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new voices IN science 2015

22
PhD students
share their research

The cover picture by Prof Le Fras Mouton, is of an armadillo lizard, the research subject of Chris Broeckhoven, a finalist in our science talk category. These little dragons roll up and bite their tails when they feel threatened, hence their scientific name Ouroborus cataphractus. *The* Ouroborus *is an ancient Greek symbol for self-reflexivity, depicted by a serpent or dragon eating its own tail.*

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Prof Wim de Villiers
Rector and Vice-Chancellor

foreword

We are very proud to bring you the 4th edition of *New Voices in Science*, in which another group of our PhD graduates share their research with the public.

Since Stellenbosch University launched *New Voices in Science* in 2011, there has been a mushrooming of science communication initiatives in South Africa, reflecting the international growth in this field. We believe that *New Voices* has retained its unique character – rooted in our original philosophy, but shaped by the lessons learned over these last four years.

The *New Voices in Science* programme includes researchers from all disciplines, in all ten of our faculties. In this context, ''science'' refers simply to the knowledge gained by systematic research. In this publication you will see insights from theology and psychology alongside the work of biomedical researchers and ecologists. Now, more than ever, conversations between disciplines are required to address the knowledge concerns of our time.

New Voices in Science does not oversimplify science, but rather invites dialogue and stimulates interest. While we do try to link our research to the everyday lives and concerns of the public, *New Voices* is not a sales pitch. In our communication, we emphasise the meticulous nature of scientific work.

Now, more than ever, conversations between disciplines are required to address the knowledge concerns of our time.

We do not want to change our researchers into journalists. But, by exposing them to science communication training in the *New Voices* programme, we aim to make them reflect on their work, and critically engage with their knowledge and the use it should be put to. We trust that their sincere effort to reach out to you, the reader, is evident.

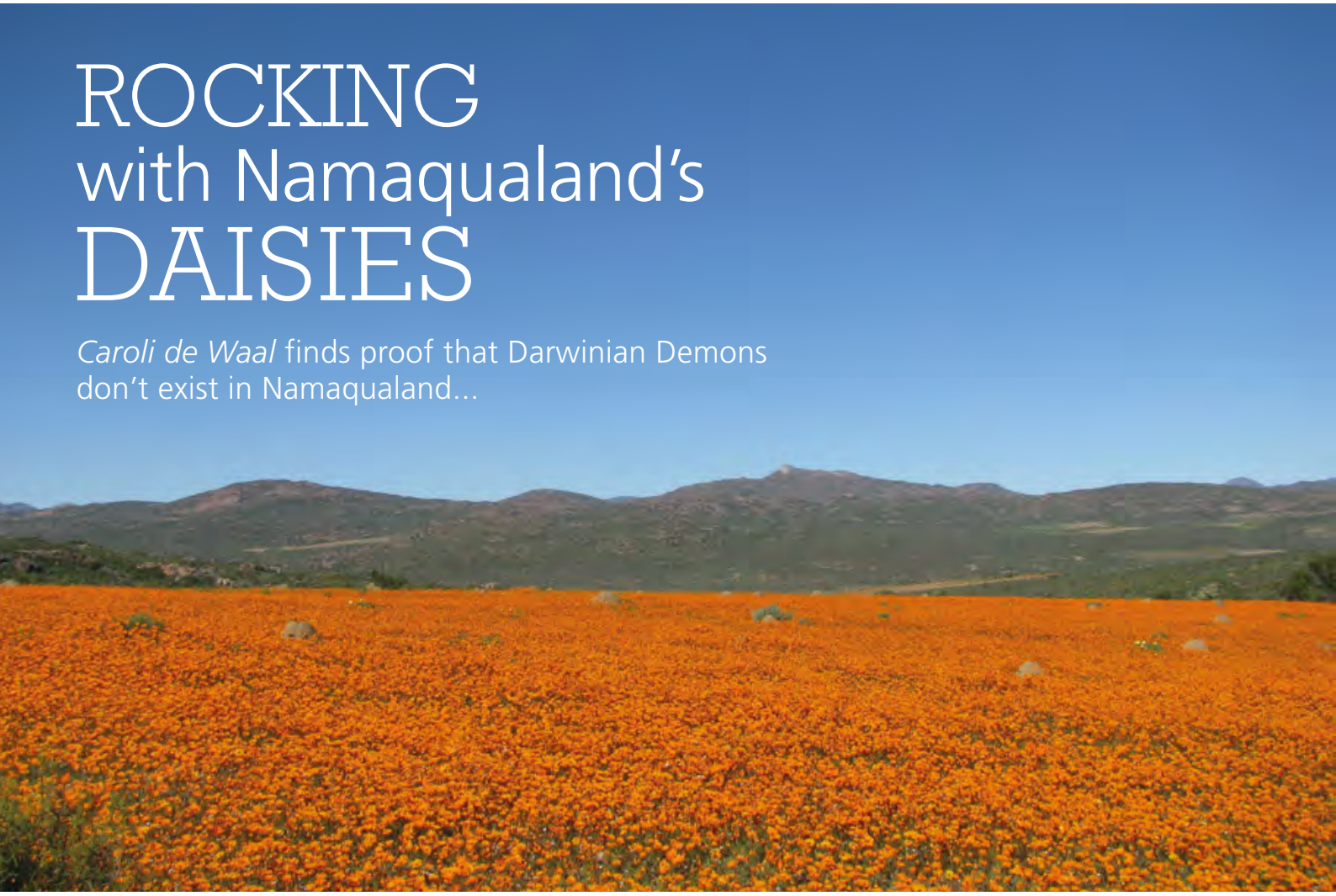
What a delight it is to read these articles! Like the Ouroborus lizard on the front cover, symbolising self-reflection or cyclicality, this publication aims to capture both the delight of discovery and the responsibility of the researcher for self-reflection.

In transforming our society – including our University – to become more inclusive and welcoming to all, we need to create a discussion in which everyone can take part. *New Voices* is an innovative attempt at doing exactly that.

Prof Wim de Villiers
Rector and Vice-Chancellor

ROCKING with Namaqualand's DAISIES

Caroli de Waal finds proof that Darwinian Demons don't exist in Namaqualand...



Let's try a thought experiment. Suppose you go out for dinner at a fancy restaurant, but doing so would mean you'd have to walk to work tomorrow, because you don't have money left to buy petrol for your car. This is an example of a *trade-off*, a term familiar enough in economics. But in the natural world, plants have to make similar trade-offs. All living organisms have a limited amount of resources to get by on, so organisms have to "choose" how they spend those resources.

An *evolutionary trade-off* is the reason why the ideal organism, the so-called "Darwinian demon" doesn't exist: an organism that can do all things well, will live indefinitely and outcompete all others.

Namaqualand daisies make similar trade-offs when it comes to dispersing their seeds, something that was believed in theory, but has now been proven using laboratory experiments with actual seeds. Species that can disperse their seeds over a large area don't have the ability to stay dormant, a strategy which would allow them to spread their seeds over time.

This is the finding of Caroli de Waal and colleagues from the Department of Botany and Zoology, following three years of studying daisies in the semi-desert Namaqualand region of South Africa.

Namaqualand daisies germinate and flower in time for spring, following the relatively reliable winter rains. But rainfall patterns change over time as a consequence of climate change and the area is prone to local disturbances such as farming and overgrazing. Therefore, these daisies have adapted to this risky environment using two distinct strategies: some stagger seed germination over many seasons (dormancy), while others spread their seed over a wide distance (dispersal).

The hypothetical "Darwinian demon" would be both a spreader and a sleeper. But scientists know that evolutionary theory says this isn't possible. However, few field biologists have tested this idea using living plants. And those who had tried it came back with contradictory findings.

To clear this up, De Waal and her team took 27 different daisy species into a lab and put them to work.

First, they measured the plants' ability

SPREADERS AND SLEEPERS

The spreaders
Here, seeds will spread from the mother plant using wings or plumes to catch the wind. Spread over a wider area, a plant's offspring can stand a chance of survival if something devastating happens to their home site, for instance if a farmer ploughs a field.

The sleepers
Seeds that are dormant will lie in the soil and only germinate years later, spreading risk over time. This means that there will still be viable seeds waiting to germinate after a drought has killed an earlier batch of seedlings.

Blown by the wind: most of these seeds from different Namaqualand daisies have tufts or wings, designed so that the wind can catch them and spread them about.

The glansooggousblom's (*Ursinia cakilefolia*) seeds don't spread far from the mother plant, but staggering their germination means there will be seeds in the ground even if a bad drought kills off the crop of young plants that year.

to spread their seed: they dropped seeds down a vertical perspex tube and counted how long it took them to reach the ground. The longer it takes to fall down the tube, the better the seed's ability to catch the wind, meaning it would spread well.

Then, the researchers incubated seeds from different populations in a growth chamber, keeping temperature, light and moisture all constant. They counted the number of seeds that germinated over a period of 30 days of constant watering. Viable seeds that didn't germinate were regarded as dormant.

The researchers then tested to see if there was a relationship between these two traits, while also taking into consideration whether species were closely related or not.

Their results show that the daisies' seeds which spread well generally aren't dormant in the soil. And those that are dormant, don't spread well. This shows that the theory was right: these daisies make an evolutionary trade-off between spreading their seed, and being dormant.

Biologists still don't fully understand the mechanisms that drive this trade-off, though. It may be that the resources used by a plant to create dispersal structures, such as wings or plumes, aren't available to make thick seed coats to allow a seed to be dormant. Namaqualand daisies may have to "choose" only one risk-reducing strategy at the cost of the other.

Evolutionary biologists are keenly concerned with understanding the evolution of dispersal and dormancy, because it may help them understand how plants will cope with the threat of global climate change. Climate change is expected to make important ecological factors less predictable. Rainfall, for instance, is expected to become much more sporadic in Namaqualand, meaning the daisies will experience more frequent "bad" years, so species that don't produce many dormant seeds may face a higher risk of extinction, because they can't escape these years of erratic rainfall. Dispersing well may not be a good enough risk-reducing strategy in the future, because seeds can't disperse far enough to escape the region entirely.

Just like we have to forgo that new pair of shoes in order to pay the monthly bills, this study shows that Namaqualand daisies trade one survival strategy off against another. It looks as though plant species' responses to tough environments are even more complex than previously thought.

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EMOTIONAL INTELLIGENCE MATTERS:

Leading from the INSIDEOUT

Shanil Haricharan finds a link between managers' emotional intelligence and the quality of their leadership

"She has a way of making every person she works with feel valued and important." That's how a colleague described Dr Rolene Wagner, the CEO at the Frere Hospital in East London, in the Eastern Cape. This is the kind of behaviour that makes Wagner an exemplary leader.

To gain deeper insight into the kinds of behaviours that influence leadership excellence, my doctoral research at the School of Public Leadership at Stellenbosch University examined the relationship between public service executive managers' emotional intelligence (EI), their behaviours, and the quality of their leadership.

During this research, I asked their superiors, sub-ordinates, peers and clients, to rate a group of identified managers using an EI survey tool. I also surveyed employees across the organisation, to measure their perception of their superior's leadership acumen. I picked the top five managers, who received the highest EI ratings and leadership nominations, and interviewed them. Wagner was amongst those.

For the first time in the South African public service context, we have evidence to show that an executive manager's EI is positively related to their leadership excellence. In my study, leaders like Wagner received the highest EI competency ratings, and also the most number of nominations as outstanding leaders.

A competency is someone's ability to act or behave appropriately in order to perform well in a job or situation. The model used in my doctoral research comprises twelve EI competencies, such as emotional self-awareness, empathy and adaptability.

Emotionally intelligent leaders possess strengths in most of these twelve competencies, organised in four clusters. They are aware of their own emotions (self-awareness); they effectively manage their emotions (self-management); they are aware of the emotions of others (social awareness), and are adept at managing the emotions of others (relationship management). These four sets of capabilities essentially define the concept of EI.

For most of the 20th century, people believed that the secret to great leadership lay in the leader's intellect or IQ. It was not until the early 1970s when David McClelland, head of psychology at Harvard University, questioned the validity of so-called "intelligence tests" in predicting success at work or in life. Instead, he recognised the importance of other types of intelligence, related to emotional and social abilities. In 1995, Daniel Goleman (once one of McClelland's students) popularised what is today commonly known as emotional intelligence.

In a transforming and turbulent South African public service sector, the study found that leaders who were inspirational, emotionally self-aware, adaptable, positive, empathetic, and coached and mentored others, were regarded as the most effective leaders. All these attributes represent EI abilities.

On her first day as the hospital CEO, Wagner demonstrated her EI competence when confronted by a 1 000 or so toy-toying managers, clinical professionals and workers who were striking to demand

their outstanding salaries and benefits be paid. The anger and resentment towards the hospital management team was palpable. Together with her management she started a process of consulting with the strikers and trade unions leaders. In her engagement, she was mindful of the strikers' emotions, and listened attentively. She made an effort to understand their perspectives, be aware of their feelings, and recognise their pain and how it affected their lives. These behaviours illustrate her deep sense of empathy – an ability crucial for social awareness.

Wagner was also attentive to her own emotions and feelings. She calmed herself prior to her meetings so as not to react impulsively or defensively. She was mindful of what was within and outside her control, and her strengths and weaknesses. This is an indication of her strong competence in emotional self-awareness and emotional self-control – two key EI abilities.

Over time, great leaders like Nelson Mandela have recognised the importance of self-awareness. While on Robben Island, in 1975, Mandela penned: "[I]nternal factors may be even more crucial [than] external factors such as one's social position, influence and popularity, wealth and standard of education… in assessing one's development as a human being… [development] is inconceivable without serious introspection, without knowing yourself, your weaknesses and mistakes".

The doctoral study results also indicated that a leader's EI competence plays an important role in how they cope within the perplexing and turbulent public service environment. Leaders with high EI competence positively influenced the well-being, motivation, creativity and performance of their subordinates and teams. In particular, EI strengths in relationship management, such as inspirational leadership, teamwork, and coaching and mentoring, are crucial for building strong and inclusive social bonds in the workplace.

Inspirational leaders like Wagner focused on engaging and inspiring people, promoting a culture of teamwork, valuing employees and encouraging their sense of affiliation. During her first year, over ninety percent of the outstanding salaries and benefits were paid to Frere employees. In her first two years as the CEO, she has, among others, inspired her 2 058 colleagues to transform the hospital, recording a significant reduction in child mortality, improving the provision of state-of-the-art clinical facilities, and noting a three-fold decrease in patient complaints and a four-fold increase in patient compliments.

In a complex and uncertain 21st-century environment, emotional intelligence matters for exemplary leadership. Emotionally intelligent leaders like Wagner develop and apply their EI abilities to positively lead from the inside out. The good news is that each one of us has the ability to acquire and improve our emotional intelligence – an essential part of the whole human.

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The hidden structure of **PLASTIC**

Mohau Justice Phiri explains

Bullet proof vests, the soles of your running shoes, shopping bags, water bottles, car bumpers, window frames, microwave dishes, ice trays, rubber ducks and hard hats all have one thing in common – they are made of plastic.

A new method for analysing plastic materials developed at the Department of Chemistry and Polymer Science will enable manufacturers to further develop plastic materials for ever-widening applications.

The reason for this wide range of applications is that the collective name "plastic" actually refers to a range of materials made out of polymers. Polymers are long chains of molecules created through a chemical process, most often involving molecules found in crude oil. Depending on the structure of the chain and the type of molecules used to build the chain, the polymer materials will have different properties. »

The hidden structure of plastic continued...

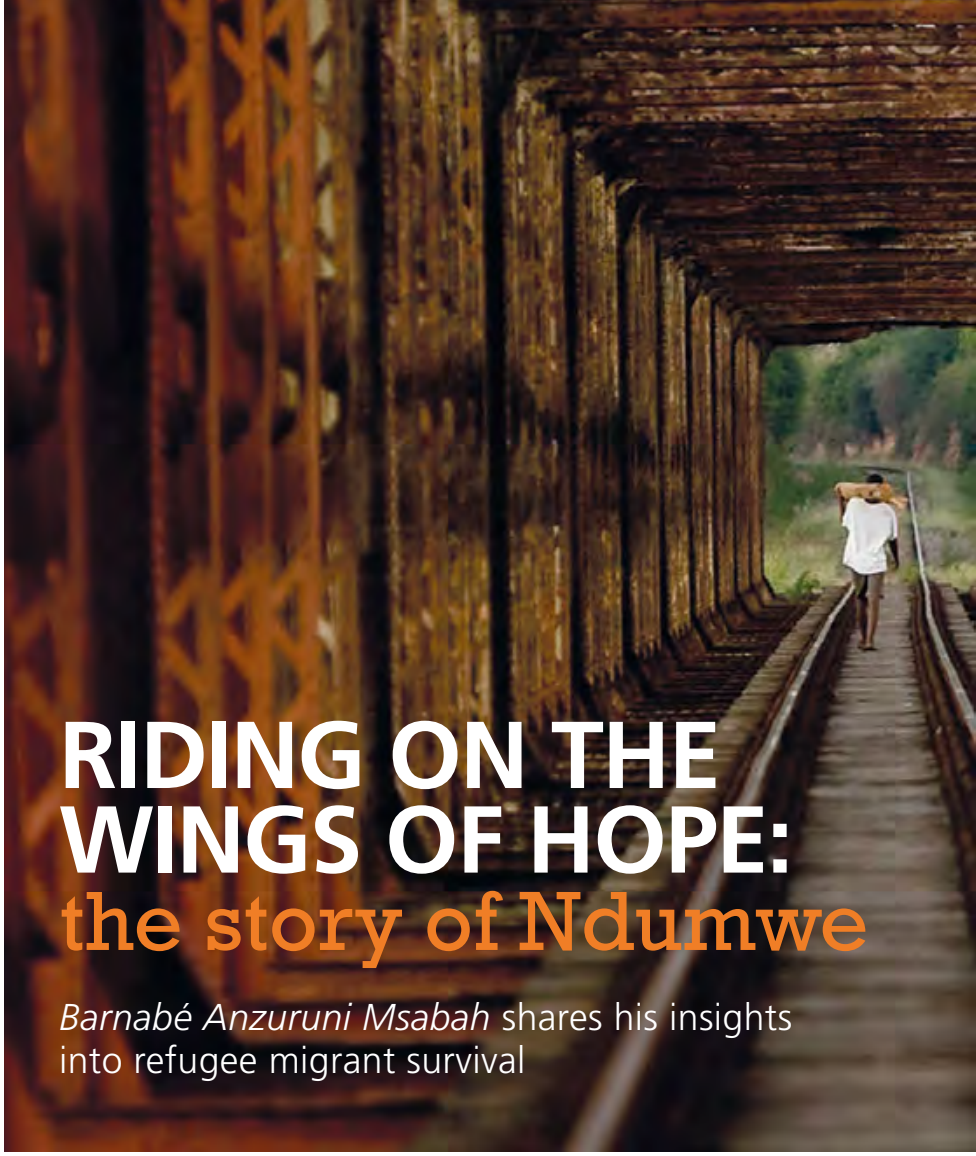
A new method for analysing plastic materials developed at Stellenbosch University will enable manufacturers to further develop plastic materials for ever-widening applications.

Some products require plastics that are scratch proof and break proof; others need to be soft and pliable. Consumers could be looking for products that are heat resistant or freezer resistant or both. While manufacturers have some basic recipes for making up these varying materials, the new method of analysing and measuring the components contained in plastic materials has opened up new possibilities for fine-tuning the production of plastic material for different purposes.

For example, researchers have generally depicted rubbery plastic materials as having a loose, amorphous chemical structure, as opposed to a more rigid, crystalline structure, and this information has guided the production of rubbery plastics. Traditional methods of analysing the chemical components of such materials have always confirmed this to be the case. This innovative method has, however, revealed a much more complex picture.

By using a number of different instruments and processes, the researchers first separated the plastic material into different components, which were then subjected to further measurements. They were able to demonstrate that rubbery plastics consist of both pliable and rigid components, as well as semi-rigid components. Being able to measure the structure of a material at this level of detail will allow for further fine-tuning of the materials' properties by adjusting the relative levels of these components. The researchers can also now monitor and control the quality of plastic materials produced by different companies.

Mohau Justice Phiri is completing his PhD studies in polymer science at the Department of Chemistry and Polymer Science in the Faculty of Science. ✉ *phiri@sun.ac.za*



RIDING ON THE WINGS OF HOPE: the story of Ndumwe

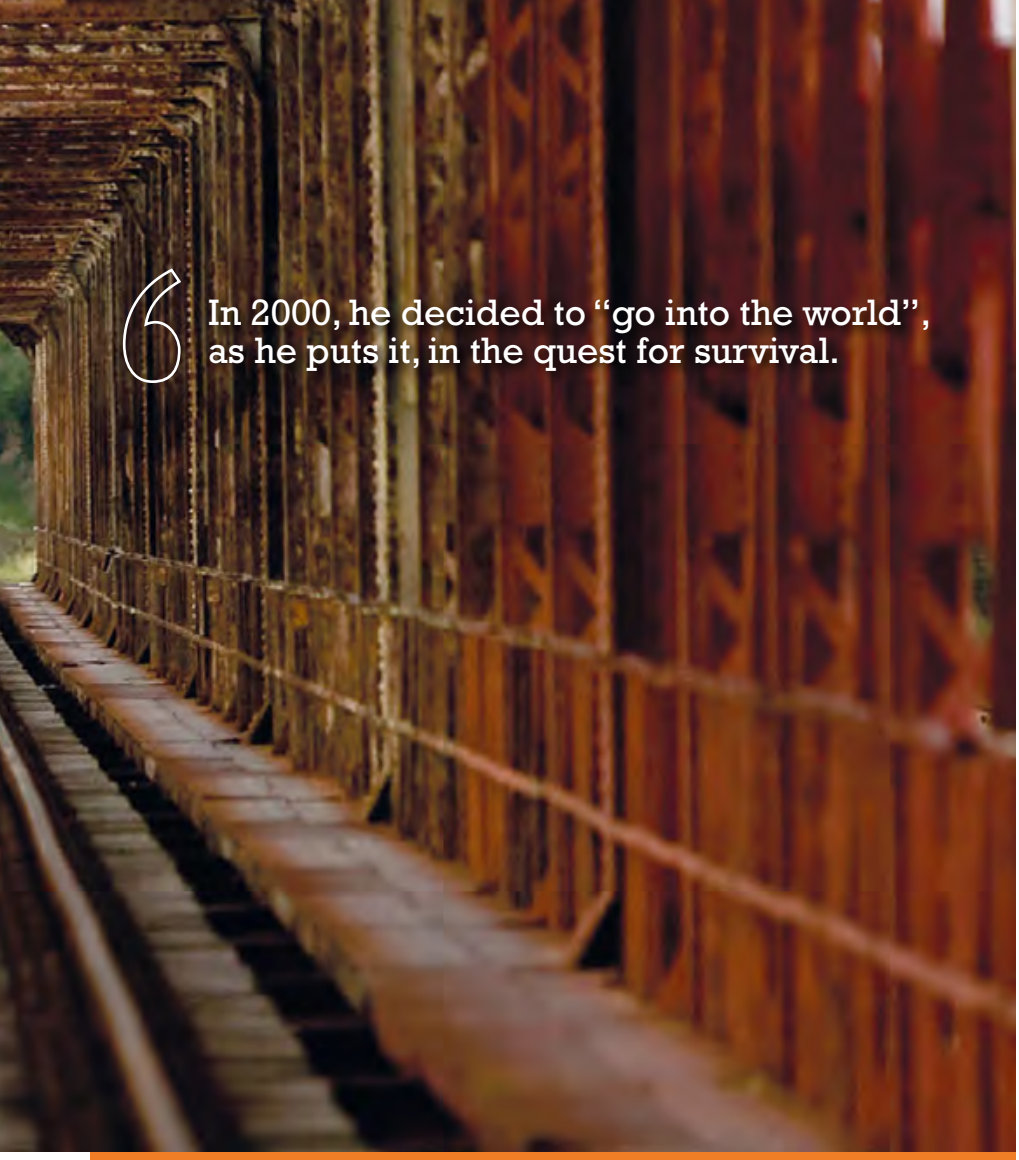
Barnabé Anzuruni Msabah shares his insights into refugee migrant survival

Ndumwe* is a refugee from Burundi running a shop in downtown Bellville along the busy road leading to the train station. We met when I went to his store one day, looking to buy a tape recorder for my fieldwork. We became friends. But when he heard that I'm a doctoral student at the University of Stellenbosch, researching refugees, his face dropped.

That's when he told me his story.

It all started in 1993 when Ndumwe was 11 years old. An outbreak of ethnic violence had just started in Burundi. His entire family was killed. The boy fled with the family's neighbours to Rwanda. It was not long before they were once again forced to flee from Rwanda following the genocide that had started there. The young Ndumwe, who had already experienced the horror of the Burundian bloodbath which had taken both his parents' lives, now witnessed the worst. They fled again in 1994, this time to the DRC, where they lived in a refugee camp.

Two years later, in 1996, they were forced to run away due to yet another civil war that had started in the DRC. The family that was taking care of Ndumwe was also killed when the camp they lived in was attacked. By now Ndumwe was 14 years old. He had seen enough. In his confused young mind, he followed the crowd and went to Tanzania. Life was not easy for the young boy. In 2000, he decided to "go into the world", as he puts it, in the quest for survival. Ndumwe walked long distances, for days, begging on the streets, sleeping in abandoned structures, and hitch-hiking



> In 2000, he decided to "go into the world", as he puts it, in the quest for survival.

on trucks, until he made it to Kenya.

In Mombasa, on the coast of Kenya, Ndumwe heard about the possibility of going overseas by hiding in a cargo ship at the harbour. When the opportunity came, he hid in the basement of the ship headed for the Netherlands, ready to escape. After some days of travel, Ndumwe was discovered and left at the nearest port: the Durban harbour on the east coast of South Africa. It was the end of his journey to the Netherlands, and the beginning of his life journey in South Africa.

Right at the harbour, he met other immigrants who offered help. They were crooks. They robbed him everything he had. Ndumwe knew no one and had nowhere to go, and became homeless. On the street, he did all sorts of things and ended up in prison. For him, the possibility of getting out of jail was unlikely. One day, Ndumwe decided to take what seemed an easy way out: suicide. He made plans for getting some drugs and took them. "I thought I was going to find myself dead right there but I got very, very angry when I woke up in the hospital", he jokingly says as we both burst out laughing. Ndumwe had been rescued.

He decided to leave Durban for Cape Town after his release in 2008 and got a job in Brackenfell. The work required that he use some heavy machinery, which unfortunately injured one of his legs. He walks with difficulty to this day. His hope to recreate a life far from Burundi began even with his physical challenge, and despite the dark depths of his despairing past. He earned R1 200 a month and saved enough to start his own business: selling sweets at the Bellville train station. Today, Ndumwe owns two businesses: the "dealershop" we first met in, where he sells various items, including some small electronic goods, and a barber shop. He is now married and has two daughters with his local wife.

Like Ndumwe, most refugees trade informally. Their small businesses, however, prove to be effective and a valuable means to improve their well-being in the face of challenges. Whether pushed from their countries because of war or persecution, or pulled to South Africa by its "better opportunities", refugees multiply their efforts to the maximum in order to survive. Regardless of their attachment to their place of origin, for most refugees, "home" is the most dangerous place to live, and asylum seeking becomes the only basis for renewed hope. This explains why refugees often rely only on hope to make do in the face of their challenges in a hosting country.

The story of Ndumwe is only one of the many stories I heard from refugees during my fieldwork. My research, *Empowerment by Hope*, conducted from the perspective of theology and development in the Department of Practical Theology and Missiology looks at the relationship between human development and hope, particularly as it relates to the wellbeing of refugee migrants in South Africa. From the lived experiences of Ndumwe, we can learn that there is always hope in the face of life's many challenges. Ndumwe was being empowered by hope when even courage and resilience were sometimes in short supply. Despite the dark depths of despair and anxiety he experienced, he is riding on the wings of hope.

**names have been changed*

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RESEARCHING SEXUALITY

Psychology researcher *Dzifa Attah*, who was confronted with unsettling sexual harassment while researching abuse amongst children in Ghana, shares her personal account

It is about 3:00 pm. ''Bing, bing,'' my cell phone vibrates. It's a text message from Uncle Raymond, one of my research informants. He had helped me recruit a number of study participants for a research project on sexual abuse amongst children in Kroboland, eastern Ghana, where I was doing fieldwork for my doctoral studies in public mental health.

I was waiting for information about an interview I'd been trying to set up, so rushed to check my phone.

But the incoming text message had nothing to do with my research. It was a sexually graphic video. I was shocked. Why would he send me that? Immediately, I deleted the message and decided to ignore it. After that incident, I felt some uneasiness anytime I was around Uncle Raymond, not knowing his real motive for sending such a message. He, on the other hand, appeared unaffected, acting as he usually did whenever we interacted in person, in a very formal and respectable manner.

A few weeks later, he sent another sexually explicit text message. This time, I confronted him.

''Do not pretend you do not like it,'' he responded.

I felt angry and humiliated, and wanted to give him a piece of my mind. I struggled to control my emotions, but at the same time felt conflicted about the fact that social norms meant I should respect him, because he is much older than me. As with people from many other African cultures, traditionally, Ghanaians are expected to respect older people, with no questions asked. But culture is silent on what one should do when an elder behaves inappropriately. I was also worried that if I reproached him, it could affect the progress of my fieldwork, since he held a central position in the community. In the end, I tried to calm down, and remained silent.

This happened while I was collecting data for my doctoral research in an area of eastern Ghana where three municipalities merge. Using individual and group interviews from many sources, including child sexual abuse survivors, I was exploring the cultural context and everyday life circumstances of the Krobo people. I was also interested in the experiences of sexual development and sexual abuse in childhood.

A major finding was just how much child sexual abuse survivors were ashamed of what had happened to them. And, because they are children, in this community they have low status. This means it is very difficult to challenge sexual propositions made by older peers or adults, and they can easily be bullied into keeping silent about their experiences.

I could now identify with some of these survivor experiences of abuse, given my personal knowledge of sexual harassment by a man who was some ten years older than me. Even though in my case, the harassment occurred via text messages, I felt vulnerable and disturbed that I had been treated in that way.

When the incident first occurred, I viewed it as a personal event and unrelated to my research work. My first reaction was to confide in a few peers who turned out to be unhelpful and rather caused me to question my sexuality. I felt victimised all over again.

I began to feel embarrassed about the event and decided not to talk about it again, until my research supervisor began to probe further about my field-work experience. Due to his genuine concern and approach, I felt I could discuss the matter of the sexual harassment. He was non-judgmental, a good listener, and counselled me each time it became necessary. His support provided me a sense of catharsis.

This taught me that a researcher should not take for granted the need for personal safety and support, no matter how trivial it may seem to others. These issues should be important considerations in preparing and planning for research of all kinds. One should not lose sight of the fact that research really is ''just a job'', as social researchers Elizabeth Kenyon and Shiela Hawker explain in their overview of how lone researchers need to manage their safety while in the field. The safety of the researcher, they remind us, is more important than accessing data. I thought that this was important to bring to the attention of other researchers.

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needing **YOU**, needing **ME**

Food shortages challenge beekeepers

Tlou Masehela explains why good forage plants are so important for food security and the health of farmed honeybees

Most people think of bee farming as only to do with honey production. While most of us know that bees pollinate flowers, few realise that fruit and vegetable farmers rely heavily on managed honeybees to pollinate their crops. Perhaps even fewer people understand that honeybees have very specific dietary needs and that if we do not protect the various plants that bees rely on for food, our own food security might be threatened.

The work of entomologists at the Department of Conservation Ecology and Entomology highlights the importance of good forage plants for farmed honeybees' health, for honey production and commercial crop pollination. The research is driven by a growing concern over the shortage of forage for bees, through destruction of natural vegetation, but also from certain farming practices and the removal of alien plant species such as eucalyptus trees.

The in-depth study of bee farming around the country revealed that bee-keeping has different stages during the year: sometimes the focus is on producing honey while at other times it is on agricultural crop pollination, when farmers pay beekeepers to bring their hives to farms for this service.

But, to keep healthy and do their work, managed honey bees need a diverse diet of both pollen and nectar from different flowering plants. Nectar serves as a carbohydrate and pollen as a protein source. Normally, honey bees are maintained on good forage throughout the year for honey production. Then, before going into their ''working'' season of agricultural pollination, they are placed on pollen rich plants to prepare them and to strengthen the colony.

In order to ensure a diverse diet, beekeepers often transport their hives to different sites. They keep records of plants flowering at particular times of year, which of these plants the bees use and when. This makes beekeepers important allies for researchers in the food security arena.

But if beekeepers don't have good forage on their farms, they may have to transport their hives for several hundred kilometers, at times even to neighbouring provinces, to find food for their bees. This makes beekeeping increasingly expensive, and highlights the importance of maintaining good forage near the beekeepers' sites.

Another major concern for beekeepers is the large scale removal of eucalyptus trees, which is done in many parts of the country because these are alien tree species. Eucalyptus or gum trees are a major forage source for bees and the complete disappearance of gums could cripple beekeeping in the country.

The SU researchers also showed that the foraging habits of bees differed across regions depending on which plants were there at the time, as well as when plants flowered in these different climatic areas. This research is vital for ensuring that there is a country-wide plan to ensure sustained future food sources for honey bees.

It is clear that honey bees need to be looked after, so that they can look after us. Public awareness campaigns are required to promote the planting of bee-friendly plants across different public and private spaces, and behaviours that harm bees should be discouraged. This includes the unnecessary removal of good bee forage plants such as weeds, the expansion of agricultural fields at the expense of natural vegetation, and spraying of harmful agricultural chemicals.

The South African National Biodiversity Institute actively encourages public participation through their website www.sanbi.org/pollination-honeybees. It is our responsibility to ensure the health and survival of honey bees, as they unknowingly enable us to enjoy a diverse diet through their pollination services.

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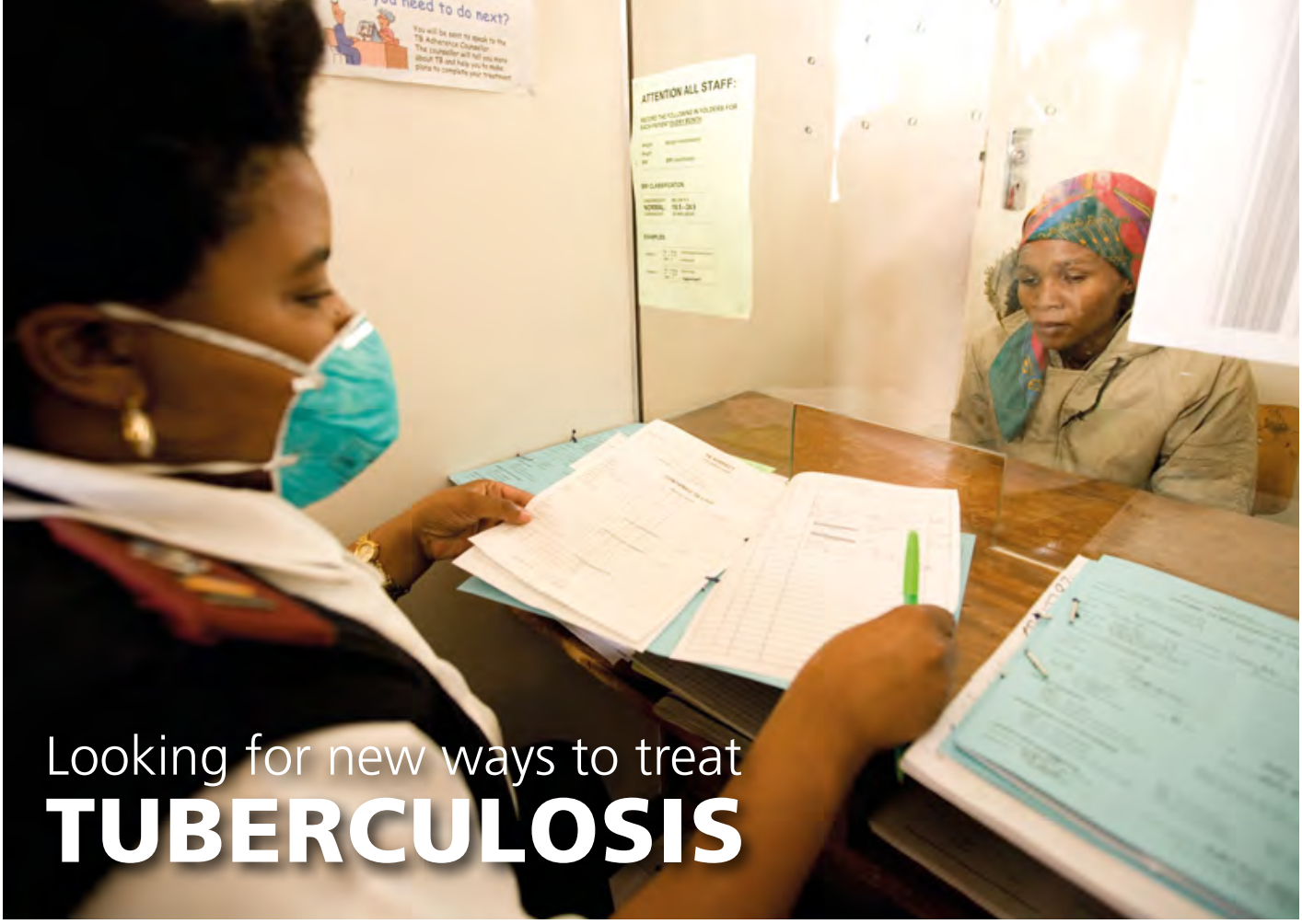


Looking for new ways to treat TUBERCULOSIS

Carine Sao Emani reveals how this can be made possible

A breakthrough in understanding how the tuberculosis (TB) bacterium protects itself, could be the key to developing a new drug to treat TB. With the rise of multi-drug resistant TB, the search for new treatments has never been more urgent.

At the Department of Biomedical Sciences in the Faculty of Medicine and Health Sciences, we have confirmed that in order to survive, the TB bacterium needs a particular vitamin, called ergothioneine. We have also identified the exact enzymes that produce this important nutrient in TB bacteria. We hope that with this information, drug companies will be able to develop drugs that specifically target these vitamin-producing enzymes, thereby curing TB.

Humans also need ergothioneine. It seems to be essential for keeping our brains, eyes and skin healthy and to play a general protective role in our bodies. We get it from eating foods like mushrooms, beans and oats.

But, scientists recently discovered that the TB bacterium has a way to produce this vitamin itself, suggesting that it's even more critical for the TB microbes' survival, than it is for us humans.

The current story starts in 2010, when researchers finally found the specific enzymes in the TB bacterium that are responsible for the microbe making its own supply of ergothioneine.

When they discovered this, they realised that they may have stumbled upon a novel way of fighting this potentially deadly organism.

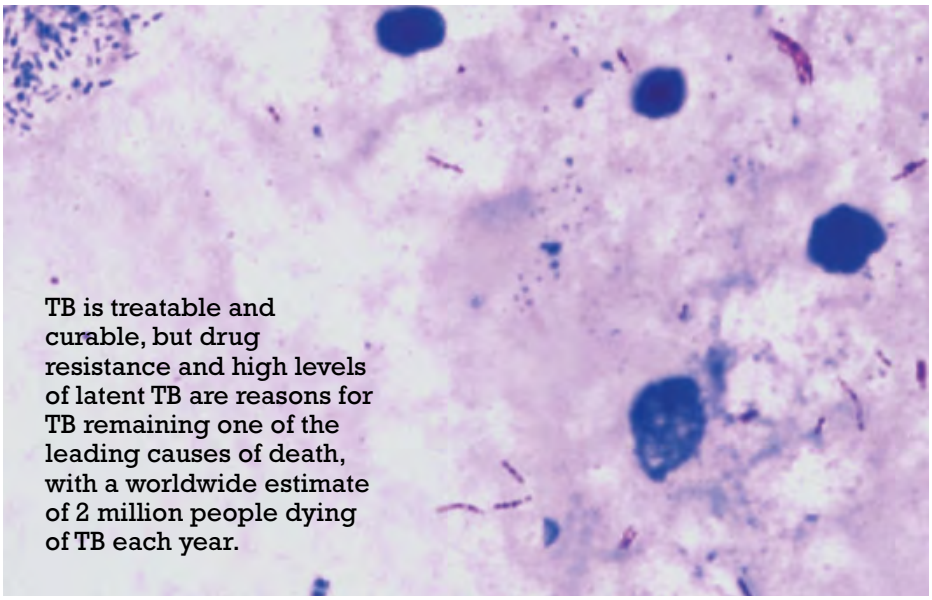
This is where my PhD research at the Department of Biomedical Sciences comes in. Using genetic manipulation on TB bacteria in the laboratory, we tested what would happen if the bacteria could no longer produce its own ergothioneine.

After blocking its ability to produce ergothioneine, we placed the bacteria in an environment within the laboratory setting that had similar features to those of a human cell during *active* TB. Sure enough, when the microbes could no longer produce their own vitamin, they weakened and even died. We repeated this experiment, this time placing the modified bacteria in conditions similar to those found in human cells with *latent* TB. We found that the microbes struggled to grow when their nutrients were depleted.

In other words, if a drug were to prevent TB bacteria from making ergothioneine, it could be effective against active as well as latent TB.

This is significant since about a third of the world's population live with latent TB, making effective containment of TB very difficult.

People who have latent TB show no symptoms, but test positive for it. In latent TB, the bacteria live within the lungs,



TB is treatable and curable, but drug resistance and high levels of latent TB are reasons for TB remaining one of the leading causes of death, with a worldwide estimate of 2 million people dying of TB each year.

Multi drug-resistant TB

Current TB treatment is notoriously onerous and difficult to adhere to. Patients have to take high doses of five different drugs for periods typically lasting six months, with unpleasant side effects. The result is that many people do not complete their treatment and this leads to drug resistance. When the patient does not complete the treatment, the remaining microbes that have not yet been killed, undergo genetic changes known as mutations, preparing them to resist the same drugs that they were initially exposed to. When these bacteria multiply, the patient relapses and the same drugs that were given initially are no longer effective. Second-line drugs are then prescribed, but are less effective and have even worse side effects, such as loss of hearing and kidney damage among others. Resistance can progress to extensively drug resistant TB and finally to the development of a totally drug resistant strain of TB.

inside round capsules made out of thick layers of immune cells, known as granuloma. The granuloma deprives the bacteria inside it from nutrients, causing it to become dormant and inactive. For most of us, this isn't a worry because a healthy body can keep the bacterium from developing into full blown disease.

It's only when a person's immune system takes a serious knock that the bacterium is able to develop into tuberculosis. Some of the possible triggers are HIV, Aids, aging, certain medications, heavy infections, diabetes, obesity, alcoholism and poor nutrition.

Our next step will be to test the behaviour of the modified bacteria in actual cells in human and animal tissue samples. Once we are sure that bacteria without their vitamin-producing enzymes struggle to survive in these cells, chemists may be able to develop drugs that block the specific enzymes that we identified.

Some of the possible triggers are HIV, Aids, aging, certain medications, heavy infections, diabetes, obesity, alcoholism and poor nutrition.

Since we were also able to pinpoint exactly which of the enzymes were most important for producing ergothioneine, these drugs can now be tailor made.

The resulting drug regime will likely be effective at lower doses than existing medications. Treatment periods will be shorter, resulting in fewer problems with poor compliance. Another possibility this research has opened up, is the development of a vaccine against latent TB, using the modified microbes that have lost their ability to cause TB.

In a country where 80% of the population has latent TB – and where HIV, poor nutrition and alcoholism can lead to high rates of reactivation of latent TB, a treatment like this will truly be groundbreaking.

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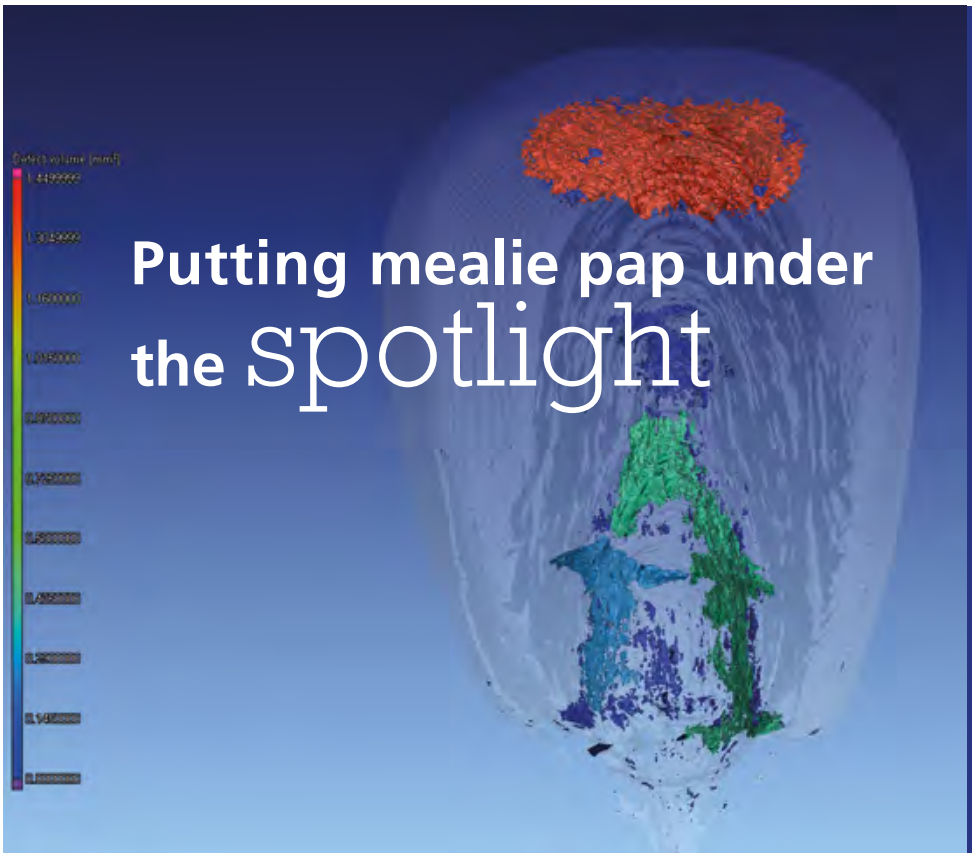

Putting mealie pap under the spotlight

What is light?

Using photonics, food scientists can test food for suitability for various purposes. To understand photonics, one has to understand what a photon is. It is simply a "piece" of light, both particle and wave. One can think of it as a weightless acrobat, moving up and down, oscillating, spinning, while carrying a load of energy. When the energy in light comes into contact with other particles, it excites them, or alters their state, providing useful information about the particles.

Anina Guelpa talks about the properties of maize

Are you just like me, indecisive about what to eat for breakfast? What will it be this morning, corn flakes or mealie pap? The people who make breakfast products from maize, stand before a similar choice when they receive a bulk shipment of maize kernels. This is because corn flakes are best made from softer maize kernels, whereas kernels milled for mealie pap, need to be hard. These properties cannot be gleaned just by looking at the kernel.

Fortunately a technique called photonics, used in my research at the Department of Food Sciences, can accurately detect the properties of maize kernels using the energy in light particles. Using photonics, food scientists can test food for suitability for various purposes, for purity and safety, or for possible adulteration.

In my research I develop techniques to analyse maize kernels using two light-based methods: near-infrared spectroscopy and X-ray scanning. These techniques enabled me to distinguish maize kernels suitable for milling, from those that should rather be used in for example breakfast cereal. In a country in which maize is a major staple food, this method can play an important role in food security, as poor sorting methods can lead to wastage, which pushes up the price of maize products.

The skinny near infrared photons

In the case of near infrared spectroscopy, the tiny photons minutely alter the state of the particles in the maize kernels. Using this technique, I'm able to scan a maize kernel as though scanning a bar code, but instead of seeing a price, I get to see how the volumes of the starch components differ, for example. This in turn tells me how hard the kernel is and whether it is suitable for milling.

Using near infrared, we can also identify adulterated or contaminated food products amongst the sound ones.

The bulky X-ray photons

While near infrared photons are tiny energy bundles, those in X-rays carry huge bundles of energy that are powerful enough to look through an object. In my research on maize, I use X-ray scanning coupled with computer software, which allows for 3-D visuals as well as complex measurements to calculate the exact density of each component of a maize kernel, to decide if it is suitable for milling. So unlike me, food producers have technology on their side to help them make difficult choices. Using the power of light they can see right into the maize kernel.

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SA TIMBER, THE "GREENER" BUILDING MATERIAL

Melanie Blumentritt clarifies why timber is believed to be the most climate-friendly building material

Picture a young family, standing on the empty plot of land where they are going to build their future home. They will have to make a lot of decisions, and spend much money, to make it the perfect home for years to come. But in the context of climate change and other looming environmental crises, what is the most climate-friendly building material that they could choose?

Here at the Department of Forest and Wood Science at Stellenbosch University, we believe it is timber.

Many studies in Europe and North America show that timber and wood products have a smaller environmental footprint than more traditional building products like brick, steel, and concrete. We are now going to see if the same is true here in South Africa.

In order to investigate the potential impact that different building materials could have on the environment, we have chosen to use a life cycle assessment (LCA) methodology, which is an internationally established holistic approach used in our field.

This method allows us to take into account all the energy, material and waste that goes into, or is generated during, the production of these different materials, throughout their lifespans.

The first step when using this approach is to decide exactly what the parameters of the study are. For instance, we could consider the amount of timber or steel that is needed to construct the roof trusses for a 42 m2 single story house.

Then we need to identify and quantify all the inputs and outputs of each step of the production, use, and end-of-life stages of the different materials. Once we have that, we can analyse these using impact factors that group together emissions by category. This could, for instance, be emissions linked to global warming potential, or those impacting on human health.

These results can be used to evaluate and compare the potential environmental performance of products with the same function – roof trusses made of wood or steel, for instance – and to identify areas where one could reduce energy, material inputs or environmental impacts at each stage of the products life cycle.

Compared to other more commonly used building materials in South Africa, locally farmed timber has the advantage in that it is renewable, and it is sustainable if it is farmed appropriately. The production and processing also use much less energy, giving it a significantly lower environmental footprint. In addition, wood products store carbon that growing trees remove from the air.

By now most of us are aware that climate change is reshaping the world we live in. The way in which we build our homes, and the materials we use, have a significant impact on that world. One third of global greenhouse gas emissions come from the built environment. In general, about 80% are generated by the operation of a building over its lifetime (for example, from electricity, heating and cooling), and 20% by constructing the building and producing the materials needed.

South Africa's continuous population and economic growth is very resource and energy intensive, and will only increase the pressure on the environment and accelerate the threat posed by climate change. Green building initiatives are gaining momentum worldwide. In South Africa the main reasons are because it is regarded as the right thing to do, and because investors can realise economic gains by lower operational costs of green buildings.

Results of our research will help home builders and developers make greener decisions, for example by choosing to use more wood over other less "green" materials.

Melanie Blumentritt graduated in August 2014 with a PhD in forest resources from the School of Forest Resources at the University of Maine, USA. She is now a postdoctoral fellow at the Department of Forest and Wood Science in the Faculty of AgriSciences. *blumentritt@sun.ac.za*

Protea-associated mites moving from an untreated protea flower (left) to an experimental flower (right).

THE secret life OF MITES

Natalie Theron finds anwers to why mites may be the protea's ally

In 2012, while doing fieldwork on cultivated proteas on a farm near Piketberg, a farmer put me on the spot by asking ''What do these mites do? Are they good or bad for the proteas?''

At the time, I had no idea. But now, three years later, I do. I've been able to show, for the first time, that mites might actually help pollinate protea flowers, and keep the species thriving.

My study investigates mites within proteas in South Africa. We know that they live inside the flowers and fruits or seed-heads; we know that there is a variety of species, and we know that they use insects and birds to travel between flowers.

But what is the role of these mites, and what impact do they have on protea populations, both natural and cultivated?

Bad mites

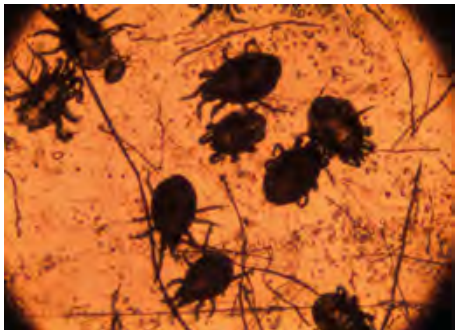
Mites are minute, spider-like organisms that are closely related to ticks. Worldwide mites are known to have a negative effect on plants, flowers and fruits, especially in the forestry and agricultural industries. For example, honeybees are the major pollinators of agricultural crops globally. The Verroa mite is a pest that not only feeds on honeybees but also spreads diseases within bee colonies. This is the major cause of the decline in honey bees and therefore, a decline in agricultural crop pollinators.

Another example is spider mites, which cause tremendous damage to crop yields as they feed on plants and fruits. This not only reduces produce, but affects the exporting of these produce. This is a similar to the situation that protea farmers are in.

The witches broom mite (*Aceria proteae*) is thought to carry witches broom disease on proteas, although this hasn't been proven yet. This incurable disease causes the protea to form gals, bushy growths of small stems and tiny leaves, all over the plant, disturbing the growing and flowering ability of the plant.

Good mites

But it looks as though there are also good mites out there. For example, Phytosiied mites are used to control the problematic spider mites. Although this can be a double edged sword, because if there aren't any



spider mites to eat, the Phytosiied mites start to feed on a flower's pollen grains. There are many studies showing how destructive mites can be for flowers trying to pollinate, as these creatures feed on both nectar and pollen, and thus damage the seeds.

Protea flowers can be pollinated by birds, insects and even rodents. Low-growing species have a musky smelling flower that is easy for rodents to visit and help with pollination. Proteas with brightly coloured flowers and no scent are mainly pollinated by birds, whereas white or lighter coloured proteas are pollinated by insects. I wanted to establish if mites might also play a role as pollinators of protea flowers.

This is what I did to answer that question:

I found sites in Franschhoek, Jonkershoek and along the Du Toitskloof Pass, where the big blue sugarbush (*Protea neriifolia*) grows wild in the fynbos.

At each site, I selected 75 flower buds which I sprayed with an environmentally friendly pesticide that only kills the fungi and mites on the flowers, and then I covered them with a fine-meshed bag.

Two months later, I went back to the sites when the flowers were in full bloom.

This time, I used three different treatments across all the flowers. With the first treatment, I sprayed a third of the flowers with the same pesticide as before and had the bag put back over them. For the second group, the "treatment" was to take the bags off the flowers and leave them as-is. Then, with the final third, I actually put mites onto the flowers and then closed them up with the mesh once more.

Nine months later, I returned and collected these experimental flowers which, by now, had matured into seed-heads. I also collected seedheads from untreated proteas growing nearby, to use these as a "control group" and to compare their seed fertility with the "treated" experimental seedheads.

My next job was to count how many fertile seeds there were – this would show me if pollinators had been at work on the flowers, because seeds would only form if a pollinating agent had carried pollen from the male part to the female part of the flower.

I found that the flowers that were closed up in the mesh bags for the duration of the experiment had no fertile seeds. But the flowers whose bags were removed had many, as did the seedheads of the untreated "control group" proteas. The flowers that had mites put on them, and then resealed in the bags, had some fertile seeds.

This suggests that while mites aren't the only pollinators for this type of protea, they probably do help these plants produce fertile seeds.

While we still need to do a lot more research to confirm this, these findings can help other researchers in the pollination field shape their own studies. It can also inform pest management practices on commercial protea-growing farms, because even though farmers aren't dependent on wild-produced seeds, if they use pesticides to kill mites (which we now know may be unnecessary), it can be very harmful to birds and other insects that carry pollination-assisting mites as they travel between flower heads.

I've been able to show, for the first time, that mites might actually help pollinate protea flowers, and keep the species thriving.

This new knowledge can also help with the drawing up conservation management plans.

So, next time when I have a conversation with a protea farmer regarding my mite research, I can answer their questions: "Mites potentially play a role within protea pollination as a pollinator, and yes, it's good!"

Natalie Theron is finishing her doctoral studies in conservation ecology at the Department of Conservation Ecology and Entomology in the Faculty of AgriSciences. ✉ *natz.83.nt@gmail.com*

The **HEALING GENIE** of the Karoo

Christina Glyn-Woods explains why she cloned Kannaland's "kougoed"

The near-desert extremes of the Karoo is home to a powerful yet gentle methuselah plant. This insignificant looking succulent grows slowly, creeping along the ground and entwining itself into other plants to shade itself from the dangerous heat of summer. Wizen and unkempt, the bleached tattered leaf skeletons remain for years to protect its few living leaves, giving this plant its official name *Sceletium tortuosum*, which means "twisting skeleton" in Latin. This scruffy succulent's ancient biochemistry contains compounds that the San Bushmen have long known to have profound effects on the human psyche.

This plant has held a significant place in the spiritual practices, healing rituals and way of life of the San for thousands of years. Hunters used it for stamina, and to gain calm focus during long and perilous expeditions for prey. Plant wizard shamans, the "bossiedokters", have understood its ability to confer endurance during the arduous inner journeys and visions of healing.

Traditionally the whole plant is crushed with a rock, fermented in a leather bag and sun dried. The plant is then either smoked or chewed, which earned it the traditional Afrikaans name of "kougoed". Some wild populations of the plant still thrive on the mountain skirts of the protected Gamkaberg Nature Reserve, 30 minutes drive from Calitzdorp in the Kannaland area. In all likelihood this area could be one of the ancient medicine plant's collecting grounds, as Kanna is one of the San traditional names for this plant.

Western biomedical researchers have recently identified several biochemical compounds in this plant that have the potential to treat severe stress, post-traumatic stress disorder (PTSD), depression, addictions and numerous other related mental conditions.

Now that the biochemical genie living within the plant has been identified, there's a growing demand for the plant. One of the challenges of my research at the Department of Botany and Zoology in the Faculty of Science, was to find a way to satisfy this demand, while at the same time protecting the wild populations of this fragile inhabitant of the ancient Karoo. Could there be a way to grow the plant on a large scale in a setting far removed from its origin, and still expect it to have the same healing powers?

To produce the biochemical genie on a commercial scale, I persuaded miniature clones of wild plants to grow rapidly in the laboratory, outside of their natural surroundings without roots, soil or seasons. The cloned genie was now captured in glass bottles and living on a nutrient growth medium with sugar and light. Could it now be encouraged to produce high levels of those biochemicals thought to be responsible for its healing properties?

While the current research shows that the plants do produce the biochemicals of interest, it is not yet clear whether they are able to produce the full complement of chemicals produced in the wild and whether the effect of taking these biochemicals in extract form would have the same effect as ingesting the plant in its natural form.

As we discover the details of how these compounds work in concert with our own biochemistry, we may come closer to understanding what is already known by the San Bushmen, about both the plant and its healing properties.

The Western biomedical approach is to focus on the specific, most obvious active ingredients of indigenous medicinal plants. But I wonder if this could potentially diminish the understanding of the healing power of plants used in their traditional contexts. Western medicine is currently limited in its knowledge of the subtleties of why certain plants have been used for particular ailments and could just be leaving a true appreciation of the healing powers of plants on the cutting room floor.

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THE threat OF TOXOPLASMOSIS

Kenneth Hammond-Aryee tells a furry tale

"Say cheeeese." Click, click, click goes the camera, as Kabaso* snaps picture after picture of the heavily pregnant Nubunthu and the presents surrounding her.

It's Nubunthu's baby shower and all her girlfriends are here to make the occasion a memorable one. Nubunthu and Kathleko are expecting their first child after six years of being together.

The twin cats, Daisy and Tabby, are happily playing on Nubunthu's lap as she smiles broadly for the camera.

"It's a girl" shouts Chewe, and all the other girls start jabbering excitedly as they happily anticipate all the sleepovers and dress-up games they were going to have with the new addition to their circle.

Those who are most at risk are unborn babies, immune-compromised people such as those living with HIV/Aids, and people receiving organ transplants.

In walks Chewe's mother, whom all the ladies affectionately call Dr Nel, and on seeing the cats playing with Nubunthu, she asks in a serious tone if they, or their cats, have been tested for toxoplasmosis.

For most people in South Africa, the answer to Dr Nel's question will be "no", because few get tested for this parasite.

Toxoplasmosis is a disease caused by the parasite *Toxoplasma gondii*, and about a third of the global population is exposed to this pathogen at any given point in time. Even though most infections are not severe in nature, in certain people with weakened immune systems, it can cause brain calcifications, malformations and, in some cases, may even be fatal. Those who are most at risk are unborn babies, immune-compromised people such as those living with HIV/Aids, and people receiving organ transplants.

Spores of the pathogen are shed by cats through their faeces, and then get spread into the environment through natural means. The disease can also be contracted through eating under- or uncooked meat, or through unwashed vegetables and fruits, or from contaminated drinking water. In rare cases organ transplantation and blood transfusion may also be a source of infection.

It can also be transferred from mother to child through the placenta. In the case of the pregnant mother, the severity of the infection in the foetus depends on when, during the pregnancy, the mother picks up the infection. If the mother is infected during the first trimester, then the infection to the foetus is severe and can often be fatal. If infection occurs in later trimesters, it can lead to eye complications later in adulthood.

Researchers at the Faculty of Health and Medical Sciences did a survey in Cape Town from 2012 to 2015, to find out the prevalence of the parasite in certain

It is also important to have pet cats tested at least once a year to ensure they stay uninfected or are treated immediately if they become infected.

communities. They took samples from women who had given birth two weeks earlier at two sites, namely the Kraaifontein midwife obstetrics unit and Karl Bremmer Hospital. Then they took samples from sheep on nearby farms, and from feral cats in the area. They found that 30% of the women, 8% of the sheep and 59% of the cats had been exposed to the parasite.

The researchers have also identified the predominant strains of the parasite that's present here in the Western Cape. Now they are growing the parasite in local laboratories.

The good news is that if infections are identified early enough, they can be treated successfully.

That's why it's very important for women who are pregnant or are planning to get pregnant, to be tested early, especially if they have cats in the family. It is also important to have pet cats tested at least once a year to ensure they stay uninfected or are treated immediately if they become infected. It is also advised that you wear gloves anytime you have to handle your cat's litter box and wash your hands as often as possible.

Preventing infection is important especially when for people who are HIV positive, or those who don't know their status. The best ways to avoid infection is to make sure that that meat is well cooked, vegetables and fruits are washed very well before being eaten, and that drinking water is boiled, if you don't know that the quality is good.

**names have been changed*

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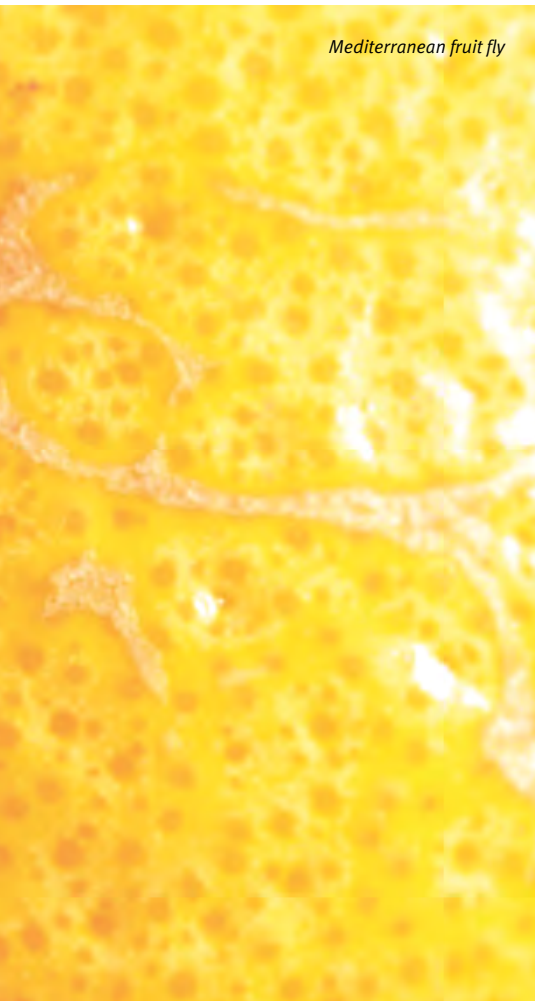
AFRICA'S INVASIVE FRUIT FLIES on the move

Minette Karsten, a molecular entomologist, tracks how invasive fruit flies spread beyond their home range

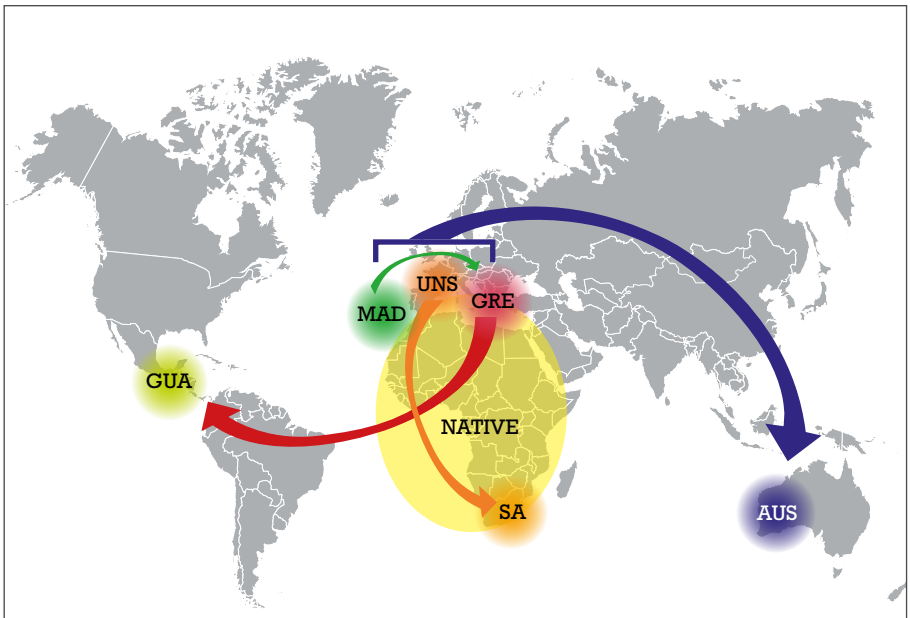
Have you ever bit into an apple or some other fruit and found a little wriggly larva inside? Chances are that it was the larva of a fruit fly. Fruit flies lay their eggs under the skin of fleshy fruit and once the larvae emerge they feed on the flesh of the fruit, leaving behind a pulpy mess. Apart from this damage to fruit, the presence of fruit fly also leads to economically damaging fruit export restrictions. Fruit importing countries that are free of this pest have strict controls to prevent it getting into the country. Ports will refuse consignments of fruit if they find fruit flies.

Fruit flies do spread naturally by flight, but most of their movement is on the back of human travel and trade. South Africa implements various quarantine and control efforts to prevent their spread through fruit and vegetable trade. Just how successful such measures have been in preventing the spread of fruit fly, was the concern of my doctoral research, conducted at the Department of Conservation Ecology and Entomology.

One of the most destructive fruit fly pests is the Mediterranean fruit fly. It is native to south-eastern Africa, but has spread worldwide in the last 200 years, including to the Mediterranean basin and Australia. Despite its African origin, the fly was first



Mediterranean fruit fly



On the move: the Mediterranean fruit fly first arrived in Europe (MAD-Madeira; GRE-Greece; UNS-unknown European site) from its home in Africa, before finding its way to Australia (AUS) and the Americas (GUA-Guatemala). It has also been re-introduced into South Africa (SA) from Europe.

described by scientists in the Mediterranean area in the 1800s, hence the name.

This research is one of only a handful of studies that has tried to establish how effective current control, quarantine and post-harvest treatments are in preventing fruit flies, and some other organisms, from moving freely between countries.

I used genetic markers, called microsatellites, to track the possible routes the Mediterranean fruit fly might have taken to colonise different countries. Genetic markers are basically a small section of an organism's DNA that we can use to identify different species or individuals. If a species moves between two different countries and reproduces, the populations from these countries will be genetically more similar than between countries that are not linked. We collected samples from South Africa using fruit fly traps in orchards, and had a number of collaborators do the same in other African countries, as well as in Guatemala, Madeira, Greece and Australia.

This research is one of only a handful of studies that has tried to establish how effective current control, quarantine and post-harvest treatments are in preventing fruit flies from moving freely between countries.

Based on my results, I found that these fruit flies are now moving freely around Africa. But the good news for farmers exporting to important markets like Europe is that there don't seem to have been any recent re-introductions of the species into that part of the world since it was first introduced there over a century ago.

I also used this information to produce a map to show how the species had dispersed around the globe. First, it spread from its home in Africa into Europe. From there, it found its way to Australia and the Americas. Interestingly, it also seems to have been re-introduced back into South Africa from Europe.

The fact that the fruit fly isn't managing to leave the continent despite the increase in trade, suggests that quarantine and interception measures being used for export consignments of fruit and vegetables from Africa have largely been successful.

But it is worrying that the fly is moving so freely across the African continent. This can't just be attributed to its natural movement, and it is most likely aided by our own travel and trade. This is a challenge for the fruit industry on the continent and increases the chances of new invasions occurring. Another species, the Oriental fruit fly, arrived in Africa quite recently and has spread in spite of efforts to eradicate it. This is a worrying trend and suggests that we need more research if we want to improve management of these fruit flies on the African continent.

Minette Karsten is a postdoctoral fellow at the Department of Conservation Ecology and Entomology, and completed her doctoral research at the Department of Entomology in the Faculty of AgriSciences. ✉ *minettek@sun.ac.za*

THE BELLVILLE SOUTH COMMUNITY'S **DIABETES RISK**

Zelda Vergotine gets to the bottom of genetic abnormalities that may contribute to high diabetes risk

The residents of Bellville South in the northern suburbs of Cape Town, South Africa, are plagued by one of the most common health problems of the modern era: type 2 diabetes. But in the past eight years, some people in the community have been so committed to saving their lives that they're prepared to go to bed hungry. They do this so that they can take the test for type 2 diabetes the next morning – an oral glucose tolerance test to measure changes in their blood sugar. By making this once-off sacrifice for a good cause, they have allowed researchers to get to the bottom of genetic abnormalities that might contribute to their high diabetes risk.

Bellville South is a traditionally mixed-ancestry, or so-called "coloured" township, that was formed in the late 1950s. Recent data show that type 2 diabetes in the mixed–ancestry population has more than doubled within the last decade. With a current prevalence of almost 30%, the mixed-ancestry South African population has the second highest prevalence of diabetes after the South African Indian population. This is amongst the highest in Africa and makes diabetes one of the top ten leading causes of death in South Africa.

Thus since 2008, the mixed-ancestry population from the Bellville South community has become an integral part of a large multi-purpose health research study conducted by the Cape Peninsula University of Technology, Stellenbosch University and the Medical Research Council in Cape Town.

Type 2 diabetes is associated with a diet high in carbohydrates and fat and a lack of exercise. However, how the body responds to these environmental factors also depends on your genetic make-up. That is why different ethnic groups respond differently to risk factors. In some people, unhealthy lifestyle choices could cause changes in DNA, which result in abnormalities in the genes that play a role in the function of the pancreas. Pancreatic cells secrete the hormone insulin, which affects how glucose is used and stored in the body's cells.

Genetic analysis done in adults living in this community, found genes interacting, leading to insulin resistance and a 64% increase in the risk of diabetes. In particular, a nuclear receptor gene, well-known to have a protective effect against the development of insulin resistance, was found in this population group to be negatively affected by interaction with another gene, which impacted on the working of insulin and the breakdown of glucose in the body.

In South Africa, changes in lifestyle have led to high levels of obesity throughout all population groups. For the mixed-ancestry population, this poses a particularly high risk. As nearly half of this group is unaware of their diabetes status, this could lead to adverse health conditions like cardiovascular disease.

The research into the genetic factors uniquely affecting this population group highlights this risk. It could also be useful for early detection of insulin resistance, which is a likely reversible condition, before the irreversible onset of diabetes. Genetic testing for type 2 diabetes in this high risk community of Bellville South holds the promise of preventing diabetes and related conditions through awareness about lifestyle changes that can protect against insulin resistance.

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WHEN TOILETS DON'T MAKE LIFE BETTER

Sheillah Simiyu finds that people who have toilets in informal settlements in Kisumu, Kenya, may be living more precariously than those who don't

At first, I did not take any notice of Brenda.* I would not have given her a second thought. This middle-aged woman would have passed as someone who was satisfied with her circumstances. After all, there was a toilet in her compound. I had stopped to talk to Brenda because I was doing fieldwork in an informal settlement in Kisumu, a city about 360 km west of Nairobi, and I was lost.

As I was there to investigate conditions of people living without sanitation facilities, I wasn't concerned with what was happening to those residents who already had access to toilets. But, I needed directions. While I asked Brenda for help, I explained to her what I was doing, and where I needed to go.

She paused with washing her laundry, stood up, and looked me straight in the eyes. ''Go and have a look at that toilet!''

I made my way to the structure, opened the creaky iron sheet door, and peeped inside the little room. I was shocked. How could a structure looking so fine from the outside be so filthy inside?

Research conducted in informal settlements of Kisumu shows that though we might assume that people with toilets are better off than those without, this might not be the case. In fact, they may even be worse off.

The structure was a pit latrine, typical of toilets in Kisumu's informal settlements. It was made of bricks, while its roof was an iron sheet. After opening the door, I looked closely: on the inside was a slab with a drop hole, but there were faeces and urine strewn all over the slab. Houseflies swarmed about, while others fed on the excrement. I could tell that the pit was full, because the contents were visible and there were lots of maggots wriggling in the pit.

Many questions filled my mind. Why this state? How do people use this toilet? What if children, in their playful nature, accidentally touch the waste then dip their fingers in drinking water or in food? What if flies carried the filth from this little room onto food that is sold openly along the street? I closed the toilet door and looked towards Brenda, who was now standing with her arms akimbo. I couldn't read her expression anymore. What would her next command be? Should I just walk away, or should I step closer and listen to what she had to say?

She motioned me to come closer and sit down. I found a spot, and she started talking. ''My neighbours do not clean the toilet; we are always having quarrels over who left the toilet dirty and who should clean it.''

I listened to Brenda as she told of her ordeal; disgust written all over her face. Brenda lives in a compound that has six other houses, and the families in these houses all share one toilet. Each of her neighbours had a ''justifiable'' excuse for why they were not willing to clean the toilet. Some claimed that they leave for work early in the morning, and only return in the evening. Some refused to because they do not have children, and some said they cannot use a dirty toilet anyway. Yet according to Brenda, they all used the toilet when it was clean.

''Who cleans it?'' I asked. ''I do, because my children use it. But I am tired of cleaning it every other time. People should learn to act responsibly.''

In informal settlements where toilets are unavailable, the immediate solution always seems to be the provision of toilets, which is a step in the right direction. However, after installation, the toilets need to be cleaned regularly, especially because they are shared by a number of families. If the users do not act responsibly, the toilets are likely to be left dirty and therefore unusable. Having unhygienic toilets like Brenda's may be as bad as, or even worse than, not having a toilet. This is because the people who must use filthy toilets, especially children, are at high risk of contracting diseases.

As though she had been waiting for me all day to share what was in her heart, she bent down to continue with washing. And as if to jog my mind, she asked: ''Would you say we have a toilet?''

I could not give her a straightforward answer.

**names have been changed*

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This land is my land

Elke Matthaei explains how Namibian communal land law gives greater security to women farmers

An elderly woman sits under a shady tree in front of her homestead in a small village close to Outapi, in the Omusati region in northern Namibia. Together with half a dozen of her grandchildren, she is busy peeling ''mahangu'', a type of maize, which they will grind into flour. It is a blisteringly hot day, not a cloud in sight. Yet Otilie*, a widowed communal farmer, still plans to go out later to work in the crop field with her grandchildren and tend to their small herd of cattle.

They grow their mahangu on a tiny piece of land, just 30m², and keep a few chicken and cattle on the rest of their 7 ha farm. They do not have the tools or enough labour to expand their farming activities. The uncultivated land remains mainly bushland with wild trees and shrubs. There are two small brick houses and a few dwellings just a little distance from the crop field. The rest of their farm is used for collecting wood and wild fruits.

Across Namibia, communal farmers just like Otilie have to work hard to sustain themselves and their families. Otilie might not become rich from her farm, but she is proud that this is her land. She shows off her Communal Land Rights Certificate with a bright smile. This small piece of paper may look insignificant, but it has the power to prevent her from being evicted without cause. It recognises her and her children as the rightful occupiers of a portion of land that has immense value to them.

Most of the land in Namibia consists of commercial farms, and state land such as national parks. Only 36% of the land is communal, yet nearly 70% of the population depends on it for subsistence farming. Farming on communal land produces food mainly for their own households, but may sometimes provide an income. Communal farmers agree that the land itself is their most valued asset. ''I wouldn't have animals and even a

> "I wouldn't have animals and even a house if I didn't have a piece of land. I would have nowhere else to go and settle."

house if I didn't have a piece of land. I would have nowhere else to go and settle'', an elderly subsistence farmer from the Kavango region explains.

The value Otilie places on her land is the reason she decided to register her property in 2007 when she heard about the new law which the government had introduced in 2002. This law was intended to give communal farmers protection from land grabs, and encourage them to invest more in their property.

How effective it has been in its goals, is something I wanted to test as part of my doctoral research with the Department of Geography and Environmental Studies. I visited the area between December 2013 and September 2014, and spent time with people like Otilie to see whether they felt more secure as farmers, and if they'd invested more in their properties.

Communal land belongs to the state and cannot be owned by individuals. Communal farmers only have user rights over the piece of land they occupy, and share the commonage with the other farmers in their area or village. This means that many farmers can become targets of land grabbing by local elites such as corrupt traditional authorities or wealthy businessmen.

In 2002, the Namibian government passed the Communal Land Reform Act (CLRA) to ensure that communal land is fairly allocated and that natural resources on that land are managed properly. This is done in close cooperation with traditional authorities. Any citizen of Namibia can apply to have a communal land right registered in his or her name. Once a plot is granted under the Act, certificates guarantee the use of the land in perpetuity, and the right to inherit land.

What are the real outcomes of this law? Research in selected villages in four regions of Namibia shows that 85 per cent of farmers plan on investing more in their farming activities regardless of whether they have a communal land rights certificate. Similarly, decisions to make changes to housing and farm infrastructure are not dependent on having a certificate. Every one of the farmers who took part in the research said that having a certificate does not influence their decision to take a loan to invest in their farm. Even if a lack of money is the main reason they do not invest, taking a loan was seen to be too risky and they valued having the land itself more than they valued expanding their output.

So it looks as though communal land rights registration doesn't necessarily lead to more investments or income. However, it does make the people feel safer. Nearly 80% of all farmers questioned during the research said that once they had registered their land rights, they felt their land was better protected against land grabbing or intrusions. ''Now your [farm] boundaries do not depend on verbal agreements anymore, you have to adhere to your boundaries as indicated on your land rights certificate, and the witnesses cannot turn against you due to bribes'', one farmer explained.

"Now your [farm] boundaries do not depend on verbal agreements anymore, you have to adhere to your boundaries as indicated on your land rights certificate, and the witnesses cannot turn against you due to bribes."

It can be argued that registration has the biggest impact on women. Nearly 60% of those who said they felt safer after registering, are women. A widowed farmer feels that ''[i]t is us women who work the hardest on the land. We raise our children; ensure that traditional values are passed on. We cultivate the fields. So why are we the most vulnerable ones who get chased off the land first when our husbands die? At least now with a certificate we can enjoy what we have worked so hard for until we are very old.''

Registration of communal land rights thus has a significant impact on especially women's sense of security on their land. It means that women like Otilie can continue to work hard on their land without fear that someone can just take it away. Now she can rest assured that her children and grandchildren will one day legally inherit her land. Having the certificate might not lead to an easier and wealthier life for Otilie and her family, but it means that at least they know this is their piece of land for generations to come.

**names have been changed*

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Shape shifters

understanding the success of the invasive smallmouth bass

Genevieve Diedericks tackles the problem of invasive smallmouth bass head-on

The Olifants River, nestled between the great Cederberg Mountains in the Western Cape and the nearby citrus groves, is thought by many to be a pristine body of water. Indeed, it was once home to large populations of fish species, some of which aren't found anywhere else in the world, and some of which are now endangered.

These ''locals'' include the Clanwilliam yellowfish, the Clanwilliam sandfish, Clanwilliam rock catfish, and chubbyhead barb, to name but a few. However, this river, like many others in South Africa, hides a dangerous secret: the smallmouth bass.

Initially introduced into South Africa from Maryland, USA, in 1937 for recreational angling, this species has been spread across the country, unbalancing delicate river ecosystems. These dominant predators don't just have the obvious effect of preying on endemic fish. They also bring some indirect effects to the river, such as competing with indigenous species for the same food, natural resources, and nesting sites.

Although the smallmouth bass is recognised as an invader across the globe, few studies have been conducted on this species, with most studies drawing conclusions from research done on the closely-related largemouth bass.

But does this excessive injection of cash into the economy justify keeping such dangerous invaders, capable of total ecosystem destruction?

Researchers from the Department of Botany and Zoology and the Centre for Invasion Biology, both at Stellenbosch University, are now exploring the mechanisms driving the invasive success of the smallmouth bass in South Africa.

By combining techniques from different research fields, such as genetics, morphology and dietary analysis, we can tackle the problem from different angles in the hope of discovering the metaphorical ''ace up its sleeve'' promoting its success. It's the smallmouth bass's fighting spirit that first attracted the attention of anglers, which is why they wanted to introduce it to local rivers. However, this is one of the character traits that have allowed it to become so invasive.

In the course of our research, we collected over 200 smallmouth bass at ten different sites along an 80 km stretch of the Olifants River. We took 22 different measurements on each individual fish, so that we could compare the ten populations. The results revealed that the smallmouth bass is capable of changing its body shape and size depending on the environment in which it occurs. This means it is a jack-of-all-trades – what we call a ''generalist'' species – and that allows it to thrive in many different kinds of river systems. To make matters worse, many of our endemic and now endangered fish species, huddle together at the sight of danger as a defence mechanism, unknowingly serving themselves up as ''McFillets'' at the bass's ''drive-through''.

In 2007 a report – *The Economic Impact of Sport & Recreational Angling in the Republic of South Africa* – revealed that angling contributes a staggering R18,8 billion to the South African economy, with bass angling alone bringing in R1,2 billion of that. But does this excessive injection of cash into the economy justify keeping such dangerous invaders, capable of total ecosystem destruction?

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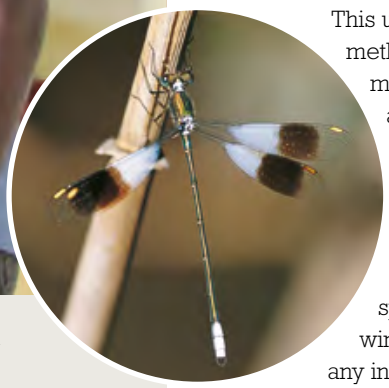

LASER LIGHT TECHNOLOGY **IMPROVES INSECT DETECTION**

Alem Gebru sheds more light on the secret life of an insect

The wing beats of different flying insects are as unique to the species as a finger print is to a human being. Knowing that a mosquito's wing beats are four times faster than that of a dragon fly is crucial to a new technology that is taking the gruelling manual labour out of capturing and counting insects in agricultural fields, in order to know what pests and pollinators are living on a commercially important farm.

Insect researchers at Stellenbosch University are teaming up with fellow scientists in the Department of Physics to use a bold new laser light-based technology to study insect activities. Knowing which insects are present on farmlands is important for pest management, as well as for managing the environment in a way that supports healthy populations of pollinating insects.

Insects are natural service providers of the ecosystem. They make up about 80% of the animal population on Earth. They are garbage collectors, natural fertiliser producers, and pollinators – insects such as bees pollinate up to 80% of flowering plants. They are excellent indicators of the purity of flowing water, or abuse of pesticides, or of climate change. Generally, insects play a crucial role in attaining the natural balance of the ecosystems.

On the other hand, insects can have a negative impact on agricultural productivity and forestry. Insects can harm agricultural productivity by sucking the juice of fruits, chewing the leaves of crops, boring within the roots, stems or leaves, and spreading infectious agents to plants. They can also transfer disease to livestock and humans.

In the past, if insect researchers wanted to study insect populations and distribution, they'd have to trap the insects using labour-intensive manual methods such as light traps, flight interception traps, pitfall traps, water pan traps, beating trays and sweep nets. Now however, by beaming a laser light across a field and using continuous wave light detection and ranging technology, called CW-LIDAR, researchers can improve their insect detection abilities significantly.

This unique insect detection method can pick up insect movement 24 hours a day without disturbing the insect life in their natural habitat, and with no detection bias. It allows researchers to catch even the fastest speed and highest wing-beat frequency of any insect. This method not only catches the speed of insect wing beats, but enables researchers to study other insect interactions, such as chasing and predation.

So far, this new technique has been used for study purposes in farmlands in South Africa and Sweden, and has the potential to be commercialised as the Stellenbosch and Lund University research partners work together. From the experiments done so far, the Stellenbosch and Lund teams have been able to determine: wing-beat frequency, size, speed, flight direction and overall activity of insects – both day and night – over a range of several kilometres. All this information could allow commercial farmers to use a natural means of controlling pests, and use insecticides or pesticides more appropriately, without affecting the beneficial insect population of a certain habitat.

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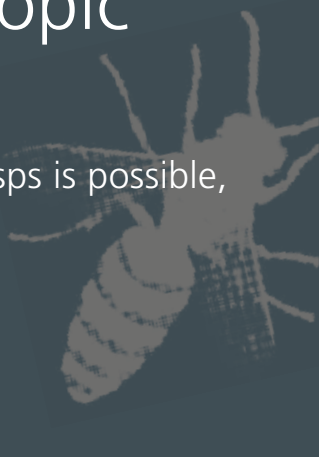
INVASIVE WASPS foiled by microscopic secret agents

Curbing the wrath of invasive wasps is possible, reports *Carolien van Zyl*



If you live in parts of the Western Cape close to Stellenbosch, Wellington, or Franschhoek, chances are that you have involuntarily shared your sandwich or Coke with the villain of this story. The yellow jacket wasp has been known to keep farmers from harvesting their crops, to gatecrash birthday parties, spoil picnics and even attack dogs.

This black and yellow striped topedo of an insect has a taste for protein and sugar and is the thug of the insect world. It is one of two invasive wasp species that arrived on our shores in recent years, in 1974 and 2008 respectively: the yellow jacket wasp – *Vespula germanica*, otherwise called the European wasp; and the paper wasp (*Polistes dominula*).

This black and yellow striped topedo of an insect has a taste for protein and sugar and is the thug of the insect world.

Native to Europe, North Africa and Asia, both are widespread pests. In invaded parts of the world, they are known to cause damage to the bee-keeping industry, horticulture, tourism, and biodiversity. They're also known to harass people and affect quality of life. To prevent potentially similar negative impacts here, such as wasps voraciously preying on local insects that occur in the Cape Floristic Region of the Western Cape Province, it is important to control their population numbers. Now would be the time to find creatures that have the potential to kill and curb the further spread of these two invasive wasps in South Africa.

South Africa's biodiversity laws state that these wasps need to be controlled by means of a management plan, and part of that provides for using biological agents such as fungi or other organisms that can infect them. Primary control worldwide has been in the form of chemical pesticides. However, biocontrol agents, such as pathogens, predators and parasites, can be incorporated into an integrated pest management (IPM) programme. At the Conservation Ecology and Entomology Department, researchers from the "invasive wasp team" have been trying to find such suitable agents.

The first step was to test whether the wasp species will die when exposed to two live biocontrol agents: fungi; and microscopically small roundworms, a type of nematode.

The researchers collected live wasp nests over a period of a month during the summer of 2013, from underground nest sites, and above ground such as under house eaves. In the laboratory, these nests were covered in a solution of nematodes and fungi and dissected a few days later. If the live wasp material showed distinctive signs of infection, it meant that the fungi and nematode application worked, because the agents were able to enter the insect bodies, release toxins, drain it of nutrients and eventually kill it.

The research found that both wasp species were highly susceptible to all of the agents that were tested.

The research found that both wasp species were highly susceptible to all of the agents that were tested. In the case of the nematode-treated material, the wasp larvae died within two days after treatment. When they were dissected, they were found to be filled with hundreds of microscopic-sized nematodes, consuming the larvae from the inside out. Similar results were obtained with the fungi-treated material, where infection could visually be confirmed by the otherwise usually milky-coloured larvae, now pale-pink with fungal filaments growing out of the dead larvae like snow-covered sprouts.

Now that we know that there are live organisms, endemic to South Africa, which could be used to control the wasps, a platform has been created for future research to investigate how well these agents will work outside of the laboratory, before being released into the wild.

Now would be the time to find creatures that have the potential to kill and curb the further spread of these two invasive wasps in South Africa.

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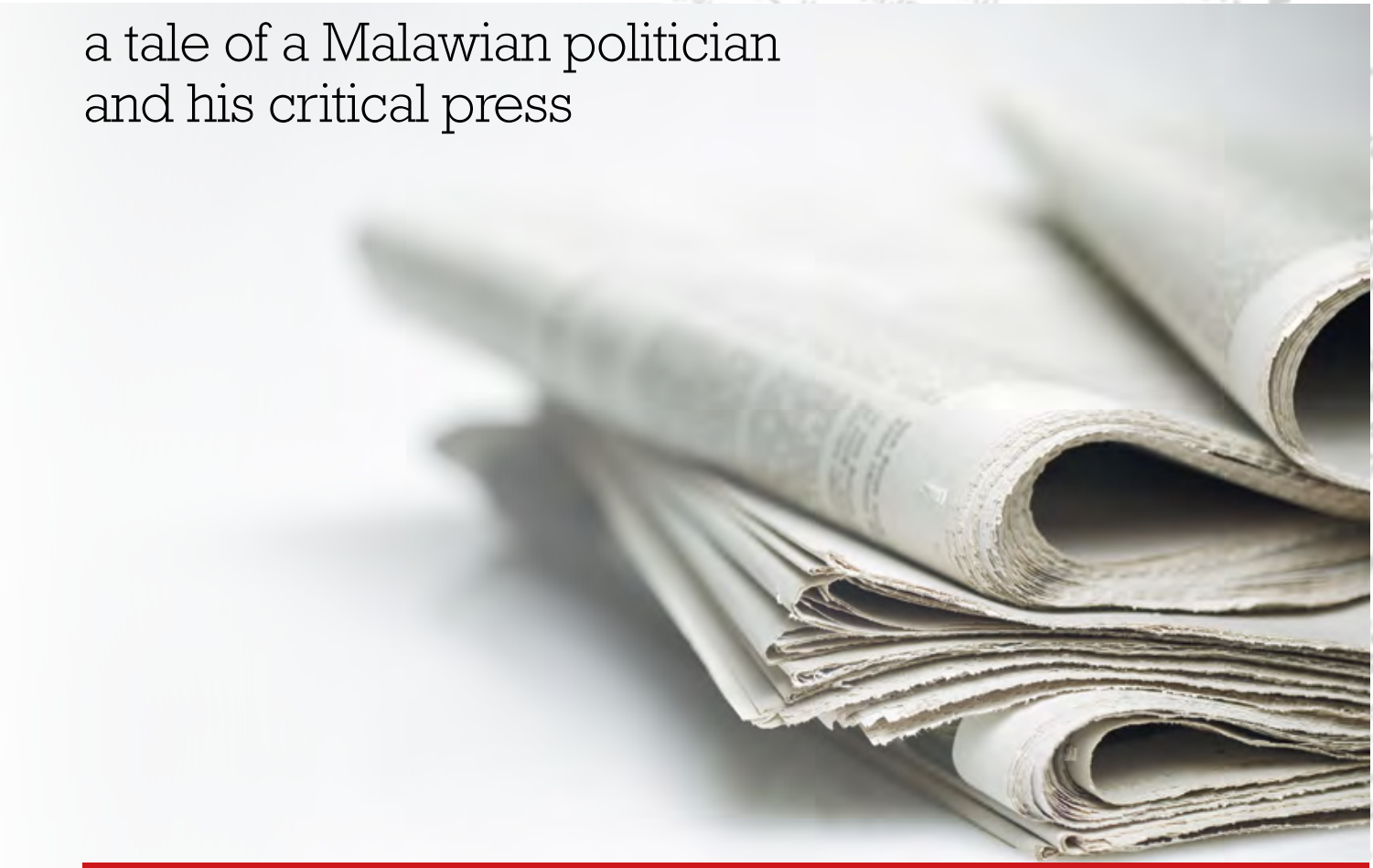
WHEN **MEDIA OWNERSHIP** AND **POLITICAL INTERESTS COLLIDE:**

a tale of a Malawian politician and his critical press



Anthony M Gunde shares a unique Malawian case of editorial independence

A critical, independent and investigative press is the lifeblood of any democracy. These were the words of South Africa's first democratically elected president, the late Nelson Rolihlahla Mandela to the Congress of International Press Institute in February, 1994. The fourth estate is, indeed, a critical pillar of any healthy democracy. But what does it mean when political leadership and ownership of a country's newspaper collide?

This was the question that I brought with me to Stellenbosch University's Department of Journalism in January 2013. I was interested in understanding how a Malawian weekly newspaper, the *Weekend Nation*, emerged to be one of the country's leading voices in the political press, in spite of it being founded by a leading politician in the advent of democracy in the early 1990s, the late Aleke Banda. One major finding in the study was that Banda was not just a veteran politician, but he was also an experienced journalist. The study revealed that the ''journalism factor'' in Aleke Banda played a key role to the *Weekend Nation*'s political role in the consolidation of Malawi's nascent democracy. This however, risked his own political career.

Journalism, politics and business seem to have formed the three governing interests in Aleke Banda's life. From a young age, he fought against British

colonialism in both Southern Rhodesia (now Zimbabwe), where he grew up, and later in his homeland, Malawi. It was within this latter struggle, that in 1959, he launched a Malawian unionist newspaper titled *Mtendere pa Ntchito* (Peace at Work) to fight workers' oppression from their colonialist employers. This publication kept the agitation against the British occupation alive. When the nationalists, led by Orton Chirwa, founded the Malawi Congress Party (MCP), Aleke Banda not only became its secretary general but the founding editor of the party's mouthpiece, *Malawi News*, at the age of 20. After independence from Great Britain in 1964, with the late President Kamuzu Banda (not related to Aleke Banda) and the MCP governing Malawi, he became the first director general of the Malawi Broadcasting Corporation (MBC). Aleke Banda further attended journalism training in Great Britain, Germany, Canada, and the United States of America. He also served in the MCP-led government in several ministerial posts.

Nonetheless, in 1978, under the repressive regime of Kamuzu Banda and the MCP, Aleke Banda was imprisoned for nearly 14 years for allegedly harbouring presidential ambitions. But in the early 1990s, he re-emerged as the founding member and vice-president of the United Democratic Front (UDF), leading the fight for democracy. During this time, he started Nation Publications Limited (NPL), publishers of the *Weekend Nation* and its sister titles, the *Nation*, *Nation on Sunday* and *Fuko* newspapers.

When the UDF won the first democratic elections in Malawi in 1994, Banda retained ownership of the media house, but left the running of the business in the hands of his daughter to fully devote his career to politics for the next 10 years. When the democracy was just a year old, his media company launched the *Weekend Nation*, a political weekly that was to become such a thorn in the side of the newly elected government and two subsequent governing parties that were to follow.

My analysis of the *Weekend Nation*'s news content through its editorial columns and opinion columns on major political issues showed that Aleke Banda's ownership of the newspaper had no direct bearing on the media content. This was confirmed through interviews I had with its political journalists who had worked there between 2002 and 2012.

Despite threats from governing parties to withdraw government advertising, the *Weekend Nation* never altered its editorial policy.

For example, when Aleke Banda was finance minister under the UDF party, the newspaper criticised the government for the purchase of luxury Mercedes Benz vehicles for cabinet ministers at the time when Malawi was reeling in famine. The article irked his fellow cabinet colleagues but he told them, according to one research participant, that the newspaper was a business and therefore, in the hands of the editorial team who had to abide by an editorial charter. This charter allowed the newspaper to publish articles without due influence from the political owner.

My analysis also showed that two subsequent governing political parties that followed the UDF after 2004, the Democratic Progressive Party (DPP) under late Bingu wa Mutharika (2004–2012) and the People's Party, led by President Joyce Banda (2012–2014) expressed distaste with the *Weekend Nation*, as the newspaper continued to unearth the abuse of human rights and corruption. For instance, in 2010, the DPP ordered all government departments to stop advertising with the NPL, publishers of the *Weekend Nation*, arguing that what was reflected in their news content was negative and unpatriotic. Joyce Banda's PP officials made similar advertising withdrawal threats following an exposé by the newspaper of systemic corruption within the government after she ascended to power in 2012.

Despite threats from governing parties to withdraw government advertising, the *Weekend Nation* never altered its editorial policy.

In 2007, the Media Institute of Southern Africa, a regional media monitoring body, recognised Aleke Banda with an award for his newspaper's promotion of pluralistic media in Africa, confirming its role in strengthening democracy in Malawi. He died of cancer in April 2010.

But the *Weekend Nation* has also been a business success. It is the leading Malawi's newspaper in terms of circulation, outpacing long-established newspapers before democracy as well as others that even folded within a few years of their establishment by other politicians.

What can we make of this story? Is it just that, a story that can never be repeated elsewhere? Or could one trace its success – both from a business and press freedom perspective – back to the fact that its editorial remained independent when it was least expected?

Perhaps we can learn something from this unique Malawian case – those who fiercely respect editorial independence, even if it puts their political career at risk, could be building a successful media empire and a democratic society at the same time.

Perhaps we can learn something from this unique Malawian case – those who fiercely respect editorial independence, even if it puts their political career at risk, could be building a successful media empire and a democratic society at the same time.

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HARVESTING THE HEALING POWER OF FAT: THE MIRACLE OF STEM CELLS

Warren Antonio Vieira explains the importance of understanding the potential and properties of fat-derived stem cells

Being overweight or obese is risky. As the needle of your bathroom scale goes up, so do your chances of developing serious health conditions, including diabetes and heart disease. Too much extra weight can even impair your wound healing abilities. However, does this make all fat bad?

Simply put, no. Although some societies spurn the idea of body fat, fat cells have amazing healing potential. They may in fact be medical gold due to them being packed with stem cells; cells that have the potential to transform into other types of cell.

Stem cells have fueled a re-imagining of the world – a world where debilitating diseases such as diabetes could be controlled; wounds could be repaired easily; and organs could be ''grown'' in a lab and given to someone without the complications of tissue rejection.

Importantly, fat-derived stem cells have a great transformation potential, which means that these cells can be converted to several different cell types – from heart cells to cartilage.

This special property may one day allow for the repair of damaged organs or even the personalised generation of a functional organ outside the body that can be inserted into a patient without the risk of organ rejection. Therefore, adults may ultimately use their own pool of fat stem cells for self-healing.

Harvesting stem cells from adult fat tissue has the added advantage of avoiding the ethical controversy linked to the use of foetal stem cells. Fat tissue is also easy to access – for instance, fat removal by liposuction is a routine procedure.

The Stephan Hough Research Laboratory, based at the Tygerberg campus of Stellenbosch University, is involved in research to understand the potential and properties of fat-derived stem cells.. This unit is run by scientists that make use of rats and mice as model animals to tackle the daunting task of understanding stem cell biology. The group is mastering the process of extracting fat tissue from animals and separating out the associated stem cells in order to study their function and activities.

The problem, though, is that being obese affects stem cells negatively, impairing their ability to transform into other cell types and to secrete their healing properties. That is why this unit's research is focused on understanding the benefits and limitations of fat-derived stem cells in response to disease states such as obesity. Scientists want to collect ''impaired'' fat-derived stem cells and learn what has changed in these cells, what effects these cells have on the body and the disease, and what could potentially be done to restore the beneficial properties of these cells.

Scientists have looked at fat, and re-imagined the medical world. By working towards a better understanding of fat-derived stem cells there is the potential of personalised healing for people, lean or obese. So next time you look in the mirror, do not curse your fat but rather be in awe of a potential medical marvel just a few centimetres below your skin.

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ARE WE ALL mentally healthy?

Psychologist *Angelina Wilson* reflects on our notions of what makes a person mentally "healthy"

The absence of a diagnosable form of mental illness, such as anxiety or depression, does not mean that a person is in a state of good psychological health. And making the distinction between these two states has important implications for policy-makers and psychologists' treatment methods.

This is what emerges from my preliminary research in the field, being done through the Department of Psychology at Stellenbosch University.

There's a new trend in the field of psychology, where some professionals want to focus on understanding and promoting mental health, rather than merely treating mental illness. Curiosity about this shift in thinking is what spurred my own interest, as a psychologist, to understand the different elements of mental health.

My research has shown that the distinct components of mental health do not necessarily equal the absence of psychological distress. There are many benefits of making this distinction, both for health workers and the communities they work with.

My initial findings show that although psychological distress and psychological well-being might be related, these two constructs are independent of each other. The research I've been doing is in Ghana, where I've worked with young people, trying to understand how they experience the elements of psychological distress and the elements of mental health.

Examples of elements of mental health could include feeling good about one's life, being emotionally connected to others, and having an overall positive view of life. Psychological distress, on the other hand, includes depression, anxiety and at times, a lack of control over one's behaviour.

After collecting this information, I ran statistical analyses that show that these elements were not opposites of one another, and at times they could co-exist. In other words, based on my findings, the absence of mental illness might not necessarily indicate the presence of optimal mental well-being. For example, the absence of depression and anxiety doesn't necessarily mean that someone will have positive emotions or feel good about their life.

One conclusion that could be drawn from this is that when psychologists or clinicians make diagnoses indicating the absence of mental illness, such a diagnosis might not guarantee that an individual is experiencing positive mental well-being. There is therefore more work to be done in developing mentally healthy communities, besides just treating mental illness.

My study also clearly shows that even when the elements of mental health are there, it doesn't necessarily mean a person is free of psychological distress. On the other hand, the presence of the elements of mental health make it less likely for certain symptoms of psychological distress to occur. For example, people who had a positive view of life are less likely to have problems with how they reacted to negative events. The traits that indicate the presence of mental health, such as an overall positive view of life, could occasionally affect the elements of mental illness, but separate psychological interventions might be needed to improve mental health.

One could argue that mental well-being is a right that all people are entitled to.

Psychologists now campaigning for this new line of thinking have shown that a population that is mentally healthy, is economically more productive. Mentally healthy people are also less likely to become mentally ill, which means a decrease in the costs of treating mental disorders.

By understanding the distinction between mental health and mental illness, as my study shows, we can give information about those that are actually "mentally healthy". This perspective can help policy-makers to design appropriate mental health promotion programmes for communities.

With this new knowledge, researchers could focus on discovering the factors necessary for mental health, instead of only focusing on mental illness. This would enable policy-makers to invest more financial and human resources on enhancing mental health while they try to reduce the things that cause distress.

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Sharing views on science communication

CARINE SAO EMANI
It is easy to tell your parents I study law, or dentistry or medicine, because they know what you will become. But when you say you study medical sciences or simply you are doing research, you face the challenge of having to explain in very simple language to your relatives and friends what it means, what is the role of a scientist in the society, and what is your research all about. I gave up hope to do that, but through *New Voices in Science* I have learnt to tell non-scientists about my work without boring them. Thanks *New Voices*!

ALEM GEBRU
Research can be more meaningful if the society who invested in our education is able to make informed decisions. The only way to achieve this is by communicating the outcome using understandable language. I believe that *New Voices* is paving the way to reach the society.

MOHAU JUSTICE PHIRI
New Voices helped me to explain complicated scientific findings of my research using a very simple and effective style that can be understood by any audience. I encourage other researchers to get involved in public events like *New Voices* so that science can be appreciated in our communities.

SHEILLAH SIMIYU
I have learnt to place myself in the listener's shoes by asking myself, what do they know and what don't they know about my research? How then do I use what they know, to tell what they don't know? Knowing that gap is in itself, thrilling!

GENEVIEVE DIEDERICKS
New Voices has made me realise that if we do not learn to communicate and share our work outside of our field, our research is pretty pointless. This competition provides us with a platform to learn this valuable skill and I would encourage all future researchers to partake.

ELKE MATTHAEI
Through the science communication training, I have become more aware about what it is I want to bring across – regardless of whether it is in my thesis, in presentations or discussions about my research. I am still not an expert, but I am now more focused on being to the point and avoiding long elaborations which distract from my core message.

CHRISTINA GLYN-WOODS
The *New Voices* opportunity has in a fun way forced me to look at my research with new eyes and from a broader perspective. It has been an invaluable exercise on how distil the core message and to find the language to communicate this to an audience not in my field. With the move towards a more transdisciplinary approach to conducting research, more common ground is something we could all benefit from.

NATALIE THERON
The *New Voices* programme has improved my view to see my research in another perspective. It is our duty to share what we have learned from nature, not just with our peers but our community as well.

ANTHONY M GUNDE
New Voices taught me to communicate my social science research comprehensively with interdisciplinary audiences. Insights of this kind can be very useful in helping PhD researchers devise effective ways of taking science to the public.

Mohau Justice Phiri

Genevieve Diedericks

SHANIL HARICHARAN
The *New Voices* programme has empowered me to communicate my PhD research beyond the realm of academia through demystifying complex concepts and empirical research results – opening a window to a larger world of readers.

MINETTE KARSTEN
Communicating science to the "man on the street" is actually really hard for us scientists. *New Voices* has helped me develop these skills and has encouraged me to share my research in informal ways.

ANGELINA WILSON
The *New Voices* programme has opened my eyes to another system of writing and presentation of the important research work we do daily. It has been a challenging and worthwhile learning period, which has been accompanied by the acquisition of skills that I hope to bring to bear in future attempts at community engagement and transformation.

Warren Viera

Carine Sao Emani

Alem Gebru

Sheillah Simiyu

Barnabé Msabah

Caroli de Waal

DZIFA ATTAH
I am glad a very critical aspect of my research journey got to be shared with other researchers through this medium. *New Voices* helped me communicate the reality of conducting scientific research in simple, plain language that anyone can understand.

CAROLI DE WAAL
I have encouraged all the other students in my lab to participate in the *New Voices* programme and activities. It provides valuable skills to young researchers, not only by learning how to communicate your work to a broader audience, but also to view your research from a different perspective.

BARNABÉ MSABAH
Through the *New Voices* programme and activities I have grown up as an academic in such a way that I now know how to inspire, inform, educate, build capacity and influence change in a conversational manner using uncomplicated, everyday language. I encourage researchers (both young and more experienced ones) to consider taking the *New Voices* course so they can learn how to share their research and convey a clear message to all the layers of the society whether by writing or speaking.

ZELDA VERGOTINE
Since partaking in the *New Voices* programme I have developed science communication skills both in writing and preparing presentations for wider audiences. This programme will benefit any researcher who is interested to engage with the public to improve their understanding of research.

TLOU MASEHELA
As scientists, we carry out research to find solutions to problems or generate new knowledge for our communities. *New Voices* helped to better communicate this knowledge and solutions in the easiest way possible.

CAROLIEN VAN ZYL
Experiencing the conveyance of science in a pithy and concise manner is always refreshing. The *New Voices* programme gave me the opportunity to improve on an area of research that I am not good at.

KENNETH HAMMOND-ARYEE
The *New Voices* programme provided me with an opportunity to get my work into the mainstream domain as opposed to just the scientific community. I believe there is no point in keeping the science we do to ourselves. It has to be packaged such that the lay end user can relate to it and therefore academic institutions need more such initiatives.

WARREN VIERA
The *New Voices* programme has been a powerful and beneficial learning experience for me. It has taught me a valuable set of writing skills that will allow me to communicate my research to a wider audience.

Rewarding science images

In the science photograph category, we asked participants to capture something about their research that they wanted to share with the public. Here are the 2015 finalists, with their own descriptions of what the photographs are about.

This year, we also challenged participants to make a 1 minute video clip of an aspect of their work. View the finalists at https://www.youtube.com/user/pgskillsatsun

The winners in these categories will be announced at the public event on 7 December 2015.

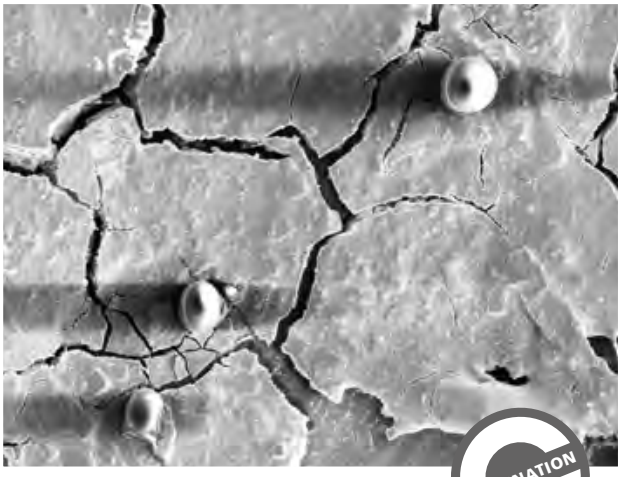
Insect Taxi
Natalie Theron

One of the insects found within protea fruits, that is covered in mites. Mites are tiny spider-like creatures, smaller than a sugar grain. They travel between protea flowers by catching a ride on insects. When we found these mites it unlocked the door to an unexplored and almost invisible world. My research now focuses on the role of mites in protea health – are they crucial pollinators, or are they dangerous carriers of fungi and diseases?

NOMINATION

Greed
Genevieve Diedericks

My research subject, the smallmouth bass, died due to greediness. Bass are known to be top predators, annihilating all potential prey that may cross their paths. Here, the bass has a bluegill sunfish lodged in its mouth, unable to swallow it due to its size. Both fish in this picture are alien invasive species.



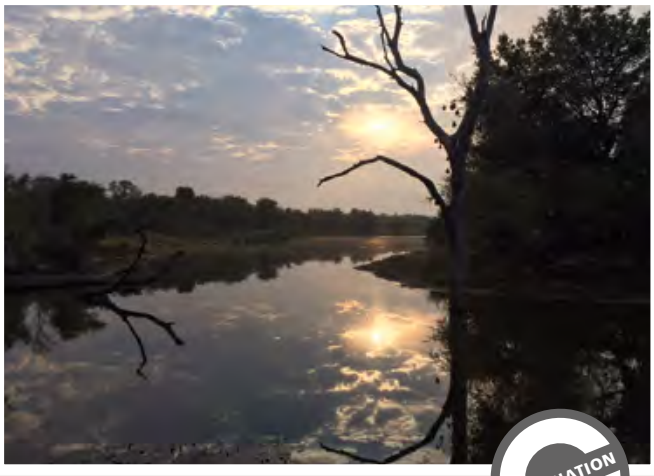
NOMINATION

Exploring new worlds with polymers
Guilaume Greyling

The electron microscope photo shows the self-assembly of polymers into large semi-spherical particles on top of polymer layers. The “shadows” are a result of electrons cancelling each other out by destructive interference. This is the only electron microscope picture of PMMA-PS polymers forming large semi-spherical particles in the world. The picture shows that polymer science can be a completely different world, literally and figuratively.

Infected alien
Carolien van Zyl

This is a dead wasp larva infected with a fungus. The fungus infects the wasp larva, kills it and eventually grows out of the larvae. This fungus can potentially be used to control this specific invasive wasp species. At the time I took the photograph the light coming through the window hit the specimen in a very peculiar way, making it look like something from a different world.



Before the panic sets in
Tammy Olivier

Sunrise at Lake Panic in the Kruger National Park. I study TB in lions and am part of the SU Animal TB group. Mostly confined to the laboratory, I enjoyed the opportunity to a take part in a lion capture, to see exactly how my research is applied, and how important it is. This photograph was taken on my first field trip earlier this year to the Kruger National Park.

Osteoderm
Chris Broeckhoven

To study the protective plates arranged like roof tiles in its skin, I place the *Ourborus cataphractus* [also seen on our cover (Ed)] under a medical CT scan. This allows me to digitally remove the outer layers of the skin without hurting the lizard. This particular scan shows the osteoderm/bones in white while the skin is made transparent brown.

A day in an informal settlement
Sheillah Simiyu

This a snapshot of events on a busy pathway through an informal settlement. There are many activities going on: a young child playing next to a dirty stream, a man trying to make a living, women selling their wares, children coming from school – all in a very dirty environment.

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