Richard Tennant

Richard Tennant is a Senior Research Fellow at the University of Exeter, UK. His research focusses on understanding microbial diversity in a range of natural and industrial environments. He uses conventional and imaging cytometry alongside NGS techniques in his work. His team utilises portable, long-read sequencing devices to allow for rapid analysis in the field.

Tell us about your background. How did you first become interested in microbial ecology and biofuels?

I've always been fascinated by analytical techniques, and the ability to identify completely unknown samples. This was one of the reasons I chose Forensic Science at Nottingham Trent University as an undergraduate degree; for me it was the perfect blend of analytical sciences with a dash of law and criminology. It was here during my dissertation project that I was first introduced to using molecular techniques for taxonomic classification. It was also my first introduction to the trials and tribulations of PCR! After my undergraduate degree, I completed an MSc in Biocatalysis at the University of Exeter. The MSc featured a six-month research project in conjunction with an industrial partner, which gave me valuable experience of research partnerships and communication and showed me how you can apply research in the real world.

Afterwards, I joined Professor John Love's team, also in Exeter, as a research technician, operating a flow cytometer and other high-throughput equipment. We worked on a range of microbes, including *Botryococcus braunii*, a green microalga capable of producing long-chained hydrocarbons. *B. braunii* has a lot of potential for biofuel production but was also a majority contributor to Type 1 kerogens: precursors to crude oil. I later started a PhD at Exeter, focussing on developing techniques to extract microfossils (e.g. pollen, diatoms and microalgae) from lake sediments in sufficient quantities for sensitive downstream techniques such as radiocarbon dating and DNA sequencing. By analysing DNA purified from 8,000 year-old *B. braunii* microfossils, we were able to confirm that these microfossils were *B. braunii* and to perform palaeogenomic analysis against extant cultures. During this time, I also started performing metagenomic analysis on lake sediment samples to investigate whether we could identify *B. braunii* without needing to purify the microfossils from the sediment prior to DNA sequencing.

Since then, I've continued to apply metagenomic and metatranscriptomic techniques to a range of different natural and industrial environments such as soil, anaerobic digesters, and silage. This enables us to study how and why the microbes are responding to their environments.

What are you working on currently?

I'm currently involved with a range of different projects, but they all focus on the demographic and functional classification of the microbiome. Recently, I've begun investigating the microbes involved in anaerobic digestion: the biological degradation of waste products for the production of biomethane. It's a fascinating balance of microbes, all working in harmony to produce a hugely important product. The metagenomics alone don't give us the full picture, and it's only through collaboration with chemists and engineers that we can begin to understand how these microbes respond to the digester environment and what interventions we can make to maximise the production of biogas.

Above: Richard taking soil cores during his PhD with one of his supervisors, Dr Richard Jones (down the hole!).

What does a typical day look like for you?

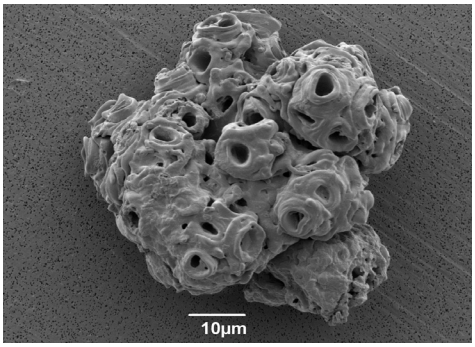
It's incredibly varied, and sadly there is increasingly less time in the lab these days as I begin to take on more of a PI role. There is usually a project update meeting of some kind, either with our team in Exeter, across the wider research programme, or with our industrial collaborators. I try to ensure that I'm available and accessible to the lab group wherever I'm working from, and tools such as Teams have really helped with that. There are bioinformatic tools constantly being developed and refined by the community, so I'll invariably have a terminal window open to one side analysing new data and trying new methods.

What do you most enjoy about your work?

The people. Working in such a multidisciplinary environment, and with industrial partners, allows me to interact with so many people, with such a rich diversity of backgrounds and interests. The excitement of developing a new project is something that never goes away. Enabling staff and students to learn new techniques, and to see them take that knowledge and apply it themselves is incredibly rewarding too.

What do you find most challenging?

Over the last two years, transitioning from a post-doc role to more of a PI role has had its challenges. I think of it like stepping out from under the umbrella of your own PI and ensuring you can keep dry as possible, but inevitably you're going to get a bit of rain on you! Trying to keep up with all the incredible research in environmental metagenomics (or any topic) is always a challenge. Also, with a young family, the constant juggling of home and work is hard, but learning to be realistic with what I can achieve in a day is something I'm getting better at.



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What are you hoping to work on in the future?

I hope that one day I can point to something and say 'I was part of that'. Using our expertise and techniques to understand microbial processes is fantastic, but applying this knowledge to something with real impacts on society and the environment is where I hope we can really play our part.

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

Try. It's better to have tried and failed than not tried at all. I really try to emphasise this to new staff and students. If you have an idea, give it a try. Some of my best work has come out of conversations around a 'crazy idea' that was 'worth a try'. Getting involved across a project is important too, not only for you to understand how your part integrates, but also to give others an appreciation of your work. This is incredibly important on big projects, and in my experience often leads to greater collective success.

Who are your scientific heroes?

I've interacted with incredible scientists, and I'm continually inspired by the work that I see across the scientific community. I've always looked to Professor Ken Haynes and Professor Chris Turney as examples of how to do great work while making sure it is fun at the same time. I've also had the privilege of working with Dr George Littlejohn, who is not only a brilliant scientist but also a fabulous role model for being a good member of the scientific community. Dr Karen Moore is a fantastic advocate of giving everyone a chance, and Professor Rob Lee and Professor John Love both still encourage me to push the boundaries. Dr Richard Jones is someone I try to emulate on daily basis. His care and compassion for his colleagues, students, and collaborators, coupled with fantastic science, made him my scientific hero. While he sadly passed away a few years ago, not a week goes by without me thinking 'what would Richard do?', and I use that as my basis for moving forwards.

Left: An SEM image of an exemplar *B. braunii* colony which was sorted by flow cytometry and confirmed as *B. braunii* via DNA sequencing. *Right:* Richard performing DNA purifications, on site, in the back of a car to enable identification of the effect of storage on the sediment microbiome.