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Faculty of Science NEWSLETTER

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FUTURE PUBLIC LECTURES 2013

- **16 May:** Council Chambers: Mr Bertus Smith: ***The life and environments of the early Earth***

- **30 July:** Auditorium: Dr Marianne Cronje: ***Cancer***

- **22 August:** Auditorium: Prof Hassina Mouri: ***Medical Geology: an interdisciplinary emerging field of science***

- **17 September:** Auditorium: Prof Bettine Jansen van Vuuren

- **3 October:** Council Chambers: Dr Francois Durand: ***The fish within***

Winners of 2013 National Microsoft Imagine Cup

A team from the Academy of Computer Science and Software Engineering won the 2013 National Competition in the South African leg of the Microsoft Imagine Cup. The team was placed first in the Innovation category, and was selected as the National Winners of the South African leg of the Microsoft Imagine Cup 2013. The project also won a prize for best use of the Microsoft Azure platform in their system.

The finals of the South African Imagine Cup was contested by 14 teams in various categories who were selected from over 70 initial projects. The team will now represent South Africa and compete against teams from across the world in the international finals of the Microsoft Imagine Cup which will take place in St Petersburg, Russia in July 2013.

The team who consisted of Mr Jan van Niekerk, Mr Merrick Bengis, and Mr Lorenzo Boccetti, mentored by Dr Ian Ellefsen, developed a software system called Sentimeter. The system is a business analytics platform that mines information from social media sources. The judges commented on the outstanding quality of the system and their innovative use of technology.

The Academy of Computer Science and Software Engineering had a total of 4 teams competing in the South African finals of the Microsoft Imagine Cup. The Academy is proud of all its students that took part in the competition. The Academy has won the South African leg of the competition twice in a row and three times in four years.



The team: Mr Jan van Niekerk, Mr Merrick Bengis, Mr Lorenzo Boccetti and Dr Ian Ellefsen.

Report on Fielding Performance Measure

The *Times of India*, the most popular Indian newspaper, recently described the construction of a fielding performance measure in cricket - developed in a paper that was published in the *International Journal of Sports Science and Coaching* - as a 'path-breaking development'. They mentioned that the paper has attracted the interest of different cricket statisticians from Australia, England, South Africa, Bangladesh and India.

Prof HOFFIE LEMMER, Emeritus Professor in the Department of Statistics of UJ, was requested by Mr H Saikia, a student of Prof D Bhattacharjee at the Assam University in Silchar, India, to assist him with the development of a measure of fielding performance in cricket. Saikia sent him a manuscript containing an extensive list of fielding actions, each with a description of three or four ways in which the action could be executed. Prof Lemmer made some suggestions and during the next year slow progress was made. In March 2012 Prof Bhattacharjee sent Prof Lemmer a further manuscript containing possible weights for the actions, and also a statistic to measure the fielding performance of a player. The statistic was not suitable and Prof Lemmer gave a different definition. He also did not quite agree with the weights they had chosen. He worked out a multistage system of weights where weights are allocated according to the outcome (wicket taken versus any other fielding action), the degree of difficulty of the fielding action and also how well the action was executed. The product rule for independent events of probability theory was used to choose the product of the weights to construct the measure.

Then Prof Bhattacharjee, having Sachin Tendulkar in mind, suggested that if a wicket was taken, the strength of the batsman whose wicket had been taken, should be taken into account. By using wicket weights from a study of Prof Lemmer published in 2005, these were also included in the formula. It was further decided to give two versions of the measure, depending on the specific purpose of its use, i.e. whether or not wicket taking is considered more important than excellent fielding in general. By making use of a video recording of the final match in the *2007 World Cup Twenty20 Series* played on the Wanderers, Mr Saikia observed each ball bowled and quantified the performance measure of each fielder who had fielded at least five balls during the match. A ranking of the Indian fielders according to each of the two versions of the measure was given. The manuscript was submitted to the highly rated *International Journal of Sports Science and Coaching* and it was published in its December 2012 issue.

Prof Bhattacharjee succeeded in bringing the work under the attention of the media in India. On 21 February 2013 the North Eastern newspaper *Seven Sisters Sport* published a discussion of the work in their main article on the front page of the paper. This drew immediate attention from other news media. On 4 March the *Times of India* also had a long front page discussion of the fielding performance measure. Various Bengali and Hindi newspapers have reported it, and it was also mentioned on News Live, a regional TV channel.

Prof Lemmer's first reaction when he was approached to give advice on the project was that such a measure would only be of academic interest. After observing the wide media interest and bearing in mind that technological development occurs at an overwhelming speed, he now believes that sooner rather than later someone will construct an optical device that would be able to observe, interpret, quantify and transfer the observations to a computer that will calculate the measure. It will then be possible to rate fielders, as in the case of batsmen and bowlers, and to rate teams according to their fielding performances.



Prof HOFFIE LEMMER.

Toyota Enviro Outreach for 2013



Prof Van de Bank & Gerhard Groenewald, owner at the Klipbökkop Mountain Reserve, Worcester.

KAROO PLANTS: OUR TREASURES, OUR FUTURE

The Toyota Enviro Outreach for 2013, led by Prof Michelle van der Bank from the Department of Botany & Plantbiotechnology in the Faculty of Science, University of Johannesburg, started at the Klipbökkop Mountain Reserve. During this time scientists and students from the University of Johannesburg, the South African National Biodiversity Institute, University of Pretoria, and University of Cape Town visited several floristically interesting sites in the extremely arid Gariep region (Gariep Desert, Bushmanland Inselbergs, quartz patches) and the Upper Nama-Karoo region of the Northern Cape Province. Their goal was to collect material for herbarium specimens and DNA barcoding, as well as information about species distributions, population surveys of threatened species, habitat and threat assessment data while also recording information about plant utilisation. The project is part of an effort, called the International Barcode of Life (iBOL) project, the biggest biodiversity genomics initiative ever undertaken and led by a team of Canadian scientists.

The Toyota Enviro Outreach provided a unique opportunity for scientists to study and contribute to the national electronic flora of South Africa. The Outreach Team visited a remote and poorly explored part of the country, namely the arid of the Northern Cape. The region harbours many rare and interesting plant species, etching out a living in some of South Africa's most arid environments, with many of these only known from few and very old herbarium records. The opportunity to do surveys of their populations and observe their habitats and the threats to them will enable improved conservation assessments and accurate locality information, vital components to ensuring the conservation of rare and threatened species.

South Africa is the third most mega-diverse country in the world, with almost 10% of the world's plant species. Without fundamental knowledge of this diversity the country will be limited in its ability to use this national asset to solve environmental and human welfare challenges. Furthermore, with the current unprecedented rate of extinction no other generation will have access to the number and diversity of species that we have now (many of which still remain unknown to science). The resources our biodiversity holds, especially species that are poorly known, are therefore extremely important and their preservation for future generations pivotal. Efforts such as the 2013 Toyota Enviro Outreach enable scientists to make strides in the exploration of these hidden treasures, ensuring their preservation.

In order for South Africa to meet the targets of the Global Strategy for Plant Conservation, the South African National Biodiversity Institute has committed to produce a national electronic flora documenting all the species in the country by 2020. The Northern Cape Nama-Karoo, along with the adjacent summer rainfall areas, is the last remaining region within the country still requiring a floristic treatment. Such a Flora project is currently in progress at the Biosystematics Division of SANBI and the University of the Western Cape (lead by Drs Magee and Boatwright) and aims to be completed by 2016. Once finished, it will complete the picture of the floristic diversity for South Africa. This will also provide valuable information to draw up conservation strategies particularly in light of various potential threats to the region, such as proposed hydraulic fracturing (fracking) and various other mining activities in some parts of the Karoo.

Physics on the move

REPORT OF TRIP TO THE UNIVERSITY OF MELBOURNE

Prof Steven Karataglidis from the Department of Physics visited the School of Physics at the University of Melbourne to work with his collaborator there, who is also a Visiting Professor at UJ, Prof Ken Amos. Currently, they are both involved in a four-nation collaboration (UJ, South Africa; University of Melbourne, Australia; University of Padova, Italy; and University of Manitoba, Canada) developing a Multi-Channel Algebraic Scattering (MCAS) Theory to describe low-energy scattering off nuclei from direct solution of the attendant Lippmann-Schwinger Equations in momentum space. Work along these lines will assist in development of the flagship Radioactive Ion Beam Project at iThemba Labs (Western Cape).

This formulation, which in its current form describes nucleon scattering from nuclei, allows also for the calculation of bound and resonant states in the compound nucleus. For that reason, comparisons are made with calculations of states from the shell model, and currently the work is concentrating on the heavy isotopes of carbon: ^{12}C through to ^{18}C . The states of those isotopes were obtained from calculations of large space shell models, which then allowed for comparison with those states obtained from MCAS, which is based on a collective model specification of the nuclei.

The results obtained, especially for ^{15}C , ^{16}C , and ^{17}C are encouraging, and the results compare well with those obtained from MCAS. Further work is currently being done with the shell model calculations extended to much larger spaces, and the results will be published in two, possibly three, journal publications.

The visit further cements an ongoing and strong relationship between the Department of Physics at UJ with the School of Physics, at the University of Melbourne, both universities also being members of Universitas 21. Further visits are planned for the future to continue this work and collaboration.



Prof Steven Karataglidis.



COLLABORATION WITH SCIENTIST

Professor Giovanni Hearne spent two weeks on research visits at European laboratories. This commenced with beam-time for a week at Synchrotron SOLEIL (south of Paris). Prof Hearne has established close collaboration with a number of scientists at SOLEIL in the field of x-ray absorption spectroscopy (XAS) under extreme pressure-temperature (P-T) conditions. This permits *element-specific* probing of the chemical state (XANES), local atomic environment structure (EXAFS) and magnetism (XMCD) in materials under in-situ extreme P-T conditions.

Following on this beam-time Prof Hearne made short visits to his contact points in extreme pressure-temperature research at the II-Physics Institute at the University of Cologne and both the Physics Institute and Geosciences Institute at the Goethe Universität in Frankfurt. This was to pave the way for further future collaboratives.



Various views of the ODE beamline at Synchrotron SOLEIL configured for XMCD (magnetic) experiments. High resolution (x-ray dispersive) CCD camera detector is located at the end of the track in the top panel. Sample chamber within the electromagnet is in the bottom panel.

Professor Giovanni Hearne

SCIENTISTS ARE GLOBE TREKKERS

Study of extremely energetic particles that are produced naturally at astrophysical sources, is the main research area of Dr Soebur Razzaque, who recently joined the Department of Physics as a Senior Lecturer. These tiny subatomic particles can reach the kinetic energy of a cricket ball delivered by a fast bowler. Even the largest man-made machine, the Large Hadron Collider at CERN in Switzerland, is unable to accelerate particles to this energy. By detecting these "cosmic messengers" one can probe the extreme conditions both at the astrophysical sources (extremely high temperature, density, magnetic field, etc.) and in the intergalactic medium (extremely low temperature, density, magnetic field, etc.). Modeling how these cosmic particles gain energy; interact and produce other particles such as gamma rays and neutrinos; and propagate to the Earth are some of the topics that Dr Razzaque has worked on and published over fifty articles in high-impact peer-reviewed journals.

South Africa's investment in Astronomy and Astrophysics is huge. At a time of contractions elsewhere in the world, a commitment made by South Africa in 2012 to build the Square Kilometer Array (SKA) is welcomed by the global Astronomers' and Astrophysicists' community. South Africa has also raised its visibility in Astronomy by building the South African Large Area Telescope (SALT) and by supporting the High Energy Stereoscopic System (HESS) in Namibia. Dr Razzaque, among many others, took this great trek to South Africa in order to become a part of this new era in Astronomical sciences. As one of the top universities in South Africa, University of Johannesburg naturally facilitates this goal with a great scientific environment.



Dr Soebur Razzaque

UJ IS THE NEWEST MEMBER OF FERMI-LAT GAMMA-RAY SPACE TELESCOPE

University of Johannesburg has become the newest member institute of NASA's Fermi-LAT gamma-ray space telescope mission (as of 1 March 2013). About 145 Fermi-LAT collaboration members and similar numbers of affiliated scientists, postdocs and graduate students are spread over 19 countries in 6 continents.

The Fermi spacecraft was launched into a near-earth orbit on 11 June 2008. The goal for mission operations is 10 years. The Large Area Telescope (LAT) is the principal scientific instrument on the Fermi. It is an imaging high-energy gamma-ray telescope covering the energy range from about 20 MeV to more than 300 GeV. Such gamma rays are emitted only in the most extreme conditions, by particles moving very nearly at the speed of light. The LAT's field of view covers about 20% of the sky

at any time, and it scans continuously, covering the whole sky every three hours. The science topics cover:

Galactic sources: Pulsars, Supernova Remnants and Novae

Blazars, other AGN and Galaxy Clusters

Gamma-Ray Bursts

Diffuse emission from Milkyway, Molecular Clouds and other Galaxies

Emission from the Sun

Dark Matter and New Physics

Prof Peter Michelson of Stanford University is the Principal Investigator of Fermi-LAT and Stanford Linear Accelerator Center (SLAC) is the main LAT science center.

<http://fermi.gsfc.nasa.gov/>

<http://glast.slac.stanford.edu/>

The benefit of becoming a full member institute is that postdocs and postgraduate students at Department of Physics at UJ will have opportunities to take part and contribute to Fermi-LAT science topics. Since non-thermal, relativistic particles are responsible for both gamma ray and radio emission, Fermi-LAT science is complimentary to the science of the Square Kilometer Array (SKA) which will be hosted by South Africa.



UJ is co-hosting a TED event

It was excitement on 3 May 2013, (13:45 to 20:00) in the Foyer / Exploratorium of the Department of Physics with TEDxCERN, the live event at the CERN main stage : Globe of Science and Innovation. The talk is part of the TEDxCERN series, under the theme *Multiplying Dimensions*. It is stimulated by the discoveries at CERN, especially currently from the Large Hadron Collider. The message is *Science is everywhere; our life as individuals and our survival as a society depend on its development*.

THE SPEAKERS WERE:

George Church: Recent breakthroughs using DNA; Hiranya Peiris: The Early Universe;

Ian Foster: Big Data; Londa Schiebinger: Gendered Innovation;

Maya Tolstoy: Ocean Floor/Tidal Triggering; John Searle: Consciousness;

Eliezer Rabinovici and Zehra Sayers: SESAME and Collaboration

Brittany Wenger, the 2012 Google Science Fair (High School) Grand Prize Winner: Research and Inspiration

The TEDx program gives communities, organizations and individuals the opportunity to stimulate dialogue through TED-like experiences at the local level.

TED is a nonprofit devoted to ideas. It started out (in 1984) at a conference bringing together people from three worlds: Technology, Entertainment, Design. Since then its scope has become even broader. The two annual TED conferences, in Long Beach/Palm Springs and Edinburgh, Scotland, bring together the world's most fascinating thinkers and doers, who are challenged to give the talk of their lives (in 18 minutes or less). A TED talk must have a NEW IDEA worth spreading. TED talks are available on TED.com; some TED talks have been viewed by more than 10 million people. This month they celebrated 1 BILLION VIEWERS on TED.com.

HAVING A FIELD DAY

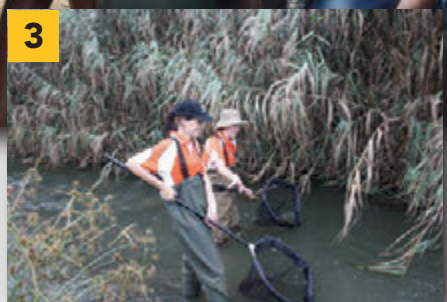
An interactive workshop on river health and ecology, combined with a scientific survey of the Klipspruit River, was recently done in Kliptown, Soweto. The workshop was presented by staff members, Dr Cobus van Dyk and Mrs Pietro de Lange-Jacobs, and students Caitlin Balt and Melissa Gates of the Department of Zoology for a group of high school learners who are part of an initiative known as the Kliptown Youth Program (KYP). KYP is geared at empowering the youth of the Kliptown Community with information, skills and guidance and to provide social and academic support (www.kliptownyouthprogram.org.za). The scope and content of the workshop was decided on after liaising with Siphwe Mhlaba, Environmental Manager of KYP.

The workshop forms part of a current Honours research project by Caitlin, supervised by Dr Cobus van Wyk and Mrs Pietro de Lange-Jacobs. In 2012, both staff members were also involved as consultants for the *Eat My Dust* program on ecology at the KYP. The current research project involves an assessment of aspects of water quality and biological integrity at different locations along the Klipspruit, a tributary of the Klip River. The Klipspruit is impacted by informal settlements and industry from its origin to its confluence with the Klip River. In a country like South Africa, where usable water is extremely scarce, it is increasingly important to monitor and minimize negative impacts on our precious water resources.

The workshop, as well as the fieldwork for Caitlin's project, was also an ideal opportunity to invite an undergraduate Zoology student, Melissa Gates, along to participate and gain some valuable experience in postgraduate research activities within the Department.

Caitlin Balt presenting a lecture to the class on River Health and River Ecology.





On arrival at Kliptown, the team was greeted with warm weather, dusty roads, and 16 eager learners from the surrounding community. They arrived eager to learn, with notebooks, text books and enthusiasm on hand. The workshop began with a short introductory lecture by Caitlin on river health, aquatic ecology and the importance of preserving our water resources. The youths, now clued-up on how to assess the health of a river, set to work on the nearby Klipspruit. Gumboots and waders were put on, samples of invertebrates were collected, and water quality parameters such as pH, temperature and dissolved oxygen were measured. The invertebrate samples were taken back to the classroom for identification with the aid of microscopes.

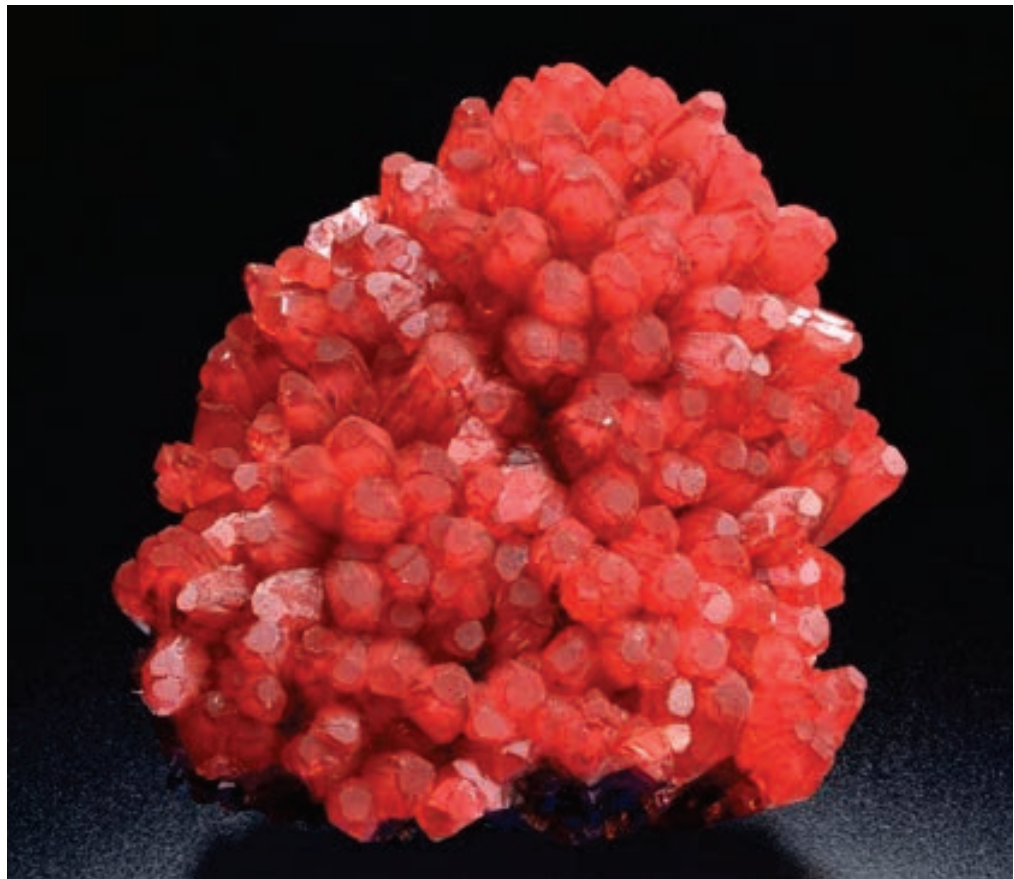
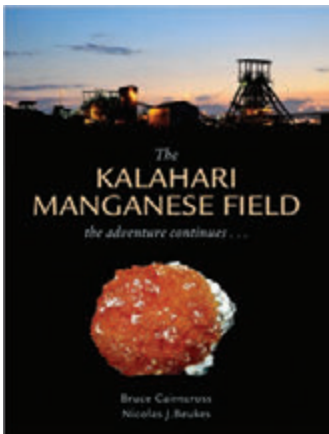
There was a buzz of excitement as the learners could clearly see the microscopic detail of the different organisms. They also managed to correctly identify some of the invertebrates and shared their findings with the group. A fish dissection was also performed, and the learners were thrilled and surprised to learn that fish have many of the same internal organs as humans do. The workshop was concluded with a discussion on the days' activities and possible solutions to the challenges facing the Klipspruit.

The workshop was a huge success and not only will it be possible for the learners to use these results for their Grade 11 or 12 Geography and Life Science experimental assignments, but they were also inspired to change the community's attitude towards improving the health and status of their river.

1. The youth from KYP who attended the workshop.
2. Some of the learners at work in the river, collecting invertebrate samples.
3. Melissa and Caitlin ready to collect fish.
4. Dr van Wyk and Caitlin performing a fish dissection for the learners to observe.
5. Learners observing invertebrates through a dissection microscope.

First prize in the 59th International Tucson Gem & Mineral Show photographic competition

For the third time in five years, Professor Bruce Cairncross, Head of UJ's Department of Geology, has won first prize in the 59th International Tucson Gem & Mineral Show photographic competition. This event coincides with the largest gem and mineral show in the world which is held in Tucson Arizona during February each year. The competition is open to all photographers of gemstones and mineral specimens and is adjudicated by a panel chaired by Jeff Scovil, the world's leading mineral and gemstone photographer. There are two categories of entrants in the competition, one for pictures of 'micromount' specimens, that is, crystals photographed under the microscope, the other category for macro, or larger specimens. Prof Cairncross submitted a photograph of a 9.1-cm rhodochrosite specimen from the N'Chwaning I mine in the Kalahari Manganese Field; the specimen belongs to Desmond Sacco. This picture that won the prize, together with several hundred other pictures that he took, will feature in the book on the geology and minerals of the Kalahari Manganese Field that he wrote together with his colleague at UJ, Prof Nic Beukes.



Winning Photo: Rhodochrosite, 9.1 cm. N'Chwaning I mine, Kalahari Manganese Field, South Africa. Desmond Sacco collection. Photograph ©Bruce Cairncross.

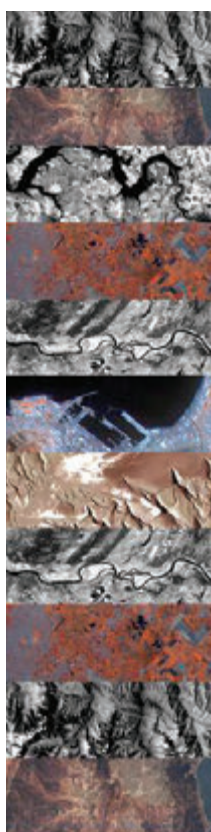


The Department of Geology at UJ once again celebrated their annual acknowledgment to the best performing students in 2012 during the annual prize giving. The student(s) with the highest average marks in first, second and third year and in Honours received a certificate and various prizes that include books, a compass and a geological hammer. The best third year student also received the Yule Crosby Rand Pioneers award. This year the prize winners were Mrs Christelle van der Merwe (best Honours student), Mr Darren Tiddy (best third year student), Ms Jacolene Herbst (best second year student) and Mr Karabo Mogapi and Mr Brian Ndhlovu shared the prize for best first year student. They received their various certificates and prizes during a lunchtime function held recently in the Department of Geology. It is noteworthy to mention that Mrs van der Merwe, who is now employed as a geologist by ASSORE, won all the top student prizes from 2009 to 2012!

Department of Geology Top Student Achievers 2012



Left to right: Mr Darren Tiddy (top 3rd year student), Mrs Christelle van der Merwe (top Honours student), Ms Jacolene Herbst (top 2nd year student), Professor Bruce Cairncross (Head of Geology) and Mr Karabo Mogapi (left) and Mr Brian Bdhlovu (right), joint top 1st year students.



FUNDISA DISK 2012

Your gateway to Earth Observation

Fundisa Disk 2012 was unveiled by the South African National Space Agency's Earth Observation directorate and the Department of Geography, Environmental Mangement & Energy Studies. The Fundisa Disk 2012 is an earth observation resource packed with an assortment of remote sensing data, metadata and software.



NEWS FROM DFC

Left: Mr Lesley Mabasa from AfricaBio addressing the audience.

The Department of Biotechnology hosted AfricaBio (Biotechnology Society), EgoliBio (Life Science Business Incubator) and GDARD (Gauteng Department of Agriculture and Rural Development) on DFC Campus.

Biotechnology as well as some Food Technology and Biomedical Technology students were addressed by representatives from these organizations on issues related to employment opportunities and career-development, research, bursaries and sponsorship, Biotechnology Conferences and AfricaBio membership. They were also entertained by a Biotechnologist turned musician who had the whole audience singing with him in no time.



Transmission Electron Microscope for Spectrum

The application by Prof John Maina from the Department of Zoology and other colleagues for a *Transmission Electron Microscope* has been granted by the National Research Foundation (NRF). The instrument, to the value of approximately R10 million, will be housed in Spectrum, the Analytical Facility of the Faculty, and it is expected that the custom built instrument will be available by early next year.



Prize for best paper in journal

The Douw Greeff prize was awarded to Dr Francois Durand from the Department of Zoology and co-authors for their article entitled *Die karst-ekologie van die Bakwenagrot (Gauteng)* which appeared in the *Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie*, Vol 31(1), 2012. The prize is for the best paper in this journal in a specific year. It will be awarded to him during the awards ceremony in June in Pretoria.



Distinguished Leadership Award for Internationals

The *Distinguished Leadership Award for Internationals* from the University of Minnesota was awarded to Prof Azwinndini Muronga from the Department of Physics, UJ. This Award is a University-wide award for alumni, former students, and friends of the University who have distinguished themselves in their post-university work as leaders in their professional careers.

The Award may be conferred on alumni, former students, and friends of any campus (current or former) of the University of Minnesota. These individuals will have attained unusual distinction as professionals in their careers within institutions or in public service and have either demonstrated sustained outstanding achievement and leadership, or demonstrated promise of such on a local, national, or international level.

Prof Muronga is invited to present a public lecture, visit classrooms, and to interact with the University and with the outside community.

UJ Science Centre demonstrates forensic science to learners



The Science Centre at the University of Johannesburg (UJ) is making strides in increasing the number of learners taking mathematics and science subjects in high schools. Recently the Centre hosted Dr Ruth Tennen, a Science Lecturer from the United States of America, to teach learners about the importance of Crime Scene and Forensic Evidence.

Dr Tennen made demonstrations to more than 300 learners from surrounding Johannesburg schools, on how to use DNA samples to trace suspects during investigations.