

# Science Matters

## Science Faculty Newsletter



### Message from the Deam



Welcome to the first issue of "Science Matters" in 2016. The year started off under unusual conditions for most staff with the repeat series of 2015 examinations held in late January and early February, with all the associated marking and marks processing that had to be done immediately prior to the start of term. I am grateful to all those who were impacted by these difficult circumstances for the extra work you put in to ensure that our students were looked after, and could either proceed to the next academic year of study or graduate, despite the disruptions of late last year.

Other than the disappointing and unacceptable vandalism and destruction of property by a small group of students that took place on 16 February, the semester has been

peaceful and ended successfully with two enjoyable Science graduation ceremonies held last week. Over both ceremonies, 23 PhD, 52 Master's, 147 Honours and 304 Bachelor degree candidates graduated, many of the latter two groups having been carried over from last year. Whereas we slightly over-shot our new Science student enrollment target for 2016, the significant increase in EBE students (~200 more than expected) placed considerable strain on both the lecture venue allocations and the class-room and laboratory teaching for many of our staff. I am hopeful that this won't occur again next year. The effort by staff to accommodate these high numbers of students is appreciated.

Perhaps the overriding issue on most people's minds this past semester has been the austerity measures introduced by the centre to ensure that UCT stays financially strong, and that moving forward we are as an institution able to better fund our research, teaching and transformation imperatives. The Science Fac-

ulty's savings target is significant, but I am confident that it can be achieved without undue impact on the academic project. Discussions on how best to achieve our savings target will continue through late July.

This edition of Science Matters highlights a number of successes by students and staff during the first six months of this year. We are proud of our two newly NRF A-rated researchers, Professors Bruce Hewitson and Chris Reason; a number of staff received national and international recognition for their research; and two staff received international recognition for their innovative teaching. Research continues to flourish across the Faculty and a number of short research highlights are captured in the final pages.

**Anton le Roex**

### Two new A-rated Scientists in the Science Faculty



**Professor Bruce Hewitson** (left) from the Department of Environmental & Geographical Science and **Professor Chris Reason** (right) from the Department of Oceanography, were recently awarded A-ratings by the NRF.

Professor Hewitson's work focuses on activities around regional climate change that includes climate modeling, climate analysis methods, downscaling and regional projections. In parallel he does research on the interface of climate and society, and engagement with decision makers and policy that seeks to optimize the adoption of climate information by society. Complementary interests include a role in international climate activities, including the Intergovernmental Panel on Climate Change, and the World Climate Research Programme.

Professor Reason's work focuses on Southern Hemisphere climate variability and change, particularly with respect to floods and drought, and the role of the oceans in driving this change. Other focus areas include severe weather events over southern Africa such as mesoscale convective complexes, cloud bands, cut off lows and tropical cyclones and regional atmospheric and ocean modelling, particularly in the African / western Indian Ocean region.



# Our Science Stars:

## 3 Science Faculty finalists for 2015/16 NSTF Awards

The NSTF Awards, in partnership with South32, recognise outstanding contributions to science, engineering and technology (SET) and innovation by researchers and other SET-related professionals.

This year, ten UCT researchers have been chosen as finalists for a total of 14 awards. Three of them, namely **Emeritus Professor Jennifer Thomson** and **Professors Jill Farrant** and **Peter Dunsby**, are from the Science Faculty. They have been nominated in the following categories:



Lifetime Award: **Emeritus Professor Jennifer Thomson's** laboratory has developed genetically modified (GM) maize that is tolerant to dehydration. South Africa is currently in a critical drought situation, with farmers experiencing crippling losses and maize prices are rocketing.



Special award in crop science and food security **Professor Jill Farrant**: DST/NRF SARChI chair in Systems Biology Studies on Plant Desiccation Tolerances for Food Security, Department of Molecular and Cell Biology.



Research or engineering capacity development (For a contribution by an individual over the last five to ten years) **Professor Peter Dunsby**: Professor of Cosmology, Co-Director of the Astrophysics, Cosmology and Gravity Centre, Department of Mathematics and Applied Mathematics.

## International Award for Innovative Teaching Practices by Stefan Britz

**Dr Leanne Scott** and **Mr Stefan Britz**, from the Department of Statistical Sciences recently received the Apereo Teaching and Learning Award (ATLAS) 2016 for their innovative teaching practices in the first year introductory statistic course STA1000. The ATLAS Awards recognise innovation in teaching and learning using software supported and developed by the Apereo Foundation, amongst others Sakai, on which UCT's Vula is built.

The aim of the award is to create a community of like-minded educators who develop excellent teaching methods by incorporating innovation in order to stimulate learning. "We were thrilled to have this course recognised as being 'educationally innovative' as it has been our focus to continually find ways to engage our students... both to keep them working and to facilitate breakthroughs in their understanding of the subject matter," said Dr Scott when asked about the award.



*Mr Stefan Britz and Dr Leanne Scott*

Introductory statistics had traditionally been viewed as a "killer course", with very large student numbers (up to 1400 students in the second semester) and relatively low pass rates causing many students to extend their curricula. After research conducted by Dr Scott and Prof Graham Barr on the use of technology in teaching statistics, a blended learning model was introduced. In the new model, the syllabus is delivered to the students via a set of 25 videos, which were developed in partnership with GetSmarter. Although the majority of the interaction in the course occurs online, face-to-face tutorials and workshops allow tutors and lecturers the time and space for the consolidation of concepts.

Stefan Britz presented the winning entry at the 2016 Open Apereo conference at New York University in Manhattan in May. He emphasised that, "this award is the culmination of dedicated effort made by the lecturing team, our tutors, and the Vula support staff. It will remind us to keep continually adapting our approach to fit the ever-evolving requirements of our specific learner cohort within the dynamic landscape of statistics".

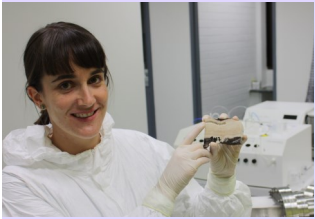
## International and Local Awards for Professor George Ellis

**Emeritus Professor George Ellis**, Department of Mathematics & Applied Mathematics, has been elected Doctor Honoris Causa by the Pierre and Marie Curie University in Paris. He will receive this award at a ceremony at La Sorbonne in Paris, in October this year. Professor Ellis will also be receiving an honorary degree from the University of Witwatersrand in July this year.



## New P-rating for Geochemist

**Dr Robyn Pickering**, a newly appointed lecturer in the Department of Geological Sciences, was awarded a P-rating by the NRF, one of only twelve awards across the country. Dr Pickering has spent the last decade working on the uranium-lead dating technique, developing it to be applicable to the early human (hominin) fossil bearing caves sites in South Africa and providing the first set of direct ages for these deposits. Part of her new role at UCT is to set up a U-series dating lab in the existing, state-of-the-art facility in the Department of Geological Sciences. This will be the first modern U-series lab in Africa and will provide the opportunity for research and training only available overseas until now.



## Computer Science student awarded scholarship for MSc at Oxford University

**Craig Feldman**, who completed Computer Science Honours in 2015—was recently awarded The Standard Bank Africa Derek Cooper Scholarship—to pursue an MSc at Oxford University. This prestigious award is offered to individuals who represent the best and brightest that Africa has to offer—to assist in creating African leaders to actively build a future for Africa. Congratulations to Craig.



## Lifetime Achievement Award for Women in Science

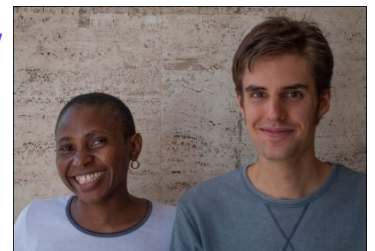
**Emeritus Professor Jennifer Thomson**, Department of Molecular & Cell Biology, was recently awarded a global Lifetime Achievement Award for Women in Science by United Nations Environment Programme (UNEP)



Professor Thomson has also been elected as President of OWSD (Organization for Women in Science in the Developing World) at the organisation's 5th General Assembly and International Conference in Kuwait. "My new role is an extension of my lifelong passion for promoting women in science," says Thomson. "I co-founded SAWISE (SA Women in Science and Engineering) in 1995 and it is still going strong".

## Postgrads to attend 2016 Lindau Nobel Laureate Meeting in Germany

**Agnes Mboniyirivuze** and **Greg Jackson**, (pictured right) postgraduate students in the Department of Physics have been selected to attend the 66th Lindau Nobel Laureate meeting in Germany in June 2016. **Arrykrishna**



**Mootoovaloo**, (pictured left and also known as Harry), has been selected to represent Mauritius at the Lindau Nobel Laureate Meeting. Harry who is working towards an MSc in Astrophysics and Space Science, is currently doing his research with Professor Bruce Bassett at AIMS (African Institute for Mathematical Sciences). Harry comments, "I believe that being part of this meeting is a stepping stone to pursuing a career in research. I am also keen to make a contribution to the education sector for the developing African partner countries.



The 66th meeting is dedicated to the field of Physics and the opportunity to join the annual gathering of Nobel Laureates is provided exclusively to outstanding young scientists aged up to 35 years old and is a valuable opportunity to meet previous Nobel Laureate role models and mentors, to seek their advice, to exchange thoughts and views and to discuss current developments in science and beyond.

## UCT Scoops Top places in annual IT Challenge

The annual team programming contest “IT Challenge”, organized by Standard Bank saw 18 teams from UCT participate in the qualifying ‘heats’ in April this year. In the packed senior Computer Science lab, approximately 100 teams from universities across South Africa, took on the challenge. Teams of 3-4 students have only one PC to solve as many problems as they can in the 4-hour non-stop contest. This year, the winning team, “BetaGo” composed of **Taejun Park**, **Robert Spencer**, and **Robin Visser**, broke the records by having solved all six problems in a mere 2.5 hours. They will represent UCT in the finals in Johannesburg in August.



## Next Einstein Fellow

**Associate Professor Amanda Weltman** was recently named a Next Einstein Fellow and attended the Next Einstein forum in Dakar in March.

The Next Einstein Fellows (NEF) is a programme that recognises 15 of Africa’s best young scientists and technologists. These innovators and emerging leaders, at least 40 percent of whom are women, have two main opportunities as a NEF Fellow, namely to (a) advance their scientific career and (b) to inspire the next generation of African innovators.

Through the forum, they have opportunities to present their work at the NEF Global Gathering in the presence of leading scientists, journalists, industries and business people from across the world; gain exposure to a global audience of approximately 100 million viewers and readers worldwide; draw upon the vast networks of NEF members and participants for support, connections and counsel to advance their work and develop mentoring relationships with leading scientists, policymakers, industry representatives and civil-society leaders. NEF Fellows participate in campaigns and events to encourage young people to pursue scientific careers. For Amanda’s Einstein Challenge, she hopes to develop a fundamental theory to explain dark energy and the cosmological constant, Einstein’s so called fudge factor, that is necessary to account for the accelerated expansion of our universe.



*Amanda during her spotlight talk*



*Amanda Weltman (far left) with the 6 women Fellows and heads of state Macky Sall and Paul Kagame (centre)*

## Connections across the globe...

**Dr Adam West**, and his PhD student, **Rebecca Karpul**, from the Department of Biological Sciences, recently joined 30 other South African scientists on a week long visit to the International Institute of Applied Systems Analysis (IIASA) in Vienna, as part of the new South African Systems Analysis Centre (SASAC) initiative, funded by the NRF. SASAC is designed to develop the next generation of systems analysis thinkers in South Africa.

The South African group represented a wide-range of disciplines including technology, social development, energy, water, pollution, ecology/ evolution and environmental management. The trip focussed on building links and collaborations with IIASA scientists to further develop a multi-disciplinary, systems analysis and policy-relevant approach in SA. A productive and stimulating visit that forged many new collaborations.



*The UCT contingent. From left: Adam West (Biological Sciences), Nien-Tsu Tuan (Construction Economics and Management), Masiwa Rusare (Construction Economics and Management), Rebecca Karpul (Biological Sciences), Keegan Steyn (Department of Information Systems)*

## Major Antarctic Expedition—Oceanography's Sarah Fawcett to head off into the blue



The newly created Swiss Polar Institute (SPI) recently announced an international scientific Antarctic expedition to study the Earth's poles and extreme environments. The expedition will comprise 55 researchers from 30 countries, working on 22 research projects, while circumnavigating Antarctica. **Dr Sarah Fawcett** (pictured left) from the Department of Oceanography will be the Principal Investigator of the only African-led project that has been selected to participate. The project team also includes scientists from Cape Peninsula University of Technology, Nelson Mandela Metropolitan University, Rhodes University, the Department of Environmental

Affairs, and SAEON, as well as collaborators from Princeton University and the University of Texas in the USA, and the University of Szczecin in Poland. Sarah and her team's research while on the expedition will focus on profiling the Southern Ocean's microbial community.

The future of the Earth's poles is critical. In the coming decades, major international negotiations will focus on the polar regions, which are bearing the brunt of global warming. The newly created Swiss Polar Institute (SPI), based at the Swiss Federal Institute of Technology in Lausanne, is an interdisciplinary center devoted to researching the Earth's poles and other extreme environments. The *Antarctic Circumnavigation Expedition (ACE)* which will take place at the end of December 2016, on board the *Akademik Treshnikov*, a Russian ship dedicated to scientific research, will be the first scientific expedition to fully sail around the southernmost continent. The purpose of this expedition, with key logistical support from Ferring Pharmaceuticals, will be to measure and quantify the impact of climate change and pollution in the Southern Ocean.

In addition to Sarah and her team, there are 7 other South African scientists, including UCT's **Professor Peter Ryan**, who will be participating in ACE as co-investigators and collaborators. Their research interests range from marine technology to microplastic pollution in the ocean. **Associate Professor Isabelle Ansoorge** from UCT is involved in the ACE organizational and scientific steering committee.

# STAFF NEWS

## WELCOME TO NEW STAFF

### Department of Astronomy

- Mr Olwethu Kwayiba—Admin Officer
- Dr Bradley Frank - Lecturer

### Biological Sciences

- Ms Jamie-Lee Cupido—Senior Secretary

### Department of Chemistry

- Ms Lisl George—Admin Officer
- Ms Crystal Losper—Admin Assistant
- Mr Lehnonn Martin—Departmental Assistant
- Dr Kawaljit Singh—Principal Scientific Officer

### Drug Discovery & Development (H3-D)

- Dr Andre Horatscheck—Principal Scientific Officer
- Mr Edmore Kativu—Technical Officer
- Dr Alissa Myrick—Senior Research Office
- Ms Deidre' Kruger—Lab Administrator

### Department of Environmental & Geographical Science

- Mrs Melanie Rustin-Nefdt—Admin Assistant
- Ms Alice McClure—Academic Co-ordinator
- Ms Nonhlanhla Mbatha—Assistant Lecturer

### Department of Geological Sciences

- Mr De Villiers Basson—Chief Technical Officer
- Mrs Khensani Moses—Senior Scientific Officer
- Dr Robyn Pickering—Lecturer
- Mr Nicholas Laidler—Senior Scientific Officer

### Department of Mathematics & Applied Mathematics

- Mr Mmoloki Matotong—Chief Technical Officer
- Ms Sameya Esterhuizen—Senior Secretary
- Dr Bishop Mongwane—Lecturer

### Department of Physics

- Mr Roger Hansen—Lab Assistant
- Dr Thomas Leadbeater—Lecturer
- Mrs Nonzwakazi Mzamo—Departmental Assistant

### Department of Statistical Sciences

- Ms Kim-Joy Franz—Admin Assistant
- Ms Anneli Hardy—Statistical Consultant

### Science Faculty Office:

- Mr Anneq Abrahams—Senior Finance Officer

## FAREWELL TO STAFF

### Department of Biological Sciences

- Mrs Nazlie Davids
- Mr Granville Faulmann

### Department of Chemistry

- Dr Dyanne Cruickshank

### Department of Molecular & Cell Biology

- Ms Felicia Stuurman
- Mr Halford Dace
- Mrs Nomathamsanqa Fulani

### Department of Statistical Sciences

- Ms Ushma Gala

## Action Stations...



After losing more than 45kg since 2014 and working very hard on her fitness and strength, **Monique Muller**, from the Department of Chemistry, competed in her first Obstacle Course Race (OCR) namely The Grind 5km (containing 20 obstacles) earlier this year, at Hillcrest Quarry, Durbanville. She received a medal for finishing within 1 hour 22 minutes. Now that the bug bit her, she plans to participate in several more events this year.

## Promotions in the Faculty:

Congratulations to the following staff for their *ad hominem* promotions, effective in 2016.

Department	Title	Name	Promoted to
Astronomy	Ass. Professor	Patrick Woudt	Professor
Astronomy	Dr	Sarah Blyth	Senior Lecturer
Chemistry	Dr	Takalani Theka	Senior Scientific Officer
Chemistry	Dr	Hong Su	Chief Scientific Officer
EGS	Dr	Gina Ziervogel	Associate Professor
EGS	Dr	Shari Daya	Senior Lecturer
EGS	Dr	Kevin Winter	Senior Lecturer
EGS	Dr	Pippin Anderson	Senior Lecturer
Mathematics & Applied Maths	Dr	Nora Alexeeva	Senior Lecturer
Molecular & Cell Biology	Dr	Laura Roden	Associate Professor
Molecular & Cell Biology	Dr	Zenda Woodman	Senior Lecturer
Physics	Dr	Steve Petersen	Senior Lecturer

## MCB Celebrates Africa Day with style and flair..



Algeria



Mauritius

MCB celebrated Africa Day with great festivity in both fashion and cuisine on the 27th May 2016. Everyone was able to sample delicacies from various African countries such as South Africa, Zimbabwe, Mauritius, Lesotho, Algeria, Mozambique, Ethiopia and Seychelles. In the end Seychelles was judged the winning country.



Seychelles



Zimbabwe

## Research Bytes

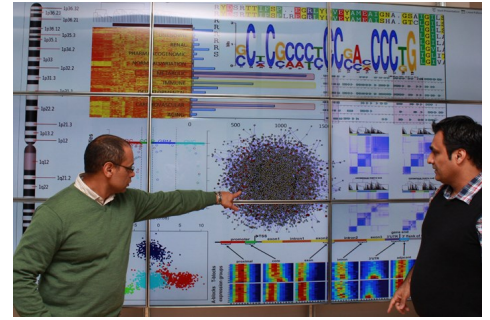
### Researchers identify genetic patterns for six common cancers

A team based in the Department of Chemistry has discovered that each of six cancer types (breast, colon, lung, kidney, ovarian and brain) has a unique genetic expression pattern, which can be used for accurate early diagnosis and targeted treatment.

**Professor Kevin Naidoo**, the SA research chair in scientific computing in the Department of Chemistry at UCT, and **Dr Jahanshah Ashkani**, also of the UCT Chemistry Department, made the discovery. Using statistical classification algorithms on massive tumour gene expression data, the UCT researchers found that the gene expression pattern of a patient can be used to accurately classify cancer types. This then lays the ground for developing an early diagnosis. The expression patterns may further be used to identify variations within each of the cancer types, which can then guide specialised patient treatment.

“An early cancer diagnostic is critical for patient survival, as most cancers can be cured if discovered in their early stages” says Professor Naidoo. The ability to identify distinct subtypes of cancer opens the door to further research, which will guide the choice of specialised treatment to significantly enhance a patient’s chances of survival. This complements the shift towards personalised medicine approaches that deliver specialised oncotherapy to patients following diagnosis.

Professor Naidoo is now leading a multi-laboratory collaboration that includes scientists in the divisions of pathology and human genetics at UCT’s medical campus and the Centre for Proteomics and Genomic Research. Their work entails the analysis of blood samples of South African patients. They hope to develop a low-cost gene expression tool for breast cancer, which will form the basis of a routinely used early diagnostic.



*Professor Kevin Naidoo and Dr Jahanshah Ashkani analysing genomic data on a video wall in the Scientific Computing Research Unit Informatics and Visualisation Laboratory.*

### Birds of a Different Colour: Why Some Birds Have More than One Colour

Researchers who study Black Sparrowhawks, which occur as either dark or light forms, have found that the hunting success (measured by how much food they brought to their chicks) of each colour type differed depending on natural light levels. Thus dark birds did better when it was darker and light birds did better when it was brighter. When the investigators looked at Black Sparrowhawks across the whole of South Africa, they found that the frequency of the colour types varied according to the ambient light levels found during the breeding season.



“Our study is the first study to reveal support for the idea that color polymorphism is due to different morphs being better adapted to different light conditions,” said **Gareth Tate**, PhD student at the Percy FitzPatrick Institute and lead author of the Ecology Letters study. “This is an important finding and helps evolutionary biologists understand how multiple color varieties can co-exist together in the face of natural selection.” **Dr. Arjun Amar**, from the Department of Biological Sciences at UCT who is corresponding author of the paper added, “We think that dark morph birds capture more prey in duller conditions because they are better camouflaged against darker cloudier skies. Within our study area, high rainfall coincides with when the species is breeding, and this may also explain why we have so many of this usually rare colour type here.”

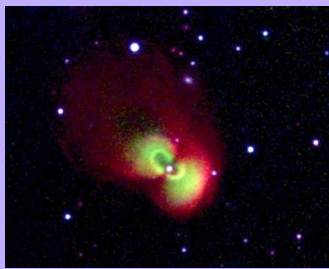


## Astronomers pinpoint echoes of ancient exploding star on our stellar doorstep

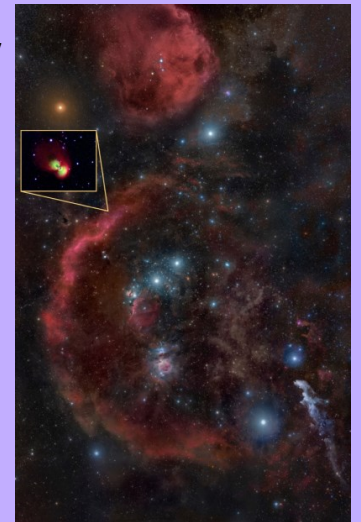
Dr Brent Miszalski, SALT astronomer at the South African Astronomical Observatory (SAAO), said: "Putting together the pieces of this cosmic puzzle has been a detective story bringing together the very latest astronomical equipment and millennia-old Chinese records of the variable night sky." The find was reported in a recently published paper by a team of astronomers based in South Africa, England, Chile, Spain and Mexico. Amateur astronomers found the peculiar-looking nebula, called Te 11, in the Orion constellation in 2010. Astronomers weren't sure what to make of it, but they have now resolved the conundrum. First observations of this star at the centre of the nebula (a cloud of gas and dust in outer space) showed it to be a double star system in a close orbit of almost three hours.

The team responsible for this discovery, a group of astronomers with expertise in the envelopes of old stars led by Dr Brent Miszalski at the SALT/SAAO, were soon joined by UCT astronomers **Professor Patrick Woudt**, head of Astronomy at UCT, **Emeritus Professor Brian Warner** and PhD student **Ms Mokhine Motsoaledi**, who had also directed their attention to this unusual star. By noticing variations in the brightness of this star over several years, Professor Woudt and colleagues amassed high-speed observations recording the changes in the binary's light.

The jumps in the light curve imply that the star is a dwarf nova (a star hiccuping material nibbled off the companion). "Such a combination of a dwarf nova with a nebula is extremely rare," said Professor Woudt.



*Colour image of Te 11 made from images showing light from Hydrogen and Nitrogen gas (red), Oxygen gas (green) and visual light (blue).*



*Location of Te 11 in the constellation Orion (background image by Rogelio Bernal Andreo).*

## Your next DNA vaccine might come from tobacco

In a pioneering step towards using plants to produce vaccines against cervical cancer and other viruses, University of Cape Town (UCT) researchers have generated synthetic human papillomavirus-derived viral particles called pseudovirions in tobacco plants. "We've succeeded in making a completely mammalian viral particle in a plant - proteins, DNA, everything. That's enormously exciting," says **Dr Inga Hitzeroth** of the Biopharming Research Unit (BRU) at UCT.

In an Open Access study recently published in Nature Scientific Reports, BRU researchers report using tobacco plants to create a synthetic viral particle known as a pseudovirion, which looks like a virus, but contains no infectious viral DNA. A virus is usually made up of a shell surrounding the virus's own genetic material. Pseudovirions instead carry whatever DNA the researcher wishes to include within the shell of proteins that make up the outer coating of the virus.

Until now, such particles have only ever been created in yeast or mammalian cell cultures - this is the first time researchers have successfully created pseudovirions in plants.

The BRU is part of a new movement known as biopharming, which means using plants as biological factories. Biopharming has been used to create flu vaccines, potential Ebola drugs, and an enzyme used to treat Gaucher's Disease in humans. The technique employs the cellular machinery within tobacco plants or other plant cells to manufacture enzymes, antibodies or even the viral capsid proteins (the proteins that make up the shell of a virus), which act as vaccines.



*Dr Anne Meyers, Prof Ed Rybicki, and Dr Inga Hitzeroth of the Biopharming Research Unit (BRU) at UCT, seen here with young tobacco plants. Image credit BRU.*

## Endophyte Workshop for Tuberculosis Drug Discovery: The Isolation of endophytes from medicinal plants for the discovery of anti-tubercular agents.

**Dr Sunny Sunassee**, from the recently established Natural Products Research Group (NPRG) in the Department of Chemistry, recently hosted members of the Natural Products Research Group (NPRG) from the University of New Brunswick (UNB) in Saint John, Canada. The UNB group spent one week at UCT and ran a workshop on the isolation of endophytes for natural products chemistry - work that could lead to the discovery of molecules with promising activity against tuberculosis.

Endophytes are microorganisms (either fungi or bacteria) that live inside of plants without causing diseases and are known to produce secondary metabolites, also known natural product molecules. A growing body of research, in the early stages of drug discovery, is showing that these endophytes can produce natural product molecules that are active against not only the pathogen *Mycobacterium tuberculosis*, but also against different tumour cells and other diseases.

The purpose of this workshop training was to enhance participants' skills in the isolation of endophytes for natural products chemistry research, in order to discover bioactive molecules against *M. tuberculosis*. Compared to traditional plant natural products chemistry research, which requires the collection of kilograms of whole plant material, the endophyte approach only involves the collection of small plant parts (i.e. 1-2 leaves) and therefore provides a sustainable, ecologically-friendly and low-tech source for bioactive molecules.



Workshop participants during a field trip to Kirstenbosch Botanical Gardens



Participants being briefed in an MCB Lab

## Seismology: Remote-controlled earthquakes

**Dr Alistair Sloan**, who recently joined the Department of Geological Sciences at UCT, was recently involved in studying an unusually large earthquake which occurred in Pakistan. The international team used a wide variety of methods from seismology to satellite radar technology to reveal that the earthquake actually involved two ruptures separated by 50 km and 19 seconds. The team suggest that the second rupture was triggered by passing seismic waves of the first. This type of dynamic cascading rupture is not considered in modern seismic hazard analyses, and can significantly increase the area effected by strong shaking and associated damage.



In a recently published article in *Nature Geoscience*, Dr Sloan and colleagues analysed earthquakes in Pakistan and Chile — each listed in global earthquake catalogues as single events — and show that both involved multiple episodes of slip, on independent faults, separated by a small distance and short amount of time. The studies suggest that the passage of seismic waves can almost instantaneously trigger secondary events beyond the rupture area of the first earthquake, increasing the region of significant shaking and thus the associated potential impact on population and infrastructure. Observationally, these studies reveal that we now have the tools to identify earthquake complexity at a level that has not been possible in the past. Dr Sloan hopes that the findings from the study can be used to modify existing seismic hazard models, to guard against the destructive risk that such double earthquakes pose.

## Did you know....that the coldest place in Africa is in the Physics Department?

The Physics Department recently acquired a Dilution Fridge, which is officially the coldest place in Africa, able to reach a temperature as low as 8.190mK. i.e. 122 times colder than the known naturally coldest place in the universe: the Boomerang Nebula. It is also one of the largest and most powerful fridges in the world.



Mark puzzling over the fridge components

Photo: Gregor Leigh

The fridge had an arduous journey to the RW James building, originating in Holland, flying to Johannesburg and then being trucked from Johannesburg to Cape Town. **Associate Professor Mark Blumenthal** has been eagerly awaiting the fridge's arrival for two years and was really frustrated when they opened it up and discovered that this R6.5 million piece of equipment had been damaged while in transit. However, it is now up and running.

So why the need for the fridge? Is it to keep the physicists chilled? The fridge will be used to study material systems and electron transport. Some of the research applications of the fridge are those of quantum computing, metrology which is the science of standards, and quantum cryptography. The fridge will also be used for the training of students in understanding vacuum systems, cryogenics and solid state physics.

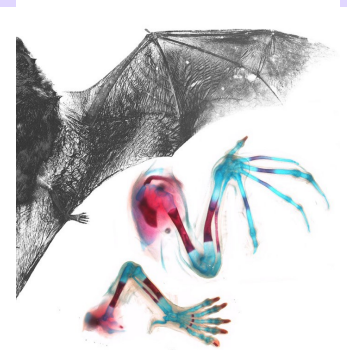


Getting the fridge operating:  
photo: Gregor Leigh

The fridge has a powerful superconducting magnet, 25 000 times more powerful than the Earth's magnetic field, and allows the physicists to manipulate the spin of the electrons. Mark and his team are working in the field of nano-electronics and are building devices that can track individual electrons and examine the spin on electrons. In order to "catch" something as small and elusive as an electron, there is a need to cool it to a very low temperature in order to slow it down.

## Bat research takes off after a decade of research

An international team of scientists from UCT and University of California, San Francisco recently published a landmark paper in *Nature Genetics*, which identifies both genes and gene regulatory elements that are essential in wing development in the Natal long-fingered bat (*Miniopterus natalensis*), a species widely distributed in east and southern Africa.



Bats are the only mammals capable of powered flight—an ability that evolved about 50 million years ago. The structure of the bat wing, as noted by Charles Darwin in 1859 in *On the Origin of Species*, is widely used among biologists as an example of both evolutionary novelty (the appearance of a new trait) and vertebrate homology (shared ancestry between two seemingly different structures) – in this case, the wing of the bat and the forelimb of other mammals .

The path of bat evolution is unclear, noted **Professor Nicola Illing**, co-senior investigator based in the Department of Molecular and Cell Biology: "The fossil record does not show the transition from tree-climbing mammals with short, free digits to ones that have elongated fingers supporting a wing. We have had the privilege of being able to use the tools of modern genetics to decipher how genes are turned on and off during bat embryonic development to transform a mammalian forelimb into a wing."

The scientists, including co-lead authors UCT PhD student **Stephen Schlebusch** and Walter L Eckalbar, a postdoctoral fellow at UCSF, first sequenced the entire genome of the Natal long-fingered bat. They then used the latest sequencing technologies to take a snapshot of which genes were active to complete a genomic analysis on the developing wings and feet of bat embryos. **Zoe Gill**, an MSc student in the Illing lab, characterised where a number of key regulatory genes and novel long non-coding RNA transcripts were precisely expressed in bat embryos, validating the high throughput molecular genomic analysis.

## Science has spoken: jet lag disadvantages SA Super Rugby teams

Rugby fanatic and doctoral graduate **Lovemore Kunorozva** (pictured right), from the Department of Molecular & Cell Biology, has found evidence that the performance of South African Super Rugby players is affected by time zone travel.



Together with his supervisors, **Associate Professor Laura Roden**, from the Department of Molecular & Cell Biology and Dr Dale Rae from the Division of Exercise Science and Sports Medicine, Lovemore recruited about 30 players from each of South Africa's five Super Rugby teams in 2011 and 2012. The players' performance, injuries and illnesses were meticulously tracked throughout the two seasons. A player's data that were gathered when there was no time-zone travel was compared to data gathered for that same player when he travelled to Australasia and when he returned to South Africa.

The results support what many sports doctors, commentators and fans have long contended: players who travel eastward are more sensitive to the effects of jet lag, and it shows in their play. "We tracked their involvement in the game – which didn't differ significantly when they were jet-lagged," says Lovemore. "But the quality of their involvement diminished considerably." Mistakes crept into a jet-lagged player's game and they were more prone to injury and illness.

Whether one operates best in the morning, in the evening or equally well at both times may depend on one's PERIOD3 (PER3) genotype. Individuals with a PER3 variant associated with 'morning people' may cope a lot better with eastward time travel. This could be because 'morning people' tend to fall asleep earlier anyway, which may make it easier for them to fall asleep during the Australian or New Zealand night time, says Lovemore.

The results of the research have important implications for team doctors, who may well choose to expose players to time under bright blue lights at particular times of the day, to phase shift players into new time zones. Knowledge of the different genotypes may also facilitate better management of the players and enable contingency plans to reduce illness and injury in players. It is hoped that the findings of this study will increase performance and longevity of players, managing players individual requirements appropriately.



## Congratulations to NASSP Graduates in MSc in Astrophysics and Space Science.

For **Buntu Ngcebetsa**, **Simon Malinga** and **Michael Hlabathe**, their journey to Astrophysics and Space Science was an interesting one that they hadn't initially set out on. All three of them were undergraduates when they attended talks by the National Astrophysics and Space Science Programme (NASSP) and were convinced to follow this programme.

*Buntu Ngcebetsa, Prof Patrick Woudt (HoD Astronomy), Simon Malinga, Dr Kurt van der Heyden (NASSP Director) and Michael Hlabathe.*

Michael completed his Master's degree with a dissertation entitled, "Post-common-envelope binary central stars of Planetary Nebulae". He worked with Dr Miszalski and Dr Vanessa McBride, who he said played a pivotal role in challenging him and assisting him

to produce research and work of a high quality. Michael's research has yielded results worth following up and he has now embarked on a PhD at UCT.

Buntu, who has just completed his MSc with a thesis entitled, "Star formation in the bars of nearby barred galaxies", started off the year by going for two months to the National Radio Astronomy Observatory in the USA, under the guidance of Professor Tom Jarrett and Dr Kartik Sheth, (NASA) who were the advisors on his project.

Simon has been working with Dr Kurt van der Heyden, Dr Kartik Sheth and Dr Sudhanshu Barway (SAAO) examining the molecular gas presence by looking at dust extinction in lenticular (SO) galaxies in the nearby universe using the colour map technique.

## In Memoriam

**Emeritus Professor Tim Dunne**, who was head of the Department of Statistical Sciences for eight years, was tragically killed in a car accident on 17th April 2016. He was a well known figure while studying at the University of Natal in Pietermaritzburg, where he served two terms as SRC president and rallied students and organised marches and picket lines. He completed his PhD at UCT and taught at universities in Texas, Minnesota, Indiana and California before returning to lecture at UCT. Professor Dunne played a leading role internationally in the statistics community and served on government committees overseeing the standards of national examinations. South Africa's statistician-general Pali Lehohla, said, "He lived to be an intellectual giant, yet imbued personal humility. Through his soft-spoken mannerisms he would deliver an intellectual killer punch, always standing firmly behind those he believed in."



Colleagues from the Department of Statistical Sciences commented, "Through his untimely death we have lost a very special man who will be remembered for his intellect, his integrity, his humour and his generosity. He always had the wellbeing of individuals and the community at heart and did not hesitate to fight for what he believed was right. We will treasure his legacy for a long time to come." Dunne is survived by his son Rowan, his first wife Lucille Hattingh, his second wife Dee Wills and his six stepchildren and seven step-grandchildren.



The Science Faculty mourns the passing of **Mr Goodman Mlungu**, a departmental assistant in the Department of Chemistry, who worked at UCT for 31 years,.

Mr Goodman Mlungu will be sorely missed by the Department of Chemistry, where he was an integral member of the team and a departmental assistant. Goodman first started working at UCT in 1985 in the catering division at University House and Glen Res, where he also worked as a handyman. Before joining the Chemistry Department, Goodman worked as a departmental assistant in Virology.

## Last laugh....

