CONTACT

NEWSLETTER OF THE FACULTY OF SCIENCE • DECEMBER 2016
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SOME ARTICLES IN THIS ISSUE

Message from the Dean

Welcome to this 2016 edition of our Faculty newsletter, "Contact". The newsletter is aimed at maintaining contact with our alumni, and conveying various items of news from some of the year's highlights, which I hope you will find interesting reading. Nationally, 2016 has been a difficult year for universities. The protesting student movements gained renewed energy round the #feesmustfall slogan, with strong calls to shut down all universities until free and "decolonized" tertiary education could be implemented. The exact meaning of the latter, which has become an ideology meaning different things to different people, particularly in Science, needs debate and understanding, but remains contested in the absence of a clear understanding of its meaning. The University of Cape Town had its fair share of the disruption and intimidation by a relatively small, and very unrepresentative, group of students, often augmented by students from other Western Cape campuses, who showed little respect for the rights and dignity of others. The Science Faculty did not escape the disruptions, with our students suffering more than our staff, and particularly those in residences. At UCT many of the issues around which the protests revolved were more UCT specific, than national. This was largely due to the strong and progressive Financial Aid system which has been in operation at UCT for the past 8 years, and protects students from poorer backgrounds having to pay fees.

As a Faculty, staff and student views span the spectrum of opinions on the validity, legitimacy and approach of the protests. Some of our Science Faculty students have articulated their discomfort at the culture and their learning experiences in the Faculty. 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 issues that might be less obvious to many as causes of discomfort. I am confident that we can achieve this goal in the coming year. Hopefully this can be achieved through respectful and mature debate and challenge, which should be the corner stone of any university and not via the aggressive intolerance we have recently seen.

Despite the intensity of the protests prior to November, the end of year examinations were successfully completed, late but without disruption. All students had the opportunity to defer their examinations until the second half of January 2017, but fortunately most wisely chose to write in November. A new academic year plan is in place for 2017 to ensure that any academic losses incurred during 2016 are recovered, and I am hopeful that student learning will return to normal in 2017.

On a more positive note, research and teaching – at least until the height of the disruptions late in September, continued to flourish in the Faculty. Three more of our staff were accorded prestigious A-ratings in 2016 by the National Research Foundation – i.e. were deemed to be international leaders in their research fields. In total, the number of NRF rated researchers increased, funding raised for research projects increased over 2015 by some 47%, reaching R159 million, and the number of postgraduate students continued to grow. Numerous national and international awards were bestowed on our Faculty staff, and 2016 was no exception in terms of the number prestigious awards our students received. Some of these achievements are highlighted in the following pages. The range and number of cutting-edge research projects underway in the Faculty are too many to report, but a selection of interesting projects are captured, together with short accounts of other more general Faculty activities.

I hope that you enjoy this 2016 edition of Contact, and please remain in touch with us.

Anton le Roex
Dean of Science

Staff Achievement and Awards

The Faculty is proud to have three new A-rated researchers recognised by the NRF

The National Research Foundation uses a rating system to rank researchers in the country. The highest accolade is an A-rating, and a P-rating (President's Award) is the near equivalent, but for young researchers below the age of 35 and recently graduated with a PhD. An A-rating implies an international leader in the field; a P-rating implies a young researcher with potential to become an international leader.

»Professor Bruce Hewitson, Department of Environmental & Geographical Science

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 Chris Reason, Department of Oceanography

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.

»Professor Anusuya Chinsamy-Turan, Department of Biological Sciences

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.

New P-rating in the Faculty

»Dr Robyn Pickering, Department of Geological Sciences

Dr Robyn Pickering, a newly appointed lecturer in the Department of Geological Sciences, was awarded a P-rating by the NRF. Dr Pickering has spent her career 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.

SOME FACULTY ACHIEVEMENTS DURING 2016

National and International Awards

»**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.

»**Professor Kelly Chibale**, Department of Chemistry, received two prestigious awards in 2016. The Gold Medal for major scientific breakthroughs, from the South African Medical Research Council (SAMRC) in 2016, and a 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

»**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 received this award at a ceremony at La Sorbonne in Paris, in October this year. Professor Ellis also received an honorary degree from the University of Witwatersrand in July this year.

»**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".

»**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.

»**Dr Leanne Scott** and **Mr Stefan Britz**, Department of Statistical Sciences, recently received the International 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 the Sakai platform on which UCT's Vula is built.

»**Dr Freedom Gumedze**, Department of Statistical Sciences, has been awarded a Newton Advanced Fellowship from the Royal Society, in partnership with the Academy of Medical Sciences, for the period 2016-2019. During the Fellowship, Dr Gumedze will collaborate with Professor Jane Hutton and researchers at the University of Warwick under a research project titled "Robust statistical methods and statistical diagnostic techniques for multivariate longitudinal and survival data in health research". The two research groups will join forces to extend statistical methods for the analysis of longitudinal medical or health studies which follow patients over time.

Student Awards and Achievements

»**Agnes Mbonyiryivuze and Greg Jackson**, postgraduate students in the Department of Physics were selected to attend the 66th Lindau Nobel Laureate meeting in Germany in June 2016. Another Physics student Arrykrishna Mootoovaloo, (also known as Harry) was selected to represent Mauritius. 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).

SOME FACULTY ACHIEVEMENTS DURING 2016

- 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 held in Cape Town.
- Computer Science PhD student **Joan Byamugisha** 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.
- **Ian Rogers**, a PhD student in the Department of Chemistry, was one of only three people who received a South African Chemical Institute post-graduate medal for 2016. Using High Performance Computational (HPC) methods, Ian showed why enzymes -"nature's nanomachines", are so precise in their promotion of specific chemical reactions.
- A Science Faculty team, consisting of **Robin Visser, Guy Patterson-Jones** and **Kieren Davies**, all students in the Department of Computer Science, won the regional annual 5-hour long nonstop team programming ACM Intercollegiate Programming Contest, which 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 and as the winners of the regional competition, they will represent UCT at the World Finals, to be held in Rapid City, South Dakota, USA in 2017.
- The annual team programming contest IT Challenge, organised by Standard Bank, saw 18 teams from UCT participate. The winning team, composed of **Tae Jun Park**, **Robert Spencer** and **Robin Visser**, from the Department of Computer Science, broke the records, solving the six problems in a mere 2.5 hours and qualified to attend the finals in Johannesburg.

AXA awards first research chair in Africa to UCT

AXA Research Fund 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) and Professor in the Department of Geographical & Environmental Science. Worth R20.65 million (€1.35 million) over 15 years, the chair aims to make a significant contribution in the research field of African climate risk.

African countries are among the most vulnerable to climate change. Existing developmental challenges, such as high levels of poverty, underinvestment in infrastructure and technology, increasing ecosystem degradation, and weak governance systems aggravate the burden of climate variability and change. "The AXA Research Chair provides another established research chair in the area of climate change, alongside **Bruce Hewitson**'s Department of Science and Technology/ National Research Foundation South African Research Chair (SARChI) in Climate Change, that will help to underwrite UCT's ambition to contribute meaningfully to addressing African climate change issues," says New.

Adverse impacts of global warming in southern Africa have already been detected. They include decreases in water availability, reduced agricultural production and food insecurity, and increased social and economic costs of extreme weather events. Assessing the impacts of climate change in southern Africa is of the utmost importance to economic and social development. However, the task is complicated by the disparity between climate model projections and the complexity of natural and societal systems. Much more expertise is needed across a wide range of areas, but the community of professionals and researchers working on climate change is relatively small throughout Africa.

In the context of these challenges, the AXA Research Chair aims to produce scientifically innovative and cutting-edge research related to the intersection of climate change risks with African development issues. Additionally, it is aligned with the long-term research strategy of UCT in that it will help attract the best African talent to return to or remain in Africa, working on African issues. A new generation of researchers will be trained.

RESEARCH IN THE FACULTY

A giant leap for astronomy, another giant leap for South Africa

Earlier this year, an international team of astronomers that included **Professor Renée Kraan-Korteweg**, Department of Astronomy, managed to explore behind thick clouds of dust particles in the Milky Way that had previously made it impossible to map large parts of the sky. A colossal supercluster of previously hidden galaxies has been revealed which covers more sky than the biggest supercluster previously known to man, with a gravitational pull that could have a massive cosmological impact on the galaxies around it – including ours.

Kraan-Korteweg led the team from South Africa, the Netherlands, Germany and Australia, that has just announced their discovery of another massive supercluster of galaxies, also previously obscured behind dust and stars around the plane of the Milky Way. Professor Thomas H. Jarrett from the Department of Astronomy at UCT is also part of the team. The concentration of galaxies, which they have dubbed the Vela supercluster, is located in the constellation Vela – in the largely unknown area rather aptly called the Zone of Avoidance (ZOA), for the challenge it poses in viewing distant objects.

Superclusters of galaxies are the most colossal known structures in the Universe. They consist of clusters embedded in wall-like structures of galaxies that can span up to 200-million light-years across the sky. The most famous is the Shapley Supercluster, some 650-million light-years away. It is believed to be the largest of its kind in our cosmic neighbourhood. (A light-year, for some perspective, is approximately 9.5 trillion km.)

The Vela supercluster is about 800-million light-years away, it covers even more sky than Shapley and has an immense gravitational pull, and shapes the pattern of cosmic flows on enormous scales.

The discovery was based on multi-object spectroscopic observations of thousands of partly obscured galaxies, where the researchers used multiple complementary observations to gather pieces of the puzzle, which they then put together to construct a more thorough understanding of the bigger picture. In 2012, they used the refurbished spectrograph of the Southern African Large Telescope (SALT) to confirm that eight new clusters resided in the Vela area; subsequent observations with the Anglo-Australian Telescope in Australia added thousands of galaxy redshifts, which revealed just how vast the new structure was.

Looking to the future, the researchers say that follow-up observations will be necessary to fill in the gaps regarding the full extent, mass, and influence of the Vela supercluster. This region of the sky is sparsely sampled, while the part closest to the Milky Way has not been probed at all because dense star and dust layers block our view. South Africa is likely to play a central role in navigating this uncharted territory. The central core of the supercluster can only be mapped with dedicated radio surveys that can penetrate the Zone of Avoidance. Here, the South African Square Kilometre Array Pathfinder, MeerKAT, can pave the way, and it can do so as early as next year. “We have proposed to use this powerful radio telescope in early-science mode, when 32 of its total of 64 dishes are in place, during 2017, for a systematic search of the fully hidden core of the supercluster,” says Kraan-Korteweg.

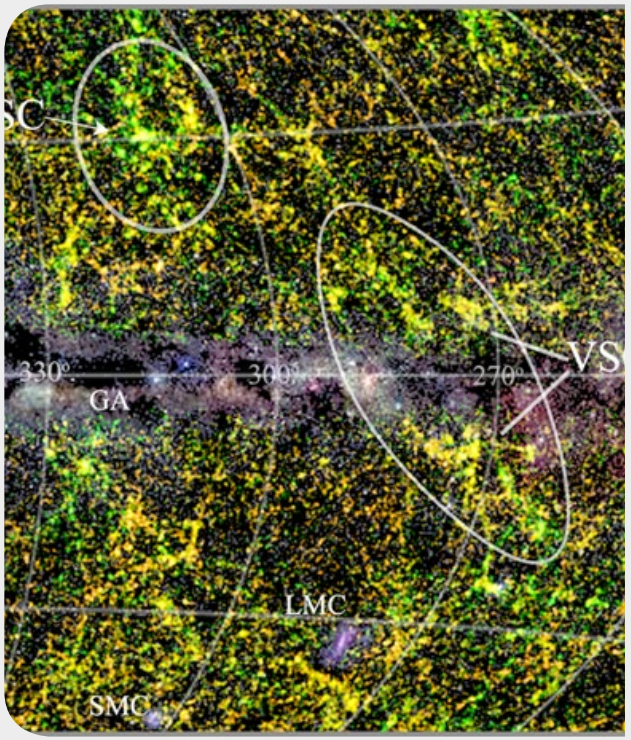


Image by Thomas Jarrett (UCT), based on data from the 2MASS Photometric Redshift catalogue (Bilicki et al. 2014) and the All-Sky Milky Way Panorama (Mellinger 2009).

Kelp: The canary in the coal mine

Professor John Bolton, Department of Biological Sciences, was part of a 37-strong team of international scientists who co-authored a study which discovered that kelp forests, while declining in some parts of the world due to climate change (warming seas), anthropogenic inputs and fishing, and ecosystem changes, are actually growing and thriving in other parts of the world.

Kelp forests provide Cape fur seals a place to hide when escaping from Great White sharks. Moreover, they provide essential food and shelter for large parts of the marine ecosystem. But overfishing and climate change are threatening this vital cog in the oceanic life cycle.

Unusually warm temperatures in Western Australia damage Ecklonia (brown seaweed) forests, for example, and in Tasmania the forests of giant kelp, Macrocystis, are rapidly disappearing due to various environmental changes. Chief among these adverse changes are the mainly southward movement of the East Australian Current, which is too warm and low in nutrients to feed the kelp-eating urchins, causing them to move southward too, where they feed on the kelp forests. In some parts of the world (southwestern South Africa being a good example), however, kelp beds are doing well and even spreading. Bolton says that their paper documents a small eastward spread, but also indicates that South African kelps are becoming more abundant within their geographical distribution. “The bottom line from the paper is that there are region-specific responses to global change by kelp forests,” says Bolton.

The new study, recently published in the Proceedings of the National Academy of Sciences (PNAS), reports that while kelp has clearly declined in 38% of the regions analysed, it has increased in some 27% of the studied regions, with no net change being observed in 35% of the samples. The range of trajectories seen across regions far exceeded a small rate of decline at the global scale, which sits at 1.8% per year. Researchers suggest that this variability reflects large regional differences in the drivers of local environmental change. So, while global factors linked to climate change are affecting kelp forests, these effects vary by region depending on the kelp species, the local environmental conditions and other sources of stress. “This is unlike other major groups of inshore marine organisms, such as corals, mangroves and seagrasses, which are under threat just about everywhere,” adds Bolton. This difference is likely due, in part, to the unique capacity of kelp to recover quickly from disturbances.

Kelp forests support diverse and productive ecological communities throughout temperate and arctic regions worldwide, providing numerous ecosystem services to humans. Literature suggests that kelp forests are increasingly threatened by a variety of human impacts, including climate change, overfishing and direct harvest. But kelp appears to be a rock star of resilience. In many places, it has managed to hold its own against environmental change. What is worrying, though, is that in one third of the regions of the world the scientists studied, even kelps have not been able to withstand the pressures of a changing world. Kelps may well be the canary in the coal mine for the effects of global environmental change for our oceans; their loss may be a sign that we have finally tipped over the edge of a precipice.

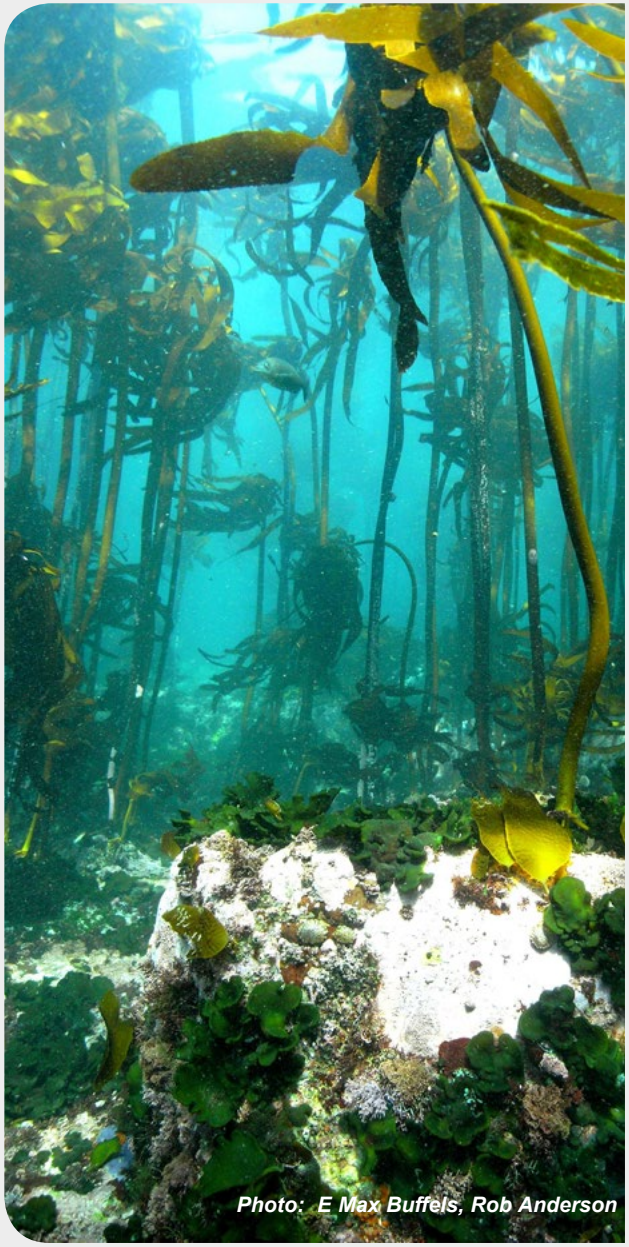


Photo: E Max Buffels, Rob Anderson

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 and **Dr Jahanshah Ashkani**, also of the Chemistry Department, made the discovery. Using statistical classification algorithms on massive tumour gene expression data, they 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.

Your next DNA vaccine might come from tobacco

In a pioneering step towards using plants to produce vaccines against cervical cancer and other viruses, Science Faculty 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) in the Department of Molecular & Cell Biology.

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.

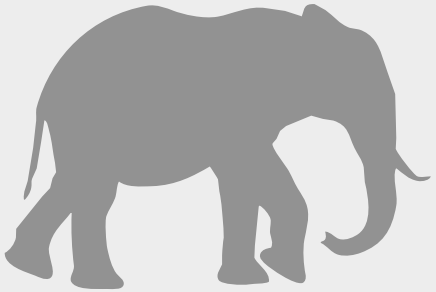
The BRU is hoping to use this technology to create a therapeutic vaccine, which would be a first of its kind. The idea would be to use the

pseudovirion to deliver DNA that could treat an ongoing HPV infection or even a tumour.

With global acceptance and support for the biopharming movement growing rapidly, it might not be too long before the first plant-produced HPV vaccine is making a difference in Africa and around the world.

RESEARCH IN THE FACULTY

Earliest Evidence of Ivory Trade in Southern Africa



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 the earliest ivory trade in southern Africa, in 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.

Decorative artifacts made from ivory – such as pendants and arm-bands – have shown to have been traded 200 years earlier than originally thought.

How humans and wild birds collaborate and communicate for honey and wax

Professor Claire Spottiswoode, Pasvolsky Chair in Conservation Biology at the Percy FitzPatrick Institute, recently published a paper in Science showing that by following birds known as Honeyguides, people in Africa are able to locate bees' nests to harvest honey.

Research by Professor Spottiswoode reveals that humans use special calls to solicit the help of Honeyguides, allowing Honeyguides to recruit appropriate human partners to find wild bee hives, which provide a valuable resource to both of them. 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

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 Professor Spottiswoode 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'.

Professor Spottiswoode and the Beggs 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 they 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.

As a next step, the team wants 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" says Claire Spottiswoode.

rePhotoSA: Citizen Science Matters

The importance of understanding environmental change, can be captured by examining photographs of fixed areas over multiple decades. **Professor Timm Hoffman**, from the Plant Conservation Unit (PCU) in the Department of Biological Sciences has initiated a project entitled rePhotoSA, a repeat photography project of southern African landscapes.

rePhotoSA is a collaborative project between the Plant Conservation Unit (PCU) and the Animal Demography Unit (ADU) in the Science Faculty, 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” says project leader Professor Timm Hoffman. 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 by 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.

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).

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. he expedition will comprise 55 researchers from 30 countries, working on 22 research projects, while circumnavigating Antarctica. **Dr Sarah Fawcett** 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 environment around 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 **Professor Peter Ryan**, from the Percy FitzPatrick Institute, 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 Ansorge**, head of the Department of Oceanography, is involved in the ACE organizational and scientific steering committee.

Visit to Vienna: Development of the next generation of systems analysis

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. Dr West says, "This was a productive and stimulating visit that forged many new collaborations".

NEWS FROM ALUMNI

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

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, focusing 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.

Computer Science graduate off to Oxford

Craig Feldman, who completed Computer Science Honours in 2015—was 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.

Computer Science graduate wins Distinguished Young Researcher Award for innovation

Dr Muthoni Masinde, who obtained her PhD through the Department of Computer Science in 2012 and was supervised by Dr Antoine Bagula, received the Research and Innovation Award at the SA Women in Science Awards 2016. This award was made for her research arising from her PhD which entailed finding solutions to predict drought patterns. Using IT technology, artificial intelligence and mobile phones, in conjunction with indigenous knowledge, she is able to predict drought conditions in Africa with 90% accuracy. Because her work incorporates the knowledge of rural farmers, they identify with it and utilise it effectively.

EVENTS IN THE FACULTY

Faculty of Science Distinguished Visitors Programme: 2016

Professor Mark Pelling, a geographer from King's College London, visited UCT from July to September 2016 as a Science Faculty Distinguished Visitor. He was hosted by the Department of Environmental and Geographical Science.

Professor Pelling's research interests are in the institutions and social relationships that shape vulnerability and adaptation to natural disasters, including those associated with climate change, and in the ways in which conflicting values and practices of development inform resilience and transformation in the face of environmental change. Professor Pelling's work has been most impactful in championing the notion of transformation in climate change adaptation, with an emphasis on progressive development agendas.

While at UCT, Professor Pelling gave a Faculty seminar, titled "Megacity transitions in the risk-development relationship". He also gave a seminar to a group of graduate students and co-hosted a 3 day workshop with Associate Professor Gina Ziervogel and Dr Lorena Pasquini, on Resilience and justice trade-offs across scales: climate adaptation in urban Africa.

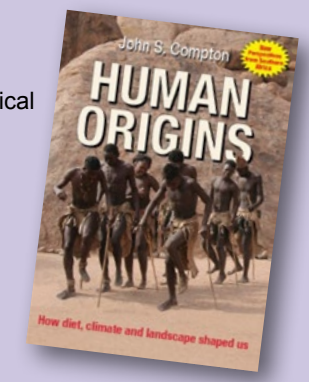
Professor James Clark, Director of the Green Chemistry Centre of Excellence (GCCE) at the University of York, UK was hosted by the Department of Chemistry as a Science Faculty Distinguished Visitor in 2016/2017.

Professor Clarke's centre is one of the largest and most successful centres in the world promoting sustainable chemistry. Green Chemistry Education is the education of future generations and training of current employees in sustainable industrial technology which is vital for the wellbeing of society. Professor Clark leads Europe's first Green Chemistry Master's degree programme, which has produced over a hundred young scientists who have gone into careers in industry, government, retail and education. He also developed on-line courses that are bringing continuing professional development to scientists and technologist in industry worldwide.

As a visiting academic, Professor Clark delivered topical lectures to the Chemistry Department: *Bioenergy, Bio-refinery and the Bio-economy; Opportunities and Challenges for the African Chemist; Upskilling to address the sustainability development goals and the role of Green Chemistry*. In the first quarter of 2017, he will return and aims to stimulate inter-departmental dialogue and potential collaborations.

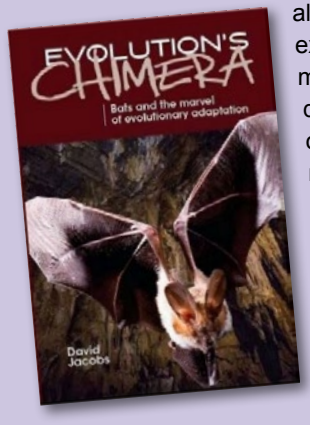
The Science Faculty, through formal and informal learning, aims to raise environmental awareness and influence societal behaviour through research and outreach programmes. The challenge is on our door-step, to prepare students to enter the labour markets and emerge with skills to drive green economies with innovative ideas.

NEW BOOKS in the Faculty



Associate Professor John Compton, Department of Geological Sciences, has recently published a book entitled "Human Origins: How diet, climate and landscape shaped us". In this book he provides a narrative of our deep history from the big bang to the present, with projections into the future. The book emphasises the latest science on where, when and how our species evolved.

Associate Professor David Jacobs, Department of Biological Sciences, has recently published a book entitled, "Evolution's Chimera: Bats and the Marvel of evolutionary adaptation". In Greek mythology, the chimera was a hybrid monster made up of the parts of different animals. Bats look like they have the body of a mouse, the face of a gargoyle or fox, and the wings of a pterosaur, giving rise to this book's title. Evolution's Chimera describes the amazing physical and behavioral adaptations of bats, using them to illustrate the processes of natural evolution. Bats comprise a quarter of all mammals in the world and are the only mammals that can fly. They occupy every landmass and almost every habitat on Earth, except for the Antarctic, and make up the second-most diverse group of mammals on the planet, numbering more than 1,270 species. They are therefore ideal for the study of how evolution generates the diversity that is the most outstanding characteristic of life.



SEAmester Floating University explores the ocean

SEAmester, the brainchild of **Associate Professor Isabelle Ansorge**, Department of Oceanography, 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, coordinated by Ms Tahlia Henry.

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.

2016 Science Spring School in Sutherland

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

Associate Professor David Gammon reflects, "The premise of our Winter Schools has 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. The aim of the Winter/Spring school is 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 the Spring School, together with a broader programme to illustrate just how far-reaching "science" is. 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. They were then joined by **Professors John Parkington and Simon Hall**, Department of Archaeology, who took students to a site just below SALT where there is evidence of stone- age tools.

There were lively discussions about "what is science?" and "what are belief systems?", and what the relationship is between the two. The students 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. Science postgraduate students on the trip shared their journeys to their present studies, and talked about ambitions and trajectories.

Dr Emese Bordy, Department of Geological Sciences, took us the students 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. Students discussed more broadly how they as scientists should engage in these real-life issues, and how to be true to the science while also being true to their humanity.

In the evenings, in addition to the night of star gazing, there was 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. What did the students make of all of this? They were pretty unanimous in declaring it a wonderful experience. And hopefully it will inspire the students to plot their careers in Science and to excel at their studies.

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. Professor Dunne completed his PhD at UCT and taught at universities in Texas, Minnesota, Indiana and California before returning to lecture at UCT. He 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."

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.

KEEP CONNECTED – STAY IN TOUCH – KEEP CONNECTED

We value regular contact with our alumni, so please email us on Katherine.wilson@uct.ac.za. We would like to hear about what you are doing with your Science degree in order to enable us to build career profiles of opportunities for Science graduates. We would also like to cover interesting initiatives you are involved in, in future *Contact* newsletters.

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