November 2016 Faculty of Science University of Cape Town Vol. 5 Issue 2

Science Matters

Science Faculty Newsletter

Message from the Dean

Welcome to this end of year edition of Science Matters, marking the approaching conclusion of a turbulent 2016. The past two months have seen deep divisions developing across campus as a result of the level of student protests and associated intimidation and infringement of individual rights, of both staff and students, which have left many wondering about their future at UCT.

The issues were and remain complex, multi-faceted and many near intractable. As a Faculty, staff views span the spectrum of opinions on the validity, legitimacy and approach of the protests; student opinions similarly span the spectrum of views with some of our Science Faculty students articulating their discomfort at the culture and their learning experiences in the Faculty. Irrespective of one's particular view, as a Faculty it is incumbent on us to address the legitimate concerns during the course of 2017, and debate and reach a better understanding of those that might be less obvious to many as causes of discomfort. I am confident that we can achieve this goal in the coming year, and hopefully through respectful and mature debate and challenge, which should be the corner stone of any university; not via the aggressive intolerance we have recently seen.

Mirroring last year we are now again in the middle of a significantly delayed examination period, with examinations, marking and final result approval processes running through to 23 December. With little break for academic or PASS staff, teaching related activities start again in mid-January 2017. The November examination period has fortunately been quiet, and the threatened disruptions have to date not materialised; likely on the back of the agreement that was eventually reached between Management and the protesting student groups. With luck we will be able to successfully see out the planned examination period without disruption.

Despite the disruptions of the second semester of 2016, Faculty academic staff and students continued to excel in a range of research and teaching activities, producing research with considerable international impact and teaching of the highest calibre, ably assisted by the support staff in the Faculty. The pages that follow highlight some of their achievements – both national and international. These include a new NRF A-rated researcher, Professor Anusuya Chinsamy-Turan, a prestigious Cheney Fellowship to Leeds awarded to Professor Kelly Chibale, and a National Science & Technology Forum (NSTF) award for capacity building went to Professor Peter Dunsby. Postgraduate students from Biological Sciences, Chemistry and Computer Science received national recognition for their work in a variety of fora. A number of interesting and important extra-curricular engagements are reported on, and a few short articles give a small taste of some of the exciting science that is being done across the Faculty.

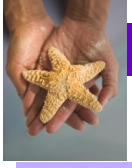
I wish you all an enjoyable and peaceful, if somewhat shortened, festive break once the extended second semester activities are over.

Anton le Roex

New NRF A-Rating for Palaeobiologist

The Science Faculty is proud of **Professor Anusuya Chinsamy-Turan,** Department of Biological Sciences, who was awarded an A ratings by the NRF for the first time, based on the quality and impact of her research outputs in the recent past.

Professor Chinsamy-Turan is internationally renowned for her ground breaking research on the microscopic structure of fossil bones that has led to pertinent deductions about the biology of extinct animals, such as Mesozoic birds, dinosaurs, and the ancestors of mammals. She has an extensive publishing record, with several papers in leading high ranking journals (e.g. Nature), and is the author of two acclaimed academic books, as well as two popular level books.



Our Science Stars:

Professor Kelly Chibale collects awards...

Professor Kelly Chibale, Department of Chemistry, was awarded a Gold Medal for major scientific breakthroughs, at the South African Medical Research Council (SAMRC) Scientific Merit Awards in 2016.

Professor Chibale has also been awarded the prestigious Cheney Fellowship to attend the Astbury Centre for Structural Molecular Biology at the University of Leeds in the UK. This programme brings highly talented and creative academics to Leeds to advance their research, build lasting collaborations and to create a high profile international network of world-leading researchers, scientists and engineers.

National Science & Technology Forum (NSTF) award for Professor Peter Dunsby

Professor Peter Dunsby, Department of Mathematics & Applied Mathematics, was honoured at the National Science & Technology Forum (NSTF) Awards in 2016, for research capacity development over the last five to ten years.

Professor Dunsby's strategy for developing human capital over the past twelve years has focused on a pioneering initiative to develop the next generation of astronomers and space scientists—The National Astrophysics and Space Science Programme. He has also developed a successful integrated research programme in his own discipline (theoretical cosmology), involving postgraduate students, postdoctoral researchers and international collaborators.

AXA awards first research chair in Africa to UCT

AXA Research Fund (a scientific philanthropy initiative of global insurance leader AXA, dedicated to boosting scientific progress and discoveries that contribute to understanding and better preparing against environmental, life and socio-economic risks) has awarded its first research chair in Africa to the University of Cape Town. The new chair, in African Climate Risk, will be held by **Professor Mark New**, director of the African Climate and Development Initiative (ACDI). Worth R20.65 million (€1.35 million) over 15 years, the chair aims to make a significant impact in understanding African climate risk.

UCT Chemists feature strongly at the 2016 SA Chemical Institute awards

Professor Timothy Egan, Department of Chemistry, received the Gold Medal from the SA Chemical Institute, in recognition of his outstanding scientific contribution in the field of chemistry. Professor Egan's work centres on the bioinorganic chemistry of the malaria parasite and in particular on the way in which this parasite incorporates haem into malaria pigment also known as haemozoin. This process is of great significance because it is inhibited by a number of clinically very important antimalarial drugs, such as chloroquine, quinine and related compounds, some of which remain a mainstay in the treatment of malaria, a disease that still claims almost 500 000 lives every year in Africa.

Ian Rogers, a PhD student in the Department of Chemistry, was one of only three people who received a SACI postgraduate medal. Using High Performance Computational (HPC) methods, Ian showed why enzymes -"natures nanomachines", are so precise in their promotion of specific chemical reactions. Relying on his skills to vastly accelerate software developed in the Scientific Computing Research Unit, Ian showed for the first time how high level computations are able to burrow into the machinery of enzymes and reveal their inner workings. Co-authoring with his thesis supervisor Kevin Naidoo, this work has been published in high impact journals such as the American Chemical Society's Catalysis .

Emeritus Professor Luigi Nassimbeni, Department of Chemistry, was elected a fellow of SACI, in recognition of his extensive contribution to Chemistry in South Africa over many years.

Postgrads from Percy Fitzpatrick institute win prizes

Two postgraduate students from the Percy Fitzpatrick Institute, **Noelle Tubbs** and **Alistair McInnes**, won the Royal Society for the Protection of Birds prizes for Best Conservation Poster and Best Conservation Talk, respectively, at the 9th International Penguin Congress.

Alistair Mc Innes (left) and Noelle Tubbs (far right) with their awards.

Best Student Paper Award at Controlled Natural Language Workshop 2016 in Scotland

Computer Science PhD student **Joan Byamugisha** (pictured right) won the Best Student Paper award for her peer-reviewed, published paper at the Controlled Natural Language Workshop 2016, which was held recently in Aberdeen, Scotland.

Joan investigated the feasibility of bootstrapping a controlled natural language (CNL) for Runyankore, which is spoken in her home country Uganda, taking as starting point a CNL for isiZulu. The paper presents the 'verbalisation patterns'—akin to logic-based templates where one can slot in the values for the variables to generate understandable sentences in natural language—and the evaluation with Runyankore speakers to find out their preferences on what reads better.

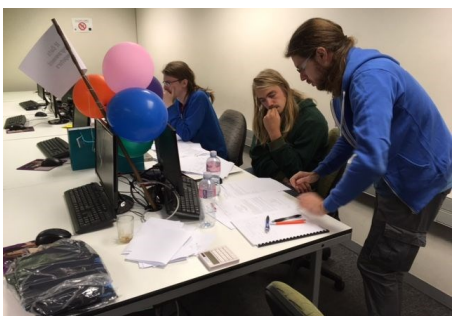
Computer Scientists programme up a storm at ACM Intercollegiate Programming Contest

The annual 5-hour long nonstop team programming ACM Intercollegiate Programming Contest pits teams of three against one another to solve as many problems as they can with just one PC. A record 130 teams from across Sub-Saharan Africa participated. Dr Maria Keet from Computer Science describes how, "the last hour proved to be an exciting one, with suspense, secrecy and exclamations of joy for the 12 Western Cape teams, who were together in one location; the psychology of team contests is not to be underestimated".

The UCT team, "If Cats Programmed Computers", which consisted of **Robin Visser**, **Guy Patterson-Jones** and **Kieren Davies**, won the Regional competition and will represent UCT at the World Finals, which will be held in Rapid City, South Dakota, USA in 2017. Approximately 40 000 students from across the world participate in these qualifying rounds and getting to compete in the world finals, where they will be competing against 127 other teams, is a fantastic achievement.

Stellenbosch University's team, with UCT alumnus Dylan Nelson in their team, came second. The UCT team "Alpha Code Masters", made up of second year students **Jonathan Bouwer, Jonathan Alp** and **Dylan Sims**, took third place and the UCT team "I CLEARLY PRESSED CAPLOCKS", with **Jacques Heunis**, **Sarah Taylor** and **Satchen Gush** took fourth place. UCT team "Dynamic Programming Required", consisting of second year students **Udarshan Oodit, Ryan Broodryk** and **Luke Tylor**, took sixth place overall. Considering the challenges of reduced training and practice as a result of the disruptions at UCT, this is an impressive achievement for all of the UCT teams.

At work in the lab



The winning team: If Cats Programmed Computers

3rd placed team: Alpha Code Masters

Medal awarded for Operations Research

Ian Durbach, Georgina Rakotonirainy, Sheetal Silal, Theo Stewart & Timothy Blake at the ORSSA meeting

The 45th meeting of the Operations Research Society of South Africa was recently held in Stellenbosch. Several members of the Department of Statistical Sciences attended the meeting. The conference programme included an Operations Research Wine Hunt where participants were required to solve a series of mathematical and statistical problems to win prizes. The Society's premier award, the Tom Rozwadowski medal, was awarded to **Dr Sheetal Silal** for the best written contribution to Operations Research, published by a member of the Society during the previous year. The award was made for the publication: *Hitting a Moving Target: A Model for Malaria Elimination in the Presence of Population Movement.*

Zoology graduate attends International Visitor's Leadership Programme in USA

Chanel Rampartab, who graduated with an MSc in Zoology earlier this year, was nominated by the CEO of her company to join the USA Embassy's International Visitors Leadership Programme, and was accepted onto the programme. She was one of a group of 25 youth (aged 18-25 years old) from around the world, who travelled from San Francisco to New Hampshire and Washington DC as part of a two week programme focusing on ocean protection and sustainability. Chanel was the only South African and one of only four Africans to attend

This was Chanel's first experience of travelling to the USA and indeed anywhere outside of southern Africa. She particularly enjoyed spending two weeks with people from other countries and said, " it was a wonderful cultural experience to explore not only the diversity of each country, but also understanding the complexities that bind us". The programme was geared towards empowering youth in ocean conservation and natural resource management issues that our planet faces globally. "The highlight of the trip was meeting and listening to important people in my field such as Secretary of State John Kerry, National Geographic Explorer Sylvia Earle, President Obama's Scientific Advisor and Jacques Cousteau's heir, Philippe", said Chanel.

At the fisheries consulting company where she is employed, Chanel is working on a global study project for the United Nations, assessing the discards of fisheries in sub-Saharan Africa. She is also working with the US embassy on an outreach programme for youth and the public, where focus is placed on ocean issues surrounding illegal fishing, climate change and biodiversity loss. Her future plans include striving to alleviate illegal fishing practices and improving the relationship between fisheries, business, NGO's and governments.

Photographer captures imagination with his winning photograph

Davide Gaglio from the Percy Fitzpatrick Institute, won the international Bio Med Central (BMC) Ecology Image Competition 2016, for his silhouette of antelope grazing against the sunrise in the Kalahari Desert in southern Africa. The image was selected as the best from entries submitted by 140 ecologists across the world.

Guest judge Dr. Matthew Palmer, Columbia University, said: "The winning image is strikingly beautiful, particularly the colours and the composition, but it also tells several stories." The Kgalagadi Transfrontier Park spans the border of South Africa and Botswana and is an example of cooperation and shared management between countries –a peace park.

Out and about in the Faculty….

MCB inspires with dynamic Postgraduate activities

The Molecular & Cell Biology Postgraduate Representative Committee (MCB PRC) aims to enrich the postgraduate experience by fostering a vibrant postgraduate culture in the department. This year the group hosted a number of activities geared towards promoting academic and social cohesion. Below is a summary of some of the events/activities that took place this year.

The **MCB Pub Quiz** took place in May and served as a means to welcome new postgraduates to the department. Academics and postgraduate students were divided into teams that participated in charades and play-doh sculpting, in addition to the main quiz. Events of this nature foster camaraderie in a sociable atmosphere. The photo on the left shows the victorious "Viral Freedom Fighters" from the Biopharming Research Unit (BRU).

The **MCB Soccer Tournament** was held over a period of four-weeks in August and it attracted both academics and postgraduates alike. Teams challenged each other for the greatly desired title of MCB Soccer Champions. Sales representative from the department's different suppliers joined in on the fun and provided players with refreshments and awarded the members of the winning team with gift vouchers. The photo on the right shows the MCB Soccer Champions, "Man-Chesthair United".

The Plant Conservation Unit at the AZEF conference, Prince Albert

The Arid Zone Ecology Forum (AZEF) is a platform for researchers to investigate, highlight, and discuss the socio-ecological issues and potential solutions facing the arid and semi-arid regions of southern Africa. This year, AZEF held their 31st annual conference from 3 - 6 October 2016 at The Showroom Theatre in Prince Albert, Western Cape. The event was sponsored by the National Research Foundation (NRF), the South African Environmental Observation Network (SAEON) and the Plant Conservation Unit (PCU) at the University of Cape Town (UCT).

Prince Albert was a particularly important and relevant location to host the conference this year because of its proximity to the Tierberg Long-Term Ecological Research (LTER) site, Wolwekraal Nature Reserve, a Karoo BioGaps project site and the unconventional grazing methods site at Tarkaskuilen. All of these locations were included as exciting field-trip options for conference attendees. Tierberg LTER (recently acquired by SAEON) was established in 1986 (30 years ago) by Prof Sue Milton and Dr Richard Dean and has been an important site for Karoo research including vegetation dynamics, grazing impacts, heuweltjies and rehabilitation.

The conference was divided into several sessions surrounding pertinent research in the Karoo, including ecological and conservation-related research, the impact of renewable energy and livestock grazing on the Karoo veld, and rehabilitation and long-term ecological monitoring projects in this biome. **Hana Petersen (**PCU), **Kervin Prayag** and **Juan Swanepoel** from the Department of Biological Sciences, won prizes for the research that they presented at the conference.

PCU Team & Associates from left to right: Liesl Eichenberger (SANBONA), Joe McAuliffe (Desert Botanical Garden, USA), Timm Hoffman (PCU Director), Elelwani Nenzhelele (PCU Masters Student), Hana Petersen (PCU Masters Student), Samantha Venter (PCU Research Assistant & rePhotoSA project coordinator), Helga van der Merwe (SAEON Arid Lands Node) & Kervin Prayag (Honours student).

SEAmester Floating University explores the ocean

SEAmester, the brainchild of **Associate Professor Isabelle Ansorge**, set sail on a ten-day voyage to discover more about life in the sea, marine instrumentation, ocean dynamics and data analysis, with a specific focus on the Agulhas Current. "The strength of SEAmester is that students are able to combine theoretical class-room learning and the application of this knowledge through ship-based, and more importantly, hands-on research. Greater awareness of the ocean's physical and ecological response to climate change highlighted through experiences will inspire and attract students into the marine sciences", says Professor Ansorge.

A total of 41 postgraduate University and Technikon students from 15 institutions across South Africa were selected to go to sea for 10 days, and for many of them it was their first time out at sea and a life-changing event. Seven post graduate students and five academics from the Faculty of Science were on the expedition. Ms Tahlia Henry, who will be doing her MSc at UCT in 2017, coordinated the entire programme—a student running the show for other students. Tahlia is passionate about being at sea and has spent more than six months at sea on the SA Agulhas II, since 2014.

Which aspects of SEAmester did the students like best?

- Hands on experience with the equipment during the deck hours
- Interaction with all the lecturers and scientists and being able to network during the 10 days
- Meeting and living with students from various backgrounds, universities and interests
- Having students also lecture - allows us to learn from our peers
- Evening non-scientific lectures provided another view on science
- Being able to put science into a wider context
- Connecting lectures to assignments pulled their understanding together

International Collaboration for Cosmology & Gravity Group

Professor Peter Dunsby and **Dr Alvaro de la Cruz-Dombriz,** from the Department of Mathematics & Applied Mathematics have driven an initiative, the Erasmus+ programme, with several Spanish Universities belonging to the Alliance4Universities network. This programme allows students from UCT and universities in Europe to participate in a five-month learning agreement for Master's courses and a five-month internship for PhD students wanting to broaden their international exposure and develop their collaboration with leading experts on their PhD topics. Professor Dunsby and Dr de la Cruz-Dombriz as well as PhD student **Suloma Kandhai** have received grants from this programme, which is fully funded by the European Commission.

Professor Dunsby and Dr de la Cruz-Dombriz were also awarded a substantial grant from the Norwegian Centre for International Cooperation in Education (SIU) to establish a joint study and research programme between the Universities of Oslo, Norway and Cape Town. In addition to collaborative research projects, they aim to jointly develop courses in theoretical cosmology and computational astrophysics.

2016 Science Spring School in Sutherland by Associate Professor David Gammon

For the fifth year in a row the Science Faculty held a successful Winter School for first year Science students and this time we did things differently, taking our students on a 4-day excursion to Sutherland, the Karoo town which is host to significant national and international astronomical observatories, including the SALT (South African Large Telescope) facility.

The premise of our Winter Schools has always been that students' success in their Science studies is in part dependent on their levels of motivation and interest in what they are doing. These are in turn dependent on just how much exposure they have had to what Science is and what scientists do. We are fortunate here at UCT and in our region to have a high concentration of excellent scientists and scientific expertise, as well as outstanding research centres and sites of scientific interest. So, we aim to take the students to the science and the science to the students, in the belief that they will become inspired by what they see and experience, and will have their minds opened to new possibilities for their own futures.

The observatory formed the focal point of our Spring School, together with a broader programme to illustrate just how far-reaching "science" is. We arrived by bus on a Friday evening, and took over the Sutherland Hotel, which was our base for the 4 days, and home to some vibrant discussions and interactive sessions between excursions to the observatory and other field sites. We started by discussing "what is science?" and "what are belief systems?", and what the relationship is between the two. We considered the implications for science and belief systems that the closest star is 4 light years distant, and that a gaze into the night sky is to glimpse the distant past. We had Science postgraduate students with us who shared their journeys to their present studies, and talked about ambitions and trajectories. Each student was given a copy of Barbara Oakley's book, *A mind for numbers*, and we discussed assigned readings each day. The book sets out ways of thinking about Mathematics and ways of learning it – and the ensuing discussions led to valuable insights and changed approaches to the continuing semester.

The most exciting field excursion was to the astronomical facilities where SAAO astronomer and UCT alumnus Lisa Crause and 3rd year Astrophysics students, guided us through some of the telescopes. We were then joined by **Professors John Parkington and Simon Hall** of UCT's Department of Archaeology, who took us to a site just below SALT where there is evidence of stone age tools. We thought collectively about how one might investigate this, what questions are to be asked, what observations sought. Why here? And who were they? And later that evening we looked through the telescopes at the beautiful mysteries of the night sky; for most students it was the first time they had viewed Saturn through a telescope; a memorable occasion.

Dr Emese Bordy of UCT's Department of Geological Sciences, took us through the geology, economics and social impact of "fracking" (hydraulic fracturing" in the search for natural gas) in the Karoo. Her presentation and the ensuing discussion were a great way to think about the intersection between science, industry, economics, the environment and sustainability, and of course an introduction to an important current controversy. We discussed more broadly how we as scientists should engage in these real-life issues, and how to be true to the science while also being true to our humanity.

Then the evenings … In addition to the night of star gazing, we had a wonderful talk one evening by John Parkington, on work he has done in association with the newly established SKA radio-astronomy facility further north near Carnarvon, and the wider historical context of rich cosmologies of the region, and how people think about their skies. We ate good karoo food, and played endless games of pool. Some of us stayed up late into the night talking, talking, talking.
What did the students make of all of this? They were pretty unanimous in declaring it a wonderful experience.

Student initiative that has made a difference: Help@Science by Stefaan Conradie, Ziningi Madonsela & Goitseone Thamae

Help@Science Student Academic Network is a student-led, student-run initiative in the Science Faculty which strives to provide a safe work/ study space in which study sessions are run for students doing first year science courses. Tutors are available during the sessions to provide additional help with questions and to facilitate group work. Help@Science is housed in the Science Learning Centre in the PD Hahn Building.

The initiative was founded as the UCT Science Students Academic Network in 2009, by Margeret Johansson-Lipinski, Ziningi Madonsela and Goitseone Thamae, Science students who met at the UCT Emerging Leaders Conference. Their aim was to address the significant academic and related difficulties first year Science students faced, based on their personal experiences. Tutors who assisted were volunteers, which was important since the tutors offered assistance because they had a sincere interest in assisting fellow students, rather than just being paid to do so. It was also deemed important that the space be distinct from more conventional tutoring and lecturing environments, with the initiative providing a space for students who felt overwhelmed, alienated and intimidated in the course-based contexts, to feel a greater sense of belonging and more able to engage meaningfully with the course material. It was envisaged that this could reduce failure rates in first year courses and consequently the rates of academic exclusion and non-completion of degrees.

Though the initiative went through some ups and downs, attendance has increased and Stefaan has been pleased to see students who attended UCTSSAN/ Help@Science sessions, returning to tutor. Help@Science runs independently of all departments and courses, assistance is provided for free and the research shows that students who attend the sessions regularly gain the most from their association with the initiative.

Stefaan says, “I have deep gratitude to the student founders of this programme for allowing other Science students to benefit from it. It has taught me valuable life lessons and given me insight into the experiences of Science students at UCT. This is an initiative which has made, and can continue to make, a notable difference in the academic lives of Science students”.

Inspiring Young Scientists: Eskom Cape Town Expo for Young Scientists

The Eskom Cape Town Expo for Young Scientists, hosted by the Science Faculty in August, showcased 487 projects by 739 scholars from 52 schools – the cream of the Western Cape’s junior and senior scientists. The themes of many projects showed that the province’s budding young scientists are keen to get to grips with society’s common problems, such as insulating township shacks and securing clean water. But they’re also thinking of what’s needed to secure societies in the future: sustainable energy and food security, for example.

Opening the junior section of the expo, Professor Kevin Naidoo from the Centre for Scientific Computing, said that many of the country’s future scientists would come from schools competing at expos such as this. Opening the expo’s senior section, Professor Anusuya Chinsamy-Turan, Department of Biological Sciences said that science opened the mind, “All of you young scientists are standing on the threshold of becoming real scientists ... and even if you don’t win [an award] you’re still on the right track.”

Cape Big Day: attempt to break record for most birds seen in a day in Western Cape by Andrew de Blocq, MSc student at Percy Fitzpatrick Institute

Scanning Kirstenbosch from atop the Boomslang!

Birders are a crazy bunch. We will do crazy things to see a special bird. We love going to strange places (think rubbish dumps and sewerage plants). We are easily distracted. I think every birder has jumped up without warning mid-conversation to see what that odd-looking flash was flying into the hedge, leaving a non-birder bewildered and socially stranded.

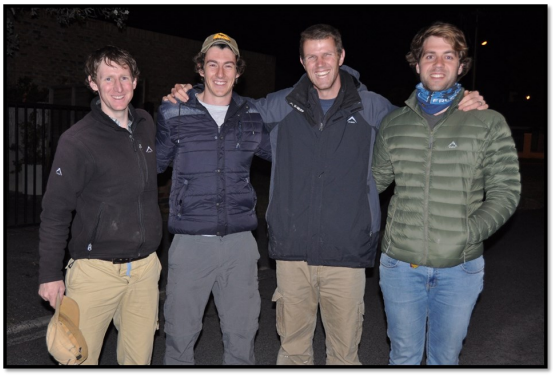
Birders can also be obsessed with numbers. Lifelists, world lists, country lists, yearlists, province lists, reserve lists, garden lists. Numbers of species on one's list is often used as a benchmark for assessing another birder's ability (often wrongly!). Records are important in the birding community. The record of the most bird species recorded in a year was broken in 2015 (Noah Strycker saw 6042 species!), and is already being challenged this year. When Garth Shaw messaged a group of Western Cape birders enquiring who wanted to make an attempt at 200+ species in a day around Cape Town, there were some excited replies. Getting people's schedules to agree did cause some difficulty, but eventually four birders found a date, 8th October, and the team of **Garth Shaw, Frans-Hendrik Joubert, Dominic Rollinson,** and **Andrew de Blocq** was formed!

We planned the route and a high-speed, intense birding 'Big Day' where you jog between the car and the birding spots, quickly moving on to the next place. No tea and cookie breaks for us! The rules were simple. Record as many birds as we could (seeing/hearing), with a majority of team members (i.e. 3 of the 4) needing to confirm the sighting for it to go on the list. The national Birding Big Day record in the Western Cape stands at 216, set by Peter Ryan, Phil Hockey, John Graham, and Phil Dresser in the 1980s— some of the best-known names in South African birding, and academia! We had not-so-secret ambitions of challenging this monumental total and setting our own record for the most birds recorded in the Western Cape within 24 hours! We also had the idea to use this event to raise some funds for avian conservation. We unanimously decided on supporting Birdlife South Africa.

We started at midnight with a sighting of a spotted Thick-Knee and then drove 900km in total, from Fish Hoek to the Wildevoelvlei Wastewater works, to Boulders Beach, Cape Point, Constantia, Tokai, Kirstenbosch, Liesbeek River, Darling Hills, West Coast National Park, Riebeek Kasteel, Paarl, Ceres to the Tankwa Karoo and back.

Our final tally was 191 species, just a few short of our ambitious target, but we had an awesome time birding together across all sorts of interesting places and habitats; we saw some breathtaking birds and raised a substantial amount of money for Birdlife SA.

The diminutive Cape Penduline Tit



Exhausted but ecstatic! The mandatory group photo after over 22 hours of travel and birding

STAFF NEWS

WELCOME TO NEW STAFF

Department of Chemistry
- Dr Siyabonga Ngubane—Lecturer
- Ms Lydia Dreyer

Department of Computer Science
- Assoc Professor Deshendran Moodley

Department of Mathematics & Applied Mathematics
- Mr Patrick Adams—Lecturer
- Dr Claire Blackman—Lecturer

Department of Molecular & Cell Biology
- Dr Raymona Hurdayal—Lecturer

Percy Fitzpatrick Institute
- Professor Claire Spottiswoode

Department of Physics
- Dr Trisha Salagaram—Lecturer

FAREWELL TO STAFF

Department of Archaeology
- Mr Oscar Noels

Department of Astronomy
- Dr Vanessa Mc Bride—Senior Lecturer

Department of Chemistry
- Dr Catherine Kaschula—Lecturer
- Ms Lisl George

Department of Computer Science
- Dr Anne Kayem—Senior Lecturer

Drug Discovery & Development
- Mr James Biwi

Department of Geological Sciences
- Ms Lyn Evon

Department of Mathematics & Applied Mathematics
- Dr Jesse Ratzkin—Lecturer

Department of Molecular & Cell Biology
- Dr Shane Murray—Lecturer

Department of Physics
- Dr Andrew Hamilton—Senior Lecturer

Department of Statistical Sciences
- Dr Melvin Varughese—Senior Lecturer
- Associate Professor Sugnet Lubbe
- Dr Jonas Stray—Lecturer

Faculty Office:
- Ms Bhavani Krishna

RETIREES:

Department of Chemistry
- Mr Arthur Joseph
- Ms Shanaaz Manie
- Mr Kevin Willis

Department of Environmental & Geographical Science
- Dr Richard Hill—Senior Lecturer
- Ms Shaada Reddy
- Mr Tony George

Department of Mathematics & Applied Mathematics
- Mrs Julia Steenveld

Department of Molecular & Cell Biology
- Associate Professor Sharon Reid
- Mr Keyamdien Diedericks
- Ms Ethne Liebenberg
- Mr Jacobus Solomons

Department of Oceanography
- Dr Howard Waldron—Senior Lecturer

Department of Physics
- Dr Jeff Fearon
- Mr Leslie Oliver

Department of Statistical Sciences
- Professor David Bradfield

Research Bytes

What is a plant? By Professor John Bolton, Department of Biological Sciences

Seems a silly question, but the problem is that everyone uses the word, but different people have different ideas in their heads about what it means. Are they just plants on land? Are algae plants? 'Animal Planet' presenters talk about 'the Plant Kingdom'. That is a formal name (otherwise known as the Kingdom Plantae), with a formal definition, and it currently includes not only land plants but also a variety of red and green algae (but not lots of other algae, which confuses the issue even more). Scientists have many varied opinions in this regard.

Other questions worth asking are: if a pond fills up with large algae are these called plants? (many people would). If the water in your swimming pool goes green (microscopic algae) would you call them plants? (many people wouldn't, although many nature programmes define marine phytoplankton as 'microscopic plants in the sea'). This extends to the word 'Botany', which is 'the study of plants'. Many people use the word without defining what they mean by a plant (it traditionally included all algae, but increasingly even scientists mean only land plants - usually without saying so!).

The key to it all is that I want the broad sense of plants (including all photosythetic organisms) to be considered valid, as they are, as a whole, critical to the future of the planet, and there is no other word for them. Humanity is facing its greatest ever challenge in global climate change and, as well described by *Nature Plants*, "the global significance of plants cannot be overstated" (Nature Plants, Guide to Authors). The key process is photosynthesis. We cannot carry on without an acceptable word in English (the current main language of international scientific publication) for organisms which carry out this process, and the only word likely to be generally acceptable is 'plant'.

Below are some examples of green, brown and red seaweed (large algae that live in the sea). The green one is much more related to Proteas than to the other two, but currently the green and red are in the 'Plant Kingdom' but the brown isn't. Some would call none of them 'plants', some scientists only the first two, and I would call all of them plants!

Green Algae: Caulerpa zeyheri, *Double Mouth*

Brown Algae: Dictyopteris ligulata,

Red Algae: Botryocladia beckeriana, Cape Vidal.

African Soil Microbiolgy Project: addressing challenges facing Africa's soil conservation and food security

In the light of increasing populations and environmental change, Africa faces significant challenges concerning soil conservation and food security.

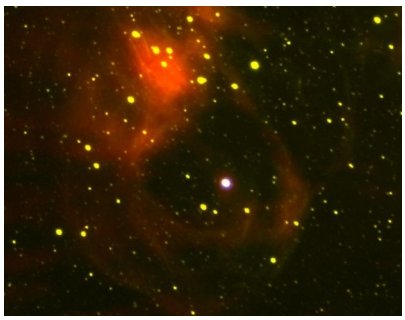
Sampling with the group from AfSM

Scientists from seven sub-Saharan African countries met recently at the University of Pretoria to launch the African Soil Microbiology project. This three year project, funded by USAID, aims to undertake a broad-scale survey of soil microbiology across the entire African continent, using the latest Next Generation DNA sequencing and computational technologies.

This unique multi-national project, the first such study ever undertaken in Africa at this scale, is expected to unravel the complexities of soil microbiological diversity across sub-Saharan Africa. The results of the research will contribute to our understanding of soil fertility, soil degradation and the future impacts of climate change, and important health issues such as soil-borne pathogens.

Dr Frank Eckardt, from the Department of Environmental & Geographical Science, has been brought into the project to provide the geologic, geomorphic and soil context for the 800 samples that are to be collected using additional GIS and Remote Sensing data. The countries involved in the project include continental SADC, Ethiopia and Ivory Coast. Samples will be collected by biologists from each of the countries.

Luminous gamma-ray binary discovered in our neighbouring galaxy, the Large Magellanic Cloud by Dr Vanessa Mc Bride & Dr Lee Townsend



Using data from NASA's Fermi Gamma-ray Space telescope and other facilities, an international team of scientists, including **Dr Vanessa McBride** and **Dr Lee Townsend** from UCT's Department of Astronomy, have discovered the first gamma-ray binary in a galaxy other than ours.

Gamma-ray binaries consist of a neutron star or a black hole interacting with a normal star to produce gamma-ray emission that dominates the radiative output of the system. Only a handful of such systems have previously been discovered, all within our Milky Way Galaxy. This gamma-ray binary, discovered within the expanding debris of a supernova explosion located in the Large Magellanic Cloud (a small nearby galaxy about 163 000 light-years away from Earth), is the most luminous one ever seen. The dual-star system, dubbed LMC P3, contains a massive star and a crushed stellar core that orbit each other every 10.3 days to produce a cyclic flood of gamma rays, the highest energy form of light.

Two big questions intrigue us about gamma-ray binaries. Firstly, do they harbour neutron stars, or black holes? In most cases, we are unable to tell. But optical observations made with the SOAR telescope in Chile tentatively suggest that a neutron star is responsible for the cyclic behaviour in LMC P3. Secondly, how are these energetic gamma-rays produced? These systems must act like giant particle accelerators to produce such energetic radiation, but the acceleration mechanism is still a question for debate. "These are very rare stars – less than ten have been detected in our own galaxy and this is the first one discovered outside the Milky Way. We still don't understand how they work." says Dr Vanessa McBride. Lead researcher, Dr Robin Corbet from NASA's Goddard Space Flight Centre in Maryland, says, "Finding one so luminous and distant is very exciting. Gamma-ray binaries are prized because the gamma-ray output changes significantly during each orbit and sometimes over longer time scales. This variation lets us study many of the emission processes common to other gamma-ray sources in unique detail".

Next steps for the research include confirming the neutron star nature of LMC P3 by making observations to directly detect its rotation period. The team of scientists is also interested in tracking the two stars' orbits, to see if they are truly circular or more elliptical. Because there are so few of these systems, and this is the only one outside the Milky Way, any new information will help with understanding how these energetic star systems evolved and how they are powered.

Computing tools for the sciences in the spotlight

Associate Professor Michelle Kuttel, Computer Science Department, and her collaborators developed the CarbBuilder software application, which made the cover of the *Journal of Computational Chemistry (*pictured right*)* thanks to its quality and capacity to create effective 3D models of complex carbohydrate molecules. Carbohydrates are increasingly recognized as key factors in infectious disease mechanisms. The sophisticated algorithm that runs behind the scene to create the models enables scientists to explore the range of possible conformations, which is important for understanding the biological function of these molecules. The core algorithm and the software's architecture were developed in-house. CarbBuilder is the first software application in the world to have the capability to build very large, branched polysaccharide structures. The cover image depicts a highly-branched repeating glycogen-like polysaccharide containing 740 glucose monomers, which was created with the CarbBuilder software based on just command-line (text-based) input of the primary structure of a carbohydrate.

This spotlight followed recognition of another tool developed by Associate Professor Kuttel and her students, which is aimed at the other end of the spectrum, namely, health workers. They have developed an eHealth application for Android mobile phones that enables a smartphone to act as an affordable and mobile alternative to an expensive microplate reader. This application is expected to support drug research in developing countries by enabling rapid, cheap drug assays in small laboratories and in fieldwork with a standard Android smartphone.

Their contribution was honoured with a "Runner up" paper award at the IST-African 2016 conference.

Honeyguides and people cooperate and communicate with each other

By **Professor Claire Spottiswoode,** FitzPatrick Institute

A male Greater Honeyguide. Photo: Claire Spottiswoode

By following honeyguides, people in Africa are able to locate bees' nests to harvest honey. Research from the Percy FitzPatrick institute reveals that humans use special calls to solicit the help of honeyguides, allowing honeyguides to recruit appropriate human partners. This relationship is a rare example of cooperative mutualism between humans and free-living animals, which has probably evolved over the course of hundreds of thousands of years.

Humans have trained animals such as dogs, falcons and cormorants to help them find food. However, human-animal collaboration in the wild is rare. But it has long been known that, in many parts of Africa, people and wax-eating Greater Honeyguides work together to find wild bee hives which provide a valuable resource to them both.

Honeyguides give a special call to attract people's attention, then fly from tree to tree to indicate the direction of a bees' nest. Humans are useful collaborators to honeyguides because of our ability to subdue stinging bees with smoke and chop open their nest, providing wax for the honeyguide and honey for ourselves. In this way, people and wild birds can increase their chances of accessing vital sources of calorie-laden food, with no competition for the prize.

Keith and Colleen Begg, conservationists working in Mozambique's Niassa National Reserve, first alerted me to the Yao people's traditional practice of using a distinctive call which they believe helps them to recruit honeyguides. With the help of Niassa's honey-hunting community, they tested whether the birds were able to distinguish the call from other human sounds, and so to respond to it appropriately. The 'honey-hunting call' made by honey-hunters, and passed from generation to generation, is a loud trill followed by a short grunt: 'brrr-hm'.

We wanted to test whether honeyguides associate 'brrr-hm' with a specific purpose, rather than it simply alerting them to the presence of humans. To do so we compared the honeyguides' response to the honey-hunting call to their response to arbitrary human and other animal sounds. When these sounds were played back in the wild during experimental honey-hunting trips, the traditional 'brrr-hm' call increased the probability of being guided by a honeyguide from 33% to 66%, and the overall probability of being shown a bees' nest from 16% to 54% compared to the arbitrary control sounds.

Intriguingly, people in other parts of Africa use very different sounds for the same purpose. For example, Dr Brian Wood from Yale University has shown that Hadza honey-hunters in Tanzania make a melodious whistling sound to recruit honeyguides. We wondered if honeyguides learnt this language-like variation in human signals across Africa?

As a next step, we want to test whether young honeyguides learn to recognise local human signals, creating a mosaic of honeyguide cultural variation that reflects that of their human partners. Sadly, the mutualism has already vanished from many parts of Africa. The world is a richer place for wildernesses like these, where people and animals coexist and where this astonishing example of human-animal cooperation still thrives.

This research was recently published as a paper in *Science* titled "*Reciprocal signaling in honeyguide-human mutualism"* by **Professor Claire Spottiswoode** and co-authors Keith Begg and Dr Colleen Begg of the Niassa Carnivore Project.

Yao honey-hunter Musaji Muamedi presenting wax to a honeyguide .Photo: Claire Spottiswoode

rePhotoSA: Citizen Science Matters by Samantha Venter, Department of Biological Sciences

Historical photograph (#3705) of Erin farm near Middleburg taken by John Acocks on 6 May 1971. The repeat was taken by Justin du Toit on 8 April 2016.

rePhotoSA is the repeat photography project of southern African landscapes. It is a collaborative project between the Plant Conservation Unit (PCU) and the Animal Demography Unit (ADU) at the University of Cape Town (UCT), and the public as citizen scientists. In its first year, rePhotoSA has had a good response from citizen scientists, with the upload of about 65 repeat photographs by 17 active repeat photographers.

Currently, rePhotoSA is the only project of its kind in Africa and only one of two online citizen science repeat photography projects in the world. rePhotoSA builds on a decades-long research programme on long-term environmental change in southern Africa and is founded on one of the largest historical landscape photograph collections in Africa, which currently consists of over 20,000 images. With the help of students and colleagues, over 2,000 historical photographs have been repeated and subsequently used in understanding issues such as the rate of alien vegetation invasions, bush encroachment and biome shifts, changing stocking rates and land-use practices, the effects of post-fire vegetation recovery, growth rates and long-term survival of key threatened plant species.

Citizen scientist contributions matter because they can reach extensive areas of southern Africa that our team may never get to and the combined effort means that more historical images can be repeated to understand these changes more efficiently. In addition, citizen scientists have the ability to spot the location of a photograph 'in their own backyard' and therefore have helped us locate (and in some cases relocate) images uploaded to our database. Repeats can also add to past research conducted at the PCU. For example, in 2010, Dr Mmoto Masubelele (PCU PhD graduate) looked at vegetation changes in the Karoo. He found that due to a change in land use, perennial grasses had crept into an area that was thought to be desertifying. In 2016, citizen scientist Justin du Toit took repeats of the same farm and we see that the results are consistent with Dr Masubelele's findings.

Historical photograph of Erin farm near Middleburg taken by John Acocks on 6 May 1971. The repeat was taken by Mmoto Masubelele & Timm Hoffman on 10 October 2010 for Dr Masubelele's PhD

rePhotoSA connects with the public on various social media platforms including Facebook (https://www.facebook.com/groups/rePhotoSA/), Instagram (@rePhotoSA_uct) and Twitter (@Plants_PCU_UCT).

Historical photograph (#340) of Dias Beach, Cape Point taken by IB Pole Evans in 1921. The repeat was taken by John Watermeyer on 13 July 2016.

Earliest Evidence of Ivory Trade in Southern Africa

From left to right: elephant ivory copy of canine tooth, bone copy of a canine tooth pierced for suspension, and four copies of canine teeth, three with perforations - all from KwaGandaganda

Professor Judith Sealy and her post-doc **Ashley Coutu** from the Department of Archaeology, together with **Dr Petrus le Roux** from the Department of Geological Sciences recently published a paper in the *Journal of African Archaeological Review*, indicating evidence for ivory trade, dating to the second half of the first millennium.

The paper reports carbon, nitrogen and strontium isotope analyses of elephant ivory from archaeological sites in KwaZulu-Natal dating to the second half the first millennium CE. These analyses enable them to infer - within broad categories - what types of environments the ivory came from. Their research indicated that it is clear that even at this early date, people were obtaining ivory from a range of environments, some a considerable distance away. In addition, ivory found at three sites came from different environments, suggesting that there was some partitioning of the landscape, with resources from different areas channelled to selected centres.

Some of the ivory was worked on site to produce decorative items such as pendants and especially arm-bands which were like bracelets, but varied in size from what we, today, would call bracelets, to much larger armlets

The amount of effort made to obtain the ivory, across considerable distances, and the degree of organisation involved, implies that this ivory was not only for local use, but also for trade. Rare finds of imported glass beads and fragments of Middle Eastern glazed ceramics start to appear at archaeological sites in KwaZulu-Natal and elsewhere in southern Africa at this time. Southern African communities must have exchanged local commodities for these imported luxuries. The authors of the paper suggest that ivory was exported in the trade networks that were opening up at this time, across the Indian Ocean. This is about 200 years earlier than evidence for ivory trade from better-known archaeological sites in the Limpopo River Valley, including Mapungubwe. It therefore constitutes the earliest evidence for long-distance ivory trading in Southern Africa.

Aerial view of Ndondondwane site—in the ploughed area on the left of the Thukela river Photo: Tim Maggs

Ivory armband found at Kwa-Gandaganda, dating to the Ndondondwane phase. Armband was approximately 9.5cm in diameter, 4.5cm tall and 1cm thick

Last Laugh