Distinguished Research Medal winner Professor Greg Cook is passionate about his work – and it is this passion that is driving him towards a breakthrough in the international fight against TB.

Long before Professor Greg Cook discovered science, he wanted to be an athlete like his idol, record-breaking runner John Walker.

Cook dedicated himself to the discipline of training, putting in the time and the miles to improve his performance.

As a teenager he was competitive at a national level, but unforeseen knee problems led doctors to advise him a running career was no longer an option. His dream of becoming the best was shattered.

“I was devastated, but perhaps this was a key moment as it drove me towards my other passion – science – and all my energy went in that direction,” says Cook.

At university, two of his biology professors helped to fuel that fire when they discovered microbial life living in thermal hot springs in Rotorua. When they started investigating to see if their findings could be useful in industry, Cook was hooked.

“There was academic interest in extremophilic bacteria, but it turned out that the enzymes from these bacteria – extremozymes – had incredible potential as biological catalysts in industrial applications. That combination really captured my imagination and I think it still appeals to young researchers today.”

Cook should know. As head of a team leading the world in research into the biology of life forms living in extreme conditions, he’s just been awarded the University of Otago’s
highest research honour, the Distinguished Research Medal.

His pioneering work has recently led to a potential breakthrough into drug treatment for such fatal diseases as tuberculosis, which is one of the world’s major killers.

Cook has even achieved a level of immortality, having had a bacterium named after him – *Amphibacillus cookii* – and having inspired new generations of students at his research lab within the Department of Microbiology and Immunology.

When Cook was a doctoral student, he worked at a thermopile research unit at Waikato University, visiting thermal springs around Lakes Rotorua and Taupo to collect samples of bacteria living in these extreme environments up to pH 10 and at temperatures around 100 degrees.

“Trying to isolate bacteria with novel metabolic properties was very exciting research and, even better, was the fact that we were one of the world-leading laboratories and many international researchers came during this period to learn from us.”

Cook now runs his own world-leading lab, but before that came years of postdoctoral work at Cornell University in the US, and King’s College London and the Krebs Institute (University of Sheffield) in the UK. While overseas he began to build his own international reputation and made contacts he is still collaborating with today.

“Distance is a challenge for New Zealand scientists,” he says. “I made my connections by working overseas and I advise my students to do the same. Science is a very small world. Everybody knows one another. We’re all connected by a common thread and you become part of the scientific family by doing good work. Once you are known and respected people will want to work with you.”

Cook currently works with other world-class institutions around New Zealand and in the US, the UK and Germany, bringing a wealth of talent and funding to the University.

The last year has seen a perfect storm of scientific breakthroughs, published papers and publicity, culminating in the award of the Distinguished Research Medal.

Cook credits his team. “The reason we have won this award is not because of what we have done in the last two years, but because of what we have done over the last 20 years. Being a scientist is like being a runner. You have to be prepared to put in the time in the laboratory and, for a long time, there is no glory or medals.

“I often tell my postgraduate students that if you can survive the tough times when experiments are not working and remain focused with good work habits, then the rest will take care of itself.
"Passion is a key ingredient in this success – it is hard to maintain the drive if you don’t love what you do. Microbiology for me has never been a job – I just enjoy it too much."

“Part of my passion comes from a desire to work on something that is incredibly important for human health. That project for us is the fight against tuberculosis, which is one of the greatest threats to world health. In 1993 it was one of the first infectious diseases declared by the World Health Organization to constitute a global health emergency.

“TB is killing around 5,000 people a day. Men, women and children are dying of tuberculosis, and big pharma have largely opted out of drug discovery, particularly diseases of poverty. This, of course, represents a wonderful opportunity for academic labs like my group to enter the war against TB.”

Cook’s team may have identified a key factor in its fight. “Our research is focused on trying to understand how human pathogens like *Mycobacterium tuberculosis* metabolise and grow in our bodies. If we can cripple this ability to metabolise, we are confident we can develop new strategies to treat TB patients.”

It has been a long-standing mystery as to how mycobacteria can survive in our bodies for extraordinarily long periods in the absence of growth and at low oxygen levels. Understanding this mystery is vital to eradicating the large human reservoir of latent TB. Microbes can lie dormant for years – as in TB patients whose disease appears to be under control – but can come to life when conditions are right.

Cook and his collaborators have worked out how mycobacteria can survive long periods with little or no oxygen. The bacterium can switch its cellular metabolism from a primarily oxygen-based one to one that uses fermentation for energy production instead, recycling molecular hydrogen until it can source sufficient oxygen to grow again.

Cook’s team now knows how the hydrogen energy system works and how it is regulated. They have already shown how intervention can reduce the microbe’s survival rates a hundredfold. Now they hope that they can use their knowledge to disturb the survival process in *Mycobacterium tuberculosis*.

“The key thing we have to do now is to translate our findings into a new drug for TB. We’re on the verge of doing that with our latest compounds, but it’s still a little way off.

“Remember that out of 100 new potential drugs discovered, probably 99 will fail – it’s such a hard area. Then there is the time factor. One new drug took 18 years to reach the market. Testing is not trivial."
“However, drug-resistant tuberculosis disease is becoming such a problem and such a threat that we are starting to see a relaxation of rules around approval. A case in point is the first drug licensed for TB in 40 years – it took only seven years from discovery to use in humans, despite unexplained deaths in clinical trials.

“The drug targets we are working on have the greatest potential to shorten the long treatment period for tuberculosis from months to weeks, which would be a fantastic outcome for patients. Watch this space.”

While Cook would consider the discovery of a new drug to counter TB a career highlight, he takes even greater pride in his role in mentoring the 50 postgraduate students he has trained since starting at Otago in 1998.

“The greatest thrill I get out of science is watching my postgraduate students grow as scientists in my group and then go on to have outstanding careers. These students are my extended family and I consider them my greatest contribution to microbiology.”

NIGEL ZEGA

Photo: Alan Dove