Is Red Seaweed the Next Big Thing in Plant-Based Protein?

by **Tara DiMaio** - *July 4, 2019*

Earlier this year, GFI announced the winners of our inaugural Competitive Research Grant Program. Thanks to the generosity of two visionary donors, we were able to allocate three million dollars in research funding to fourteen scientists from all corners of the globe—from Estonia to China to Israel—for critical, open-access research in plant-based and cell-based protein.

Over the next few months, we will dive into each project with the scientists leading the charge. Today we start off in the U.S., where technologist and ocean entrepreneur Beth Zotter is researching a unique source of plant-based protein: red seaweed. Red seaweed has a high protein content and a remarkable umami flavor. Its “red-meat like attributes” are perfectly fit for alternative protein products.

Zotter and her team at Trophic LLC are creating a method of protein extraction specifically for seaweed. They aim to test different protein concentrates to find the best fit based on cost and quality, as well as to characterize the taste and texture of different species. Zotter is transforming the possibilities for seaweed. She spoke to us about how the plant “can feed the world,” the importance of nori, and even a species that tastes like bacon.

What about seaweed is most exciting to you?

Humans have been eating seaweeds for thousands of years, but for those of us who weren't raised in Asian food culture, seaweed might seem like a novel food product. When I compared the world record yield for soybeans and seaweed, I was amazed to learn that seaweeds are capable of producing five times as much protein per acre. I had to check my math a few times. Seaweed can quite literally feed the world. And it’s delicious. I'm starting to see a lot

more people, especially kids, gobbling up seaweed, and that gets me really excited.

What are the advantages of researching plant-based meat in the U.S.?

The culture of entrepreneurship, especially here in the Bay Area. We have many world-class biologists and chemists who tend to circulate in early-stage biotech companies. They all have a mindset of pushing the boundaries of science and technology, motivated by the power of making something new with an impact.

Why did your team choose to work with red seaweed?

Red seaweeds tend to have the highest protein levels, which is actually responsible for the red color. We think the protein content and color has some unique advantages for making meat alternatives.

How many species of red seaweed are you studying to find the optimal fit for protein functionality?

We are starting with the species that are already commercially produced in large volumes. At the same time, we are testing seaweeds such as dulse that have high value as specialty food products. Dulse is famous for tasting like bacon when it's fried, but right now it's mostly wild harvested, making it more expensive than we would like for raw material. However, our company is engineering high tech sea farms that could potentially lower the cost of seaweed farming dramatically in the near future. Next year we are deploying a $5M state-of-the-art farm 10 miles off

the coast of New Hampshire. I'd like to grow dulse.

Why does red seaweed already have a large global supply chain?

Red seaweed has an already-established global supply chain of over 18 million tons per year. Most of the current production is grown to extract agar and carrageenan for processed food products, where they enhance gel strength. If you brushed your teeth this morning or ate ice cream last night, you consumed a bit of seaweed as well. Both toothpaste and ice cream often contain polysaccharides (carbohydrates) from red seaweed, which are found in many foods and cosmetics as a thickening agent. Agar also plays an important role in biological research. It is a popular growth medium for microorganisms as the base lining in a Petri dish. The next largest seaweed category by volume is nori. Nori is a red seaweed with the highest measured protein content (up to 47 percent) of any seaweed I know. Nori is common in Japanese cuisine in soups, salads, and as a wrap for sushi rolls.

What unique food science experience does your team bring to the project?

We have a number of people helping us out with a mix of experience in algal chemistry, protein extraction, process engineering, and food product development. Our lab is located in Berkeley, in the heart of the Bay Area food tech ecosystem, which is great for tapping into the wealth of insights for what features to look for. In addition to protein, we're evaluating the potential for other compounds to make a protein concentrate more valuable as a food product. For example, many seaweeds have vitamin B12.

Wouldn't it be great if we could keep that essential nutrient for vegans in our product?

What do you anticipate the main challenges will be?

Making a product that meets the specifications of food product developers, at a cost point that is affordable. There are lots of sophisticated process techniques available in the lab. But unless those methods are scalable, it might not make sense to go down that path. There's also the question of what to do with all the rest of the stuff besides the protein! Designing a process with valuable co-products is another priority for us.

Wow! Can you imagine a world where seaweed is the queen of protein? Red seaweed has an impressive protein content, and yet is most famous for the gel-like properties of its carbohydrates. The team at Trophic is transforming this plant commonly used for food additives into a sustainable source of food for the world. Zotter sees the potential for red seaweed to join the fast-growing market of plant-based protein. Her innovative approach will no doubt lead red seaweed to shine.

Check out all of the projects here! For a deeper dive, GFI senior scientist Dr. Erin Rees Clayton contextualizes all fourteen plant-based and cell-based meat projects within current industry challenges.

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