Media release
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Developing more sustainable food systems of tomorrow with microalgae-based proteins

Singapore – The new research project 'Urban Microalgae-Based Protein Production' is set to establish a resilient and sustainable agri-food platform, in a step towards more sustainable food systems and greater food security. It is led by the Singapore-ETH Centre, together with the National University of Singapore (NUS) and Agency for Science Technology and Research's (A*STAR's) Singapore Institute of Food and Biotechnology Innovation (SIFBI).

It is projected that by 2050, up to 68 per cent of total human population will live in urban areas. With a limited amount of land for agricultural production in cities, innovative food systems are required for food security. In Singapore, the ambitious '30 by 30' target calls for an increase in capability and capacity to grow 30 per cent of total food needs locally and sustainably by 2030. In highly urbanised and land-scarce Singapore, meeting this goal through traditional food production methods alone will be challenging. While the demand for conventional sources of protein, such as meat and seafood, remains high, the production of these proteins tends to be resource-intensive and puts a strain on the environment.

In recent years, meat and seafood alternatives have become more commonly available. However, many alternatives tend to use soy or wheat as key ingredients, meaning considerable land resources are still required to produce them.

A new research project, which starts on 1 January 2022, will develop more sustainable methods to produce protein based on microalgae.

"Microalgae-based food products are good sources of protein, with high protein content of up to 70 per cent, vitamins, well-balanced amino acid profiles, and good ratios of polyunsaturated fatty acids. What is currently needed to make them commercially more viable are innovative processes that improve the eco-efficiency and productivity of microalgae supply chains," says Prof. Alexander Mathys, lead principal investigator of the project in Singapore, and Assistant Professor of Sustainable Food Processing at ETH Zurich.

The 'Urban Microalgae-Based Protein Production' project will produce bright yellow microalgae-based protein concentrates in an urban setting under heterotrophic conditions (in the absence of light). Furthermore, the project will incorporate consumer insights to innovate food concepts to better meet consumer needs and preferences.

Prof. Mathys has been working on increasing the efficiency and sustainability of value chains in food and feed at ETH Zurich, as part of the ETH World Food System Center's 'Novel Proteins for Food and Feed' flagship project. In the new project at the Singapore-ETH Centre, he is collaborating with the Department of Food Science and Technology at NUS, and SIFBI at A*STAR, as well as food production and ingredient processing companies.

"The goal of this project is not only to develop nutritious microalgae-based seafood alternatives, but also to establish a platform to produce them efficiently in an urban facility and in a cost-effective way, by using process technologies such as extrusion and 3D printing," says Associate Professor Liu Shao Quan from the Department of Food Science and Technology at NUS, who is the second lead principal investigator in this project. "By capturing organic nutrients from the side streams of processing tofu, beer or other food products, our approach embodies sustainable circular economy concepts in food production," he adds.

Taking a whole value-chain approach, the project combines emerging microalgae concepts with technological and process innovation, with a clear goal of developing a tangible food product concept. As a matter of fact, some meat and seafood alternatives have at times met with low consumer acceptance when cost, nutrition, taste, texture, and smell were not sufficiently tailored to the preferences of the local market. Therefore, the team will not only develop emerging food concepts in a laboratory and establish innovative processes for industrial production, but also ensure consumer acceptance and commercial viability.

The researchers will take a reverse engineering approach, incorporating consumer insights and collaborating with Swiss and Singapore-based food producers such as Nestlé and ingredient processing companies such as Bühler, Givaudan, Planted Foods, and Sophie's Bionutrients to co-create food concepts. The Singapore Food Agency will play an advisory role and provide feedback on the project's R&D direction and decisions.

Based in Singapore, the three-year research project is supported by the National Research Foundation, Singapore (NRF) under its Campus for Research Excellence and Technological Enterprise (CREATE) programme.

Heterotrophic Microalgae-Based Protein Production
(Full-resolution image available here)

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About the Singapore-ETH Centre

The Singapore-ETH Centre was established in 2010 as a collaboration between ETH Zurich and Singapore's National Research Foundation (NRF). Based in the NRF's Campus for Research Excellence and Technological Enterprise (CREATE) in Singapore, the centre is the only research centre set up by ETH Zurich outside Switzerland. Today, the centre runs the Future Cities Lab Global, Future Resilient Systems, Future Health Technologies and a range of research projects to develop practical solutions to some of the most pressing challenges, including sustainability, liveability, resilience and health.
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About CREATE

The Campus for Research Excellence and Technological Enterprise (CREATE) is an international collaboratory housing research centres set up by top universities. At CREATE, researchers from diverse disciplines and backgrounds work closely together to perform cutting-edge research in strategic areas of interest, for translation into practical applications leading to positive economic and societal outcomes for Singapore. The interdisciplinary research centres at CREATE focus on four areas of interdisciplinary thematic areas of research, namely human systems, energy systems, environmental systems and urban systems.
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