From Nature to Bedside

1 Building the Algae4IBD Collection

Health Potential

Cyanobacteria, micro- and macroalgae produce an infinite number of molecules, many of which have properties beneficial to health. They can relieve pain, alleviate inflammation, or boost our microbiome. Therefore, we believe it can be a source of treatment for IBD.

Growing Algae

We grow our algae in photo-bioreactors. In these machines, we control their growth by adjusting light, CO_2 concentration, and temperature – important conditions for algae to thrive. By creating the ideal artificial environment, we produce maximum amounts of our algae, while going easy on nature.

Sustainability

With the right equipment, algae cultivation has a low environmental impact. They are also an efficient way to capture carbon dioxide.

Why?

To find the exact compound that will fight inflammation and may be useful for treating IBD, we need to isolate and test it.

Breaking Algae

The desired compounds are inside the algae cells. How do we get them? We have to break the algae cells, which can be done with ultrasound, for instance. These sound-waves of 20 kHz and higher cause the algae cells to vibrate so heavily that they break, releasing all the different inner compounds.

Extracting Compounds

Once we have released the compounds from inside the algae cells, we separate them. After all, each compound can have different effects, so we want to test them individually. To do this, we use solvents. These are liquids that will pull the desired compounds out of the mix of released molecules.

2 Identifying Compounds

Compound Structure

To produce the compounds, we need to determine their 3D structure. How many carbon or oxygen atoms are present? How are they connected?

3D-Scanning of the Compounds

One of the techniques we use to do so is nuclear magnetic resonance. We place the compound between magnets. With the magnets, we set the compound's atoms in vibration. We record and analyse the vibrations and get a clear picture of what our compound looks like.

Producing Compounds

Since we now know their 3D structure, we know which building blocks we need to synthesise the compounds. In a sequence of chemical reactions, we let the building blocks interact with each other and build our compounds step by step.

3 Testing Compounds

Why?

We test the most promising algal compounds on different organisms to demonstrate if it can relieve inflammation or demonstrate their effects on the gut microbiota.

Gut Bacteria

As IBD is linked to gut bacteria, we test the compounds on both good and bad bacteria to find those that act as prebiotics or antibiotics.

Importance

By doing the trials on human cells, animals, and bacteria, we can determine if the compounds revert patients' IBD symptoms. It will also help us understand the patient-specific responses to the different compounds. This is important to make the treatment of IBD more effective.

Human Relevance

We test the most promising compounds on cells from IBD patients. Tissue obtained during a colonoscopy is grown in the lab and the algae compounds are added to it.

4 Characterising Compounds

5 Scaling Up Production

Why?

To be able to produce the products we aim to for treating IBD we need to produce compounds on an industrial scale.

Macro Algae

Macro algae need larger areas to grow and proximity to the sea. They also take longer to grow than microalgae. But they can be an interesting source of compounds and be used in new functional food.

Challenges

Commercial microalgae cultivation needs expensive photo-bioreactors to provide enough light and nutrients for the algae to grow and be kept alive. Multiple steps are also required to extract and purify proteins and bioactive compounds to be produced at a commercial scale.

Possible Solutions

Bioreactors placed in regions with much sunlight such as the Algarve in Portugal, use less energy than in-door reactors. Learning more about different algae strains and how a targeted compound production can be triggered by changing culture conditions can also be a solution to improve product yield.

6 Focusing on IBD Patients

IBD

IBD is a complex disease whose incidence is steadily increasing. Patients require tailored therapies which are often expensive. Yet, not everyone responds to the available treatments, leaving some with only one option: surgical removal of parts of their bowel. Therefore, a great need for new medication exists.

Algae & IBD

In our oceans, rivers and lakes lies a nearly untapped potential to improve our health. However, most algae remain unstudied, with their health potential unexploited.

Solutions

We aim at developing functional food, food supplements, nutraceuticals, and pharmaceuticals to prevent and relieve IBD symptoms.

Impacts

With Algae4IBD we hope to increase patient well-being, reduce hospitalisations and health care costs and to generate new revenues and solutions.

Algae4IBD

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