

# Katherine Helliwell

**K**atherine Helliwell is a molecular microbiologist based at the University of Exeter and the Marine Biological Association in Plymouth, UK. The Helliwell Lab studies the fundamental biology and environmental responses of photosynthetic marine microbes. Katherine was awarded the SEB's 2022 President's Medal for the Cell Section.



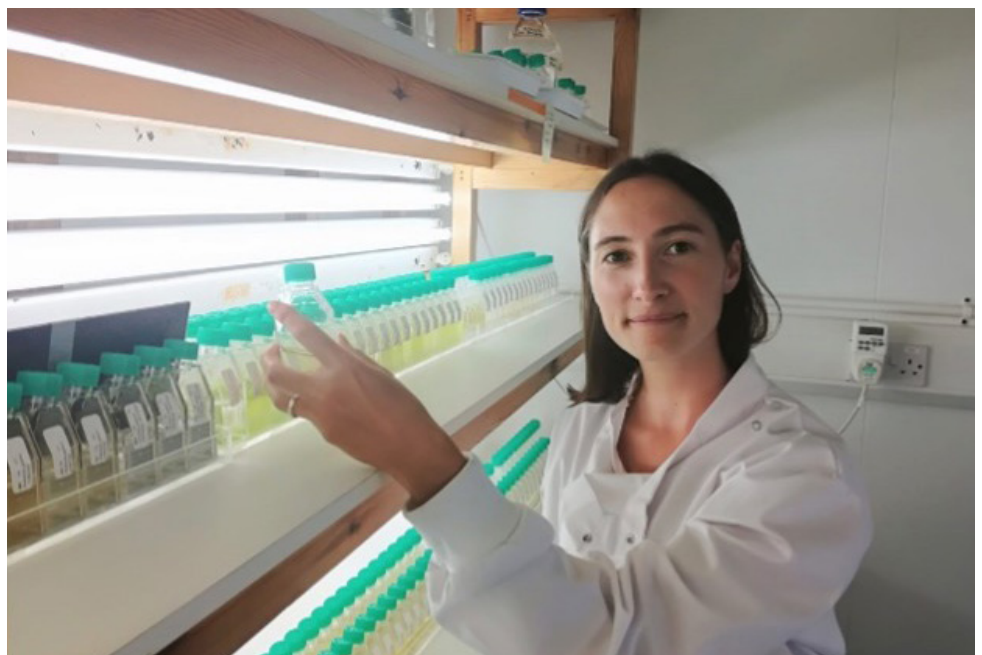
investigating the role of vitamin B12 in mediating algal-bacterial interactions, in Prof. Alison Smith's lab in the Department of Plant Sciences at the University of Cambridge. My fate was sealed. Once you start working on algae it is hard to go back, they are fascinating from their evolutionary diversity and metabolic complexity to their amazing shapes and forms under the microscope. Whilst I began working on a freshwater green alga *Chlamydomonas*, 'Chlamy', I became drawn to marine algae due to their ecological significance sustaining life in the oceans. This led me to join the Marine Biological Association (MBA) in Plymouth, working on algal signalling as a postdoc with Prof Colin Brownlee, before setting up my own lab, holding a joint appointment between the MBA and the University of Exeter.

## *What is your lab working on currently?*

My lab aims to advance understanding of how an important group of marine algae, the diatoms, interact and are controlled by their dynamic environment. Diatoms are particularly successful bloom formers, and so it is important to understand the metabolic attributes enabling them to respond rapidly to abiotic and biotic factors. One of our current focuses is investigating how diatoms sense fluctuating supplies of vital nutrients such as phosphorus. We are employing a suite of approaches to characterise the mechanistic basis of diatom nutrient sensing pathways, combining molecular methods (e.g. CRISPR-Cas9) with live-cell imaging of single diatom cells to visualise early signalling events. Another major focus of our work is investigating the biotic interactions

## *Tell us about your background. How did you transition from plant science to studying marine microbes?*

I've been fascinated by biology for as long as I can remember, but I realised Plant Sciences were my passion during my undergraduate degree at the University of Bristol, where I soon began to specialise in plant biology modules. This led me to choose a final year research project in Prof. Keith Edwards lab, investigating new molecular methods aiming to diversify wheat. During my degree I also became fascinated by the spectrum of symbioses between organisms, and particularly enjoyed a parasitism module led by Prof. Richard Tinsley, who I still remember describing a remarkable specialised interaction between a desert toad and a parasitic flatworm. Following my time in Bristol, I found a PhD project that captured my interests in both photosynthetic life and biotic interactions:



Above: Katherine in the lab with algal cultures of The Plymouth Culture Collection held at the MBA that hosts many different algal cultures including several of the strains isolated by Mary Parke.

of diatoms with bacteria. We are coupling marine sampling methods in order to isolate environmentally relevant diatom-interacting bacteria and to bring these into the lab. Using this sea-to-the-lab approach, we are isolating and characterising novel antagonistic bacteria of diatoms from the Western English Channel, where diatoms frequently bloom.

Beyond providing fundamental new insights into diatom biology, this work has the potential to inform algal bloom prediction and management strategies, plus potential applications for algal biotechnology, for instance, optimising production of desirable products such as novel anti-microbials, nutritional supplements (e.g. vitamins), and even fuel.

#### *What does a typical day look like for you?*

After dropping my son at nursery I enjoy a walk to the seafront, whatever the weather! Once in my office, my daily tasks vary considerably and may include meeting students, paper and grant writing, reviewing and examining, data analysis, planning projects, meeting colleagues and collaborators, and preparing and giving lectures. Sometimes I even manage to get into the lab!

#### *What do you most enjoy about your work?*

Those moments of discovery, when you go into the lab to check an experiment, or when a student comes to share new results, are hard to beat. I also love talking and collaborating with other scientists – working in a field with people who are so passionate and knowledgeable feeds the mind and the soul. Another great satisfaction of my work is seeing students

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develop as scientists, build their confidence, and find their feet as their projects advance. I also love to spark students' interest in the importance of algae.

#### *What do you find most challenging?*

Figuring out why something isn't working can be a hard (but often a very satisfying) part of the job. Grant and paper rejections are always pretty tough. Finding the time to do everything you want to do and read all the papers you want to read is also a constant balancing act.

#### *What is your lab hoping to work on in the future?*

A key ambition I have is to further develop our ability to couple characterisation of algal cell and molecular

processes in the lab with environmental approaches, enabling us to test the importance of such mechanisms in natural algal populations.

#### *What advice would you give to aspiring scientists in this area?*

There is so much to be done and discovered in this field, with many new tools and resources at our fingertips – the sky's your limit! Find something that stimulates your interest, and people you like working with. It is an exciting time to be a marine microbiologist! However, be sure to make room in your life for other things – that is also so important.

#### *Who are your scientific heroes?*

I am inspired by the outstanding work of the marine phycologist Mary Parke. Her research in marine biology labs in Plymouth from the 1940s pioneered the isolation of many new species of single-celled algae, which she meticulously picked from seawater with a hand-drawn pipette. Many of these strains are still maintained in culture collections across the world today, and provide an invaluable resource for modern day phycologists studying algal cell biology. Mary also made many important observations with her cultures, including identifying specialised cellular features of algae, such as the 'haptoneema' of Coccolithophores, the role of which is still not fully understood. Alongside eminent algal biologists, I am also in awe of the biochemist Dorothy Hodgkin who discovered the structures of penicillin and vitamin B12, which has been so important to my own work! Last but not least are the great scientists I have worked with and who have helped me grow and develop along the way.



*Left:* Light microscopy image of a mixed culture of diatoms including the centric diatoms *Odontella sinensis* and *Thalassiosira weissflogii* (credit Glen Wheeler, MBA).

#### **Selected Publications from SEB journals**

Scaife MA, Nguyen GTDT, Rico J, Lambert D, Helliwell KE, Smith AG. 2015. [Establishing \*Chlamydomonas reinhardtii\* as an industrial biotechnology host](#). *The Plant Journal* 82, 532-546.