

Studentships

THE STUDENTSHIP POOL includes selected BEng, BSc and BSc Hons graduates who are full-time students registered at tertiary education institutions (TEIs) for Master's and PhD studies and whose studies may be partly funded by the CSIR, in addition to other funds being made available by TEIs and other sources. Candidates must work on CSIR research projects, under the joint supervision of CSIR staff and TEIs involved. Following successful completion of their studies, the studentship candidates form a strengthened pool of appropriately-qualified students from which the CSIR will increasingly fill professional research positions at entry level.

Flagship initiatives within the CSIR include the laser-science studentship programme. Some 16 postgraduate students are currently registered on the programme, which is managed by the CSIR National Laser Centre. Senior CSIR researchers mentoring the current crop of students include Dr Andrew Forbes, Dr Anton du Plessis, Dr Lourens Botha, Dr Christoph Bollig and Dr Sisa Pityana.

Ledger is a technology development project managed by the CSIR and funded by the Department of Defence through Armscor. Students at the universities of Stellenbosch, Cape Town, Pretoria and the Western Cape are awarded post-graduate grants to complete Master's and PhD degrees on a full-time basis in technical disciplines of interest to the South African National Defence Force (SANDF). Ledger allows science, engineering and technology specialists to hone their skills, while the defence topics they focus on are also of particular interest to the wider defence community.

Another strong studentship initiative to promote human capital development in the information and communications technology domain resides within the Meraka Institute. Studentships were initially funded from a Department of Communications grant and are now funded by the Department of Science and Technology.



Faranani Ramagoma
with his mentee, Master's
student Nokukhanya
Mfumo, in the background

Riding the waves of opportunity from Limpopo to Europe

Born in a small village, Ha-Makhitha in Limpopo, he studied at some of Europe's best universities. Now Abel Ramoelo is back to make a difference and share his knowledge with the rest of South Africa's geo-information science and earth observation communities.

MOST OF US HAVE SEEN IT. Few of us believe it and live it. It's a popular wall poster adorning many corporate offices. In the middle, a photo of arid agricultural land clearly in need of rain. Below the picture, the word **Opportunity** grabs your attention. This is followed by the phrase: "At the heart of every difficulty, lies opportunity." Abel Ramoelo, researcher within the CSIR earth observation (EO) research group, lives by this philosophy.

From humble beginnings, Abel has accomplished much in his relatively short life to date. The 26-year old recently obtained his Master's degree in geoinformation science (GIS) and earth observation (EO) for environmental modelling and management.

The degree was made possible by a scholarship from the European Union's Erasmus Mundus programme, which was granted while he was working as junior researcher at the CSIR in 2005.

Abel grew up in Ha-Makhitha village in Limpopo, where he completed his elementary and senior schooling. In grade 11, he won a mathematics olympiad, the Kentucky Bursary Fund, bagging prize money of R750 for his efforts. As a sign of early maturity and clear ambition, he spent most of that money on postage costs applying to universities.

Financial constraints were to prevent him from going to any university for some time. Ramoelo was undeterred.

In 2000, following what Abel refers to as a "concerted savings effort by my mother, aunt and uncle", he enrolled for a Bachelor's degree in environmental sciences at the University of Venda. He graduated top of his class and was named the best student in the School of Environmental Science. He obtained his BSc Hons in environmental science in 2003, passing with distinction.



Abel Ramoelo



The latest in GIS and EO – Abel Ramoelo using an analytical spectral device (ASD) field spectroradiometer to collect field spectra. The spectroradiometer collects electro-magnetic (light) energy reflected from a target in the visible, near-infrared and shortwave-infrared domains. These data are used to simulate air and spaceborne remote sensing data towards assessment of vegetation systems, e.g. gauging plant water, nutrient and disease stress and for applications such as species differentiation

Having first heard about the CSIR in 2004 when the organisation's representatives visited his university, Abel started at the CSIR in 2004 as a junior researcher. A year later he was off to Europe to study for his Master's.

"I had been doing research on a suitable Master's project when my then research leader, Humbulani Mudau, informed me of a scholarship offered by the EU Erasmus Mundus programme," Abel recalls. "I did not hesitate to apply and fortunately, I was accepted," he adds.

Abel made his first European stop at the University of Southampton – United Kingdom – where he did some introductory courses. During this time he was chosen to represent South Africa at the 2005 International Youth Summit on Climate Change in Canada. By June 2006, he had crossed to Sweden, Lund University, where he undertook advanced courses in GIS and environmental modelling. He stayed there for a month before touching down in Poland for some field work at the University of Warsaw. His Master's was completed at the Dutch-based International Institute for GIS and EO in 2007.

His thesis, titled *An innovative method to map land cover changes at a country level utilising hyper-temporal satellite images: A case study of Portugal*, was among the best five out of a class of 28.

Now, back at the CSIR, Abel is involved in a research project on the mapping of

ecosystem services and benefit flows. The project, which will be overseen by CSIR earth observation research leader, Dr Jan van Aardt, focuses on building CSIR scientific capacity in this regard. Other objectives include identifying stakeholders and beneficiaries of ecosystem services and benefit flows, and developing a leading international profile through scientific outputs, such as peer-reviewed papers, post-graduate theses, as well as conference proceedings. On a scientific level, the project is focused on providing information targeted at demonstrating the links between human well-being and ecosystem integrity, making useful inputs into the policy debate around ecosystem management, and developing questions and studies that will lead to case studies for mainstreaming biodiversity at policy level.

Abel says the South African fields of GIS and EO need a hands-on approach to match European standards. "The infrastructure for practical assignments blew me away over there," he says. "I'm eternally indebted, not only to the CSIR, but to the country at large, for offering me this great opportunity. I now have the responsibility of imparting some of those lessons learned to the rest of the local scientific community."

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He stresses the need to build networks. "We can't develop in isolation," he says. "To harness the European expertise, we need to work closely with them." Abel is optimistic about South Africa's research prospects. "In some aspects, such as mentoring and lecture hall teaching, I think South Africa comes out tops," he says. He regards his former research manager, Humbulani Mudau, and his mother as the people who've inspired him most. "Considering my background, where resources were not always readily available, I've also had to do much self-motivation." The thought of doing his PhD soon motivates him. "I need to settle down, having just arrived from Europe, then I'll be set for the next challenge," he says. "The opportunity will soon present itself and I'm ready to grab it."

– Lehlohonolo Mokheema

Tammy Whyte

Putting human safety first: finding creative solutions to safeguard our peacekeepers

TAMMY HAS ALWAYS BEEN fascinated by biomedical engineering, "I began my BSc in electrical engineering as a prerequisite for entry as a postgraduate student into the study of biomedical engineering." Now – some five years later – she finds herself newly qualified in one of the scarcest fields of study in South Africa: the research field of human effects. She enrolled for her Master's degree at the University of Cape Town under the supervision of Professor Gerald Nurick of the Blast Impact and Survivability Research Unit and will graduate later this year. "This field of research is relevant to the South African National Defence Force

(SANDF) and to the body of internationally available knowledge," Tammy confirms. It so happened that the work required for her dissertation was entirely in line with an Armscor project titled Aboma, which focused on armoured vehicle protection.

Becoming a full-time student

Tammy's CSIR studentship allowed her to devote her working hours to the study of human effects. This focuses on assessing the safety of occupants in landmine protected vehicles. "Vehicles fail on the lower

limb criterion," she explains. "Put bluntly, people break legs in vehicles when they drive over landmines." This factor impacts on the safety of occupants during wartime, but is also a risk to humanitarian efforts in post-conflict countries.

"Several factors worked in my favour during my studies," Tammy notes. "The topic of my Master's degree was in line with the Armscor project, which meant that I could do parallel write-ups on both the project and the dissertation." She also ascribes the success of her studentship to the support of her colleagues and the nature of the organisation, "An attitude

Tammy and 'the other man in her life': a Hybrid III 50th percentile male anthropomorphic test device (ATD) used to study human effects

Coming across Tammy Whyte in the somewhat austere environment in which the CSIR landwards sciences group operates, is a delightful surprise. She combines youthful good looks and charm with a singular focus on her field of study: developing injury criteria – an area that has been neglected to date in South Africa.



"I plan to use the skills developed in engineering to solve problems in the medical or biological domain."

of sharing, good teamwork and an openness to new ideas make it an inspiring environment in which to work and study."

"Singling out people will make it look like the credits at the end of a movie, but underlines the attitude of sharing that I mentioned," she says. "Theo van Dyk's wide-ranging knowledge of the real threat to military personnel and civilians in the field puts the human effects research in context. The practical expertise of Leon Broodryk and Deon Malherbe turned ideas into reality in the workshop. Rayeesa Ahmed conducted simulations to explore a range of possible solutions to determine which is the one most likely to succeed. And, when it came to the writing of my first paper, support was forthcoming from colleagues Izak Snyman and Frikkie Mostert. All along, David Reinecke, my supervisor, and the landwards sciences management team have provided enthusiastic support and guidance across the research area."

Tammy's project entailed testing on site at the CSIR in specially-designed facilities and at the Paardefontein test range north of Pretoria. Tammy has designed a system that would provide a force to a lower limb surrogate (a realistic-looking limb, complete with one sock and a boot) as it would experience within a vehicle during a landmine explosion. "The system is used

to test various parameters of lower limb surrogates," she notes. She explains that these parameters may affect the forces recorded and the ability of the vehicles to 'pass' or 'fail' during certification tests.

Her MSc (mechanical engineering) is titled *Investigation of Factors Affecting Surrogate Limb Measurements in the Testing of Landmine Protected Vehicles*.

Tammy's past, present and future

Her first acquaintance with the CSIR was through a friend; she completed a stint of vacation work at the end of her first year and secured a CSIR bursary for her undergraduate studies. Following her Honours year at the University of Pretoria in bio-engineering, she chose a topic for her Master's in line with her interest in bio-mechanics.

"Putting in daytime hours on my Master's during my CSIR studentship was an enjoyable time," she notes. The organisation allows students this freedom, which will change when Tammy is appointed full-time and project-attributable hours need to be logged. She advises those considering a studentship to select a topic carefully to ensure alignment with the strategic direction of a unit or group.

Her attendance at the NATO HFM (Human Factors and Medicine) event held in Canada earlier this year was the highlight of Tammy's working life. She joined a group of international peers from the Netherlands, Germany, Canada, Sweden, France, and the USA in Quebec at the DRDC Valcartier. "I found it most exciting to discuss results of recent tests. This international alliance provides a fantastic support base for research in the field of human effects. We are all members of similar defence organisations and as we conduct very similar research, we can share information and thus fast track our research through collaboration," she says. She intends to continue burning the midnight oil, "I'd like to work towards a further degree in injury criteria-related research. I believe there is a desperate need in the area of vehicle testing and validation for more information on this subject. Injury criteria enable us to relate measurements to injuries that humans would sustain, thus this research is broader than vehicle protection and extends to all situations in which a human may be harmed. If injury mechanisms and criteria are better defined and validated, we can begin to design improved protection systems that may ultimately save lives."

– Biffy van Rooyen

Eunice Ubomba-Jaswa

Unleashing
the beauty
of science
to make a
difference

For Eunice Ubomba-Jaswa, the beauty of science lies in applying academic knowledge to improve the quality of the lives of ordinary people. To her, her research project on the solar disinfection of water translates into a young disadvantaged girl not having to collect unhealthy pathogen-contaminated water, and spending half her life fighting illnesses, instead of going to school and acquiring an education. To her, science is a passion.

"SCIENCE LITERALLY MEANS 'knowledge' and I believe there is a lot of truth in the saying 'knowledge is power'," Eunice says. "I have always preferred mathematics to other subjects, because it's the one thing I have never struggled with," she adds. "It came naturally to me, and the good marks I got encouraged me to work harder at it."

Eunice was born in Ghana, but due to the nomadic nature of her parents' careers, she grew up in six different countries – Ghana, Nigeria, Zimbabwe, the United Kingdom, Botswana and South Africa. Her dad is in the population and development field, while her mother is a medical demographer. "Working in these particular fields has afforded them the opportunity to work in the academic and government institutions of different countries," says Eunice.

She studied at Canada's University of Alberta, where she obtained her BSc in medical laboratory science, before heading off to the London School of Hygiene and Tropical Medicine, where she completed her MSc in medical microbiology.

She now finds herself shuttling between Ireland and Spain, while working on her PhD project – the European Union (EU)-funded Solar Disinfection of Water (SODIS) research project. Eunice was awarded a Royal College of Surgeons, Ireland (RCSI) studentship to work on SODIS, of which the CSIR is part, shortly after joining the organisation in 2006. "My CSIR supervisor, Martella du Preez, gave me the SODIS research proposal to read and after I had expressed my interest, she suggested I send my CV to Dr Kevin McGuigan, SODIS coordinator and PhD supervisor, as he was looking for potential PhD students," says Eunice. "I was awarded the three-year studentship based on my academic record."

SODIS is a water treatment method that involves making water microbiologically safe by exposing it to sunlight in transparent containers (usually two litre plastic bottles) for a period of up to six hours. A synergistic effect of increase in temperature and ultraviolet (UV) light radiation leads to the inactivation of waterborne pathogens.

The main objective of the SODIS project is to show that solar disinfection of drinking water is an appropriate, effective and acceptable intervention against water-borne disease for communities that do not have reliable access to safe water, as well as in emergency situations, such as in the aftermath of a natural or man-made disaster. "The success of this project will see a reduction in the number of infectious diarrhoea deaths that occur worldwide due to poor water quality," says Eunice.

She says the focus of her research is to conduct microbiological studies on the response of yet untested important waterborne pathogens. She also has the responsibility of determining whether SODIS enhancement technologies, such as continuous flow reactor systems, and compound parabolic collector mirrors – that are meant to generate larger volumes of SODIS treated water in a shorter time – are efficient in the pathogen-inactivation process.

Her laboratory-controlled pathogen inactivation experiments will be conducted at the RCSI, where she can make use of a sunlight simulator, while other real sunlight experiments

will be conducted using solar reactors at the Plataforma Solar de Almería, a well-established solar research facility in Spain.

Eunice says she has learned to be more independent. "Conducting my research in countries that I have never been to or lived in, will ensure that I'm a more internationally-rounded, fluid and adaptable scientist," she says.

"Learning how academic institutions in other countries conduct successful research while learning from their mistakes, can only help enhance my input and contribution to the CSIR on my return."

In the long term, Eunice hopes to be an inspiration to aspiring African women. "I want them to challenge the stereotypes. I wish to show people all over the world there are young African women who strive to excel in their respective fields," she says.

She regards her parents and siblings as her biggest motivators. "My parents have given my sisters and I

an inheritance of a good education, which has opened doors for us." Her CSIR supervisor, Martella, is also a good influence.

"Today's researchers are very competitive and everyone is trying to get ahead, so it is a privilege to have a mentor who is considerate and swift to share knowledge and information that enhance my career and personal growth."

Her motto is to live life in the best way possible and in the process, influence and change other people's lives for the better. She advises young researchers not to be 'pigeon-holed' into one field early in their careers. "Young researchers must take time to find out where their passions lie, so that they can make a real difference," she says.


"After all, that is what it's all about," she concludes.

– Lehlohonolo Mokhema



"Science literally means 'knowledge' and I believe there is a lot of truth in the saying 'knowledge is power'."

Looking for answers in every water droplet is Eunice Ubomba-Jaswa who works on the SODIS project



Perseverance – the essence of his science

Experimenting with science was almost a luxury at the rural high school where Faranani Ramagoma and his classmates matriculated. Without adequately-equipped laboratories, it was only in grade 12 that Faranani was able to experience the thrill of quality experiments. These days when he is excited about an experiment, it is difficult to keep him out of the lab – even over weekends. But maybe he is making up for lost time. Faranani's passion for science took him beyond the sparsely-equipped laboratories at Ralson Tshinanne Secondary School situated in the idyllic village of Ngovhela, about 2 km north of Venda's capital Thohoyandou.

FOLLOWING MATRICULATION, his friends pursued studies in commerce and other fields. Faranani, supported by his parents, was the only learner from his group to read towards a degree in science and in 1999 enrolled for a BSc, majoring in biochemistry and microbiology at the University of Venda. "My parents agreed that I should choose a career that I would be happy with for the rest of my life," he says.

At the age of 26, Faranani has already accomplished much – he is the only person from his remote village of Ngovhela (pronounced 'ngobela') in Venda to have graduated with a degree in science to date, and more recently he became the first scientist to be awarded a studentship from CSIR Biosciences since the reconfiguration of the CSIR.

Experiencing the tough side of science

Faranani completed his Master's degree in microbiology at the University of the Free State (UFS) last year. Without a second thought, he decided to enrol for a PhD thereafter. The CSIR studentship programme is sponsoring these studies. "I figured, 'why wait?'; at Master's level the super-



Faranani Ramagoma's research centres on yeast expression systems, which like the human cellular system, fall into the category of eukaryotes

Faranani Ramagoma's goal for the future is to one day join the ranks of developed scientists contributing to the upliftment of South Africa's science and technology base.

visors tend to spoonfeed you and you are hardly involved at an intellectual level. At PhD level, the project becomes your baby, you conceptualise it and are very much part of its execution – you are the main shareholder," says Faranani, whose ambitious nature urges him to pursue challenges, one of the reasons why – when his Master's project took a turn for the worse in 2004 – he willingly followed his supervisor, who had relocated from the UFS to the CSIR. "Research is unpredictable. Sometimes things just don't go as planned. I encountered glitches and had to re-plan but time was not on our side. Then (Dr) Bethuel (Nthangeni) received an offer to work at the CSIR and since I was still working on my project, he suggested I come to round up my MSc here."

Under the guidance of Dr Michel Labuschagne, his colleague in the yeast expression systems research group, and supervisor Professor Martie Smit of the UFS, Faranani is focusing on developing the yeast *Yarrowia lipolytica* as host for the overproduction of extra-cellular proteins in preparation for his PhD. "We are looking at certain genes involved in the regulation of extra-cellular proteins," he explains. "The idea is to genetically engineer the genes in this yeast to produce any kind of protein." According to Faranani this

technology – when fully developed – could be applied as a tool to produce vaccines to target diseases such as hepatitis, influenza and malaria.

Faranani is working on a second project involving glyco-engineering, where the group is aiming to engineer *Y. lipolytica* in such a way that its glycosylation (a process of adding sugar residues to proteins) pattern is similar to that of humans. "We are trying to humanise the *Y. lipolytica* glycosylation pathway so that when they produce proteins, at least they'll be compatible with the human system," he says.

Contributing to human capital development

It is his enthusiasm for science that he wishes more people from his village could experience. While they do receive television and radio signals, Faranani believes their lack of exposure to real science through, for example roadshows, is a barrier to understanding its impact on their lives. "They need people on the ground to relate to and as far as I know I am the only scientist that comes from that village."

Faranani commandeered his own learning process by attending outreach

programmes in neighbouring Thohoyandou while he was at school. And while completing his undergraduate degree, he returned to his former school as often as possible to give learners there a glimpse of what a career in science entails. Lately, Faranani has taken to mentoring Nokukhanya Mfumo, a Master's student in his research group at the CSIR.

Future plans

"I feel there is room in the science domain for much more to be done. Look at the HIV pandemic – it is still a serious problem and it has already been around for more than 20 years. As Africans we should stop looking at other countries and do our in-house science to get things done without worrying whether the US or other countries will provide. They have more advanced equipment, but that shouldn't be an excuse for us not to progress," he adds almost scoldingly.

"In the next five years I want to be on par with other developed scientists so that I can say I've contributed to the development of science in South Africa and exposed some more people in Venda to science. The CSIR has devised a good platform for people like me who are students to learn and at the same time get exposure to the application of science techniques. My horizons have been broadened and I'm sure many others on this kind of programme will say the same." For now he plans to successfully steer his PhD project to fruition even after his three-year studentship comes to an end.

– Asha Speckman