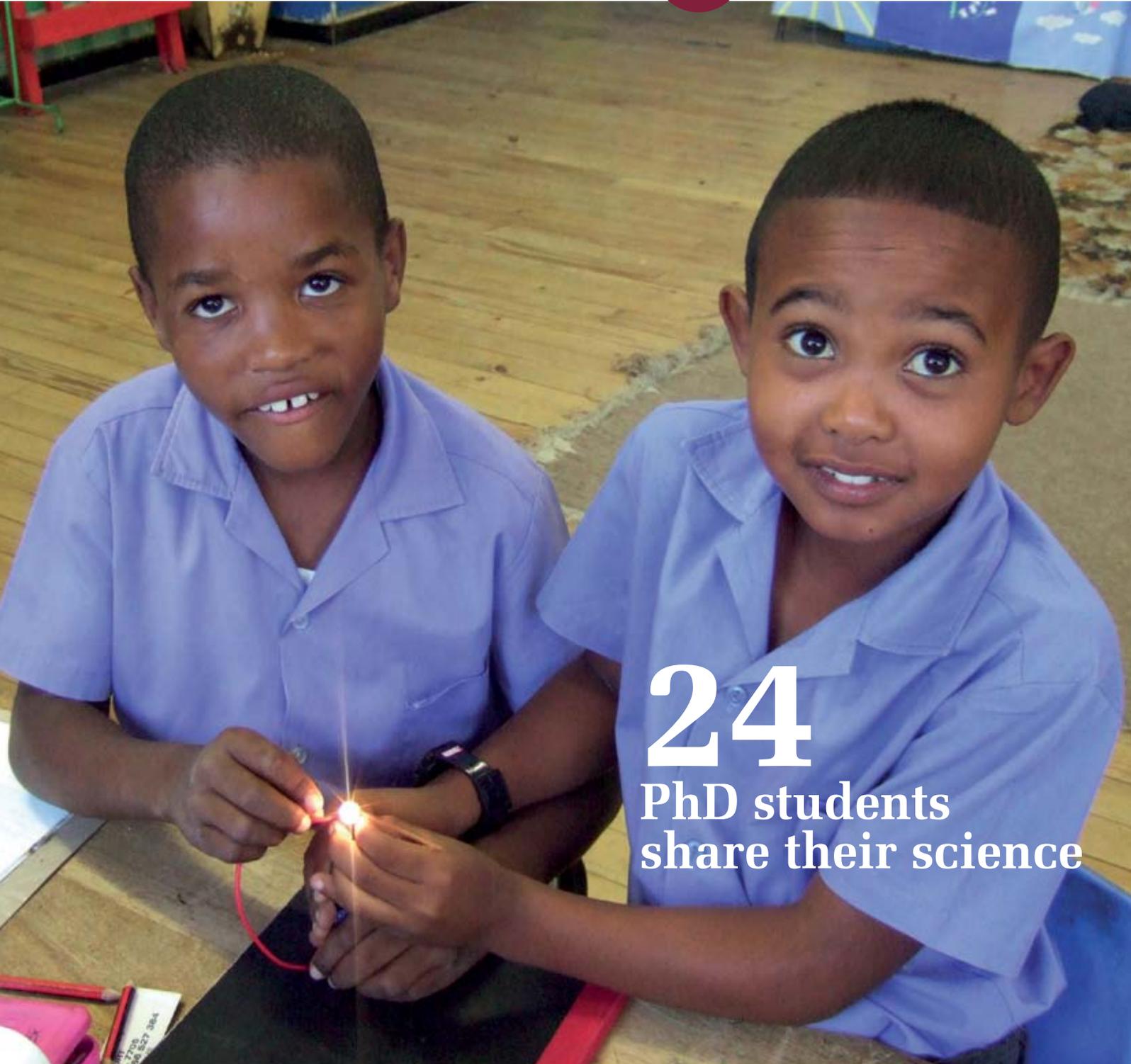




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new voices

IN science 2013



24

PhD students
share their science

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foreword

We are proud to bring you this second edition of *New Voices in Science*, in which 24 PhD students of Stellenbosch University write about their research.

Even though you might know little or nothing about subjects such as aerospace engineering or mathematical modelling, each of these popular science stories will give you a fascinating glimpse into the work of our young scientists, and why their endeavours matter to all of us.

Behind these articles lies another story – that of science communication training at SU, and of our endeavours to deliver the next generation of thought leaders in science that our country and continent so desperately need.

In May this year, all of our PhD students were invited to enter the *New Voices in Science* competition. They could choose to compete in two categories, namely the presentation of a popular science talk, or the writing of a popular science article.

All entrants were offered science communication training, provided by some of the best minds in the field in South Africa. The process included feedback, edits, retakes and further polishing to finally give birth to the written work you can read in this publication. Fourteen finalists in the oral category were also selected to present their talks at our public event on 5 December 2012.

Why is our University making this investment in science communication?

We believe that science communication creates a scientifically literate society, which is crucial to respond effectively to the challenges and opportunities we face. As envisaged by our HOPE project, it holds scientists accountable and ensures that science is always employed in the service of society.

Of course, science communication training is difficult to get right.

It should not try to change researchers into writers or entertainers. We have learned that it is not only about honing writing and speaking skills. Rather, the ability to communicate science starts with an understanding and caring about what the public knows, and what they would actually like to know about our science. It's all about finding ways to explain our science so that it responds to these questions and concerns.

One thing that *New Voices in Science* has taught us is that this ability to communicate their sciences is absolutely within the reach of all researchers.

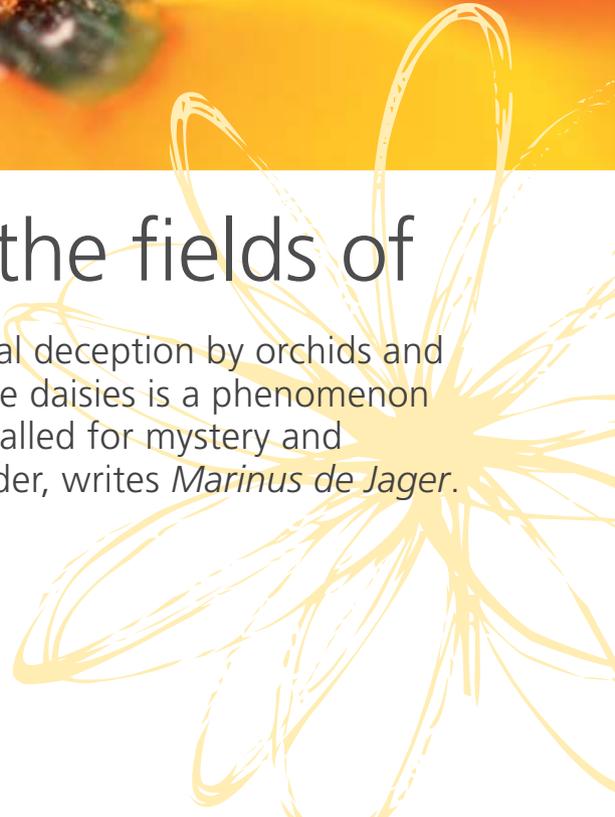
Prof. Russel Botman
Rector and Vice-Chancellor, Stellenbosch University

“ We believe that science communication creates a scientifically literate society, which is crucial to respond effectively to the challenges and opportunities we face.



Romance and regret in the fields of **Namaqualand**

Sexual deception by orchids and beetle daisies is a phenomenon unrivalled for mystery and wonder, writes *Marinus de Jager*.



Imagine a fly in a field of flowers. It's not one of those pesky houseflies that tirelessly try to share your food. This fly is ordering from a completely different menu.

Amongst the bright yellows and oranges that is the splendour of Namaqualand in springtime, the male fly sees an enticing black shape. Resting on the petals of a daisy, a lone female is making her presence known. As the hopeful male approaches, she shows no intention of fleeing.

Love, apparently, is in the air.

Our male lands and starts to pivot around like a spinning top in an attempt to mate with her. However, he senses that something is wrong. She seems withdrawn and unresponsive and appears to be fixed to the petal.

Slowly he starts to realise that he's been fooled, for this fly is utterly lifeless. Disgruntled, our male flies away.

But wait! Another female on a nearby flower seems to be waiting to catch his eye...

Sexual deception

What this imaginary fly experienced is not the insect version of playing hard-to-get, but rather the result of sexual deception, a phenomenon unrivalled for mystery and wonder within the plant kingdom.

Sexual deception involves a plant imitating the female of its pollinator, usually an insect.

In some plants, the floral structures are adapted to such a degree that the pollinating males often cannot distinguish between female and flower.

Since it was first observed in 1916, it was believed that only orchids had mastered this feat. Two years ago researchers at Stellenbosch University (SU) also discovered that Namaqualand's own beetle daisy, *Gorteria diffusa*, is the first non-orchid to join this elite group.

Furthermore, this daisy exhibits extreme floral variation, with 14 distinct floral forms already described in different populations.

How these different forms evolved and how they each interact with the flies that pollinate them are questions now being answered by the Cape Flora Research Group in the SU Department of Botany and Zoology.

The methods that plants use to achieve such a colossal charade are the focus of much research. The most common trick, at least within the orchid plant family, is the use of floral scent.

When they are ready to mate, female insects often produce sex pheromones unique to their species. Males of the same species are extremely sensitive to these compounds and can detect them over long distances. The flowers of sexually deceptive orchids have

What this imaginary fly experienced is not the insect version of playing hard-to-get, but rather the result of sexual deception, a phenomenon unrivalled for mystery and wonder within the plant kingdom.

emulated these wonderful pheromones and are able produce them in much higher quantities – some as much as ten times the amount that is released by genuine females.

Whereas scent can attract males over long distances, the ability to resemble the female insect visually can also be important over shorter distances. Some plant species have produced incredibly lifelike replicas of their pollinator's females. Through an insect's compound eye, which only has about a hundredth of the resolution of the human eye, it is almost impossible to tell the difference.

Visual mimicry

The beetle daisy from Namaqualand seems to rely almost entirely on the visual mimicry of female flies to attract male pollinators. Tests have shown that male flies show no preference for the flower's scent. They do, however, clearly prefer various visual elements of the dark fly-mimicking spots that appears on some of its floral forms.

Excited males are deceived by this ruse and will hop, turn, and vibrate on these spots. In the process they get



coated with pollen. Once they realise their mistake and depart, the pollen is conveniently delivered to the next flower that it is fooled by.

Pollination has never been so delightfully devious.

Some of the daisy's floral forms are clearly sexually deceptive and exploit eager males to the point of heartbreak. Other forms focus on both sexes.

Evidently, things are not always as they seem, as any of these flies will tell you. Next time you visit Namaqualand and its spring flowers, keep an eye out for these fast flying fools around a patch of daisies and take a moment to appreciate the wondrous ingenuity of our natural plant life.

Marinus de Jager (mdejager82@gmail.com) is working towards his doctorate in botany. He is a member of the Cape Flora Research Group in the Department of Botany and Zoology in the Faculty of Science. He focuses on the role of pollinators in generating and maintaining floral polymorphisms within spotted daisies, and especially on phylogeographic and behavioural aspects thereof.

Dishing up ‘institutional culture’: is there a recipe?



‘Institutional culture’ has become a buzzword in discussions on higher education in South Africa. Universities are urged to change their institutional cultures, whether in response to the changing educational landscapes or in order to promote transformation. The National Plan for Higher Education urges universities to ‘revisit’ or ‘refocus’ their institutional cultures.

Do institutional policy makers fully understand how they should respond to this call? What exactly is meant by the concept of ‘institutional culture’? A search through academic literature has shown that the concept is notoriously difficult to pin down. It’s a bit like trying to nail jelly to the wall.

If South African universities want to successfully employ institutional culture in their transformation efforts, they will have to deepen their understanding of what this concept really means within a tertiary institution context.

An education policy study was done at Stellenbosch University (SU). It found that institutional documents of both SU and the University of the Western Cape (UWC) refer to aspects of institutional culture, but never clearly articulate this concept.

South African universities will have to deepen their understanding of what

institutional culture means within a tertiary institution context if they are to successfully employ it in their transformation efforts.

The SU study therefore undertook a conceptual analysis, to provide higher education policy practitioners with a workable meaning of this concept.

Literature on institutional culture was grouped into logical themes, while the most recurring meanings were identified. This process made it possible to break the concept of institutional culture into four constituent ‘ingredients’, namely values and beliefs, symbols, language and knowledge production.

Further scrutiny of the policy documents of both UWC and SU revealed references to all of these ‘ingredients’. Although transformation was also mentioned in these documents, links between transformation and these items were not made clear.

Concrete strategies – that could bring about changes in beliefs, symbols, language and knowledge production to realise the stated transformation goals – were missing.

The research suggests that higher education policy-makers do not have an adequate understanding of the concept of ‘institutional culture’ and its constituent parts. Giving content to this elusive concept enables universities to move beyond mere compliance in their policies, towards concrete strategies and action plans that can achieve real transformation.

Anthea Jacobs (jacobs.a@iafrica.com) is a doctoral student in the Department of Education Policy Studies in the Faculty of Education. Her thesis provides a critical-hermeneutical inquiry of institutional culture in higher education.

Values and beliefs + symbols + language + knowledge production = institutional culture



NUMBER CRUNCHING is a healthy option

Have you been charged to improve health care in rural Africa? Have you perhaps considered consulting a mathematician?

This is exactly what the Integrated Infectious Disease Capacity Building Evaluation Project (IDCAP) in Uganda did when they wanted to find out if the training of nurses had any impact on the health of patients.

Between 2009 and 2011, IDCAP gathered data on how a group of Ugandan nurses managed cases, made diagnoses and treated patients before and after they were part of a training programme. With the data in hand, IDCAP approached the South African Centre for Epidemiological Modelling and Analysis (SACEMA) at Stellenbosch University (SU) for help.

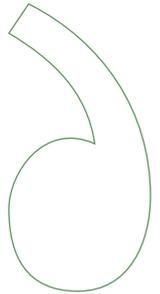
SACEMA staff, along with mathematicians in the SU Department of Mathematical Sciences (mathematics, applied mathematics, computer science) then set about to develop a mathematical model to determine whether there were any measurable improvements in patient health thanks to the training the nurses received.

The model clearly showed that the number of disease cases and deaths dropped after the training programme was introduced.

It is very important to be able to measure the impact that an intervention has. In this particular case, for instance, there is a general shortage of doctors which means that patients in rural areas are often primarily cared for by nurses.

It is hoped that this kind of

Mathematical modelling allows one to assign a numerical value to the effect that a particular intervention might have on the incidence, prevalence, mortality rates and the long-term outcome of a disease.



mathematical modelling will inform responses to the workforce crisis in the health sector, whilst at the same time meet the needs of patients. This is especially true within an African context.

Mathematical modelling allows one to assign a numerical value to the effect that a particular intervention might have on the incidence, prevalence, mortality rates and the long-term outcome of a disease. It is a very useful tool for scenario planning and decision making.

It is of course not the first time that a mathematical model has been used to answer a question relating to health matters. In fact, the results of some models have already helped to shape current health policies in South Africa, Uganda and elsewhere in the world. These include the current campaign to use male circumcision to control HIV infection, and changed guidelines on access to antiretroviral therapy (ART) by the World Health Organisation (WHO) that now allow HIV infected people access to medication at an earlier stage.

Doreen Mbabazi (doreenresty@gmail.com) is a doctoral student in mathematical epidemiology in the Department of Mathematical Sciences (mathematics, applied mathematics, computer science) in the Faculty of Science. She uses mathematical modelling to study the effectiveness of two training interventions on infectious diseases in Uganda.

WATER:

key to the forming of ancient Earth

Geologists from Stellenbosch University have proposed a new model to explain how the continents of ancient Earth were formed, writes *Angelique Laurie*.



Have you ever tried to picture a world completely covered by water? This is precisely what Earth was like when it was first formed almost 5 billion years ago.

Infant Earth was covered by a cool ocean and resembled a perfect sapphire sphere. A mass of matter lay hidden under the ocean.

Life as we know it would not have been possible without land. But water itself may have been responsible for the emergence of habitable land, according to recent research from the Centre for Crustal Petrology in the Department of Earth Sciences at Stellenbosch University.

Scientists are still not completely sure how and why the first continents formed and rose above the ocean.

Geologists do have a reasonable understanding of how continents were shaped in the last 2,5 billion years, but they are still debating which processes were involved in the period before that.

The research from Stellenbosch University (SU) has shed new light on this conundrum.

Continent formation in the first half of the Earth's life must have differed from the processes involved in the latter half, because ancient Earth was much hotter than today.

'Modern' continents form when one tectonic plate (usually an oceanic plate) is submerged below another (usually a continental plate) after colliding. The downward moving plate heats up as it shifts deeper into the Earth's hot pliable, plastic mantle. As it heats up, water is released by the oceanic crust, which is the upper part of the submerging plate. This water interacts with mantle rocks that melt and produce new continental material.

Rocks from ancient continents are only found at a few places on Earth, such as in Mpumalanga in South Africa and in Swaziland. When one studies the chemical make-up of the ancient rocks in southern Africa,

This model was tested and evaluated in the Stellenbosch University Earth Sciences Experimental Laboratory, which is the only one of its kind in Africa.

it seems that Earth's first continental crusts were formed from the oceanic crust itself.

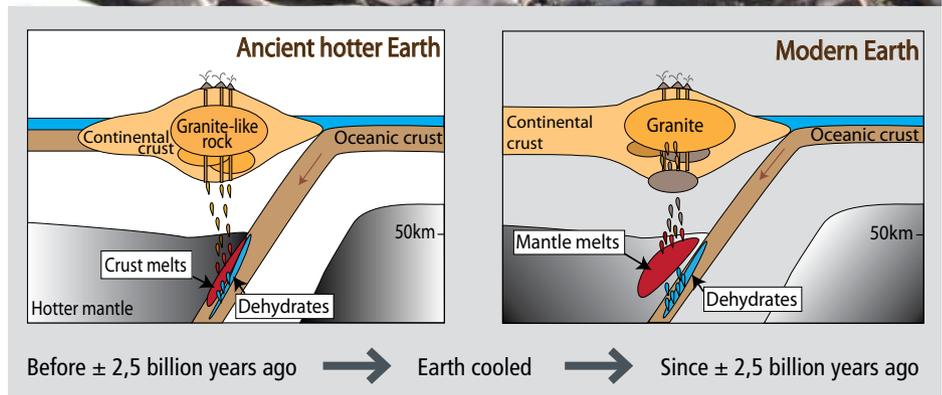
The Stellenbosch researchers used high-tech equipment to show that more than 2,5 billion years ago, oceanic crust could have melted because of conditions such as higher mantle temperatures, extreme pressure and the presence of liquid water.

The SU model is unique because of the role that water plays in it. Water is known to lower the melting temperature of rock. The research model proposes that the water which was released by the oceanic crust as it rapidly submerged and descended into the mantle, interacted with the upper, denser portions of the oceanic crust itself. The melting point was reduced and the melting of this crust was triggered. The molten rock became buoyant and cooled as it moved upwards to produce Earth's ancient continents.

This model was tested and evaluated in the SU Earth Sciences Experimental Laboratory, which is the only one of its kind in Africa. Dense oceanic crust rock was subjected to similar high pressure and temperature conditions than might have been found very deep within the ancient Earth.

The study results demonstrated that the proposed model plausibly explains how Earth's early continental crust was formed.

What then was the watershed moment after 2,5 billion years that altered the way in which continents form? The answer lies in the gradual cooling of the Earth since its inception. At some stage it simply reached a point where it was not hot enough to melt dense submerged oceanic crust, despite the presence of water.



Picture again a world covered with water. Without our continents, human life would not have been possible. The Latin saying *aqua vitum portat* ('water carries life') nowhere rings more true than in the story of land and its creation. It is the very presence of water that enabled our continents to form.

For her doctorate, Angeliqe Laurie (ang.laurie@gmail.com) studies the formation of Earth's early felsic continental crust via water-present eclogite melting. She is a member of the Centre for Crustal Petrology in the Department of Earth Sciences in the Faculty of Science.

You're settling in on an aircraft, ready to go home after the wedding of another extended family member. The faint airline intercom crackles. Above the usual faint hiss you hear the rigid voice of the pilot, devoid of any enthusiasm.

"Good day, I'd like to welcome you aboard this flight. My name is C3PO and I'll be flying you safely to your destination in this newly upgraded aircraft."

The passengers, who are usually indifferent to the pre-flight announcements, are suddenly quiet and far more attentive. "So this is it," you think. "They're actually using that autopilot system that I read about the other day."

Flying is certainly not everyone's cup of tea. Air disasters happen. While safety reports show that the

number of annual aircraft accidents is not decreasing, crash investigations suggest that many accidents are completely preventable.

Have we become so focused on making aircraft 'green' that we've forgotten to make them completely safe? How is it that we can send people into space, but are unable to prevent aircraft from crashing?

A decrease in investment in military concerns across the globe in the last decade has fortuitously shifted research attention back to commercial jet transport safety.

Postgraduate engineering students at Stellenbosch University who work in the field of aerospace automation have responded to industry needs. They are tackling the problem of aircraft loss-of-control by developing enhanced autopilot systems.

How is it that we can send people into space, but are unable to prevent aircraft from crashing?

Most commercial aircraft are equipped with autopilot systems that typically only operate in favourable flight conditions. In loss-of-control accidents, when an aircraft typically nosedives and starts spinning, current autopilot systems simply disengage and leave the control of the aircraft in the hands of the human pilot.

Timing and the ability to make quick decisions becomes crucial, but human pilots sometimes fail under the intense pressure of the situation. This does not need to be so, because by following the correct procedures it is quite possible to recover from such situations.

The Stellenbosch research aims to design an autopilot system that can

Would you let a robot fly you home?

Advances in autopilot systems will benefit aircraft safety, writes *Simon Pauck*.



RESEARCH FINDINGS

by Amanda Genis

bring an aircraft back to safe flight mode when it loses control. It is among the first academic and commercial efforts to use this method to improve air travel safety.

Programming an autopilot to do this is much like teaching an average car driver how to be a rally driver. Although conceptually simple, a lot of work still lies ahead before such a system will be commercially available.

The automated system must be general enough to use in a range of aircraft – from a standard local carrier to a 747. It needs rigorous mathematical proof to be of any use for the commercial airline industry. Certification standards are notoriously difficult to meet, and it remains a major challenge to transform a lab design into a real aircraft.

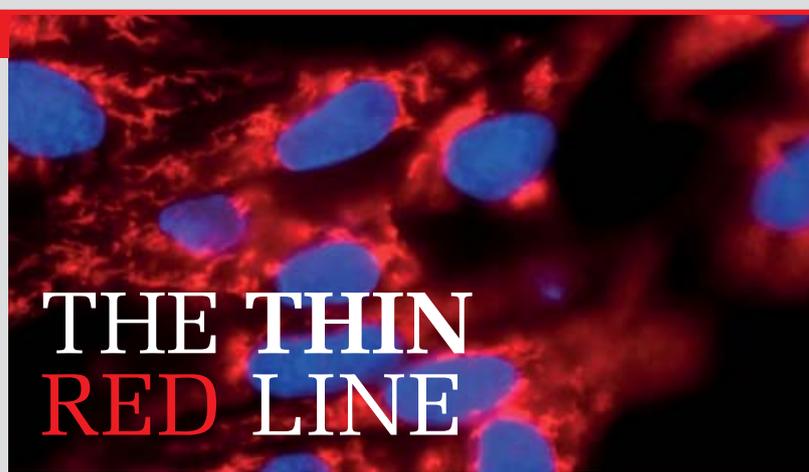
The complexities of real people in real flight situations also need to be taken into account. Extreme manoeuvres that prevent a crash but injure passengers or pull the aircraft apart will still result in a failed recovery.

Despite these challenges, the research team at Stellenbosch University are laying a solid foundation for the future of such advances, which could have significant implications for the airline industry and the public.

It will provide aircraft manufacturers with increased confidence in the product they supply. Airline operators will have a reliable fleet at hand, and most importantly, passengers will have peace of mind.

We are still a long way from handing over control to C3PO. This might come as a relief to people who still find it mindboggling that a conglomeration of metal can somehow defy gravity. Others, on the other hand, will have to be patient a while longer until what was once considered science fiction, finally becomes fact.

Simon Pauck (simon.pauck@gmail.com) is a doctoral student in the field of aerospace automation in the Faculty of Engineering.



Most of us will quite easily rate the heart, the lungs, the brain, liver and kidneys as the most essential organs in our body. Few people know that these vital organs are protected by another, much larger organ: the endothelium.

The endothelium consists of a thin layer of cells that lines the insides of our veins and arteries. These tiny cells are stacked together like cobblestones to form a barrier between the blood and the wall of the blood vessels. This first line of defence protects the entire body from harmful substances that might be circulating in our blood.

Endothelial cells also produce nitric oxide, which relaxes the muscles in the vessel walls and therefore dilates blood vessels. The dilation of blood vessels protects us from ailments as wide-ranging as heart disease and erectile dysfunction.

Things go wrong when nitric oxide levels are too low. Blood vessels can no longer dilate properly. Low levels of nitric oxide also affect the integrity of the endothelial cell walls, and therefore make the endothelium a less effective barrier.

Research done in the Division of Medical Physiology at Stellenbosch University's Faculty of Medicine and Health Sciences is increasing our understanding of how microvascular endothelial cells work, all in an effort to ensure cardiac health.

The researchers grow cells in a laboratory and expose them to different environments to simulate clinical problems. This work could eventually help to detect signs of endothelial dysfunction in patients and help to predict possible future clinical problems.

Endothelial dysfunction is reversible. A better understanding of endothelial cells could lead to effective treatment of this condition, and possibly even prevent the development of certain clinical conditions.

For her doctorate in medical physiology in the Faculty of Medicine and Health Sciences, Amanda Genis (amanda_g@sun.ac.za) is studying the cellular responses and mechanisms following the exposure of cardiac microvascular endothelial cells to harmful stimuli.

LIVING WITH ALMOST NO WATER: when surviving is just a matter of root to shoot communication



6 When I took images of the leaves using the microscope, I found something unexpected. Somehow the rootstocks had managed to change the stomatal size on the leaves of the plant it was grafted on, thereby reducing water loss.

The one year old grapevine is starting to show the effects of drought. Its older leaves are turning yellow. Its single shoot has stopped growing and the tip is drooping. Its small leaves are wilting.

For the past ten days, I've been withholding water from the 28 grapevines in my greenhouse in the Department of Viticulture and Oenology at Stellenbosch University. Temperatures have soared to 35 °C and many of the plants are beginning to die. Surprisingly, some grapevines still have greenish leaves and somehow seem to tolerate the lack of water.

My quest as part of my doctoral research is to find a Pinotage vine that can withstand drought and is able to produce good quality fruit. I do this by grafting a Pinotage producing vine onto a drought-resistant rootstock, fusing them so that the two parts function as a single plant.

The practice of grafting has been around for almost 200 years (see text box), but it is only more recently that scientists have realised just how remarkable this fusion really is.

In dry conditions the roots of all plants produce signals that are sent through the shoots to the leaves and cause the stomata (or small pores) in the leaves to close.

The stomata open to take in carbon dioxide from the air, which is essential for growth and fruit production. This comes at a cost: the plant loses water through open stomata, hence the signal from the roots to close, when water sources are low.

Grafting works because this communication between roots and leaves continues between the cultivar and its new rootstock. Because the drought-resistant rootstock has more root growth and more efficient conduits for water, it can signal to the stomata to remain open. Photosynthesis is

maintained and growth and fruit production is not affected.

In subjecting my poor young vines to the toughest conditions, I was not only searching for the best possible combination of drought-hardy rootstock to marry to delicious Pinotage producing vines. I was also trying to further our understanding of what makes some plants more resistant than others.

In the process, I inspected the minute stomata on the leaves of the different vines I'd been so tough on, to try and understand how they were responding to drought stress. For this, I used an electron microscope, which has the ability to show me a little universe that it is not visible to the naked eye.

But here's the most remarkable part of the story: When I took images of the leaves using the microscope, I found something unexpected. Somehow the rootstocks had managed to change the stomatal size on the leaves of the plant it was grafted to, thereby reducing water loss. This means that the roots are not only determining the stomatal movement of opening and closing, but also their development.

The practice of grafting has been around for almost 200 years, but it is only more recently that scientists have realised just how remarkable this fusion really is.

But how is something like this possible in roots and stomata from two entirely different plants that are separated by at least a few meters of vine growth? We clearly still have a long way to go in deciphering the strange root to shoot communication between vines.



The story of grafting

The story of grafting began in the 1860s, when aphids called grape phylloxera caused severe damage in viticulture. Vineyards in Europe were decimated by the last half of the 19th century. When it was discovered that some American relatives of the European grapevines were resistant to this plague, viticulturists decided to graft the top of the European grapevine onto the rootstock of American plants. It worked. As a bonus, the technique not only took care of the phylloxera problem but also helped the vines cope with other environmental stressors. Desirable cultivars have since been grafted onto drought resistant rootstock in order to maintain vine growth and yield under harsh conditions.

Ignacio Serra Stepke (iserra73@gmail.com) is a doctoral student in the Department of Viticulture and Oenology in the Faculty of AgriSciences. His research focuses on the study of rootstocks water uptake in Pinotage (Vitis vinifera L.), leaf transpiration efficiency and on grapevine adaptation to drought. He works at the Universidad de Concepción in Chile.

The silent cry of women: a reality in rural communities



Many women in the Western Cape live in poverty, are addicted to substances, are beaten by their partners and struggle to believe the promise of equality and freedom in our country, writes *Alitha Pithey*.

She looks much older than what is suggested by the identity document that she presents with a trembling hand. Her way of speaking and reasoning is like that of a teenager. Her dress is wrinkled and bleached by the sun of many summers. The simple concrete structure she calls home reveals her financial hardships.

We sit on crates in the kitchen, and she apologises for the lack of chairs. Flies try to take over our conversation. In the background children yell and scream. The woman walks to the broken window, leans over the dirty window sill and urges the children to lower their voices.

The unmistakable smell of alcohol fills the room as she tells her story. While desperate to be heard, she is also careful to protect her live-in partner. Several scars on her face, arms and legs confirm her reality.

Foetal alcohol syndrome

Jenny Bruintjies (not her real name) lives and works on a wine-producing farm outside Cape Town. She has four children, the youngest of which has been diagnosed with Foetal Alcohol Syndrome (FAS). Her second youngest child has symptoms of partial FAS.

FAS is the number one preventable cause of cognitive deficits in children. It is a debilitating syndrome with which affected children have to live with forever without any hope of a cure. Sadly, it is the consequence of Jenny's drinking whilst expecting her children.

Jenny has not been able to tear herself free from the claws of alcoholism. She started drinking to relieve the pain of childhood sexual abuse and neglect. She has always been involved with addicted men who abuse her.

Her past has influenced her future and has taken every bit of dignity and confidence from her.

Jenny still believes that her love could change her aggressive partner. She hopes this will provide her with the kind of love that has always eluded her – the love of parents and the affection of partners that others so easily take for granted.

Unfortunately social researchers know her love will most likely not change her man, and that the abuse will probably only become more frequent and severe as the years go by.

Researchers of the Department of Psychiatry at Stellenbosch University have interviewed many women like Jenny to understand why the rates of FAS are so high in the rural areas and towns around Cape Town.

Posttraumatic stress

They have found that childhood trauma and abuse can lead to post-traumatic stress. Desperate to take away the pain, many women do not realise that by self-medicating with alcohol they are creating even more difficulties and hardship for themselves.

Handling a child with FAS is not easy. Living with the fact that your behaviour leads to disability in your child is even more difficult and heartbreaking.

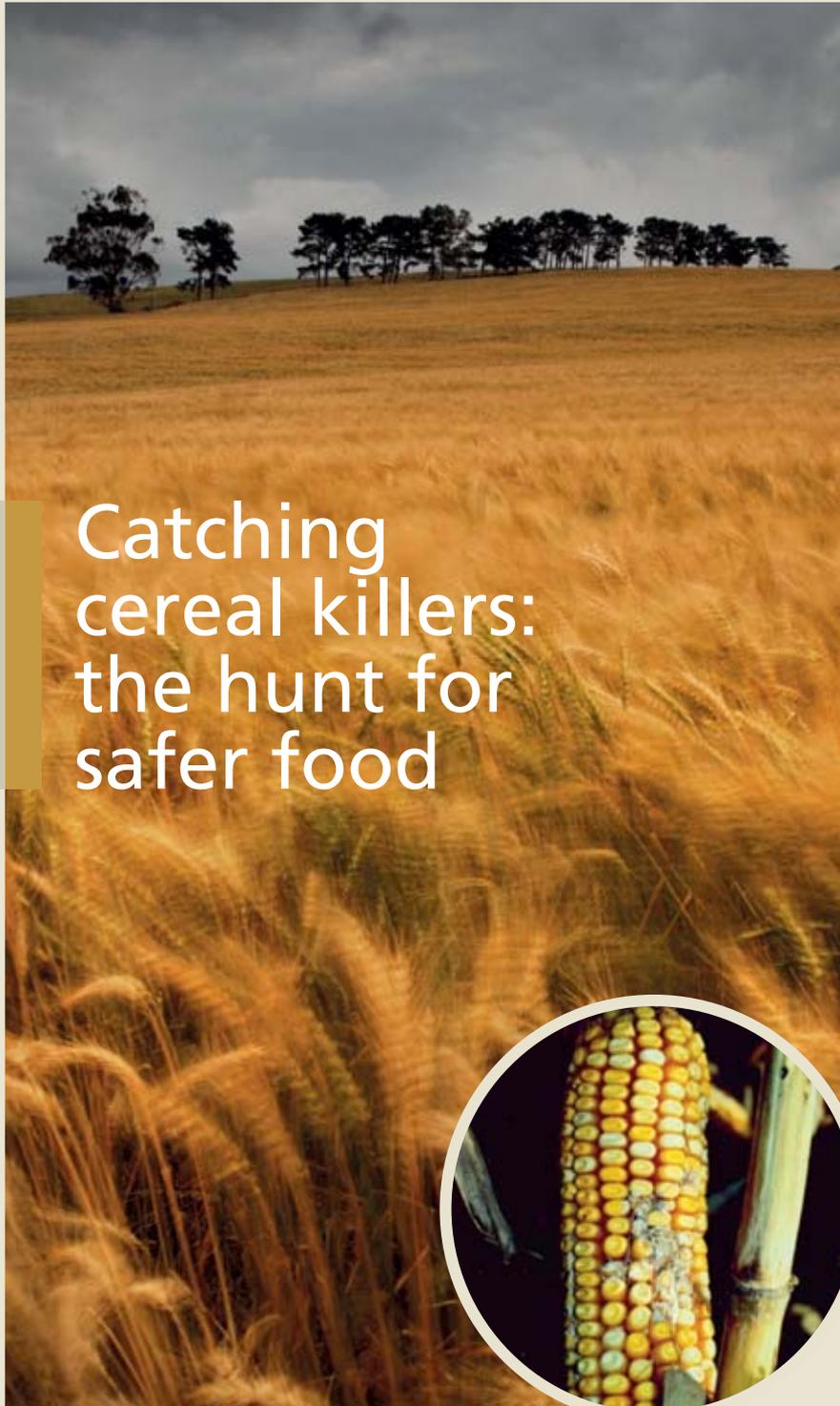
The research aims to advise social work organisations and departments working in rural Western Cape to focus more on the treatment of women and children who have been subjected to trauma and abuse. They hope that this will help to reduce the pattern of alcohol abuse and dependence, abusive relationships and the exposure of an unborn child to the debilitating effects of alcohol.

Perhaps Jenny's story can prevent one unborn child from being affected by FAS. Maybe her childhood experiences can show us how to help others in similar situations to break the pattern of abuse.

As for Jenny herself, maybe, just maybe, her heart can heal like the scars on her body.

Alitha Pithey (alithapithey@gmail.com) is investigating trauma and Posttraumatic Stress Disorder (PTSD) in women with alcohol abuse and dependence in a rural community setting, as part of the South African Research Chair (SARChI) in Posttraumatic Stress in the Department of Psychiatry, located in the Faculty of Medicine and Health Sciences.

“It works like a fingerprint, because the different colours tell us which chemical or contaminant is present.



Catching cereal killers: the hunt for safer food

The maize, wheat, barley, oats and rice that South Africans consume every day as part of their staple diet are under threat, because a cereal killer is on the loose.

A fungus or mould called *Fusarium verticillioides* can destroy entire crops and lead to dramatic losses in crops and food production. It also produces toxins that are linked to certain types of cancer.

Most fungal spores are quite harmless, while some are even beneficial. In the case of *Fusarium verticillioides*, however, the spores that germinate under certain conditions can spread rapidly and cause havoc to grain production.

Fortunately, food detectives in the Department of Food Science at Stellenbosch University (SU) are working on the case and are using a specialised camera to hunt down these cereal-killing moulds.

Through a process called chemical imaging, the camera uses infrared light to show up chemical changes caused by the fungus on and even in the grain. Different chemicals and contaminants appear in a variety of colours.

“It works like a fingerprint, because the different colours tell us which chemical or contaminant is present,” explains Paul Williams, a PhD student in food sciences. He uses near infrared (NIR) hyperspectral imaging to study *Fusarium* infection in maize.

“The camera helps us to detect the presence of fungi long before it is visible to the naked eye,” he adds. “This allows for early and more effective interventions where needed.”

“We are able to screen and remove corrupted grains before they enter the food chain,” Williams explains the technique, which has so far mainly been used to ensure food safety.

Stellenbosch University food scientists are now also finding new applications for the technique within the food industry.

In one project, they assess the suitability of grain for a particular type of flour, by measuring kernel hardness. In another, they aim to improve the shelf life of bread through using the technique to identify waxy wheat varieties.

Because chemical imaging is literally as safe as taking a photograph, it can be used from the grain silo to the food factory.

“We can use it to ensure safer and better food, one image at a time,” Williams says.

Paul Williams

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Crashing down the stairs – what stars can tell us about **atomic nuclei**

Astronomers use telescopes to zoom in on a specific type of radiation to learn more about stars and how they behave. Nuclear physicists are also turning to the heavens to understand fundamental nuclear reactions, writes *Jacobus Diener*.

If stars were humans then they would all probably be very tired. In their long lifetimes stars are subjected to violent explosions and exposed to intense radiation and pressures.

Unlike humans, stars are chronically fatigued ever since birth. Their single goal is to relax and settle down in their coolest, lowest energy state. They do this by emitting various kinds of radiation, like heat, light, X-rays and radio waves.

Stars are born when clouds of gas are brought together by gravity. The gas is compressed until it gets so hot that



it starts to burn, and forms a star. The burning gas gives off light and heat and the star cools itself down by emitting these.

For most stars, this is a gradual process. As they cool down over time, they contract under gravity and eventually just burn out. Our own sun is an example of such a star.

However, some larger stars do not move into retirement quite so gently, but go out with a bang. When the core of such a star contracts, its outer gas layers are blown to pieces to turn the star into a supernova.

Some larger stars do not move into retirement quite so gently, but go out with a bang...



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The truly unlucky stars are the ones formed in supernovae, where the cores of the exploded stars are recycled back into life as neutron stars. This is like the retiree who has to go back to work, but to a job in a very unpleasant part of town. Supernovae are very hostile environments and some neutron stars are subjected to very intense magnetic fields.

Neutron stars with extremely strong magnetic fields are called magnetars. Whereas a star such as our sun cools down by giving off light and heat, magnetars emit high energy X- and gamma rays in short, irregular but spectacular outbursts.

While the behaviour of neutron stars is interesting to astronomers, they hold a special appeal to another field of science – nuclear physics. Neutron stars have the same density as the nucleus of a heavy atom (such as lead) and are believed to be made up of the same material.

Investigating a neutron star is much like studying a gigantic atomic nucleus. For this reason many physicists have looked up from their work in laboratories and particle accelerators, and have turned their attention to the heavens to study the largest nuclei of them all.

Using their knowledge of highly magnetised nuclear matter, scientists of Stellenbosch University's Department of Physics have put forward a possible explanation why magnetars emit X- and gamma rays in such sporadic, short outbursts.

Physicists know that changes in the energy levels of highly magnetised nuclear particles do not occur gradually, but in discrete steps. In magnetised matter the particles 'feel' and interact with the magnetic field, which alters their behaviour.

When unmagnetised particles are compressed they behave like balls rolling down a smooth hillside made out of thousands of very small steps. These steps are infinitely smaller than the ball. Therefore the ball simply rolls over them without any noticeable effect. In the case of a very strong magnetic

...from the study of stars we can learn something about nuclei – the tiniest building blocks of our world.

field these unnoticeable steps are enlarged to the size of the ball, while the smooth hillside turns into a flight of stairs.

Since it is assumed that the magnetar interior contains highly magnetised particles, the star should manifest similar abrupt behaviour as it cools down. As the star contracts, particles do not roll smoothly down the hill, but encounter steps that are enlarged due to the magnetic field.

For the conditions expected in the magnetar interior, the Stellenbosch University study showed that as particles 'fall down' these steps they will emit an X- or gamma-ray. The researchers argue that these rays could be the origin of the magnetar X- or gamma-ray bursts: since magnetars should contain a great number of such highly magnetised particles, the effect will be greatly amplified.

This theoretical model is now being tested and refined by closely monitoring the bursts from magnetars and comparing them to the theoretically predicted behaviour. Fortunately initiatives such as the Square Kilometre Array (SKA) radio telescope, of which the bulk will be built in the Karoo in South Africa, will allow us to study the secrets of neutron stars with unprecedented detail.

This will ultimately further our knowledge of the magnetar interior and also of highly magnetised nuclear matter.

Consequently, from the study of stars – the largest objects in the universe – we can learn something about nuclei – the tiniest building blocks of our world.

Jacobus Diener (jacobus.diener@gmail.com) is a doctoral student in theoretical physics in the Department of Physics in the Faculty of Science. He studies ferromagnetic phase transition in neutron stars.



SECRET AGENTS

and the survival of aliens

Whether you are following the scenic Clarence Drive from Gordon's Bay or driving along the Mediterranean highway in the south of Spain, you are more than likely to find pretty purple plumes of fountain grass swaying in the wind on the side of the road.

This ornamental plant is native to North Africa, but is found worldwide along roadsides from Australia to Hawaii and North America to Europe. Its world domination is made possible by its rapid and hostile takeover of disturbed soil, irrespective of the climate.

Environmentalists are worried about alien plants such as fountain grass, because they can survive where few others can, often to the detriment of native fauna. Common sense tells us that native plants should do better than aliens. Genetic variation and natural selection are generally seen to

be driving a plant's adaptation to its environment. After all, native plants have had sufficient time and variation in their DNA to adapt to their environment.

Invasive plants, on the other hand, are often introduced to a new environment only in ones and twos. They thrive in environments quite different from their natural homes, despite having very little genetic diversity or time to adapt.

Fountain grass is an excellent example of a plant that has no genetic variation, yet thrives throughout the world in vastly different environments. Previous studies revealed that fountain grass plants, whether found locally or abroad, are so genetically similar that they might just as well be identical twins or clones.

Scientists in the Department of Botany and Zoology at Stellenbosch

University wanted to understand how plants such as fountain grass are able to survive in different climates, and also included epigenetics (see opposite page) in their search.

Fountain grass from different locations across the world was sampled. The epigenetic switches were mapped according to their position on the DNA, to create an epigenetic fingerprint for each individual.

As could be expected, the plants from different locations had different epigenetic maps. This is because epigenetic switches move in response to environmental changes.

The researchers also wanted to determine if these epigenetic switches become fixed and are passed on to the plant's offspring. Seedlings representing fountain grass populations from across the world were germinated in one environment at the University.

Although some of these marks were fixed, the majority became the same between all of the individuals. This was irrespective of their origin. This means that a single seedling can change the way its DNA is read in response to the environment it is found in – all in an effort to survive and establish itself.

Fountain grass is an excellent example of a plant that has no genetic variation, yet thrives throughout the world in vastly different environments.



Epigenetics made easy

Fountain grass does this so effectively that it has not needed to change its DNA to survive at all. It solely relies on epigenetics to survive in new environments. This is very different to adaptation through genetic evolution and mutations, which are processes that can take generations.

This study – the first of its kind to show that fountain grass uses an epigenetic strategy to survive – could also be applied to other invasive species.

The incredible adaptability of fountain grass highlights the plight of native plants in a changing climate. On the bright side, it also gives hope that a plant's instruction manual might yet have the instructions it needs to survive in a different environment, and that it just might need a single chemical switch change.

Doctoral student Marguerite Blignaut (marguerite.blignaut@gmail.com) of the Department of Botany and Zoology in the Faculty of Science studies epigenetic variation and its inheritance in fountain grass (Pennisetum setaceum). She is a member of the Molecular Ecology Research Group.

DNA is like the instruction manual according to which the cells of all living beings perform the multitude of tasks needed to keep functioning. Epigenetic switches are the bookmarks that control which parts of the 'manual' are read and in which order. Most instructions are permanently controlled by these switches. These essential instructions make a plant a plant, and keep it functioning throughout its lifetime. Epigenetic switches also have the ability to move and change position in response to different environments. When this happens, some instructions in the DNA will be switched off and others on. This allows the behaviour of the DNA to change, without ever changing the DNA code itself. This is a much more rapid response to environmental change than genetic variation and natural selection. Epigenetics, which means above or outside of the DNA, might therefore explain how a plant can cope with different environmental conditions whilst lacking genetic variation.

Hope for diabetic patients

Dr Venant Tchokonte-Nana is working on a procedure that may help to alleviate the shortage of donor pancreases needed to treat certain diabetic patients.

His research is being done in the Department of Biomedical Sciences in the Faculty of Medicine and Health Sciences.

It focuses on the ability of the pancreas to regenerate insulin-producing cells. He found that by tying off the tail end of the main duct that delivers pancreatic juices to the intestines, new islets of insulin producing cells are formed in another part of the pancreas.

"This closure causes damage to acinar or main insulin producing cells, which leads to the formation of new masses of islets," he explains.

His research focuses on the ability of the pancreas to regenerate insulin-producing cells.



"The newly formed islets are readily available to transplant into diabetic recipients."

Although the procedure has been successfully tested on small animals, more research is still needed before a human trial can be done.

*Dr Venant Tchokonte-Nana
Email: venant@sun.ac.za*

A leopard stands motionless, staring down at the lone buffalo directly below the rocky outcrop. Soft morning sunlight warms the rocks and casts an ethereal glow on the sandy riverbed. The buffalo's breath mists in the cool air as it chews slowly, oblivious of the danger poised just above it. Tail twitching, the leopard wrestles with its natural instinct as it remains frozen with indecision. Caution finally outweighs opportunity, and the leopard pads softly back from the overhang and slumps gracefully to the ground.

Perhaps the buffalo was just too big for the solitary leopard to tackle alone. In giving up its prey, the leopard inadvertently also walked away from a more serious risk: exposure to the potentially fatal bovine tuberculosis (TB).

It is a highly infectious disease that affects wildlife, livestock and people, and is maintained and transmitted by African buffalo within the game parks of South Africa.

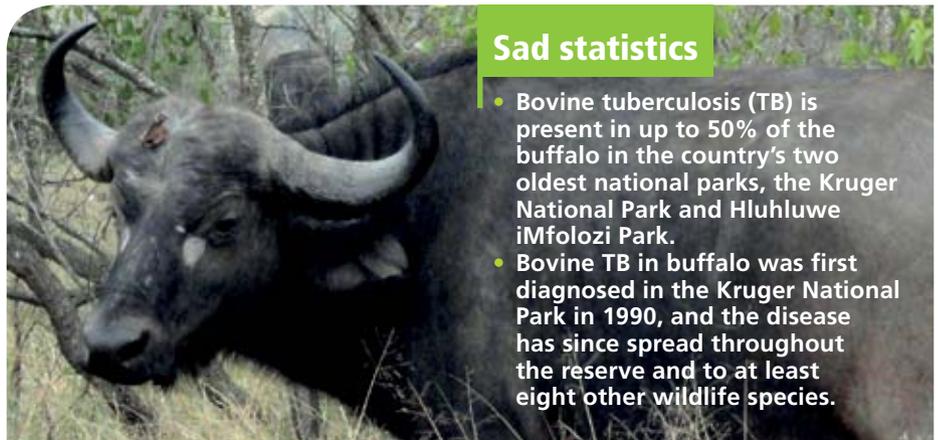
Because African buffalo live in large herds, are highly social animals and are extremely susceptible to bovine TB, they are the ideal hosts for the disease. This in turn poses a real risk to other wildlife species and the surrounding communities and livestock. Other wildlife species become infected with bovine TB through contact with buffalo, and many of these species – such as lions – quickly become ill and die.

During periods of drought and food shortages, people often move their domestic livestock across the boundary fences into South Africa's national parks. There, the animals use the same waterholes and grazing areas as the wildlife. This 'communal' use of resources exposes people and livestock to bovine TB.

Infected cattle do not only impact the trade and export of meat. People in the surrounding communities are at risk of being infected when they drink unpasteurised milk. The high prevalence of HIV in these communities makes the spread of this disease even more dangerous, because HIV positive

Wildlife, livestock and communities: a TB melting pot

In an effort to inform breeding programmes and management strategies, researchers are determining whether there are differences in the genetic make-up of the African buffalo that predisposes them to catch bovine tuberculosis (TB) or not, writes *Nikki le Roex*.



Sad statistics

- Bovine tuberculosis (TB) is present in up to 50% of the buffalo in the country's two oldest national parks, the Kruger National Park and Hluhluwe iMfolozi Park.
- Bovine TB in buffalo was first diagnosed in the Kruger National Park in 1990, and the disease has since spread throughout the reserve and to at least eight other wildlife species.

people struggle to fight infections.

Researchers of the Department of Biomedical Science at Stellenbosch University study the genetic differences between infected and disease-resistant buffalo to analyse why some animals are more resistant than others. They use advanced genetic technology to identify the DNA differences between buffalo groups, and apply statistical analyses to determine the link to the disease.

Three main DNA differences have been found in relation to a buffalo's ability to fight off bovine TB – all of which are located in genes associated with the immune system.

Once the role of these gene differences is fully understood, this information can be supplied to breeding schemes and fed into the management strategies of private game reserves and national parks in South Africa.

The ability to breed a TB resistant buffalo herd could address the risk that bovine TB poses to wildlife, people and livestock. There's also a huge commercial incentive, as the sale and movement of disease-free animals within South Africa is a lucrative business. Disease-free buffalo fetch more than 10 times the price of a regular buffalo at auction. With the recent sale of a young disease-free buffalo bull for a record R26 million, there is no doubt about it – there is big money in healthy buffalo.

Nikki le Roex (nikkilerox@gmail.com) is a doctoral student in the Department of Biomedical Science in the Faculty of Medicine and Health Sciences. She studies host genetic factors that influence susceptibility to bovine tuberculosis in African buffalo.

The proportion of our lives spent in virtual worlds is increasing. Online game junkies while away their days in role playing games such as *World of Warcraft*. Others live virtually as avatars in the appropriately named *Second Life*, where they interact, trade and build in a virtual world using virtual money.

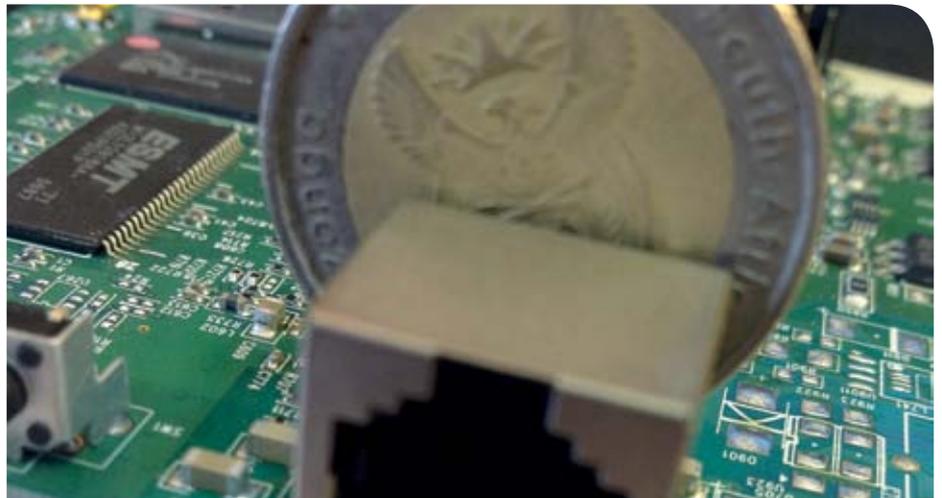
Before dismissing virtual worlds as ‘just games’, consider the fact that the trade in virtual property is estimated to run into billions of US Dollars every year. This is increasing at an almost exponential rate. All of us are affected, even if we only occasionally chat online, send a virtual gift to a Facebook friend or use virtual worlds in pursuit of more serious activities such as online research collaboration.

Actions or items accumulated in virtual worlds have value to real people. As such, people are prepared to pay real money for them. You might enjoy playing *World of Warcraft*, but do not have the time to work through the easier, less interesting first levels. For a tidy sum of 800 US Dollars, you can actually take a shortcut by buying the account of another user who has already advanced through the earlier stages. You also have the option of buying individual items, such as a special sword. Although the weapon belongs to a virtual character, it is the real world person behind the avatar who will be experiencing the pleasure of brandishing the sword. For this, he is willing to pay hard cash.

Players use a game currency called Linden Dollars to buy and develop land in the game *Second Life*. They can then subdivide, sell or rent it to other users. Linden Dollars can be bought with real money. Users readily do so to increase their virtual spending power, on the one hand to enhance their enjoyment of the game and on the other to gain financial returns on their virtual investments.

Some users have virtual property with a real world value of millions of US Dollars!

The practice of real money trade



The REAL WORLD VALUE of property in a virtual world

There’s real money at stake in virtual games. As such, virtual property needs to be legally protected in the real world, argues *Wian Erlank*.

Before dismissing virtual worlds as ‘just games’, consider the fact that the trade in virtual property is estimated to run into billions of US Dollars every year.

(RMT) of virtual property has a massive influence on the real world economic markets. In fact, several governments have indicated their interest in taxing earnings generated in virtual worlds.

There is, however, a problem with the legal status of virtual property. It is not protected by property law, despite having been bought with real money.

Developers of virtual worlds requires users to accept an end user agreement licence (EULA) which states that the players do not acquire any property rights to their virtual possessions. Some even explicitly prohibit real money trading, or at least limit the purchasing of virtual items through official channels.

The scarcity value of a virtual item increases its desirability and the motivation to play, which of course benefits the developer. Also, it means that virtual world developers monopolise the sale of virtual items.

This current legal situation does not reflect the reality of RMT. It leaves users vulnerable and does not take into account the value they attach to their virtual property, whether bought or ‘earned’. Considering the size and growth of this industry, I believe that virtual property should in certain instances be legally accepted and treated as actual property in the real world.

Adv. Wian Erlank (wian.erlank@nwu.ac.za) is completing his PhD in virtual property at the Department of Public Law in the Faculty of Law. He is a lecturer at Northwest University.



Nothing wonderful about special
infant formula

Research is inconclusive whether special infant formula actually benefits babies more than others, writes *Mary Mugambi*.



Grace's baby boy has finally arrived, but she is already looking nervously at the calendar. As a student she has to go back to university in just one month's time, where she faces long hours of lectures. Therefore Grace has decided that breastfeeding is not an option for her.

She wonders whether infant formula with added special ingredients will give her bundle of joy an advantage in growth and development over infants who are given plain formula.

In the supermarket, Grace reads the list of ingredients on the labels. Fancy words such as 'immunify ingredients', 'improved transit', 'live cultures', 'Bifidus' and 'L-Comfortis' look quite exciting, but are also confusing. Other products boast 'good bacteria' or 'fruit or vegetable carbohydrates', or a combination of both.

Most of the formula brands do not explain how these added ingredients work, but do recommend that the advice of a health professional is sought. The brands all promote breastfeeding with bold statements such as 'Breast milk is best for babies'.

Grace is confused by the sheer number of different formula brands and varying prices on offer. All she wants to do is to give her little boy the best formula that her money can buy.

Desperately she asks: "Which one do I choose? How will these ingredients help my baby?"

Surprising results

Baby food companies add 'good' bacteria (known as probiotics), fruit and vegetable carbohydrates (prebiotics) or a combination of both (synbiotics) to formula for full term infants, all in an effort to promote growth and development, and to reduce infections.

Do these added novel ingredients really work? Do full term infants drinking these brands grow and development better compared to babies who are only fed regular infant formula?

A look at thirty years of research on infants who have only been fed formula with added novel ingredients have revealed surprising results. Full term infants between 0 to 12 months of age were studied in southern Africa, North America, Europe, Australia and China.

The combination formula had no significant effect on growth, the incidence of colic, vomiting, spitting up or regurgitation, crying episodes or restlessness.

Surprisingly, special formula containing the 'good' bacteria did not have any significant effect on growth. There was also no difference in the incidences of colic, spitting up or regurgitation, vomiting, restlessness or diarrhoea. The effects of special formula on infection rates, antibiotic use or length of hospitalisation were inconclusive, while there was conflicting results about its influence on the digestive system. The beneficial bacteria in the intestines did not increase, while the impact on the immune system was not reported.

Formulas investigated

The studies that focused on formula with added 'good' bacteria were all quite small, and included a maximum of 200 infants. The studies were conducted over a short period, with the longest lasting only seven months.

Infant formula with added fruit or vegetable carbohydrates did not fare much better. The babies tested did show slightly better weight gain, and produced softer faeces than infants

given regular formula. However, they did not vomit, spit or regurgitate less, nor did they have fewer crying episodes or respiratory infections compared to infants drinking regular formula. The studies did not take a look at the effects on the immune system or length of hospitalisation. These studies were also quite small in size, with a maximum of 271 participants, and were conducted over short period between 28 days to 12 months.

What about formulas that included both the 'good' bacteria and fruit and vegetable carbohydrates? Can a mother expect better growth and development of her baby if she uses this special formula?

The answer is again a resounding 'no'.

The combination formula had no significant effect on growth, the

incidence of colic, vomiting, spitting up or regurgitation, crying episodes or restlessness. There was no clear conclusion on the impacts on infection rates, antibiotic use or length of hospitalisation. The effects on the immune system were not reported.

The only clear benefit found was that infants given combination formula produced more faeces than babies on regular formula.

There is still no evidence that formula with added good bacteria, fruit or vegetable carbohydrates, or a combination of both, improve growth and development.

Large, long term studies of babies fed only on infant formula are needed to explore whether added ingredients can boost growth and development.

For now, special infant formula is just plain infant formula.

Mary Mugambi (nmugambi@hotmail.com) is completing her PhD in nutrition in the Department of Human Nutrition in the Faculty of Medicine and Health Sciences.

Anxious about being

anxious?



Researchers who study early life trauma in anxiety patients are gaining new insights into anxiety and stress, writes *Nathaniel McGregor*.

You grip your sweaty palms around your leather wallet. You clench it tighter with each step towards the counter. There's a muffled sound of passing cars. A nearby patron relives the incident he had the previous night with his mother-in-law. Everything fades into a cold silence.

There's only the 'thump, thump, thump' of a heart beating in your throat. The choking feeling grips you instantaneously. You feel the urge to throw up.

You close your eyes, hoping to regain composure. You feel as if you're floating above yourself. You have no feeling in your legs. You stumble towards the nearest counter top and grab at it to maintain balance.

Then you realise that everyone is staring at you. They don't understand. Nobody does. Maybe you're crazy? Maybe you're...

Pant. Gasp. Hiss. Your chest tightens, you can't breathe. Black.

Anxiety treatment

You might find it hard to imagine that the simple task of getting a latté at the local corner coffee shop could bring on a panic attack. However, people who are prone to anxiety disorders know that it can happen during the most mundane everyday activities, such as driving or working in an office.

Current treatments for anxiety disorders are simply not as effective as we'd like them to be. The mechanisms involved in the development and progression of these disorders are also not yet fully understood.

Current first-line medication-based treatments rely predominantly on two

targets, namely the neurotransmitters dopamine or serotonin, but only work well on an estimated one in every two people. Behavioural based therapies, such as cognitive-behavioural therapy (CBT) also have only partial success and are often combined with drug based treatments for increased benefits.

Because recent findings suggest that traumatic life experiences play a role in the onset of anxiety disorders, researchers associated with the Medical Research Council (MRC) Unit on Anxiety and Stress Disorders in the Department of Psychiatry at Stellenbosch University are studying early life trauma in anxiety patients. They are trying to understand how your genetic make-up might predispose you to develop anxiety disorders in response to traumatic experiences in your developmental years. This understanding could allow for more effective treatment options in the long term.

The researchers are collaborating with the SU Department of Biomedical Sciences and MRC's Centre for Molecular and Cellular Biology to identify new genes that are associated with anxiety disorders in relation to trauma. They are using an animal model to observe anxiety-like behaviour.

Genetic research

The SU team has identified several new associations with genes involved in pathway formation. These genes have been shown to express differently in rats with anxiety-like behaviours, compared to rats that do not.

During early development the brain forms the pathways which determine

how we respond to a particular event. These pathways are not absolute and can be changed in response to other events.

Researchers believe that this happens when someone is exposed to a traumatic event during the forming of these pathways. This, in conjunction with deviations in a person's genetic code, makes someone more susceptible to develop an anxiety disorder.

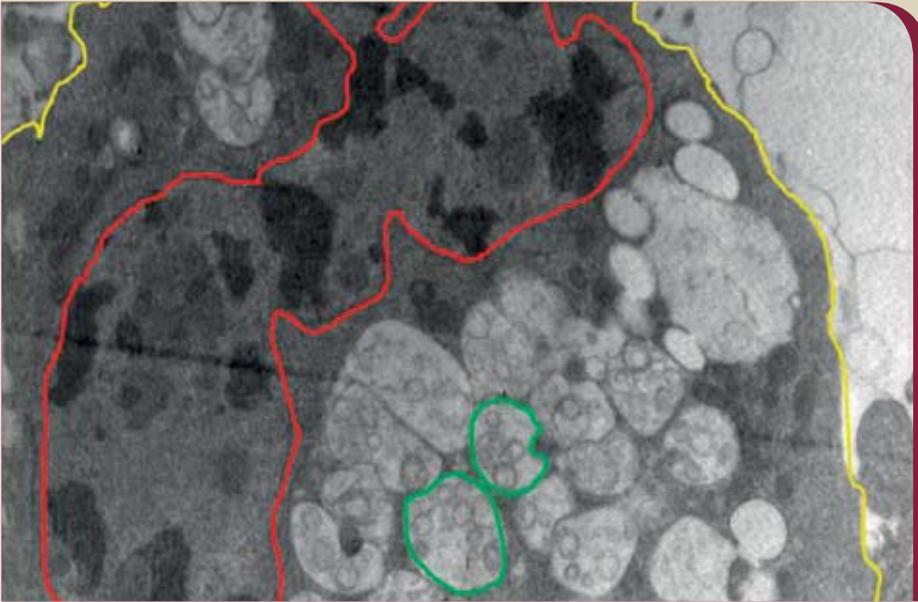
The next step is to extrapolate these findings to people with anxiety disorders in cases where there is documented information about early life trauma. Such links could point to novel pathways and targets that can in turn be used for alternative treatment methods – all in an effort to better understand and treat anxiety disorders.

Geneticist Nathaniel McGregor (nathanielmcgregor@gmail.com) identifies novel susceptibility genes in anxiety disorders as part of his doctorate in the Department of Psychiatry in the Faculty of Medicine and Health Sciences.

Why focus on anxiety disorders?

Anxiety disorders are severely debilitating conditions which affect an estimated 350 million people. Because this number is growing worldwide, it is increasingly important to explore new avenues to explain how these conditions develop and exacerbate.

An insatiable drive to survive: how cancer cells try to survive chemotherapy



Cancer patients and their families experience mixed emotions when a course of chemotherapy is recommended by their doctor. Their real hope that the body will actually be rid of the cancer is often clouded by thoughts of possible side-effects, such as hair loss, vomiting, fatigue, kidney and neuron damage.

These are all part of the reality of cancer treatment, especially when high doses of chemotherapy are administered. There is, of course, also the very real fear that the treatment might not be successful or that the cancer will return.

“When people say ‘the chemotherapy is not working’ or ‘the cancer is coming back’, it basically means that cancer cells have become resistant to a particular type of chemotherapy or radiation,” explains Gina Leisching, a doctoral student in the Department of Physiological Sciences at Stellenbosch University who is doing research on cervical cancer.

“It means that the cancer cells have in fact become more robust than before,” she adds. “The question on everyone’s lips is of course how and why this is happening.”

According to Leisching, it is very difficult to pin-point a so-called ‘weak spot’ or characteristic that most cancers have in common. “This is because of the complexity between different kinds of cancers,” she elaborates.

Recent research discovered just how smart cancer cells actually are and seems to be able to shed light on this matter.

“Believe it or not, but cancer cells are actually able to eat and recycle the parts of themselves that are damaged by chemotherapy,” Leisching explains. This is done through a built-in tool that scientists refer to as autophagy, which in Greek literally means ‘to eat oneself’. Once an important part of a cancer cell is destroyed, it develops balloon-like structures that store all these damaged components. With the help of some enzymes, the cell breaks down and recycles the components to make more energy.

Scientists have found that cancer cells rely on this tool to survive chemotherapy. They treated cancer cells with a special chemical that prevented autophagy, before they went on to administer the chemotherapy.

Clinical trials are now underway to test its efficacy in humans.

An exciting possibility is that cancer cells that are pretreated to reduce autophagy might need lower doses of

chemotherapy to kill them. This theory was tested on a cervical cancer cell model as part of Leisching’s doctoral research in which she manipulates the autophagic pathways and sensitises cervical cells to cisplatin treatment.

“Our lab has found a way of using a lower dose of the drug, which still achieves effective cancer cell death,” Leisching reveals.

“As was suggested in previous research, we found that even at low doses the cervical cancer cells use autophagy to survive,” she excitedly elaborates. “When we went on to inhibit autophagy and then treated these cells with this low dose, we saw large amounts of cancer cell death.”

Leisching hopes that these findings might provide a possible new avenue for cancer research to follow that is much more patient friendly.

“Until then, though, scientists like me will keep ploughing on, hoping that one day cancer will be something of the past,” she sets out the motivation behind her research career.

Gina Leisching, email: ginal@sun.ac.za



A BUSINESS SUSTAINABILITY STORY:

Spier's quest for carbon neutral wine

The story of how the Spier estate outside Stellenbosch tried to calculate its carbon footprint suggests that there are better ways for South African businesses to measure and reduce their environmental impact, writes *Sumetee Pahwa-Gajjar*.

Spier initiated an in-house project in 2009 to calculate the carbon footprint of one bottle of wine, as well as the carbon and water footprints of the business itself.

In the same year, Spier allowed the School of Public Leadership at Stellenbosch University access to its business operations and environmental reporting practices to help track its progress towards environmental sustainability.

Carbon footprint calculation is fraught with scientific ambiguities linked to issues of scope and lack of access to information. It is biased towards savings in electricity consumption and may not capture investments made by a business in conserving nature, raising ecological awareness among its employees, or exploring alternative technologies.

Water footprints can be tested with scientific rigour, but this requires extensive information about a production process and highly analytical skills for calculations.

Most importantly, a business may not have control over large sections of a production process (such as the generation of grid electricity in South Africa) which impacts on a carbon or water footprint.

Spier has instigated some commendable initiatives. A trigger matrix system which switches off geysers in unoccupied sections of the Spier hotel, for instance, was installed soon after the 2008 electricity black-outs in South Africa. At the same time, an energy audit of the main buildings was also commissioned. Sizeable investment in a biological wastewater treatment plant on the estate was made to improve the system in line with government regulations.

Over the last decade, the Spier business has continued to explore ways to generate clean energy on site. In the process, it has increased its own knowledge in the field of renewable energy. However, the risk of huge capital outlay in a technology which may soon become obsolete or redundant has discouraged actual investment.

Five years ago, the director for

sustainable development at Spier, Tanner Methvin developed 10-year macro-organisational goals for environmental sustainability, including carbon neutrality, zero wastewater, zero solid waste, water sustainability and nature conservation. As the target date to reach these goals neared the midway mark, Spier management spun off several processes to ensure that the business was moving well towards meeting them. The processes included group environmental reporting, such as the calculation of business and product carbon and water footprints.

The managers did not realise that not all the investments and innovations that had been made towards environmental sustainability could be captured in

Over the last decade, the Spier business has continued to explore ways to generate clean energy on site. In the process, it has increased its own knowledge in the field of renewable energy.

accounting-based goals. Therefore, a compost site, which uses organic waste generated on the estate and supplies neighbouring farmers with organic fertiliser, could not be factored into a reduced carbon footprint. Neither could the indigenous trees and plants that are slowly replacing alien vegetation, or a strategic decision to convert 25% of the estate to natural wetlands.

The case of Spier demonstrates that businesses in the developing South who aspire to confront challenges such as climate change and water scarcity should invest in appropriate and affordable technologies, conserve energy and water, and establish reliable knowledge networks. These will build business resilience in the face of unforeseen shocks and resource uncertainties in the future.

When viewed from a complexity and systems perspective, Spier is made up of flows of energy, waste, water and information which are found across the individual business units of winemaking, leisure and farming.

As a human-environment system, the business responds simultaneously to social, economic and environmental drivers. The business also responds

Water and wine

The story of wine at the Spier estate is entwined with the story of water in its many forms. Natural water rose up from the marsh, seriously damaging the historic buildings on the estate, including the wine cellar built in 1767. The new winery is now located close to the Bonte River, but on higher land. Mountain water in the Bonte and Eerste Rivers flows through the grounds. Cleansed wastewater cascades over rocks into a reed bed and a yin-yang pond before being used to irrigate the estate gardens. The embedded water in red or white grapes from the different vineyards arrives at the Spier winery, to finally end up in bottles of wine.

to external risks related to natural resources (such as biodiversity and water), physical infrastructure (for sewage or electricity) and knowledge networks.

It is therefore more important to understand the business and its needs from a strategic, resilience-building perspective than to focus on accounting-based and marketing-led terms such as being 'carbon neutral'.

A corporate resilience framework, which captures strategies towards lower carbon emissions alongside other performance areas, might rather be the answer. It assists businesses to reduce their overall environmental impact.

Designed on the basis of Spier's sustainability story, this framework has wider applicability and can assist other similar sized businesses to reconfigure their relationship with nature.

Sumetee Pahwa-Gajjar (sumeteepg2012@gmail.com) is a doctoral student at the School of Public Leadership in the Faculty of Economic and Management Sciences. She uses Spier's search for a lower carbon future as a case study to discuss the building of corporate resilience.



Gated developments in small town and rural Western Cape: a BOON or a BANE?

The tarred road to the small industrial area peters out into a gravel track. The bright advertising board on the right screams: ‘YOUR LAST DAM CHANCE’ to own waterfront property at Clanwilliam Dam.

The rental car begins to shudder as it hits the gravel road. Cheerful shouts of children find their way into the car window, along with the dust and heat.

To the left are row upon row of low-cost houses. Further on there are houses of wood, plastic and galvanised iron.

A wall on the right follows the line of the road. Suddenly there’s a gap in the wall, and an open gate signals the destination. The wheels crunch into the gravel as the car comes to a halt.

The name ‘Calm Waters’ stands out prominently on the thick brown walls surrounding Clanwilliam’s latest gated development. The remote controlled steel gate is guarded by a lone sentinel. At the gate, the gravel changes back to tar.

Inside, 50 neatly spaced plots await those who want a holiday home of their own in the *platteland*.

Economic and social impacts

The growth of gated developments in towns can potentially further divide small town and rural Western Cape, believes Manfred Spocter, a doctoral student of the Department of Geography and Environmental Studies at Stellenbosch University.

“We are not giving enough attention to the economic and social impacts that these developments might have,” he adds.

Spocter traced the growth and distribution of gated developments in non-metropolitan areas of the Western Cape, and counted 428 gated developments in 53 towns, along with a further 21 projects outside of towns. The developments were not only found in populous towns such as George, Worcester, Stellenbosch and Paarl, but also in smaller places like Clanwilliam, Ceres and Swellendam.

Towns in the Western Cape are still spatially divided as a result of the racially-based laws of the past. The provincial human settlements strategy encourages a built environment to facilitate integration between various groups of people.

“But the growth of in-town gated developments has resulted in sub-communities of private space, laagered for the exclusive use of those who can afford to live in them,” believes Spocter. “This does very little for community building on a town level, and perpetuates an economic divide and a mistrust of others.”

Labour sources

“Farms have been sold, rezoning issues dealt with, and environmental impacts completed to facilitate the building of gated developments,” he adds. “These environmental reports suggest that communities that are located next to gated developments are convenient ‘labour pools’ of gardeners and domestic workers.”

“The labour reserve of the gated development is right next door – beyond the gates, fences and walls,” says Spocter, who works in the Built Environment Unit of the CSIR.

He acknowledges that gated communities do create employment opportunities in the construction industry, the security sector, landscaping and other activities allied to keeping these developments functioning in pristine condition. The income for largely rural local municipalities from these ratepaying, and electricity and water consuming developments, is substantial.

“However, it seems that whereas permanent residents of gated developments do most of their consumer spending in the towns themselves, the same does not apply to weekend, Easter and end-of-year home owners,” he adds.

“While people have the right to secure themselves and their property, one has to question whether crime levels in small town Western Cape has increased to such a degree that people need to fortify their living space,” he ponders. “Are the extensive security features just a developer’s marketing tool that exploit and feed a fear of differences?”

Manfred Spocter, email: mspocter@csir.co.za

To teach children in a language they do not speak or understand has been equated to throwing them into a swimming pool and expecting them to swim. On the other hand, teaching children in a language they know well is compared to building them a strong bridge across a big river.

Children learn with enjoyment and participate actively in classroom interactions when they understand what the teacher is saying to them.

It would be expected that teachers would chose to build strong bridges for their learners to cross the education river.

However, an estimated 221 million school-aged children around the world are not taught in their first languages.

Why would teachers make such an unfortunate choice for their learners and effectively choose to throw them into a swimming pool and watch if they sink or swim? What really informs the language choices of teachers in the classroom?

As part of my doctoral research in the management of linguistic diversity I visited four Kenyan Grade 1 teachers to understand the language choices they made.

I learnt that all of the educators had teaching qualifications, but none had ever received any training on how to deal with learners' first languages in their classrooms.



All four teachers were expected to teach their learners in their first language, according to the policy of mother tongue education in Kenya.

Three things stood out for me.

I learnt that all of the educators had teaching qualifications, but none had ever received any training on how to deal with learners' first languages in their classrooms.

I also realised that although the teachers were expected to teach in the first languages of their learners, some of the children in their classrooms spoke a first language the educators did not know themselves.

I learnt that the teachers were only issued with English textbooks, and that even the examinations that learners sat at the end of the school term were in English.

What does this tell us? These four teachers, like many others, are working in an environment that does not

support the use of the languages for teaching and learning that learners understand well.

It underscores the need for changes at different levels in the education system to create an enabling environment for teachers. This will, in turn, empower them to make better language choices for their learners.

Such changes will go a long way to address the language needs of the 221 million children who are currently struggling at the most basic level to make sense of their educational experience.

Susan Nyaga (nyaga@btlkenya.org) is a doctoral student in the Department of General Linguistics in the Faculty of Arts and Social Sciences. Her research on managing linguistic diversity analyses the attitudes of teachers, their skills and strategies in multilingual Kenyan primary schools.

Are we building bridges or swimming pools?



How to transform the education system to accommodate more languages

- Change the current teacher education curriculum to equip teachers with the skills to handle learners' first languages in the classrooms.
- Modify the teacher placement policy so that educators are placed in schools where they speak the languages of the learners.
- Change the textbook production policy so that materials are not produced only in English.

Have your plum... and eat it!

It has happened to us all: While cutting vegetables for a stew or fruit for a salad, you are horrified to find that they are brown and inedible on the inside.

“This is called internal browning or chilling injury,” explains Mariana Jooste, a PhD student in the Department of Horticultural Science at Stellenbosch University who is researching this effect in plums.

Because harvested fruit must stay fresh long enough to reach supermarket shelves across the world, they are typically kept at $-0,5\text{ }^{\circ}\text{C}$ for three weeks or more at a time.

“Chilling injury happens during this cold storage period,” explains Jooste, who has been seconded by her employer Fruitgro^{SCIENCE} to do industry specific research.

Browning occurs when the membranes of the fruit cells are damaged after being exposed to low temperatures for long periods.

Cell membranes, and especially those that contain saturated fatty acids, mainly consist of lipids which ‘harden’ at low temperatures. “The same happens to butter when it is placed in a refrigerator, because it also mainly consists out of

saturated fatty acids,” explains Jooste.

Membranes that remain in this hard state for too long are damaged and start to leak cell fluids. This causes the browning reaction in the product.

“Also, cold storage conditions cause the cell to produce large amounts of free radicals which attack the fatty acids and cause further cell damage,” Jooste adds.

She ran extensive tests and found that a number of factors exacerbated or alleviated browning.

The industry study revealed that plums that are harvested when they are less mature have more ‘fluid’ membranes at low storage temperatures and are therefore less likely to develop the browning disorder.

“The membranes are more ‘fluid’ because they have lower concentrations of saturated fatty acids than the more mature fruit,” Jooste explains. This has to do with the fact that saturated fatty acids ‘harden’ the membranes during cold storage, while mono- and poly-unsaturated fatty acids stay ‘fluid’ at low temperatures.

Jooste uses her butter analogy again to explain this effect: “Butter hardens in the fridge because it contains high

concentrations of saturated fatty acids, while olive oil remains fluid because it contains high concentrations of mono- and poly-unsaturated fatty acids.”

According to Jooste, less mature plums also have higher levels of antioxidants that protect them against the attacks of free radicals.

“Less mature plum fruit are therefore less prone to develop internal browning when stored for long periods at low temperatures,” she elaborates.

Other findings suggest that chilling injury is also influenced by the storage regime and the period in the season when a plum cultivar is harvested.

“A producer might be tempted to store plums at slightly higher temperatures for the entire storage period, but this could simply result in overly soft fruit which are prone to rot or have a very short shelf life,” Jooste explains.

Chilling injury will remain a real headache to producers and customers as long as plums and soft fruit are subjected to cold storage for long periods of time. At least by being able to understand why it happens, it is possible to take steps to prevent its widespread occurrence.

Mariana Jooste (mjooste@sun.ac.za) is doing membrane studies on Japanese plums as part of her doctoral studies in the Department of Horticultural Science in the Faculty of AgriSciences.

Tips for the trade

- Early season varieties are more likely to develop chilling injury.
- Less mature plum fruit are less prone to develop internal browning when they are stored for long periods at low temperatures.
- Browning can be curbed by warming plums for a few days at $7,5\text{ }^{\circ}\text{C}$ in the middle of the storage period.
- It's not wise to store plums at slightly higher temperatures for the entire storage period, because the fruits will be overly soft and be prone to rot.
- After harvesting, it is much better to slowly cool fruit stepwise to $-0,5\text{ }^{\circ}\text{C}$.





When wild garlic makes you pregnant

People who use traditional remedies together with conventional medicines may want to rethink their strategy, because the combination of these substances might be doing them more harm than good.

Researchers have found that certain African medicinal herbs, including wild garlic and the African potato, could interfere with how conventional drugs work in the body. The herbs included in the study are traditionally used to treat diseases such as fever, pain, diarrhea, asthma, cold, cough, infections, hypertension, depression and ailments related to HIV and Aids.

Preliminary results of the study being conducted by the Division of Pharmacology at Stellenbosch University (SU) have shown that the herbs can quicken or delay the elimination of conventional drugs from the body.

"This adds to the risk of treatment failure or toxicity," says Pius Fasinu, a doctoral student in pharmacology.

"Patients should tell their doctors if they are taking any herbal medicine, or at best avoid taking the herbs and conventional medicines together," is Fasinu's advice based on the findings.

Traditional medicine and especially the use of medicinal herbs are popular in South Africa.

"While the use of medicinal herbs predates the emergence of HIV and Aids, a number of indigenous herbs are widely consumed as immune boosters and to manage the symptoms of this disease," explains Fasinu, who is completing his research under supervision of Prof. Bernd Rosenkranz and Prof. Patrick Bouic of the SU Division of Pharmacology in the Faculty of Medicine and Health Sciences.

The high disease burden and the strong attachment of traditional medical practices to culture and tradition have prompted various African governments to start integrating traditional medicine into the mainstream healthcare.

"Nearly two in every three people who live with HIV and Aids combine their antiretroviral drugs with medicinal herbal products," adds the doctoral student who is doing an *in vitro* assessment of selected traditional medications used in South Africa and their pharmacokinetic drug interaction potential.

For purposes of his study, Fasinu consulted traditional healers and

used available literature to identify and source the most popular herbal remedies used by people who also rely on conventional healthcare.

African potato (*Hypoxis hemerocallidea*), fat hen (*Chenopodium album*), devil's thorn (*Emex australis*), cancer bush (*Sutherlandia frutescens*), sweet thorn (*Acacia karroo*) and wild garlic (*Tulbaghia violacea*) were included in the study, and were shown to interfere with the functioning of conventional drugs in the body.

The herbs were not tested for their therapeutic benefit or for their potential toxicity when they are taken on their own. Rather, herb extracts were tested to see what their effect was on the enzymes in the body that are responsible for metabolising and eliminating conventional drugs.

Fasinu's tests showed that the herbal extracts inhibited the majority of these enzymes.

"This suggests that conventional drugs taken with some traditional herbs may accumulate in the body because of the enzyme inhibition," Fasinu believes. "This leads to toxicity."

In some cases, herbal derivatives also had the opposite effect, in that it induced the production of more enzymes and therefore sped up the metabolism of the drugs. This could lead to the failure of conventional drug treatment because it is cleared from the body far too quickly to be beneficial.

Samples from human livers that contain the active enzymes were used to assess the impact of herbal extracts on drug clearance. It provided the closest scenario to herb-drug combination in humans.

"Hypertension may persist if herbs are taken together with anti-hypertensive drugs, and pregnancy may occur when they are taken with contraceptive pills," he cites some of the inadvertent consequences of using traditional and conventional treatments together.

"Despite the popularity among South Africans to use herbs and conventional medicine side by side, there is little information available on how safe this practice is," a concerned Fasinu says. "Considering the potential consequences, it is best to exercise caution."

Pius Fasinu, email: phasynou@gmail.com



Making primary school science an experience, regardless



There's a buzz of excitement in the classroom. Shining, inquisitive eyes focus on the teacher as she is about to begin the lesson. The Grade 3 learners listen with rapt attention to her instructions. They pair off and collect their 'science apparatus': a set of 1,5 volt batteries, small light bulbs and connecting wires.

The learners have to connect all of these in such a way that the bulbs light up. Their small fingers work together excitedly, testing different possibilities. Excitement builds.

Suddenly, there's a great whoop of delight.

First one pair of learners, then another, manages to get the bulbs to

The children in this class have just experienced the joy of scientific discovery. Learning through experience becomes a lesson for life.

glow. Others peep over their shoulders to see how it was all done. Instructions fly to and fro across the classroom. There's total amazement and wonder on their faces. The occasional 'wow' escapes from their lips.

The children in this class have just experienced the joy of scientific discovery. Learning through experience becomes a lesson for life.

Teaching science

It should be possible for all teachers to provide their learners with similar educational experiences, regardless. However, teaching science in disadvantaged primary schools can be a daunting task. Many South African teachers lack a basic knowledge and understanding of important science concepts. The outdated practice of reading aloud from text books or asking learners to copy sections of text from the board is still common. Teachers also feel that a lack of basic science equipment restricts their ability to use more practical teaching methods.

This is a very disturbing situation. Educational researchers have found that practical science learning experiences foster the kind of thinking and reasoning needed in science. Child development experts confirm that an experiential approach is more appropriate for young children, and can help them to build a sound knowledge of science and its processes.

The Primary Science Programme (PSP) in Philippi in the Western Cape is a teacher development organisation. It is committed to supporting educators to teach science well, regardless of the challenges they may encounter in their schools.

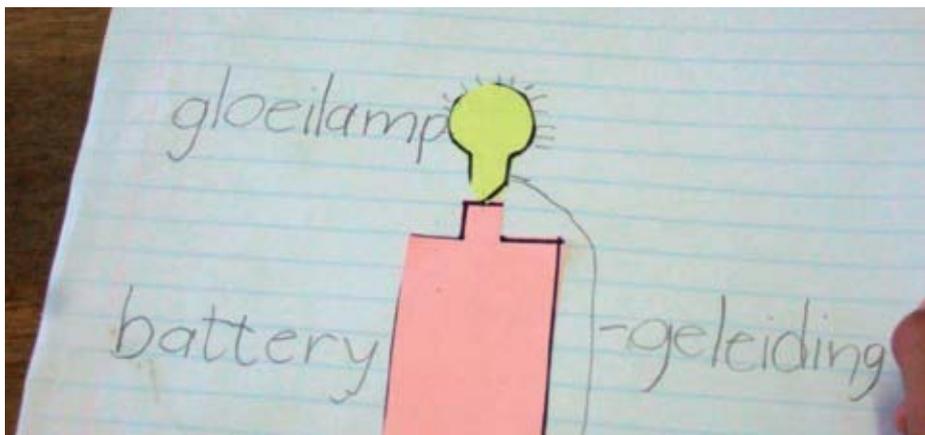
The PSP encourages a 'hands on, minds on, words on' approach to teaching primary science. The experience of doing science promotes deeper reflection. Throughout, conversations to draw out the science in the experience are encouraged. This can be done through questions such as "What do we know?", "What would we like to know?", "How can we find



From household waste to science equipment

The Primary Science Programme (PSP) encourages teachers to use waste material creatively and innovatively when they teach science. Household waste can become handy science apparatus. Different sized plastic bottles, for instance, can be used in a variety of ways in the classrooms, for instance as containers or measuring apparatus. Some are used to temporarily house insects for observation, while others are trimmed and used to germinate seeds and growing plants in. A plastic bottle can quite easily become an earthwormery, a filter funnel, a beaker, a rain gauge, a sand filter or even a test tube.

For more information, visit www.psp.org.za



out?" and "What have we learnt?"

Practical science remains a challenge without the necessary resources and equipment. To overcome this challenge, teachers are encouraged to use waste material creatively and innovatively while staying true to the science concepts being taught.

The experience of practical science

helps educators to understand that good science teaching does not depend on expensive equipment, but rather on a sound knowledge of basic science concepts. This must be combined with a measure of creativity about instructional materials, activities, and strategies for effective science teaching and learning.

Zorina Dharsey (zorinad@mweb.co.za) is the director of the Primary Science Project. She is completing her PhD in curriculum studies in the Faculty of Education and uses PSP's support of primary science education and continuing teacher development as a case study.

Sharing thoughts on science communication

Doctoral students who participated in the *New Voices* Programme had the opportunity to attend workshops on science communication to hone their skills in writing about and presenting their research to a general audience. What were the highlights of their journey together? Was the journey valuable? What did they learn in the process? *Corina du Toit* of the Postgraduate and International Office interviewed some of the participants.



Anthea Jacobs

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Advances in technology and science are transforming our world at an incredible pace. Our children’s future will surely be filled with unthinkable technological advances. Being ‘science literate’ is therefore no longer just an advantage, but a necessity.



Nathaniel McGregor

Full-time PhD student in the Department of Psychiatry and Biomedical Sciences of the Faculty of Medicine and Health Sciences
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During the process of learning about science communication and attempting to de-jargonise my research, I ended up asking myself the nitty-gritty questions and how my work can be applicable in real-life situations. These were questions I wasn’t necessarily asking when I was doing my research. The motivational boost I received from interaction with other participants that were outside my close-spectrum circle was invaluable while finishing my research.



Sumetee Pahwa-Gajjar

PhD candidate at the School of Public Leadership in the Faculty of Economic and Business Sciences
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Learning about science communication is very relevant to me as I am going to focus on improving the understanding of climate science by policy makers from diverse disciplines and backgrounds – for the sake of sustainable development. During the *New Voices* process it was very encouraging to find that research could be of interest to a wider audience, not just to people in my field.



Amanda Genis

PhD student and senior research assistant in the Department of Biomedical Sciences, in the Faculty of Medicine and Health Sciences
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In our studies, we’ve been trained to mainly communicate with people in similar fields and are used to using our ‘own’ language. When we talk to people outside of our field I think we often make the mistake of either over-explaining or over-simplifying our work. In the process we lose the ability to capture the essence of our work in a simple, but interesting way. As a BSc student at Stellenbosch University, our group of students was once referred to by an arts student as ‘the worst dressed and most boring people on campus’. This is not the case at all!



Marinus de Jager

Full-time PhD student in the Department of Botany and Zoology in the Faculty of Science
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In scientific research the key message is easily lost in details and technicalities that are only of interest to other scientists in the same field. How to highlight this message for an audience that does not share your academic background can be quite challenging, as researchers tend to build and expand strict new vocabularies useful only

in research. Learning (or remembering?) how to tell the same story in an informal and even fun way has been a wonderful experience.



Zorina Dharsey

Part-time doctoral student in the Department of Curriculum Studies in the Faculty of Education, and a full-time facilitator of natural sciences and mathematics at a teacher development organisation
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Science communication is as important as the research that is being done. Scientists have a tremendous responsibility to inform, to educate, and to demystify their work while emphasising its relevance and importance to

the general public. I learnt that it is all up to me how accessible the knowledge and understanding becomes. I realised that I have to think more creatively about how I communicate my work to others.



Simon Pauck

Doctoral student in the Department of Electric and Electronic Engineering in the Faculty of Engineering
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To me science communication has come to mean something like ‘communicating the results and benefits of scientific research’, rather than communicating ‘how’ it was done. It’s been good to realise that one’s research is interesting beyond the technical details, and that it is possible to relate to others in this way.



Danie Ludick

Part-time PhD student in the Department of Electric and Electronic Engineering in the Faculty of Engineering, and a full-time development engineer for a company that develops computational electromagnetic analysis software programs
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South Africa is currently at a very exciting stage. Our economy is slowly but surely moving from being labour

based to knowledge based. This is evident when looking at projects such as the Square Kilometer Array (SKA) radio telescope, for which South Africa is taking a big part of the responsibility. Sadly however, the general public is not always aware of this. Science communication is critical in the sense that it should spread the good news about our scientific developments.



Nikki le Roex

Doctoral student in the Department of Biomedical Science in the Faculty of Medicine and Health Sciences
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Science communication is not just about communicating your own research to a lay audience, but about communicating the official, dry results of any peer-reviewed article to anyone with an enquiring mind. There are many people who fit this description, but who have not trained in the sciences. In order to disseminate any scientific discoveries – major or otherwise – the channels of communication have to be open between scientists and the general public.



Doreen Mbabazi

Doctoral student in the Department of Mathematical Sciences (mathematics, applied mathematics, computer science) in the Faculty of Science
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Doreen Mbabazi continued...

I realised during the process that it is quite hard to communicate and write effectively in an easy, simple and understandable way. Just like everything else in life, being able to communicate your science effectively is a skill that needs to be worked upon and developed. I have learnt to make use of the 5W and H (What, Where, Who, When, Why and How) and I have learnt that you need to connect with your audience.



Natasha Mothapo

Full-time PhD student in the Department of Botany and Zoology's Centre of Excellence for Invasion Biology, based in the Faculty of Science

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It isn't enough to write a thesis and then leave it in the library in the hope that a honours or masters student will be desperately hunting it down in several years to come. People need to hear about our fabulous research. The mistake that most people make is to speak over

the head of the average person, and to use big words, complicated graphs and complex statistics.



Mariana Jooste

Researcher who has been seconded by a research organisation in the deciduous fruit industry to the Department of Horticultural Science in the Faculty of AgriSciences to do her doctoral research

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Science communication is all about translating findings in such a way that it can be implemented or can educate people in such a way that they can make informed decisions. It is the key that unlocks the door to a problem

so that the light can shine in. It was a hard journey, but also very liberating as I realised that my findings have a practical application for the man on the street – and not just for my funders.



Ignacio Serra Stepke

Doctoral student in the Department of Viticulture and Oenology in the Faculty of Science

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Science is to question everything and about trying to find answers in a systematic way. It is always easier to go from simple to complex, rather than the other way around. When you can explain something complex in a simple way, you improve your own understanding of the questions and answers you have worked on in your

research, as well as the ones that remain unanswered. It is also a way to see how your work links to daily life.



Jacobus Diener

PhD candidate in theoretical nuclear physicist in the Department of Physics in the Faculty of Science

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We live in a consumerist society. People demand neatly packaged snippets of information so much so that if you don't explain your science well, it becomes bad science. I work in the field of nuclear physics with which many people have a malicious connotation. It causes a mental barrier when I try to explain my work. My biggest challenge through the science communication learning process was to find a way to demonstrate the value of my research without losing my audience.

sci·ence – [sahy-uhns]

noun

1. a branch of knowledge or study dealing with a body of facts or truths systematically arranged and showing the operation of general laws: the mathematical sciences.
2. systematic knowledge of the physical or material world gained through observation and experimentation.
3. any of the branches of natural or physical science.
4. systematised knowledge in general.
5. knowledge, as of facts or principles; knowledge gained by systematic study.

Programme

5 December 2012

8:00	Coffee and registration	
8:30	Welcome	
09:00 – 10:40	An insatiable drive to survive: <i>A physiologist explores ways of combating cancer cells' resistance to chemotherapy.</i>	Ms Gina Leisching Dept. Physiological Sciences
	Cereal killers: <i>A food scientist sets out to catch killer fungi, one image at a time.</i>	Mr Paul Williams Dept. Food Sciences
	What's in a bottle of carbon neutral wine? <i>Can wine farms in South Africa reach carbon neutrality, asks a researcher at the School of Public Leadership.</i>	Ms Sumetee Pahwa-Gajjar School of Public Leadership
	Romance and regret in the fields of Namaqualand: <i>A botanist describes how the humble beetle daisy masters the art of sexual deception.</i>	Mr Marinus de Jager Dept. Botany and Zoology
	Anxious about anxiety: <i>A geneticist researches the influence of genes on the development of anxiety disorders.</i>	Mr Nathaniel McGregor Dept. Psychiatry
	Would you let a robot fly you home? <i>An engineer explores why this is not a bad idea.</i>	Mr Simon Pauck Dept. Electric & Electronic Engineering
	Have your plum... and eat it: <i>Our horticulture PhD explains how better fruit storage options can save consumers from nasty surprises.</i>	Ms Mariana Jooste Dept. Horticultural Science
10:40	Tea	
11:10 - 12:40	Divide and conquer the electromagnetic spectrum: <i>An engineer's work contributes to the optimal design of the SKA telescope.</i>	Mr Danie Ludick Dept. Electric & Electronic Engineering
	Primarily teaching science: <i>A teacher-trainer tells how science can be brought alive even in the most under-resourced schools.</i>	Ms Zorina Dharsey Dept. Curriculum Studies
	Turning off the tap as a life-saving measure: <i>A biomedical scientist explains how blocking a duct in the pancreas could give new hope to diabetics.</i>	Dr Venant Tchokonte-Nana Dept. Biomedical Sciences
	Winemakers, trains and knowledge: <i>An interdisciplinary scientist discovers what knowledge winemakers actually rely on.</i>	Mr Nelius Boshoff Centre for Research on Evaluation, Science and Technology
	Building bridges or swimming pools? <i>A linguist investigates why teachers choose to use English despite the benefits of mother tongue teaching.</i>	Ms Susan Nyaga Dept. General Linguistics
	The real world value of virtual property: <i>Should property law apply in the virtual world?</i>	Adv Wian Erlank Dept. Public Law
	The accidental tourist: <i>Invasive Argentine ants have launched a hostile takeover of our Fynbos, says an entomologist.</i>	Ms Natasha Palesa Mothapo Dept. Botany and Zoology
12:40	Closing remarks	
13:00	Lunch and prize giving	

Lessons from Dubeni

Dubeni genuinely seemed to enjoy human affection. Most wild animals cower away from people, but the rhinoceros allowed me to place my hand on its massive head, right between its two horns. I was petrified, but to my surprise the animal nuzzled closer and seemed to enjoy a good scratch.

I was just boy at the time and no higher than his shoulder, but Dubeni made a lasting impression on me. I became, and still remain, in awe of rhinos.



While the urgency in taking action is understandable, we cannot afford to make decisions that might have unintended consequences. If the strategy of legalising trade turns out to be wrong, we may unintentionally imperil rhino populations even further.

Unfortunately times have changed for Dubeni. He needs to be guarded. Soldiers keep his whereabouts secret and maintain constant vigilance with firearms – all to ensure that those horns he let me touch are not lobbed off for use in Eastern medicine.

The rhino poaching crisis seems to have caught South Africa unawares. Responses are frustratingly inadequate, as power, money and entrenched traditional beliefs combine to make this a complicated problem.

One major proposal in response to poaching is that the trade in rhino horn should be legalised. The thinking is that by flooding the market with horns from farmed or otherwise legally obtained horns, pressure on our wild stocks might be relieved.

As a conservation scientist I am concerned that this argument has not yet been backed up with much evidence. While the urgency in taking action is understandable, we cannot afford to make decisions that might have unintended consequences. If the strategy of legalising trade turns out to be wrong, we may unintentionally imperil rhino populations even further.

Standard economic theory suggests that humans will stop exploiting a resource once it becomes too costly to extract it. French researcher Franck Courchamp¹ and his colleagues recently showed that this thinking unfortunately does not apply to people who seek animals and animal parts. His argument is underpinned by a range of evidence, from economic models and case studies to social science.

The so-called ‘anthropogenic Allee effect’ suggests that people will continue

to pay increasingly exorbitant prices to purchase legal or illegally traded horn. This will therefore perpetuate the incentive for poachers to harvest horns, until there are no rhinos left.

The unlawful harvesting of animals is the third highest illegal trade in the world, and is topped only by drugs and firearms. Almost 14 million legal collection permits were issued in Asia alone in 2008 for a range of species mainly destined for the European and North American collector markets.

The unlawful harvesting of animals is the third highest illegal trade in the world, and is topped only by drugs and firearms.

Because the illegal trade sector is thought to be even bigger in scale, it seems impossible to simply ‘flood’ such a huge market. There is no clarity on what might happen to rhino populations if this were attempted.

Rhino poaching needs an urgent response. However, considering the cost of being wrong, other options than legalisation deserve further exploration.

We all want to make things better for Dubeni. In the absence of evidence, let’s rather use caution to guide our decisions.

Bernard Coetzee (bwtcoetzee@gmail.com) is a doctoral student in zoology and is part of the Centre for Invasion Biology in the Department of Botany and Zoology. This conservation biologist researches species assembly patterns and the ecological efficacy of protected areas.

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1. For further reading: Courchamp, F. et al. 2008. *Allee effects in ecology and conservation*. Oxford University Press. New York.



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