

Salt of the Earth

Prudence Mutowo can really identify with the organism she studies. After all, they have a lot in common. She told **Vienna Leigh** about researching a recently discovered archaeal species, *Haloferax volcanii*, which thrives in extreme conditions – and coming from Zimbabwe to the UK to pursue her career, Prudence is no stranger to those.

“I naturally expected to have a culture shock when I came to the UK,” says the University of Nottingham PhD student, who was originally able to come to study for her master’s degree thanks to a prestigious British Chevening Scholarship^{w1} for overseas students. “I expected the people, food, currency, language, culture and weather to be totally different. It didn’t disappoint, especially the weather!”

Unlike Prudence, though, the organism she studies challenges the definition of environments that we

term habitable – and much as they may hate the weather, even visitors from tropical climes can’t go so far as to describe the UK as uninhabitable. “*Haloferax volcanii* thrives in very salty environments like the Dead Sea,” explains Prudence. “In such concentrations, DNA and protein aren’t able to form crucial interactions for vital cellular processes. Most organisms exposed to such extremes of salt are known to die in such conditions. Also, *Haloferax volcanii* is known to have a complex internal system, yet it exists as simple single cells that are

easy to study. I had to learn more!”

Prudence grew up in Mutare, the fourth largest city in Zimbabwe, and credits such an environment for much of her interest in pursuing science. “Zimbabwe has a diversity of animals and wildlife, so the surroundings themselves provoked questions about the origins of life and issues of species diversity,” she remembers. “School provided some of the answers I was looking for, as we had an environmental science lesson every week.”

After studying for her bachelor’s degree in biochemistry at the

Victoria Falls, Zimbabwe

Image courtesy of Prudence Motowo



University of Zimbabwe and five years of research and development work in pharmaceuticals, Prudence was awarded the Chevening Scholarship by the British Council to study a master of science in applied biotechnology at the University of Nottingham^{w2} in September 2003. Part of her motivation in applying for this course was the chance to undertake an industrial placement with a UK pharmaceutical company, to see how this compared with her experience in Zimbabwe. During this fulfilling and interesting time, Prudence attended a lecture on halophilic (salt-loving) organisms (see box) by her current supervisor, Dr David Scott^{w3}. The Scott Group work on a variety of biophysical and biological problems centred on how organisms deal with and process biological information. Current projects study olfaction, archaeal transcription, aggregate structure and formation in pharmaceutical preparations, and development of methodologies to cope with non-ideal highly concentrated solutions. Fascinated, Prudence had found the perfect subject for her PhD research.

However, having an invitation to stay and continue her research wasn't

enough; Prudence had to finance her stay somehow. "Being a non-EU candidate, I wasn't eligible for many of the funding awards available, and I was faced with raising £11 000 [approximately €16 000] per year to continue," she says. "Considering how engrossed I had become in this research, I wasn't letting it go easily! I applied for every possible award I could find, and was lucky to receive a one-year tuition scholarship from the international office at the University of Nottingham. This covered the research fees only, so I also worked extra time as a resident tutor as well as demonstrating science practicals for the masters and undergraduate course to pay my bills."

After two years Prudence was lucky enough to be able to continue her research with a fellowship from the L'Oreal-UNESCO Women in Science initiative^{w4}. The award recognises interesting and potentially useful research projects being carried out by young women from each of the five continents. "The eve of my birthday, when I was informed I was a recipient of the fellowship, was the most memorable moment for me to date," she says. "The applications had had to be submitted through the UNESCO

commission in my home country, so after multiple cross-continent telephone calls, protracted periods of being kept on hold while the relevant person was located, and fax machines that seized up on the last page, my application was in. But with a whole continent to compete with, I was hardly placing my bets on this one.

"Had I not received the fellowship, it would have been nearly impossible for me to continue work. Now, *Haloferax volcanii* and I have been reunited for another year, at least until I officially complete my PhD."

Despite the hardships, though, Prudence never doubted that she'd made the right decision. "Researching in Nottingham has been wonderful for me. The university hosts top-of-the-range biochemical and analytical equipment, like the powerful analytical ultracentrifuges that allow the study of molecules in solution. This is ideal for looking at interactions that need to be maintained in an environment not unlike the Sea of Galilee," she says.

"I work alongside people from over 20 different nationalities, and the potential for exchange of ideas – cul-



Halophiles

Halophiles^{w5} are single-celled organisms that inhabit hypersaline environments. The mechanisms they use to cope with high salt concentrations are still not clear and hence are currently intensively studied. Some halophilic organisms, termed obligate halophiles, will die if removed from an environment with a high salt concentration.

BACKGROUND

turally, scientifically and socially – is amazing. The connections between research institutes within the UK and Europe has allowed me to go to Switzerland, France and other labs within the UK for conferences and laboratory sessions.”

In March 2007, Prudence was privileged to attend the Biovision Life Sciences Forum in Lyon alongside 100 other PhD students from all over the world, and listen to talks by “five life-science Nobel Prize winners! It was inspirational to be given a chance to speak to the people who had discovered the very tools I am using in my research,” she says.

She’s totally dedicated to continuing a career in science after finishing her PhD. “I would love to do more science communication as I find it very rewarding, and would also like to get involved in science policy and science and society activities,” Prudence says. “But I’ll definitely stay in research. I love its unrestricted nature, in that it allows you to focus on a question or issue and pursue the answers in as many different ways as possible.

“Another huge attraction is that research has the potential to yield great benefits to human life. The findings from my own research, for example, may be applicable in understanding the possible origins of life as well as understanding the ability of some

organisms to inhabit extraterrestrial environments – a field known as astrobiology. Enzymes from extremophilic micro-organisms have great potential in natural resource processing in the petroleum, detergent and food industries.”

And what about her own adaptation to her extremes in environment? “Though it took a while to get used to the UK, I was not expecting to feel like an outsider when I eventually returned to my home country for a brief holiday,” she says. “Friends had got married and moved on; the sunny climate I had enjoyed seemed overly warm. The food tasted a bit strange and, in an unexpected twist, I missed the cold!

“But as we were approaching London, the captain announced that the ground temperature at Heathrow was -2 °C. I had walked out of a tropical summer’s day to sub-zero temperatures. But I was so happy to be back to salty organism research... and the serial tea-drinking!”

Web references

w1 – The British Chevening Scholarships award scholarships to overseas students in more than 150 countries to study in the UK. See www.chevening.com

w2 – The University of Nottingham website: www.nottingham.ac.uk

w3 – For more information on Dr David Scott and his group at the University of Nottingham, see www.nottingham.ac.uk/biosciences/lookup/lookup_az.php?id=ODAzMTg5&page_var=personal

w4 – For more information about the L’Oreal–UNESCO Women in Science initiative, see www.loreal.com/_en/_ww/loreal-women-in-science/

w5 – Wikipedia entry for halophiles: <http://en.wikipedia.org/wiki/Halophile>

Resources

To read about halophiles on the ThinkQuest website, a site for children, written by children, visit <http://library.thinkquest.org/CR0212089> and click on ‘Enter Site’ then ‘Halophiles’

‘Wild Things: The Most Extreme Creatures’: an article on the LiveScience website: www.livescience.com/animals/050207_extremophiles.html

For more information on extremophiles in general and microbial life in hypersaline environments in particular, see Carleton College’s Microbial Life Educational Resources: <http://serc.carleton.edu/microbelife/>

