed in porous columns for high throughput screening purposes or for industrial heterologous protein production once suitable species have been identified. This is done via microalgal incorporation into a porous matrix made of diatomaceous earth.

Another advantage of the ACP is that it allows for high efficiency of genetic manipulation of the cell population as well as ease of screening, which is currently not the case with plant cells.

Applications

The ACP can further be applied for the screening of environmental samples containing not one species of microalgae, but all microalgae from an ecology simultaneously for their ability to be genetically modified and to produce heterologous proteins. This application does not require division of the ecology into separate isolates and allows for even more efficient screening of suitable species.

Once suitable species have been identified with this method, high genetic transformation rates of the algal population allow for large amounts of heterologous protein production on an industrial scale to be performed which is another advantage over using plant cells.

Opportunity

UCT is seeking a development partner or a licensee.

Patents

- Priority Application in South Africa ZA2018/08076
- PCT/IB2019/060330
- European Application EP19815466.7
- United States US17/298059
- Australia AU2019389307
- South Africa ZA2021/04012

IP Status

- Patent application submitted

Seeking

- Commercial partner
- Licensing