

CONTACT

NEWSLETTER OF THE FACULTY OF SCIENCE • MARCH 2013
UNIVERSITY OF CAPE TOWN



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SOME ARTICLES IN THIS ISSUE

- SKA bid implications for Astronomy at UCT
- Possible single-dose malaria cure
- UCT palaeontologists apply their sleuthing skills to cold cases



MESSAGE FROM THE DEAN

The Science Faculty had a very successful 2012. Good progress was made towards implementing agreed Faculty strategic goals, a number of staff received prestigious research and teaching awards and postgraduate numbers reached an all time high. PhD graduates increased significantly over 2011 and a number of exciting research breakthroughs were achieved.

This 2012 edition of Contact – our formal Science Faculty publication aimed at maintaining contact with our alumni, contains news and information on many of the year's highlights in research and teaching. In their pursuit of excellence in research a number of our staff (young and older) were rewarded with prestigious national and international awards, and it is particularly gratifying to see the strength of our younger staff in this regard. The number of staff with high-ranking international research profiles as judged by the National Research Foundation (i.e. A- & B-ratings) increased to 80, (near on half the Science Faculty academic staff body) reflecting our Faculty's on-going quest for excellence in research. The NRF awarded very prestigious P-ratings (for young researchers) to five of our staff, and two of our more established researchers joined our celebrated group of NRF A-rated scientists. I am fully confident in the on-going strength of our research enterprise, marred only by the deeply disturbing decrease in government funding for fundamental research from the NRF.

In 2011 the Faculty adopted a set of strategic goals aimed at improving the over-all performance of the Faculty, one of which was aimed at addressing the poor undergraduate throughput. During 2012 the final structure of a new student support programme and four-year degree structure was approved and will be implemented

from 2013. I have high hopes for its successful implementation as it is rolled out in the coming years. Innovative ideas have not been limited to the extended degree programme, and departments have embraced the need for curriculum improvement across the board to ensure that our Bachelor graduates remain competitive and are well equipped to enter either postgraduate programmes or industry. Staff work hard to ensure that the degrees we offer continue to be recognised by universities and employers across the world.

The Faculty remains proud of the increasing numbers of registered postgraduate students, which aligns well with the new UCT Size & Shape strategy of growing primarily at the postgraduate level. In 2012 the Science Faculty had 380 registered PhD students and 420 Masters students, an overall increase of some 4%. It is particularly pleasing to note that our postdoctoral fellows also continue to grow despite funding pressure. They now stand at an all-time high of 124, nearly half the total number at UCT.

I hope that you enjoy this 2012 edition of Contact, and please remain in touch with us.

Anton le Roex
Professor of Geochemistry
Dean of Science

2012 highlights

RESEARCH AWARDS – 2012

- » **Professor Daya Reddy**, who holds the South African research chair in computational mechanics in the Department of Mathematics and Applied Mathematics, was recently inaugurated as the president of the Academy of Science of South Africa (ASSAf), a post he will hold until 2016. Soon after that ceremony, Reddy was informed that he had won the Georg Foster Research Award, worth €60,000 (or nearly R700,000), from the prestigious Alexander von Humboldt Foundation in Germany, in recognition of his accomplishments in research and teaching.
- » **Dr Amanda Weltman** from the Department of Mathematics received the TW Kambule Award for Emerging Researcher for an outstanding contribution to Science, Engineering, Technology and Innovation (SETI) through research and its outputs. She received the award for the development of the Chameleon Mechanism, which has provided a locally testable theory explaining the mysterious force causing the universe to accelerate – so-called Dark Energy.
- » **Professor Cesareo Dominguez** from the Department of Physics received the Humboldt Research Award in recognition of accomplishments in research and teaching and he has been invited to undertake research in collaboration with colleagues in Germany.
- » **John Cooper**, a retired UCT ornithologist received a lifetime achievement award for his study of seabirds over nearly four decades. He was awarded the Gill Memorial Medal from Bird Life South Africa, making

him the first ever local seabird expert to receive this prestigious award. In February 2012 he also received a Lifetime Achievement Award from the Pacific Seabird Group in Hawaii. Cooper retired from UCT in 2008, after 35 years of research on seabird biology and conservation with the Percy FitzPatrick Institute of African Ornithology and the Animal Demography Unit.

- » **Professor Kelly Chibale** received the Alan Pifer Award, which rewards contribution to the advancement and welfare of the disadvantaged, for his drug discovery.
- » The NRF awarded two new A-ratings to UCT staff, one of which was awarded to **Professor Ed Rybicki** from the Department of Molecular and Cell Biology .
- » **Dr Gregory Smith** from the Chemistry Department, won the Raikes Medal, which is awarded “to a person, under the age of 40 on 31 December proceeding the year of the award, whose original chemical research shows outstanding promise, as judged by the person’s publications in reputable journals.
- » **Professor Mino Caira**, from the Department of Chemistry received special recognition from the National University of Córdoba (UNC), Argentina: they awarded him the title of **Distinguished Visitor (‘Visitante Distinguido’)**. The award recognized his sustained research collaboration as principal investigator in bilateral NRF-sponsored projects with counterparts Profs E Buján and R Hoyos de Rossi in the Department of Organic Chemistry, as well as long-term collaborations with colleagues in the Department of Pharmacy and other scientists at UNC.
- » The future research strength of UCT was recognized when Science Faculty staff received 5 out of 6 new

P-ratings. These ratings, made to young researchers who are considered likely to become future international leaders in their fields – were made to:

- › **Dr David Braun** and **Dr Shadreck Chirikure** from the Department of Archaeology;
- › **Dr Amanda Weltman** of the Department of Mathematics and Applied Mathematics;
- › **Dr Ake Fagareng** from the Department of Geological Sciences; and
- › **Dr Andrew Hamilton** from the Department of Physics.

The NRF recognised the exceptional work of three UCT researchers, two of them from the Science Faculty, naming them for **Special Category Awards**, at a ceremony, in Cape Town, on 13th September 2012:

Professor Anusuya Chinsamy-Turan (Department of Zoology) received the Transformation of Science Cohort Award in recognition of her excellent research performance and international standing as a palaeobiologist and a leading researcher.

Professor Kelly Chibale (Department of Chemistry) was named the NRF’s Champion of Research and Capacity Development at Higher Educational Institutions in South Africa. (Kelly made international headlines recently when his H3-D at UCT identified a chemical compound that has the potential to provide a single dose cure for malaria)

Vice-chancellor Dr Max Price said of the accolades: *“These awards celebrate three remarkable academics whose work has helped position UCT as an African hub of intellectual activity and research: exploring the continent’s prehistory, the science behind excellence in sports and the potential of different chemical compounds to cure Africa’s diseases. They are part of UCT’s platform for nurturing the next generation of academics for many other universities in the country and the continent.”*

2012 highlights continued

INAUGURAL LECTURES

» **Professor Kevin Naidoo**, director of the URC accredited Scientific Computing Research Unit (SCRU), and holder of a SARChI research chair in scientific computing, spoke in his inaugural lecture entitled *The Computational Revolution and how it is Reshaping the Scientific Method in Chemistry and Chemical Biology*. He highlighted how a revolution is being brought about by high-performance scientific computing and how the advent of high-performance computers has allowed modern-day scientists to push the boundaries of what scientists can do.



» At his inaugural lecture, **Professor David Britton**, founding director of the URC accredited NanoSciences Innovation Centre in the Department of Physics, whose talk was entitled *Nanoscience, Nanotechnology, and Nanovation*, encouraged scientists to stay ahead of the game and not to copy but to innovate when developing new products. The centre is the principal hub of the USAID-funded



Nano-Power Africa Network. This partnership spreads over four African countries, and aims to build research capacity and promote entrepreneurship through collaborative research, its ultimate objective to develop an indigenous solar-cell technology.

» **Professor Mark New**, pro-vice chancellor for climate change, director of the African Climate and Development Initiative (ACDI) and Professor in the Department of Environmental And Geographical Science, gave his inaugural lectured entitled *Squaring the Circle: Climate Change, Development and Sustainability*. He spoke about the need to think about putting in place plans that allow for robustness or resilience across a range of possible futures. The bottom line, New said, is that Africa has to find another development pathway if it wants to improve economic wellbeing and reduce damage to the environment. And that pathway cannot be based on the path taken by today's high-carbon emitters, and will rather have to call on green technology. The venue was packed to the brim.



UCT AWARDS

» **Dr Zenda Woodman**, of the Department of Molecular and Cellular Biology received the prestigious UCT Distinguished Teacher award. Students working under her tutelage commended her on her use of humour to create a safe environment for learning and was praised for bringing something special to the lecture and tutorial rooms.

DISTINGUISHED TEACHER AWARDS

Science Faculty teachers shone at the 2012 National Excellence in Teaching and Learning Awards, reflecting a strong resource of dedicated educators who are invested in the development of their students and go the extra mile to create a relaxed, entertaining and stimulating atmosphere in the lecture theatres.

» **Professor Gary Marsden**, of the Computer Science Department was named as one of only five academics in South Africa to receive an excellence award. He was commended for his innovative teaching and learning philosophy, which is aligned with his teaching and assessment methods. In particular he was praised for his "rigorous, robust and diverse" teaching and for his outcomes-based approach, which encourages students "to think like computer scientists" from first-year level.



The committee noted his interest in ICT for development in Africa and the way in which he has effected positive change, making a meaningful impact, working in collaborative environments.

» **Associate Professor Bette Davidowitz** of the Department of Chemistry and the Academic Development Programme in the Centre for Higher Education Development, was one of the nine academics to receive a commendation award.

2012 highlights continued

ACHIEVEMENTS

STUDENTS

» Three Third year Computer Science students, **Gwyllim Ashley, Graham Manuell** and **Kosie van der Merwe**, took top place in the Association for Computing Machinery International Collegiate Programming Contest (ACM-ICPC) – making it nine wins over 10 years. The team has won a place at their second consecutive World Finals and will compete against 100 teams from around the globe in St Petersburg, Russia in 2013.

» **Maletsabisa Molapo**, a Master's student in Computer Science, was named as one of 70 students from universities in Africa, Canada, the Middle East and the US, who was awarded the Google Anita Borg Memorial Scholarship for 2012



» **Nicholas Njuguna**, a Chemistry PhD student was selected to participate in the 2012 SciFinder Future Leaders in Chemistry programme in the US. The SciFinder programme brings together some of the most promising young scientists from around the world to network and experience the inner workings of the Chemical Abstracts Service (CAS) research methods.

RESEARCH AWARDS

- » In attempting to find new ways to celebrate scientific excellence, the Faculty of Science hosted its first Faculty Research Awards in May and handed out three prizes.
 - » **Professor William Bond** from the Department of Botany, was named the winner in the Professor/ Associate Professor category, for his paper on *What Limits Trees in C-4 Grasslands and Savannas?*
 - » **Dr Chris Clarkson** from the Department of Mathematics and Applied Mathematics, won the lecturer/ senior lecturer category for lead authorship on his paper *A General Test of the Copernican Principle*.
 - » **Dr Jasper Slingsby**, of the Department of Botany, received the Faculty PhD Medal for the best PhD thesis of 2011.



» **Dr Tirivanhu Chinyoka** (above left) of the Department of Mathematics and Applied Mathematics, **Dr Ake Fagereng** from the Department of Geological Sciences and **Dr Adam West** (above right), Department of Botany, all received prestigious Claude Leon Merit Awards for young lecturers – in recognition of meritorious scholarly work and to support their demonstrated ability to make a significant contribution to their research fields.

Will Horowitz from the Physics Department and **Ake Fagereng** from Geological Sciences received the 2012 UCT Fellows' Young Researcher Award at the annual fellows dinner. These awards are given in recognition of outstanding scholarly work by a young academic.

» **Dr Horowitz** made significant contributions to the effort to determine the properties of matter at a trillion degrees. These temperatures were last seen in nature a microsecond after the Big Bang, but mankind recreates them thousands of times a second in particle accelerators such as CERN's Large Hadron Collider (LHC). We can infer the properties of the matter tomographically (like in a PET scanner) with extremely high-energy particles. Dr. Horowitz demonstrated the importance of novel physics mechanisms in tomographic analyses, discovered a unique experimental signature of applied string theory (currently under investigation by the experimental community), and – for the first time – predicted tomographic results qualitatively consistent with all known data.



» **Dr Fagereng** studies faults and fractures in the Earth's crust, in order to understand how the Earth deforms and particularly the processes that lead to earthquakes. Because earthquakes occur deep in the crust, active faults can only be studied remotely, through seismology and a variety of remote sensing techniques. Old, exhumed faults, however, contain an integrated record of past earthquake events. He therefore looks for rocks that have, millions of years ago, been deeply buried and experienced deformation due to large strains. Such rocks are exposed in the deserts of Namibia and Antarctica, as well as on the coast of New Zealand. Through geological field work in these locations, creating maps and taking samples, Dr Fagereng attempts to understand the geometry of fault systems, and the processes that accommodated deformation. By comparison to analogous active faults, these studies lead to hypotheses of the factors that control whether a fault can produce a major earthquake.



Features

SKA bid implications for Astronomy at UCT



UCT has enthusiastically welcomed the decision by the SKA Site Advisory Committee (SSAC) and its associates to assign a portion of the Square Kilometre Array (SKA) of radio telescopes to South Africa. All the dishes and the mid frequency aperture arrays for Phase II of the SKA will be built in Southern Africa while the low frequency aperture array antennas for Phase I and II will be built in Australia or New Zealand.

Professor Danie Visser, the DVC at UCT responsible for research, said: "This is one of the biggest scientific research ventures ever undertaken and it confirms that developing nations can also be a part of solving the big questions of our day. It will bring scientists from all over the world to South Africa and thus greatly enhance not only South Africa's but also UCT's international research collaboration. SKA also brings important opportunities and job creation and the development to the country as a whole."

Professor Renée Kraan-Korteweg, the head of the Astronomy Department at UCT, said: "There is a shortage of good astronomers, in particular radio astronomers in South Africa – especially for the facilities we expect to be built or expanded, which will offer opportunities for recruiting at staff and post-doctorate levels. UCT's goal is to train future leaders in radio astronomy for these kinds of opportunities". UCT is the only South African university to include an astrophysics major in its undergraduate programme. It is attracting a steadily increasing number of students and 75% of undergraduates in the astrophysics programme at UCT are black South Africans. She also said: "MeerKAT has already started reversing the brain drain in this region by attracting talented researchers from other parts of the world. MeerKAT and SKA are attracting South African researchers to return after post-graduate or post-doctoral study elsewhere."

Baboons pay heavy pathogen price close relationship with humans

by Associate Professor Justin O'Riain, Department of Zoology

Two articles published this year suggest that the physical overlap between baboons and humans on the Cape Peninsula may have serious health consequences for both parties. Associate Professor Justin O'Riain who heads up Baboon Research at UCT said that of the 27 baboons that were captured and sampled in 2011 more than 30% tested positive for human diseases, including Hepatitis A and two Herpes viruses (Drewe et al. 2012, Emerging Infectious Diseases). Even more surprising was the discovery by O'Riain's PhD graduate Dr Ravasi and colleagues Professor Nicci Iling and Faeza Davids, that the Peninsula baboons are host to two distinct genotypes of the common gut parasite – the whipworm (*Trichuris*) that is estimated to infect over 600 million people worldwide. Together these examples of cross transmission from humans to baboons and the risk they pose to reinfection of people has provided conservation authorities with a strong platform for ensuring management policies that reduce the spatial overlap of humans and baboons both locally and elsewhere in Africa.



Features

UCT research identifies possible single-dose malaria cure



A recently discovered compound from the aminopyridine class not only has the potential to become part of a single-dose cure for all strains of malaria, but might also be able to block transmission of the parasite from person to person, according to a research collaboration involving the Medicines for Malaria Venture (MMV), based in Switzerland, and the Drug Discovery and Development Centre (H3-D) at UCT. On the basis of initial results it was selected by MMV for further development – making it the first compound researched on African soil to enter preclinical development in partnership with MMV.

An African solution to save lives

Mrs Naledi Pandor, the Minister of Science & Technology, said: “This is a significant victory in the battle to alleviate the burden of disease in the subcontinent. Clearly the war on this disease is not yet won, but I am excited by the role that our excellent scientists have played in this milestone in finding a potential cure for malaria and possibly preventing its transmission. Congratulations to Professor Kelly Chibale and all involved. This is evidence of the world-class science being done in South Africa and the continent, and of the power of continental and international scientific

collaboration in the multidisciplinary approaches that are essential in addressing the societal challenges of our time.” H3-D identified a molecule, code named MMV390048, which was selected in July 2012 by MMV’s Expert Scientific Advisory Committee for further development. The promising new compound shows potent activity against multiple points in the malaria parasite’s lifecycle. This means it not only has the potential to become part of a single-dose cure for malaria but might also be able to block transmission of the parasite from person to person.

The aminopyridine series was initially identified by Griffith University scientists in Australia as part of MMV’s extensive malaria screening campaign of around 6 million compounds. A team of scientists from H3-D, led by UCT Professor Kelly Chibale, further scrutinised and explored the antimalarial potential of the series. With parasitological, pharmacological and contract chemistry support from the Swiss Tropical and Public Health Institute (Switzerland), the Centre for Drug Candidate Optimization at Monash University (Australia) and Syngene (India) respectively, the H3-D team selected the most promising compounds from the series to be optimised and retested. In just 18 months the team had identified and developed a candidate suitable for preclinical development.

Equipping the next generation of African scientists

“We are very excited that this promising compound, researched by African scientists, has been selected by MMV for further development,” said Professor Chibale, the Founder and Director of H3-D. “This is truly a proud day for African science and African scientists. Our team

is hopeful that the compound will emerge from rigorous testing as an extremely effective medicine for malaria – a disease that accounts for 24% of total child deaths in sub-Saharan Africa. What is more, H3-D and MMV achieved MMV390048 as a clinical candidate in record time. In the process we have developed a unique model for successful technology platforms, and generic modern pharmaceutical industry expertise and skills, to discover drugs in potentially any disease area in Africa.”

Dr Tim Wells, MMV’s Chief Scientific Officer, said: “This is a great achievement and an excellent example of the quality of research that can be fostered in Africa. We look forward to seeing more exciting compounds emerge from Kelly’s team and are proud to be collaborating with H3-D; not only is it conducting excellent science today, but it is also providing world-class training for the next generation of African scientists.”

What is so unique and exciting about MMV390048

It is very potent and displayed a complete cure for animals infected with malaria parasites in a single dose given orally, and thus has the potential to cure millions of people. It is also active against a wide panel of resistant strains of the malaria parasite.

Developing the drug has made possible the training of more than 10 local scientists and cemented a strong relationship with an international partner.

This clinical candidate is in line to enter clinical trials in late 2013.



Features

Prestigious award for Professor Les Underhill



Professor Les Underhill's construction of early warning systems to help protect SA's rich biodiversity, have won him a R1 million prize. Prof Underhill, director of UCT's Animal Demography Unit (ADU) has won the Harry Oppenheimer Fellowship Award and the money will go towards funding current research projects by students and staff, ranging from African penguins, Verreaux eagles, great white sharks, brown hyenas to caracals. The ADU is a major centre of post graduate research and actively promotes "citizen science" in some of its work, with a strong philosophy of community involvement underpinning its work.

Recipients of the award are leading scholars "who have a sustained record of outstanding research and intellectual achievement at the highest level (and who) must have demonstrated a capacity for and a commitment to knowledge transfer to their fellow citizens". Prof Underhill is the 12th recipient of the award since its inception and the fourth from UCT.

"We are extremely proud of, and thankful to, Les Underhill," said Professor Danie Visser, deputy vice-chancellor responsible for research. "Not only has his vision of 'citizen science' shown how the broader community can become seriously involved in the work of the university, but it has produced data sets that are indispensable to the future of our continent. His interdisciplinary approach and huge enthusiasm for his work has enabled him to attract a very large number of highly talented Master's and PhD students," noted Visser, "making him one of the heroes in our quest to produce the next generation of scientists."

SEEING THE WORLD THROUGH SCIENCE – FACULTY SCIENTISTS WOW SUMMER SCHOOL AUDIENCE

We live in a time of exciting discoveries and developments in the field of science and are able to "see" into the past, the present and the future. Scientists from five different departments and disciplines in the faculty presented a fascinating look at the world through the lens of Science. Dr Riashna Sithaldeen, Department of Archaeology, presented "Seeing the Past", which explored where and when modern humans arose, what they were



like and the techniques that allow archaeologists and palaeoanthropologists to understand the emergence of modern humanity. Dr Frank Eckardt, Department of Environmental and Geographical Sciences, presented "Seeing the Earth from space" which examined what Earth observation technology can show us about the Earth from space and introduced the capabilities of 'mega-scope' – the collective capability of numerous instruments in the Earth's orbit. Dr Clive Oliver, Department of Chemistry, presented "Seeing Molecules" which demonstrated how chemists see molecules via X-ray diffraction, a technique unsurpassed in terms of its precision in deducing atomic coordinates and molecular geometries. Dr Andrew Hamilton, Department of Physics, presented "Seeing sub-atomic particles", moving the scale to sub-atomic particles and examining the fundamental nature of energy, force and matter, what rules their behaviour and how this has culminated in the current experiments of the Large Hadron Collider. Dr Thomas Jarrett, Department of Astronomy, presented "Seeing the universe from Earth", which focused on astronomy and the current state of the universe, including a discussion on modern methods for constructing the cosmic distance ladder to gauge the scale of the universe.

Features

New Polar Research Ship for South Africa

by Associate Professor Mike Lucas

After nearly 35 years of service, South Africa's well-travelled but aging polar research and supply vessel, *SA Agulhas*, was retired in April 2011. It has been replaced by *SA Agulhas II*, a vastly more modern, larger and more powerful R1 billion state-of-the-art polar supply and research vessel. Several UCT academics, Associate Professor Mike Lucas (EGS), Associate Professor John Compton Geology), Drs. Isabelle Ansorge, Howard Waldron & Mathieu Rouault (Oceanography) were on the committee that helped choose which ship tender was accepted and then advised about the science capability required and what on-board facilities were needed.

SA Agulhas II is world-class, so how can such a ship and her price-tag be justified? South Africa occupies an almost unique geographical position as one of the three major 'gateways' to Antarctica, along with South America and Australia/ New Zealand, and through the South African National Antarctic Programme (SANAP) provides logistical support for oceanographic research and weather observations in the Southern Ocean, particularly in the context of marine living resources and climate change. The *SA Agulhas II* will serve as a mobile scientific research laboratory for oceanographic and biological research, while continuing its predecessor's role of deploying and collecting weather buoys as part of an international collaborative effort to provide a national and global weather prediction service.



The capability of *SA Agulhas II* is far superior to its predecessor. It is capable of a maximum speed of 18 knots, can stay at sea for 90 days

and has considerably better ice-breaking capability than its predecessor. As a floating science platform, the ship is almost unmatched, with eight permanent laboratories and six portable and fully serviced container laboratories that can be secured beneath the heli-deck.

It is clear that the *SA Agulhas II* will maintain South Africa's leadership position over the next 20 to 30 years as a global player in Antarctica and the Southern Ocean. In doing so, it will provide a platform to educate and train the next generation of national and international polar research scientists.

A Treasure trove of Climate Research



Dr Anne Treasure – Ma-Re/ Oceanography Postdoc at UCT receives prestigious POGO-SCOR Fellowship Award

Prince Edward and Marion islands in the sub-Antarctic have an average winter temperature of 3.9°, strong winds all year round and an annual rainfall of about 1900 mm, so why would anyone want to spend 14 months on these islands? Dr Anne Treasure explored the islands gathering data for her PhD, which assessed the impacts of climate change and biological invasions on indigenous terrestrial invertebrates. Her PhD research led her to wonder if the terrestrial environments in this region are being impacted by climate change and invasive species, and what the impacts are on the marine environment linked to these oceanic islands.

Anne is currently undertaking postdoctoral research at UCT looking at marine food webs and ecosystems and their responses to the shifting sub-Antarctic Front (SAF) in the vicinity of the Prince Edward Islands. The primary aim of the study is to use an ecosystem approach and to link biological models to physical data to see if projections can be made regarding what changes might occur with the shifting of the SAF. These ideas led to Dr. Treasure receiving the prestigious POGO-SCOR visiting fellowship, which is made to early to mid-career scientists who will benefit from learning new skills and techniques and making new contacts. The award will allow Dr. Treasure to travel to Cambridge, UK, to spend six weeks working with Prof Eugene Murphy, who is one of the leading experts in Southern Ocean ecosystem research, at the British Antarctic Survey (BAS).



Features

A decade in the life of the National Astrophysics and Space Science Programme

An amazing time for Astronomy in South Africa!

By Professor Peter Dunsby, Department of Astronomy

The National Astrophysics and Space Science programme, an Honours and Masters degree programme run by a consortium of nine South African Universities and three National Facilities, and hosted by the Department of Astronomy at UCT, with the aim of attracting previously disadvantaged South Africans to the field of astronomy, celebrated its 10th birthday in 2012.

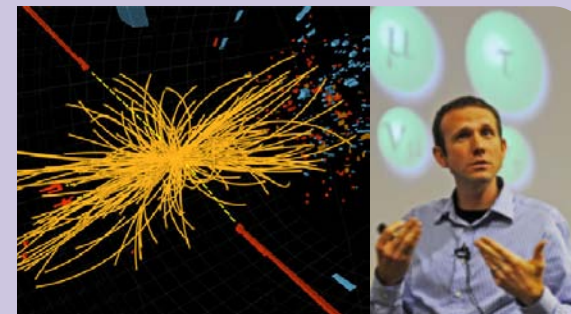
South Africa has a history of excellence in astronomy and its geographical position, modern infrastructure, good climate and its recent successful bid to host a significant portion of the Square Kilometre Array (SKA), ensure that Southern Africa is strategically placed to play a major role in astronomy of the 21st century. The southern African region is well endowed with space research facilities, including three major new developments – the 10-m class Southern African Large Telescope (SALT), the Karoo Array Telescope (MeerKAT) - a prototype and technology tester for the SKA and the High Energy Stereoscopic System (HESS) in Namibia.



Professor Peter Dunsby says, “Our goal is to provide students with the skills, knowledge and inspiration to embark upon a PhD in astrophysics or space science within South Africa or abroad, or to enter and contribute to the South Africa work force”. NASSP is utilizing this to build an international network of African astronomers.

Working towards these goals, NASSP has graduated 123 students (50 from outside of South Africa) with Honours degrees and 75 (38 from outside South Africa) with Masters degrees, in the last 8 years. Many of the Masters graduates have gone on to complete doctoral degrees at both local and international institutions. More than half of the students completing PhDs after the NASSP programme have taken up postdoctoral and permanent academic positions in South Africa, elsewhere in Africa, or at leading institutions around the world. They form the nucleus of research groups who will be users of SALT and SKA, as well as participants in the broader space science activities in Southern Africa.

HYPE ABOUT THE HIGGS BOSON



DR ANDREW HAMILTON (above right) from the Department of Physics, presented a lecture entitled, “*The Higgs Boson: What’s all the hype about?*” And it is apparent that there is a great deal of hype about this, as this public lecture drew over 900 people to attend. The talk had to be repeated and have a live streaming digital recording made as a result of the huge demand to participate in this lecture.

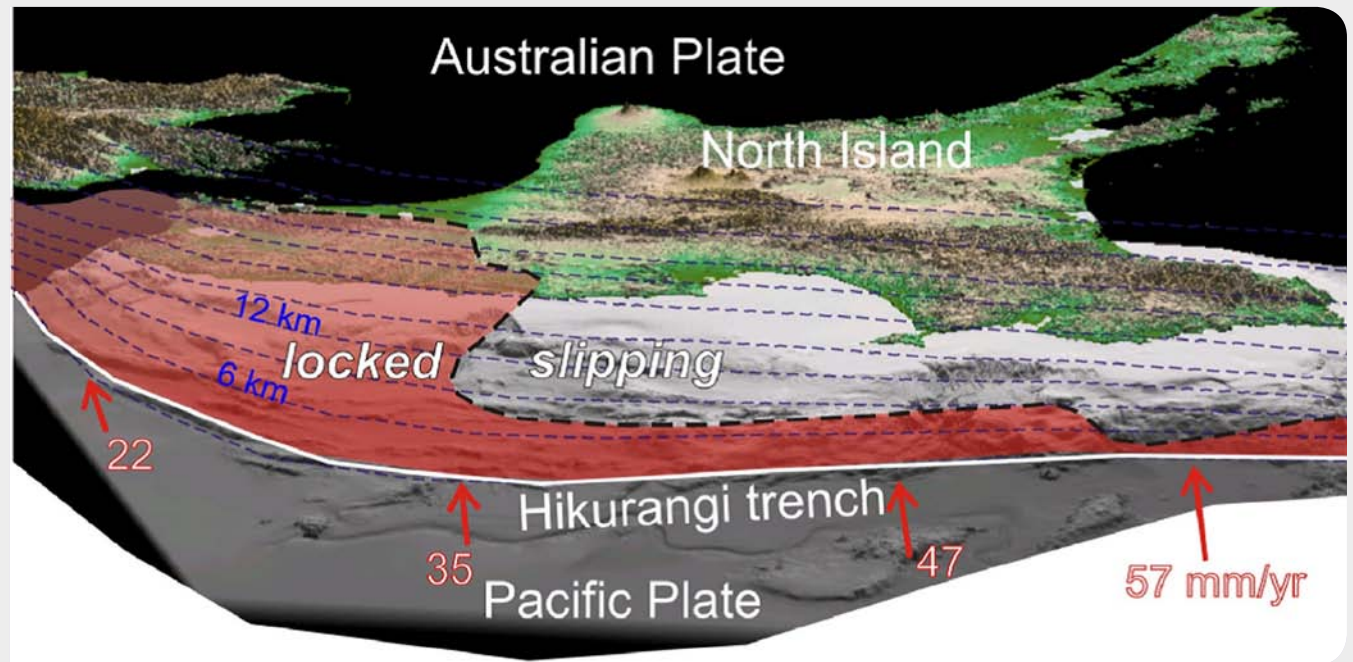
Public interest in physics spiked after the European Centre for Nuclear Research (CERN)’s announcement on July 4 2012 that it had detected a particle that looked and behaved like the mythical Higgs Boson particle that scientists have spent decades searching for. Dr Hamilton’s public lecture on 6 September went some way to shedding light on that momentous moment in scientific history, why it is such a big deal and why the Higgs Boson is an important part of our current understanding of the laws of nature and what this means for our understanding of the universe.

Features

New research on the role of fault permeability and fluid pressure on seismic behaviour

Dr Ake Fagereng, from the Department of Geological Sciences has been working for a few years on factors that control seismic behaviour (earthquakes vs creep) on big faults. He has been working on a project in New Zealand together with Susan Ellis (GNS Science, Welling, New Zealand) and Lauren Wallace (University of Texas, USA). They raised the hypothesis that faults that have low permeability, and therefore high fluid pressure, can become abnormally weak, allowing for earthquake rupture over large distances. They proposed that on the other hand, faults that are permeable and have low fluid pressure, tend to be stronger, and fault slip is arrested before sliding far. This contradicts a commonly held idea that strong faults = large earthquakes and weak faults = creep. The proposal Dr Fagereng and his group sent to the New Zealand Marsden Grant aims to test this hypothesis, and they received funding of approximately NZ\$900,000 to do the research.

Their proposal brings together a relatively large team to allow integration of several specialist techniques. Susan Ellis is a mathematical modeller at GNS Science, Wellington and together with Dr Fagereng and Demian



Saffer (hydrologist, Penn State), she is making a geodynamic model that accounts for geological and hydrological factors, with observational constraints from the other 5 team members (Laura for GPS surveys that give us kinematic constraints, Phil Barnes (NIWA, the New Zealand National Institute for Water and Atmosphere), Francesca Ghisetti (TerraGeologica) and Dan Barker (GNS) are working on geophysics and the geometrical input to the model, and Agnes Reyes (GNS) is measuring water chemistry to give some permeability constraints).

This team has been making an integrated, best constrained (by observational data), most realistic large-scale model of a subduction zone so far, with implications for how any large-scale fault zone behaves seismically. They are using the Hikurangi margin (North Island New Zealand) as a case

study, as it has a very well constrained change where the northern half is creeping, and the southern half is locked (sticky) and likely to produce large earthquakes. Therefore, they know we have two parts of the same margin where one is sticky, one is creepy, and they're looking for differences between these parts. The results of their research will have global implications for the understanding of subduction earthquake potential and help to solve the mystery of why some subduction thrusts "lock-up" and rupture in great earthquakes whereas others do not.

In addition to Dr Fagereng's history of working on the Hikurangi Margin, his role in the project comes from a specialization in working on fault rocks, and deformation processes recorded in ancient fault zones now exposed at the Earth's surface.



Features

Female white sharks show high residency in inshore coastal area

Seal colonies are well established white shark aggregation areas, but a new study shows that inshore coastal areas can be equally as important for white sharks and that use of aggregation areas can differ between the sexes, which has important management implications.

Alison Kock, from the Department of Zoology, together with Associate Professor Justin O’Riain recently published their findings with regard to a study which was conducted in False Bay, South Africa, where the scientists tracked 56 tagged white sharks of both sexes ranging in size from 1.7 to 5 meters over a period of 32 months.

“We found that white sharks showed high levels of residency to the seal colony over autumn and winter as expected, but we were very surprised to learn that female sharks showed equally high residency at inshore areas during spring and summer and that males were notably absent,” said Alison Kock, who led the study as part of her PhD research in the Department of Zoology at UCT.

Kock explains that “the shift from the island in autumn and winter to the inshore region in spring and summer by female sharks mirrors the seasonal peaks in prey abundance including juvenile seals at the island in winter and a range of migratory fish along the inshore during the warmer months”.

Many species of shark separate by sex for a period of their lives due to social, temperature or feeding related reasons. Previous studies from the US, Mexico and



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Australia have shown that adult white sharks have different timings in their migration patterns believed to be either related to reproduction or temperature preferences, but this is the first time that separation of the sexes has been identified on such a fine spatial scale and for sexually immature sharks.

White sharks are threatened apex predators and despite South Africa enacting protective legislation in 1991, there is limited knowledge available on how best to make such protection effective. Currently no critical area conservation plans exist for False Bay, or anywhere in South Africa. This study confirms False Bay as a critical area for white shark conservation and identifies that females are particularly at risk, due to their frequent use of the inshore areas of the Bay, which are impacted by fishing, pollution, and damage to natural habitat from coastal development.

Furthermore, the finding that female sharks frequent the inshore regions during spring and summer when recreational use peaks, highlights the need for ongoing shark-human conflict mitigation strategies such as the Shark Spotter program, for which Kock serves as the research manager. The Shark Spotters aim to improve public safety while simultaneously conserving this vulnerable shark population.

Although the study focused locally, its findings have broad conservation and management implications because it highlights the need for understanding how behavioural patterns differ between sexes of the same population, as this can influence a particular sex’s susceptibility to threats. Co-author, Justin O’Riain welcomed the findings as an important contribution to the broad field of predator spatial ecology. “ We have a wealth of such information for land predators and these results provide an important step in narrowing the knowledge gap between marine and terrestrial systems and assessing the extent of our generalities”, he commented.

In addition to Kock and O’Riain, the co-authors of the paper are Katya Mauff and Charles Griffiths (UCT), Michael Meÿer and Deon Kotze from the Department of Environmental Affairs (DEA). This research was funded by the Save Our Seas Foundation and the DEA provided research equipment and ship time. The National Research Foundation (SA) provided bursary funding for Alison Kock.

Features

UCT palaeontologists apply their sleuthing skills to cold cases

The fossils of pre-historic animals, often found in bits and pieces, are jigsaw puzzles that have to be pieced together, calling for lots of study and deductive reasoning.

Palaeontologists in the Department of Zoology have recently been applying their sleuthing skills to two fossils dating back hundreds of millions of years. In the first of two studies, published online in the US-based *Journal of Vertebrate Palaeontology*, honours student Tobias Nasterlack, working with postdoctoral research fellow Aurore Canoville and palaeobiologist and head of department Professor Anusuya Chinsamy-Turan, picked and prodded at the skeletal remains of a toothless mammal-like reptile known as *Cistecephalus*.

In so doing, the team hoped to glimpse insights into the lifestyle habits of the 40cm-long creatures, which lived 255 million years ago in the area now known as the Karoo. Was it, as has been debated, aquatic, amphibious, a tree climber or, the more popular theory, a burrower?

“Bone microstructure is a powerful tool that enables deductions about the lifestyle of extinct animals,” explains Canoville.

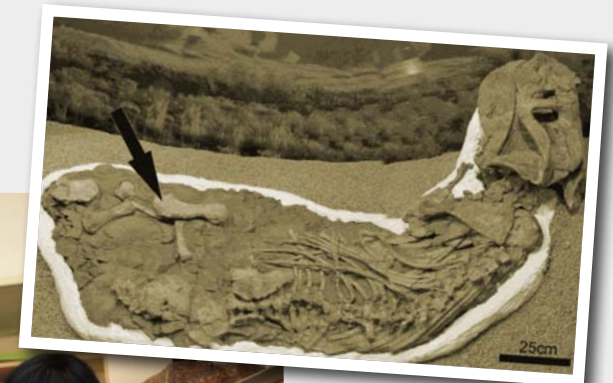
What they have been able to glean from the adults’ thick-walled bones, for example, is that it is similar



Bone collectors: Nick Fordyce with Prof Anusuya Chinsamy-Turan have made some eye-catching discoveries about some of South Africa’s prehistoric creatures.

to that of many digging animals of today, suggesting that *Cistecephalus* was not a tree climber but rather a burrower.

In a second study, published in the *South African Journal of Science*, honours student Nicholas Fordyce, working with Chinsamy-Turan and Roger Smith of the Iziko South Africa Museum, has cast a light on a 253-million-year-old murder mystery. His research pointed the finger for the killing of a plant-eating reptile known as a dicynodont - specifically one named Mamafura, whose partial skeleton was discovered in 1984 - to a suitably vicious-looking carnivore known as *Aelurognathus*.



Murder site: A picture of a dicynodont’s final resting place, its bones and associated remains providing clues to its death.

The researchers came to this conclusion based on the smoking gun found near the scene of the crime, namely a 3.5cm long, sharply pointed, curved and serrated carnivore canine. In the defence of the *Aelurognathus*, other forensic evidence - notably the belly-up posture of the skeleton and the mudrock around it - would suggest that the *Aelurognathus* had merely come across Mamafura’s carcass after it had drowned, and opportunistically fed on it, losing the tooth in the process.

“Fossils provide us with a unique opportunity to learn about how the world and its fauna and flora have changed through time,” says Fordyce.

SCIENCE FACULTY OUTREACH

Science Day

All of the departments in the faculty took Science into the community at our annual Science Day, which was held at Trafalgar High School. As well as providing interactive stands for learners to engage with, there was a wide variety of workshops which enthralled and intrigued learners. There was a murder mystery entitled “Death on the Black Pearl”, physics in action with “The Sound of Music” and “Gardens in the Ocean”.

Phenomenal Physics



300 Grade 11 learners from schools across the Peninsula, stormed the RW James building and enjoyed an afternoon of phenomenal physics.

The Physics Department staff who offer this annual event always present an action-packed and stimulating afternoon of physics in action, to excite, inspire and capture the imagination of the learners. The aim is to show learners the underlying presence of physics principles in our everyday lives, that physics is an exciting and relevant academic pursuit and to showcase UCT as a cutting edge place to study Physics.

Never Too Old to come to UCT



Learners and teachers, from 8 to 50 years old, have attended tailored science enrichment outreach programmes in the Faculty. During the second half of the year, the Zoology Department organized and hosted, in collaboration with various partners, but in particular Marine Research Institute and Save Our Seas, a wide range of Outreach

activities that have seen 400 learners and 100 teachers being thrilled by science. The aim of the outreach is to illustrate the vital importance of science and the possibility of careers in the Biological Sciences. The learners discovered some weird and wonderful creatures, had a few myths about sharks dispelled, marvelled at life on a tropical island and got up close with starfish, rock lobsters and a host of rock pool creatures! Any qualms with creatures slimy, spiny and spongy were quelled at the touch tanks. Aquaculture became understandable and fun, and there was no squeamishness to be found at the snoek dissection where the weird world of parasites was revealed. A highlight was definitely getting some of the boys into full snorkeling gear and ready to dance in front of their peers, as well as a few priceless facial expressions when the boys were confronted with a spiny rock lobster! The department’s researchers and senior students got to show off the fruit of their studies and the learners were exposed to our environment and animal kingdom, at the same time demystifying science, and opening their eyes to the possibility of studying Science at the University of Cape Town.



Science Posters Brighten Classrooms

For the past 6 years a dedicated team of volunteering staff and postgrad students have worked with the Faculty Marketing Committee to produce outstanding Science Posters for National Science week. These posters are aimed at inspiring junior school learners about the fascinating world of science. In 2012 the four posters produced were the following: **Drought Tolerant Crops; Fishing Responsibly; Energy & Hydrogen: fuel of the future.**



IN MEMORIAM



Emeritus Professor Frank Brooks (above), who was considered a pioneer in physics and application of neutron detection and spectrometry, died on 30 August 2012, after suffering a fall.

Brooks' research will be remembered for his application of the technique of "pulse shape discrimination" which allows the identification of different types of charged particles in certain scintillator detectors by means of the characteristics of the scintillation decay.

Associate Professor Andy Buffler described how Frank's teaching mirrored the way he thought about research, "His lectures were extremely well structured, often supported by carefully hand-written notes, which he always made available to students" In the course of his career Brooks supervised 19 MSc and 18 PhD students and was head of department from 1979 to 1983.



The Department of Environmental and Geographical Science mourns the loss of **Emeritus Professor Ron Davies** (above), who was hailed for his contributions to the study of geography both in South Africa and in the rest of the world, died on 13 September 2012, at the age of 81.

Davies graduated from Rhodes University with an MSc and completed his PhD at the London School of Economics. He taught at the University of Natal until 1975, when he moved to the University of Cape Town as head of Geography.

Despite taking early retirement in December 1993, Davies continued to be very active in UCT's Department of Environmental and Geographical Science (EGS) and the geographical and urban studies communities.

Davies was an Honorary Corresponding Fellow of the Royal Geographical Society. His research on the urban system of South Africa and the apartheid city allowed him to contribute to many conferences of the International Geographic Union (IGU). He was twice president of the South African Geographical Society, being elected an honorary Fellow in 1977.



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* newsletter.

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