

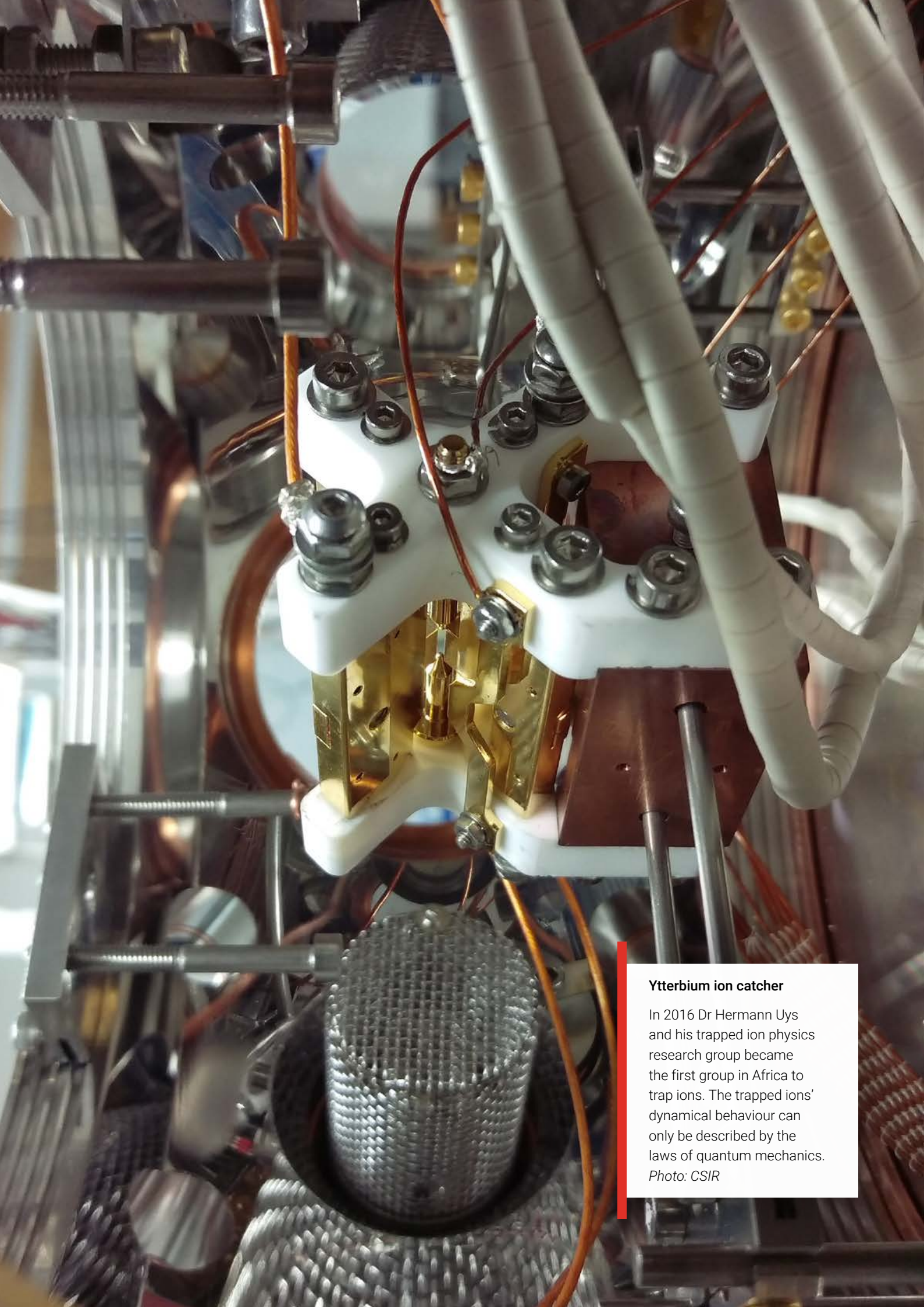


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2016

FACULTY OF SCIENCE
ANNUAL REPORT



Ytterbium ion catcher

In 2016 Dr Hermann Uys and his trapped ion physics research group became the first group in Africa to trap ions. The trapped ions' dynamical behaviour can only be described by the laws of quantum mechanics.
Photo: CSIR

FROM THE DEAN



“To this end, the Faculty initiated various opportunities for staff and students in 2016 through increased collaboration and enhanced visibility of its scientific work.”

The Faculty of Science is acutely aware of its responsibility not only to equip and prepare graduates with the high-level skills demanded by the so-called “Fourth Industrial Revolution”, but also to remain cognisant of current socio-political challenges. To this end, the Faculty initiated various opportunities for staff and students in 2016 through increased collaboration and enhanced visibility of its scientific work.

Sustaining our momentum of excellence

A new advisory board has been established with prominent members from industry. With this engagement, the Faculty aims to unlock new research and collaboration on multidisciplinary projects, and to provide industry-based training opportunities to both graduate and postgraduate students.

Due to the growing demand for high-level skills in big-data analytics, an expert has been appointed to lead Science’s bioinformatics initiative and coordinate efforts across Stellenbosch University (SU) faculties. The aim is to grow expertise and develop curricula that will equip graduates with a sought-after skills set. Capacity in this field will be further strengthened with the establishment of a German research chair in big-data analysis, which will be sponsored by the Alexander Von Humboldt Foundation and jointly hosted by SU and the African Institute for Mathematical Sciences.

In addition, the Science Teaching and Learning Forum continued to provide a platform for programme renewal, implementation of formative and summative e-assessment, and integrative learning. This includes opportunities for the ongoing professional development of academics, teaching assistants and tutors.

Several staff members received recognition for research excellence in the reporting year. Prof Bert Klumperman received the National Science and Technology Forum (NSTF)/South 32 lifetime award for his outstanding contribution to science, engineering, technology and innovation, as well as the SU Chancellor’s award for research excellence. Another SU Chancellor’s award went to Prof Leon Dicks. Prof Brian van Wilgen was awarded a gold medal by the Academy of Science of South Africa for outstanding achievement in scientific thinking for the benefit of society. Prof Guy Midgley was recognised by the National Research Foundation as a leading international scholar in global change, bringing the total number of A-rated scientists in the Faculty to six. Dr Karl Storbeck received a silver medal from the Society for Biochemistry and Molecular Biology, and Prof Anna-Mart Engelbrecht the Lasec award from the Physiology Society of Southern Africa. Moreover, a new yeast species was named after Prof Alf Botha in recognition of his contribution to the field of yeast ecology, while a new *Oxalis* species from the Richtersveld was named after Prof Léanne Dreyer.



Prof Bert Klumperman, distinguished professor in the Department of Chemistry and Polymer Science, upon receiving the NSTF/South 32 lifetime award for his outstanding contribution to SET and innovation.



Prof Brian van Wilgen (left), a leading conservation ecologist from the DST/NRF Centre for Invasion Biology (C-I-B), receiving his gold medal from the Academy of Science of South Africa. It was handed over by Dr Phil Mjwara, director-general of the National Department of Science and Technology.

The Faculty's students also excelled, particularly at post-graduate level. Matthew Mayne received the John Handley award for the best MSc thesis, and Jean Looock the award for the best honours thesis, in earth sciences in 2015 from the Geological Society of South Africa. Xavier von Stein received the S₂A₃ medal for the best MSc student in natural sciences at SU in 2016 from the Southern Africa Association for the Advancement of Science. Finally, Penelope Dobrowski and Dr Raquel Garcia received the Loréal-UNESCO regional fellowship for women in science in sub-Saharan Africa.

Having experienced a welcome increase of 17%, 14% and 16% in the number of honours, MSc and PhD students respectively over the past five years, the Faculty hopes to see many more of its postgraduate students excel in the years ahead.

To ensure sustained income for sustained excellence, the Faculty makes every effort to increase its research outputs, the throughput rate of both undergraduates and postgraduates, and the strategic application of reserve funds to promote excellence in core activities. This is paying off, as third and fourth-stream income had grown from 32% to 42% of total Faculty income from 2012 to 2015. The bulk of the third-stream income directly supports research and postgraduate student bursaries.

Broadening access

Albeit from a small base, the number of undergraduate black students has increased by 16% from 2012 to 2016. Yet, diversity remains a challenge. The enrolment numbers of Indian students remain low, while coloured student enrolments have shown a mere 7% increase. An analysis of 2016 registration trends indicates that a large number of provisionally accepted black, coloured and Indian (BCI) students eventually decide against registering. In response to this challenge, the Faculty has identified several initiatives to convince more of these provisionally accepted students to take the final step and register.

The diversity profile of administrative and support staff, in turn, has increased from 32% to 53% during the past five years, but has increased only marginally for academic staff. As a further contribution, three positions to enhance staff diversity were funded by the Rector's Strategic Fund in 2016. Close monitoring of staff diversity against the Faculty's staff equity plan will continue in 2017.

Enhancing our social impact

The Faculty of Science endeavours to provide strategic community-based support through its research and teaching programmes. One example of this is research by the Department of Botany and Zoology on the poor genetic diversity and dwindling numbers of great white sharks along the South African coastline, which received widespread national and international media coverage.

The Department of Science and Technology (DST)/National Research Foundation (NRF) Centre of Excellence for Invasion Biology (C-I-B), in turn, contributed to a landmark report about the challenges facing the Cape floral region over the next century. This research programme constitutes the longest history of concerted scientific effort aimed at the conservation of an entire region and its vegetation and animals anywhere in the world.

As their contribution to social impact, researchers from the DST/NRF South African Centre for Epidemiological Modelling and Analysis hosted an NRF Science for Society lecture on World Aids Day. The lecture, which dealt with ways in which to end the HIV/Aids epidemic in the country, was broadcast live on SAFM.

In addition, the success of the Department of Chemistry and Polymer Science's outreach initiative has seen the project being extended to include the Department of Physics. Researchers



Dr Sara Andreotti (top) of Botany and Zoology collected 302 genetic biopsies and over 5 000 photographs of the dorsal fins of great white sharks for her doctoral research. She collaborated with well-known shark conservationist Mike Rutzen to track down the sharks along the South African coastline. Photos: Götz Froeschke and Elsa Hoffman.

also participated in various science communication activities to facilitate public understanding of the role of science and research in society.

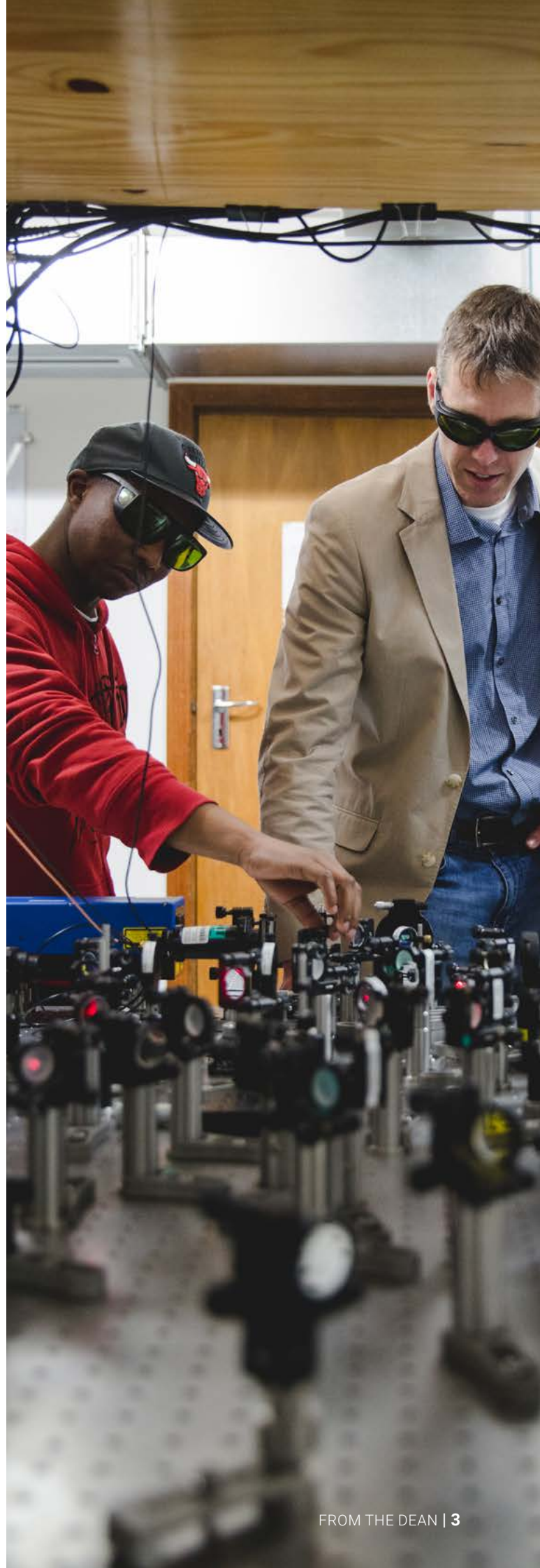
Looking forward

With Vision 2030 in mind, the Faculty will continue its efforts in 2017 and beyond to deliver innovative, critical thinkers who are able to play an active role in the development of a successful, multicultural South African society.

L W Warnich

Prof. Louise Warnich

Dean: Faculty of Science
Stellenbosch University





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DEPARTMENT OF BIOCHEMISTRY

Our research is positioned at the intersection of chemistry and biology, moving from molecular structures via macro-molecular activity to biological function.

Research topics range from applied studies in waste water treatment, potato virus spread, contraceptives, drug discovery and malaria to fundamental work in systems biology and P450 function.

“Early botanists originally believed that all Africa’s plants originated from Europe. But since the advent of DNA sequencing techniques, it has been shown that migration has taken place in both directions.”

RESEARCH HIGHLIGHTS

One *Erica* species colonised the Cape 10 to 15 million years ago

Prof D Bellstedt’s publication on the phylogenetic relationships in the biggest genus of plants in the Cape fynbos region, the genus *Erica*, is the largest phylogenetic analysis to be performed thus far on any genus of plants in South Africa:

Pirie, M. D. , E. G. H. Oliver, L. Mugabri De Kuppler, N. C. Le Maitre, and D. U. Bellstedt (2016) The biodiversity hotspot as an evolutionary hot-bed: spectacular radiation of *Erica* in the Cape Floristic Region. *BMC Evolutionary Biology* 16: 190, 11 pages.

Their research shows conclusively that the diversity of *Erica* species in the CFR is the result of a single radiation within the last 15 million years. The rate of speciation accelerated across Africa and Madagascar, with a further burst of speciation when it reached the Cape. There are only 170 *Erica* species in the rest of the world, compared to 690 species endemic to the Cape.

Early botanists originally believed that all Africa’s plants originated from Europe. But since the advent of DNA sequencing techniques, it has been shown that migration has taken place in both directions. *Proteas* also originated in the North, but other fynbos groups, such as *Disa* and *Pentameris*, the families *Iridaceae* and *Restionaceae*, all migrated from the south to the north.

Prof. Bellstedt, Dr Mike Pirie and Dr. Ted Oliver from Stellenbosch University planned and designed the research project. Dr Oliver, regarded as a world expert on *Erica* taxonomy, identified the different species collected from Europe, Africa, Madagascar, the Indian Ocean islands, the Drakensberg Mountains and the Cape. PhD student Nicolas le Maitre performed the bulk of the DNA sequencing at SU, whilst Dr Mugabri de Kuppler performed the rest in Germany. Dr M Kandziora, a postdoctoral fellow at the Institut für Spezielle Botanik und Botanischer Garten at the Johannes Gutenberg-Universität in Mainz, Germany, used some of the most recently developed analysis methodologies to perform the phylogenetic and speciation rate analyses on the DNA sequence data.

The research was largely funded by the South African National Research Foundation and grants from SU and the Deutsche Forschungs Gemeinschaft.

New research grant: Red pigment formation in *Ericas*

Prof D Bellstedt is exploring a new research area funded by an NRF grant from the Competitive Program for Rated Researchers entitled ‘The Development and Evolution of Anthocyanin production in the genus *Erica*’ from 2016 to 2018. This research is aimed at analysing the expression of the genes



of anthocyanin synthesis enzymes in relation to red anthocyanin pigment formation in the plant genus *Erica*. Red flowers in this genus attract birds as pollinators which holds significant evolutionary advantages for red flowered species in comparison to the more common pink and white flowered insect pollinated species. This project follows on a very successful project in which the relationships of the 850 species of *Erica* were determined and of which 650 occur in the fynbos biome of South Africa.



“A simulation database was added to the JWS Online simulator. This database allows for one-click reproduction of figures in scientific journals, and is part of a larger project.”

Publishing reproducible model simulations

Prof Johan Rohwer

A simulation database was added to the JWS Online simulator. This database allows for one-click reproduction of figures in scientific journals, and is part of a larger project: ‘How to publish reproducible model simulations’.

The simulation database stores curated SED-ML archives that contain links to mathematical models, links to experimental data, and simulation instructions for the mathematical model. Upon selecting a simulation in the database (which could be a simple click on a URL), the model is simulated according to the instructions, and the result plotted together with the experimental data.

The initiative is linked to a number of systems biology journals, e.g. *Molecular Systems Biology* and *FEBSJ*. The work is published in *Bioinformatics* (doi: 10.1093/bioinformatics/btw831) and was presented in an oral contribution at the Combine 2016 meeting which took place from 19 to 23 September in Newcastle, United Kingdom.

The work is part of the FAIRDOM project and done in a collaboration with Prof Dagmar Waltemath’s group at the University of Rostock, Germany, and performed together with Martin Peters who worked for six months on the SARCHI project of Prof Snoep and Dr van Niekerk.

The FAIRDOM Hub is a web-accessible registry for storing, sharing and publishing research assets of biology projects. The assets include FAIR (Findable, Accessible, Interoperable and Reusable) Data, Operating procedures and Models (DOM). It enables researchers to organise, share and publish data, models and protocols, interlink them in the context of the biology investigations that produced them, and to interrogate them via API interfaces.

New research grant for study on progestins and female reproductive health

Dr Donita Africander has received a National Institute of Health sub-award, which forms part of the original award to her collaborator, Prof Janet Hapgood at UCT. The funding is for a project entitled 'Combination treatment for protection against HIV1 and pregnancy' which investigates the effects of progestins used in contraception, and/or their metabolites, on the expression of specific clinical biomarkers, and whether these effects are reversible with estrogen replacement. The role of different steroid receptors and different concentrations of these receptors will also be investigated.

Epigenomic map of *Trypanosoma brucei* reveals new drug targets for epigenetic therapies

Prof Hugh Patterton

We have completed the genome-wide mapping of nucleosome positions in both the human and insect life-cycle stage of *Trypanosoma brucei*, the dioxenous parasite that causes human African trypanosomiasis. We have shown that, unlike in other studied eukaryotes, the region where polymerase II initiated upstream of the polycistronic transcription units, were not depleted of nucleosomes, suggesting a scattered assembly of the pre-initiation complex in the region.

We have also shown that the silent Variable Surface Glycoprotein (VSG) cassette, encoding thousands of divergent cell surface VSG proteins involved in the continual escape of the parasite from the mammalian immune system, was bordered by highly regular, extensive nucleosomal arrays. We proposed that these arrays contributed to limiting cryptic transcription initiation that would be lethal to the trypanosome. We have completed the study of epigenetic modifications of the highly divergent histone H3 N-terminal tail, and are currently looking at the genomic distribution of novel modifications and their role in the regulation of DNA function.

RESEARCH PROFILE

Research output

A 2014 paper co-authored by Prof Johann Rohwer in collaboration with the Gershenson group reached 32 citations:

Wright, L. P. ; Rohwer, J. M. ; Ghirardo, A. ; Hammerbacher, A. ; Ortiz-Alcaide, M. ; Raguschke, B. ; Schnitzler, J. ; rg Peter, Gershenson, J. & Phillips, M. A. Deoxyxylulose 5-phosphate synthase controls flux through the methylerythritol 4-phosphate pathway in Arabidopsis, *Plant Physiol.* , 2014, 165, 1488-1504 (IF 6. 28)

Overview of research groups

Dr Donita Africander

Gene regulation, Steroid receptors, Progestins, Bioidentical hormones, Immune function and Breast cancer.

Prof Dirk Bellstedt

Investigations into the evolution of viruses and bacterial pathogens of potatoes and fruit trees and their detection; plant molecular systematic and evolutionary studies of plant groups that occur in southern Africa focusing on the Cape Floral Region; development of DNA vaccines against ostrich mycoplasmas and fish phylogenetics

Dr Annelise Botes

Ostrich pathogens and vaccine development.

Dr Marianne de Villiers

Chemical Biology, Antimalarial drug design and discovery, Antimicrobial metabolism

Prof Jannie Hofmeyr

Studying the regulatory design of cellular processes using control analysis and computational analysis of kinetic models, Enzyme kinetics for systems biology, Living Cell Theory and Code Biology.

Prof Ann Louw

Steroid receptor signal transduction; steroid-binding globulins; phytosteroids from *Cyclopia* (honey bush tea) and *Sal-sola tuberculatiformis Botch.* (Gannabos); phytoestrogens; dissociated glucocorticoids.

Prof Hugh Patterton

The role of chromatin structure in DNA function on a genome wide scale, and the development of bioinformatics tools to study such epigenomic questions

Prof Marina Rautenbach

Peptide chemistry; Structural biophysics; Antimicrobial peptides as biocides and antibiotics

Prof Johann Rohwer

Enzyme kinetics for systems biology with NMR spectroscopy; Kinetic modelling of energy and redox metabolism in microorganisms and plants, and of glucocorticoid receptor signalling in mammalian cells; Flux and control analysis of plant secondary metabolism; Development of computational tools for model analysis

Prof Jacky Snoep

Mechanistic modelling of pathophysiology of important South African diseases, including glucose metabolism in malaria patients, cholesterol and CoA metabolism of *Mycobacterium tuberculosis*, immune response during HIV infection, insulin signalling and glucose metabolism in muscle cells with a focus on insulin resistance and Type II diabetes

Dr Karl-Heinz Storbeck

Steroid hormones in health and disease

Prof Erick Strauss

Chemical biology; Mechanistic enzymology; Antimicrobial drug design and discovery; Biocatalysis

Prof Amanda Swart

Adrenal steroidogenesis, cytochrome P450 enzymes, prostate cancer, and natural plant products: *Aspalatus linearis* (Rooibos), *Salsola tuberculiformis* Botch. (Gannabos) and *Sutherlandia frutescens* (Cancer bush)

Prof Pieter Swart

Molecular and cellular steroidogenesis; Membrane applications for the monitoring and improvement of water quality

Dr Dawie van Niekerk

Mathematical and Computational Systems Biology; Dynamical Systems and Pharmacometrics

Dr Nicky Verhoog

Steroid receptor signalling, gene regulation, cross-talk between glucocorticoids and inflammatory mediators

NRF-rated researchers

NRF-rated researchers	
Internationally acclaimed researchers	
Prof HG Patterson	chromatin structure in DNA and development of bioinformatic tools
Prof Jacky Snoep	computational systems biology
Prof Erick Strauss	mechanistic enzymology and inhibitor development
Prof Johann Rohwer	computational systems biology
Prof Amanda Swart	bioactivity of rooibos and <i>Sutherlandia frutescens</i>
Prof Pieter Swart	adrenal steroidogenesis, affinity separation and protein immobilisation
Established researchers	
Prof Dirk Bellstedt	molecular systematics and immunology
Prof Ann Louw	steroid receptors, bioactivity of honeybush
Prof Marina Rautenbach	antimicrobial peptides
Promising Young Researcher	
Dr MD Pirie	plant molecular systematics
Dr Marianne de Villiers	chemical biology
Dr Karl-Heinz Storbeck	steroid hormones and castration resistant prostate cancer

COLLABORATION

Dr Donita Africander

- Holds a collaborative postgraduate research grant from the National Research Foundation (NRF) with Prof Janet Hapgood at the University of Cape Town.

Prof Dirk Bellstedt

- Dr Christoph Lacomme, Science and Advice for Scottish Agriculture (SASA) Edinburgh, Scotland.
- A long standing collaboration with Dr Michael Moeller and Dr Mark Hughes, Royal Botanic Garden Edinburgh, Scotland again led to publication in botanical systematics.
- Collaborated with the botanical researchers, Dr Gudrun Kadereit, Dr Mike Pirie and Prof Regine Claßen-Bockhoff at the Johannes Gutenberg University of Mainz, Germany, and Dr Ulrich Schliwen, Department of Ichthyology, The Bavarian State Collection of Zoology, Munich, Germany, as part of a VW Foundation funded project.

Project: Exploiting the Genomic Record of Living Biota to Reconstruct the Landscape Evolution of South Central Africa.

Dr Annelise Botes

- Ongoing collaboration with Dr Adriaan Olivier, industry veterinarian at Klein Karoo International.
- A new collaborative project was initiated involving the microbiome analysis of the gut of ostrich chicks. The aim is to determine changes in this microbiome in relation to environment and feeding strategies which will allow the industry to pro-actively establish processes of dietary inter-

vention and husbandry practices to control and prevent gastro intestinal tract infections.

Prof Ann Louw

- Ongoing collaboration with Prof Lizette Joubert, Post-Harvest and Wine Technology Division, Agricultural Research Council (ARC) Infruitec-Nietvoorbij.
- Ongoing collaboration with Prof Günter Vollmer, Professur für Molekulare Zellphysiologie und Endokrinologie, Fachrichtung Biologie, Technische Universität Dresden, Germany.

Prof HG Patterton

- Part of the H3A Bioinformatics Network consortium.
- Collaborates with Dr David Clark, senior investigator in the section on chromatin and gene expression, National Institutes of Health, United States of America.
- Collaborates with Prof Gloria Rudenko, Imperial College London, United Kingdom.
- Prof Megan Pavolones, Pennsylvania State University, United States of America.

Prof Marina Rautenbach

- Ongoing collaborative research on the structural analyses of antimicrobial peptides in materials and membranes with the group of Prof Burkhard Bechinger, University of Strasbourg. Dr. Arnold Vosloo (post-doctoral fellow) and Wilma van Rensburg (PhD student) joined the group of Prof Burkhard Bechinger at University of Strasbourg for two month long research visits during 2016. In turn two group members from Strasbourg, Dr. Dennis Juhl and Prof Burkhard Bechinger came for research visits to Stellenbosch and worked with members of the BIOPEP® group on a collaborative project.
- Research visit to Dr Margitta Dathe at Leipzig Institute of Molecular Pharmacology, Berlin, Germany, as part of a long term collaborative project.

Project: Membrane interaction of antimicrobial peptides

- A new collaboration was fortified during a visit to Dr Michaela Wenzel at the Swammerdam Institute for Life Sciences, University of Amsterdam during September 2016.

Prof Johann Rohwer

- Long-standing collaboration with Dr Che Pillay, School of Life Sciences, University of KwaZulu-Natal (UKZN).

Project: Modelling of cellular redoxin networks

- Collaborates with Prof Jonathan Gershenzon from the Max Planck Institute for Chemical Ecology in Jena (Germany).

Project: Flux and control analysis of isoprene synthesis in plants

- Dr Stefan Jennewein from the Fraunhofer Institute for Molecular Biology and Applied Ecology in Aachen (Germany).

Project: Flux and control analysis of isoprene synthesis in E. coli.

Dr Karl-Heinz Storbeck

- Ongoing collaborations with the groups of Prof Wiebke Arlt at Institute of Metabolism and Systems Research (IMSR) at the University of Birmingham, United Kingdom.
- Ongoing collaboration with Prof Elahe Mostaghel at the Fred Hutchinson Cancer Research Center in Seattle, USA, and Prof Janet Hapgood at the University of Cape Town.
- Collaborated with Prof Nils Krone from the University of Sheffield, United Kingdom.

Prof Erick Strauss

- Continued a long and fruitful collaboration with Prof Kevin Saliba at the Australian National University (ANU) in Canberra, Australia.

Project: Development of new antiplasmodial agents that target vitamin pathways

- Collaborated with Dr Marco Moracci of the Institute of Biosciences and BioResources of the Italian CNR (National Research Centre) in Naples, Italy, who served as Cosupervisor of PhD student Ms Ndivhuwo Muneri.
- A recently initiated collaboration with Prof Hee-Won Park from Tulane University in the USA led to a co-authored publication.

Prof Amanda Swart

- Collaborated with Prof Constantine Stratakis, Scientific Director of the NIH Eunice Kennedy Shriver National Institute of Child Health and Human Development (2015 and 2016).

Prof Jacky Snoep and Dr Dawie van Niekerk

- Collaborators in the FAIRDOM project (BBSRC (UK), BMBF (DE), SystemsX (CH), NWO (NL) funded), with principal investigators C. Goble (UMAN), J. L. Snoep (UMAN, US), W. Mueller (HITS), B. Rinn (ETH).

Collaboration summary

South Africa

- Agricultural Research Centre (ARC) Infruitec-Nietvoorbij, Post-Harvest and Wine Technology Division, Prof Lizette Joubert
- HealthQ Pty Ltd
- Klein Karoo International, Dr. Adriaan Olivier
- Stellenbosch University, Department of Physiological Sciences, Prof F. Essop
- Stellenbosch University, Department of Physiological Sciences, Prof K Myburgh
- Stellenbosch University, Desmond Tutu TB Centre, Prof A. Hesselting
- University of Cape Town, Prof Janet Hapgood
- University of Cape Town, Molecular Mycobacteriology Research Unit, Prof V. Mizrahi

- University of Cape Town, PK Research Laboratory, Lubbe Wiesner
- University of KwaZulu-Natal, School of Life Sciences, Dr Che Pillay

International

France

- University of Strasbourg, Prof Burkhard Bechinger

Germany

- Fraunhofer Institute for Molecular Biology and Applied Ecology, Dr Stefan Jennewein
- Leipzig Institute of Molecular Pharmacology, Dr. Margitta Dathe
- Johannes Gutenberg University, Dr Gudrun Kadereit, Dr Mike Pirie and Prof Regine Claßen-Bockhoff
- The Bavarian State Collection of Zoology, Dr Ulrich Schliewen
- Max Planck Institute for Chemical Ecology, Prof Jonathan Gershenzon
- University of Duisberg-Essen, Prof B. Siebers
- Rostock University, Prof D. Waltemath
- Technische Universität Dresden, Prof Günter Vollmer
- University of Strasbourg, Prof Burkhard Bechinger
- VW Foundation

Italy

- Institute of Biosciences and BioResources, CNR, Naples

The Netherlands

- University of Amsterdam, Swammerdam Institute for Life Sciences, Dr. Michaela Wenzel
- VU Amsterdam, Prof H. V. Westerhoff
- Groningen, Prof B. Bakker
- Groningen, Prof O. Sibon

New Zealand

- University of Auckland, Prof P. Hunter

Sweden

- University of Gothenburg, Prof M. Goksor
- University of Linköping, Prof G. Cedersund

United Kingdom

- University of Birmingham, Institute of Metabolism and Systems Research (IMSR), Prof Wiebke Art
- University of Sheffield, Prof Nils Krone

Scotland

- Edinburgh, Science and Advice for Scottish Agriculture (SASA), Dr Christoph Lacomme
- Edinburgh, Royal Botanic Garden Edinburgh, Dr Michael Moeller and Dr Mark Hughes

United States of America

- National Institutes of Health (NIH) Eunice Kennedy Shriver National Institute of Child Health and Human Development, Prof Constantine Stratakis
- National Institutes of Health (NIH), Human Heredity and Health in Africa (H3Africa)
- National Institutes of Health (NIH), H3ABioNet (African bio-informatics network)
- Fred Hutchinson Cancer Research Center, Prof Elahe Mostaghel
- Tulane University, Prof Hee-Won Park

ACADEMIC ACTIVITIES

Dr Donita Africander

- Presented a keynote lecture at the SASBMB congress held in East London and chaired the session on non-communicable disease (cancer).
- Her PhD student, Ms Meghan Perkins and postdoctoral fellow, Dr Renate Louw-du Toit, both presented short talks at the SASBMB congress, while PhD student Ms Easter Ndlovu, and MSc students Ms Meghan Cartwright and Ms Angelique Cabral presented posters.
- PhD student Ms Meghan Perkins also presented a poster at the FASEB Cell Signalling in Cancer: From Mechanisms to Therapy conference held in Snowmass, Colorado, USA.

Dr Annelise Botes

- Presented a lecture entitled 'Evaluation of a DNA-vaccine against mycoplasma infections in ostriches' at the sixth International Ratite Symposium which took place from 6 to 7 July 2016 at Stellenbosch.

Prof Dirk Bellstedt

- Gave an oral presentation at the 16th Meeting of European Association of Potato Research Virology Section combined with the eighth Meeting of Potato Virus Wide organization, Slovenia, 31 May to 3 June 2016.

Dr Marianne de Villiers

- Attended and presented an oral presentation at the FEBS Workshop on Coenzyme A and its derivatives in health and disease held in Marseille, France.
- Attended and presented an oral presentation at the third H-3D International Symposium Congress held at Goudini, South Africa.
- Received her first NRF rating as a Y2 scientist.

Prof Jannie Hofmeyr

- The status of NRF Flagship Initiative was awarded to the Centre for the Study of Complex Systems in Transitions, of which Prof Jannie Hofmeyr is the co-director.
- Elected to the Council of the Royal Society of South Africa.

Prof Ann Louw

- Published a proof of concept paper 'Honey bush tea and prevention of breast cancer', demonstrating the potential of an extract from honey bush tea (*Cyclopia*) to retard the development of chemically induced breast cancer in rats in the *Journal of Steroid Biochemistry and Molecular Biology* (2015) 63, 129-135.

Prof Hugh Patterton

- Attended the Gordon Research Conference on Chromatin Structure and Function, Les Diablerets, Switzerland. One of his PhD students, JP Maree, presented an invited talk at this conference.
- Initiated the purchase of a fast protein liquid chromatography (FPLC) unit that will be used for the efficient and reproducible purification of recombinant proteins and isolation of proteins and protein complexes from cells and tissues.

Prof Marina Rautenbach

- Presented two posters on antimicrobial peptide research at the sixth International Meeting on Antimicrobial Peptides (IMAP2016) in Leipzig, Germany.
- Postdoctoral fellow Dr Arnold Vosloo presented a poster on his research in June 2016 at the 15th Naples Workshop on Bioactive Peptides in Italy.
- MSc student Simon Berge presented his research at the SASBMB conference in East London (July 2016), South Africa and won the second price for a poster presentation in Biotechnology.

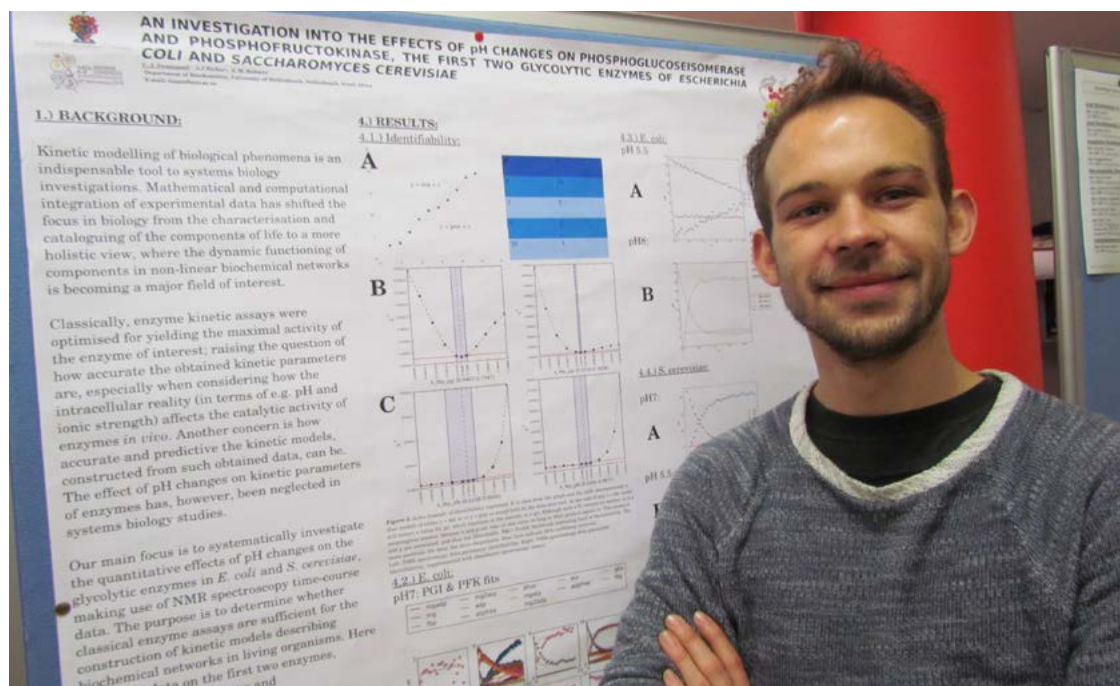
- Dr Vosloo and PhD students Wilma van Rensburg presented their research at the University of Strasbourg during November 2016.

Prof Johann Rohwer

- Spent a six month sabbatical visiting the Max Planck Institute for Chemical Ecology in Jena (Germany) to collaborate with Prof Jonathan Gershenzon and Dr Louwance Wright on metabolic flux and control analysis of the pathway of isoprene synthesis in plants.
- Gave an oral presentation at the 17th International Conference on Systems Biology, held in Barcelona, presenting his work on modelling the glucocorticoid receptor, and a poster presentation at the 17th Meeting of the International Study Group for Systems Biology, held in Jena, also presenting the glucocorticoid receptor work.
- Prof Rohwer's MSc student, Tiaan Swanepoel, presented a poster at the 25th Congress of the South African Society of Biochemistry and Molecular Biology, held in East London. His research focuses on the effects of pH on the kinetics of enzymes, and his poster received the best presentation award in the category proteins and enzymology.

Prof Jacky Snoep and Dr Dawie van Niekerk

- MSc student Kathleen Green worked for a two month period at the Bioengineering Institute of the University of Auckland in the group of Prof Peter Hunter.
- MSc student Lené Oosthuizen followed a six month bilateral exchange program with Ghent University, Belgium.
- Co-authored two oral contributions to the International Study Group on Systems Biology (ISGSB 2016) which took place from 5 to 7 October, Jena, Germany. The titles were 'Estimation of merozoite release quantity during growth of *Plasmodium falciparum* in red blood cell cultures', presented by MSc student Lené Oosthuizen, and 'Understanding dis-



MSc student Tiaan Swanepoel's poster received a best presentation award at the Congress of the South African Society of Biochemistry and Molecular Biology.

ease and drug-effects at the whole body level in malaria patients', presented by Prof Snoep. Two of their PhD students, Cobus van Dyk, and Dr van Niekerk himself, presented two posters at the same meeting.

- Prof Snoep received a B1 NRF evaluation (2016-2021) in Computational Systems Biology.

Prof Erick Strauss

- Together with his collaborator Prof Ody Sibon at the University of Groningen in the Netherlands, Prof Strauss was invited to contribute a comment article to the journal *Nature Reviews Molecular Cell Biology* to discuss the current state of our understanding of the various ways in which organisms can obtain coenzyme A (CoA). This invitation came in light of various recent findings (including ones made by the Sibon and Strauss labs) that have challenged the current paradigm concerning CoA biosynthesis.
- Invited speaker at the workshop of the Federation of European Biochemical Societies (FEBS) on 'Coenzyme A and its derivatives in Health and Disease' held at the *Institut de neurobiology de la méditerranée* (INMED), Marseille, France from 23-26 August 2016. At this meeting he and Dr Marianne de Villiers made a successful bid to host the next conference in this series at Stellenbosch in 2018. INMED is one of the most important neuroscience centres from INSERM and the University of Aix-Marseille in France, whose scientific activity focuses on brain development and plasticity and related neurological pathologies.

Dr Karl Storbeck

- Dr Storbeck and his PhD student, Jonathan Quanson, attended the 17th Congress on the Adrenal Cortex in Boston, Massachusetts, USA (29-31 March 2016) where they both presented posters. Mr Quanson received a New Investigator Award for his poster presentation.
- Dr Storbeck was invited to present talks at the Society for Endocrinology, Metabolism and Diabetes of South Africa, Cape Town 14-17 April 2016.
- Invited talk at the 25th congress of the South African Society of Biochemistry and Molecular Biology, East London South Africa, 10-13 July, 2016.
- Invited talk at a ChromSA meeting hosted by the CSIR, Johannesburg, South Africa on 18 May 2016.

Prof Amanda Swart

- Invited plenary speaker at the XV11th Adrenal Cortex Conference, Boston, Massachusetts, USA, 29 March-1 April 2016.
- Invited plenary speaker at the annual conference of the South African Society for Biochemistry and Molecular Biology (SASBMB XXV) that took place from 10 to 13 July in East London, South Africa and served as session chair.
- Invited talk at the Society for Endocrinology, Metabolism and Diabetes of South Africa, Cape Town 14 -17 April 2016.

Dr Nicky Verhoog

- Oral presentation at the 25th SASBMB Congress, East London entitled, 'A link between receptor dimerization and ligand-induced GR down-regulation?'

ACADEMIC AFFAIRS

The department successfully offered practical laboratory training to 660 second-year Biochemistry students, a feat that could only be achieved by repeating practical sessions seven times per week.

Prof Johann Rohwer published an article in SU's pamphlet on blended learning case studies, focussing on the application of clicker technology for formative assessment in third year undergraduate biochemistry courses.

In 2016 the Department again had a large cohort of 103 full-time postgraduate students and 15 postdoctoral fellows. Since 2013, there has been a steady increase in postgraduate student numbers on Honours, Masters and PhD-level.

At the 2016 graduation ceremonies 21 Honours, 11 MSc and five PhD students graduated successfully.

SERVICE TO THE SCIENTIFIC COMMUNITY

Dr Donita Africander

- Outgoing treasurer on the council of the South African Society for Biochemistry and Molecular Biology (SASBMB).

Dr Africander, Prof Ann Louw, Dr Karl-Heinz Storbeck, Prof Amanda and Pieter Swart

- Serving as members of the organizing committee for the 17th International Congress on Hormonal Steroids and Hormones and Cancer and made a successful bid to host the next conference in this series at Stellenbosch in 2018.

Prof Dirk Bellstedt

- Served as the Secretary General of the AETFAT Organization (*Association pour l'Etude Taxonomique de la Flore d'Afrique Tropicale*), or The Association for Taxonomic Study of the Flora of Tropical Africa.

Prof Ann Louw

- Serves as an editorial board member of the journals *Steroids*.

Prof Johann Rohwer

- Member of the International Advisory Board for the 17th Workshop of the International Study Group for Systems Biology.
- Member of international STRENDA (Standards for Reporting Enzymology Data) Commission and served as External examiner PhD (University of the Free State). He currently serves as Associate Editor: *BMC Systems Biology* and

review editor for *Frontiers in Plant Science* (section *Plant Systems Biology*).

Prof Marina Rautenbach

- Editorial board member of the *Journal of Microbiological Methods*.
- Editorial board review editor for *Frontiers in Chemistry and Molecular Biosciences* (Chemical Biology).
- Served on the panel for external evaluation for the BSc Honours Biochemistry program at the North West University.
- Acted as external examiner for the third year and Honours Biochemistry courses of Nelson Mandela Metropolitan University.
- External examiner for the Honours course in Pharmacology at University of Cape Town Medical School.

Prof Jackie Snoep

- Serves on the editorial boards of the *FEBS Journal*, a biweekly peer-reviewed scientific journal published by Wiley on behalf of the Federation of European Biochemical Societies.
- Serves on the editorial board of *IET Systems Biology, Microbiology and Metabolomics*.

Dr Karl-Heinz Storbeck

- Served as the treasurer of the South African Society of Biochemistry and Molecular Biology (SASBMB).
- Served as an invited member of the Brownie and Schimmer New Investigator Awards Committee at the XV11th Adrenal Cortex Conference, Boston, Massachusetts, USA, 29 March - 1 April 2016.
- Chaired a session at the 25th congress of the South African Society of Biochemistry and Molecular Biology, East London South Africa, 10-13 July, 2016.

Prof Erick Strauss

- Served on the NRF Rating Assessment Panel for Biochemistry, Molecular and Cell Biology.
- Invited to join the editorial advisory board of the journal *ACS* (American Chemical Society) *Infectious Diseases* for a two year term starting 2017.
- Served as external moderator for a second year module in Molecular and Cell Biology at UCT.

Prof Amanda Swart

- Served on the advisory committee for the Keith Parker Memorial Lecture at the XV11th Adrenal Cortex Conference, Boston, Massachusetts, USA, 29 March-1 April 2016.
- Session chair at the SASBMB XXV 10 - 13 July, 2016 East London, SA.
- Editorial board member (2014 to present) for *Scientific Reports*, a journal from the Nature Publishing Group.
- External moderator for the final year Biochemistry first and second semester modules for the University of Pretoria.

Dr Nicky Verhoog

- Elected as a council member of the South African Society for Molecular Biology (SASMB).

AWARDS TO STAFF AND STUDENTS

Dr Karl-Heinz Storbeck was awarded the South African Society for Biochemistry and Molecular Biology's (SASBMB) Silver award. The award is made biennially to a researcher 35 years or younger that has displayed a record of national and international research excellence.



Dr Storbeck was also awarded a Newton Advanced Fellowship from the Academy of Medical Sciences in the United Kingdom. This prestigious award is aimed at providing international researchers from selected countries with an opportunity to develop the research strengths and capabilities of their research group through training, collaboration, and reciprocal visits with a partner in the UK. Dr Storbeck's UK host is Prof Wiebke Art, who is the head of the Institute of Metabolism and Systems Research (IMSR) at the University of Birmingham.

Prof Johann Rohwer was the recipient of a Research Fellowship from the Alexander von Humboldt Foundation, as well as an Overseas Sabbatical Grant from the Oppenheimer Memorial Trust to spend a six month sabbatical in Germany.

Dr Marianne de Villiers received a Biochemical Society Travel Award and a Early Career Researcher funding (Stellenbosch University Division for Research Development) to attend the FEBS Workshop on Coenzyme A and its derivatives in health and disease held in Marseille (France).

FUNDING

National

- Biochemical Society Travel Award
- Cancer Association of South Africa (CANSA)
- Early Career Researcher funding (Stellenbosch University Division for Research Development)
- Medical Research Council (MRC)
- National Research Foundation (NRF)
- Oppenheimer Memorial Trust
- Potatoes South Africa
- SA Rooibos Council
- South African DST/NRF Centre of Excellence for Epidemiological Modelling and Analysis (SACEMA)
- SARCHI research chair Mechanistic modelling of health and epidemiology
- Stellenbosch University

International

- FAIRDOM grant, BBSRC, United Kingdom
- Newton Fund
- National Institutes of Health (NIH)
- National Institutes of Health, Human Heredity and Health in Africa (H3Africa)
- National Institutes of Health, H3ABioNet (African bioinformatics network)
- Alexander von Humboldt Foundation, Germany
- Volkswagen Foundation, Germany
- SA-France Bilateral Protea Grant

SOCIAL IMPACT

The department participated in the annual SU Open Day on 27 February 2016 as well as the Maties Science Winter Week during the June recess.

STAFF MATTERS

Dr Nicky Verhoog was appointed as a lecturer. At the end of 2016 Prof Pieter Swart, professor and vice-dean research, retired after 42 years of service. Coral de Villiers, technical officer in Prof D Bellstedt's lab, also retired after 39 years of service.

Staff list:

Academic

- Dr DJ Africander
- Prof DU Bellstedt
- Dr A Botes
- Dr M de Villiers
- Prof J-HS Hofmeyr
- Prof A Louw

- Prof HG Patterton
- Prof M Rautenbach
- Prof JM Rohwer (Head of department)
- Prof JL Snoep
- Dr K Storbeck
- Prof E Strauss
- Prof AC Swart
- Prof P Swart (Vice-Dean: Research)
- Dr MA Stander
- Dr DD van Niekerk
- Dr NJD Verhoog

Extraordinary professors

- Prof WCA Gelderbloem

Support staff

- Ms W Maart (Secretary)
- Mr AP Arends
- Mr KD Botha
- Mr R Brandt
- Mrs H Bredell
- Mrs CA de Villiers
- Mrs L du Toit
- Dr Y Engelbrecht
- Mrs AP Februarie
- Mrs GD Gerstner
- Mr CR Jansen
- Mrs C Langeveldt
- Ms RP Louw

Research associates

- Dr MD Pirie

Postdoctoral fellows

- Dr L Barnard
- Dr LM Bloem
- Dr C Christensen
- Dr JJ Eicher
- Dr R Goosen
- Dr L Koekemoer
- Dr T Kouril
- Dr T Little
- Dr R Louw-Du Toit
- Dr TU Magcwebaba
- Dr WJA Moolman
- Dr OR Oyenihi
- Dr A Schenkmyerova
- Dr NJD Verhoog
- Dr JA Vosloo

DEPARTMENT OF BOTANY AND ZOOLOGY

The Department of Botany and Zoology is a leader in the field of evolutionary biology, with a specific focus on the unique opportunities offered by Africa's biodiversity.

“Lizards rely on external heat sources, for example sunlight or warm rock surfaces, to keep their body temperature at levels suitable for functions such as mating and hunting prey. This makes them particularly sensitive to changes in their surrounding habitat.”

RESEARCH INTERESTS

- Biotic diversity and Ecology of the Cape Region and its coastline
- Systematics and Molecular Ecology
- Evolutionary ecology
- Nutritional plant physiology and Medicinal Plant Biology
- Global change biology

RESEARCH HIGHLIGHTS

Global change biology: Effects of invasive alien pine trees on lizard communities in fynbos

Invasions by alien pine trees (*Pinus* spp.) can have a negative impact on native lizard species by changing their native habitat, according to a recent C-I-B study published in the journal *Oecologia*.

The research, conducted by former C-I-B student Elsje Schreuder and C-I-B core team member Dr Susana Clusella-Trullas, found that pine plantations and native fynbos vegetation invaded by dense stands of pine trees had fewer lizard species and less individuals when compared to fynbos habitats.

Lizards rely on external heat sources, for example sunlight or warm rock surfaces, to keep their body temperature at levels suitable for functions such as mating and hunting prey. This makes them particularly sensitive to changes in their surrounding habitat. For example, a reduction in the availability of 'warm' and 'cool' microsites or changes in the configuration of these thermal opportunities can impair the maintenance of preferred body temperatures. These changes can readily translate into periods of body temperatures that fall outside an optimal range, imposing restrictions on activities such as mating, reproducing and feeding. This study aimed to test the effects of pine invasions on native fynbos thermal landscapes and how these effects can alter lizard communities. The authors found that pine tree invasions have an impact on lizard communities both through temperature changes and through availability of resources. These effects were shown to change drastically among sites and seasons and therefore, long-term examinations are needed to obtain a complete picture of impacts of alien plants on reptile communities.



Male Southern rock agama (*Agama atra*) basking on a rock. Photo: Elsje Schreuder



Cape dwarf chameleon (*Bradypodion pumilum*) Photo: Elsje Schreuder

New study empirically demonstrate daisies' risk reducing strategies

Dr Caroli De Waal and Profs Bruce Anderson and Allan Ellis investigated trade-offs in risk-reducing strategies (dormancy and dispersal) in plants. The study, published in the journal *New Phytologist*, is one of the first studies to empirically demonstrate risk reducing strategies of daisies at three different levels of biological diversification.



Different daisy seeds represent different dispersal strategies.

Biotic diversity and ecology of the Cape Region and its coastline

The marine group lead by Drs Carol Simon and Tammy Robinson published several papers dealing with polychaete taxonomy and dispersal, patterns of endemism along the South African coast, ecology of alien barnacles and the use of terminology in marine invasion biology.

With colleagues at the University of Leipzig, Germany, Dr Simon published the first record (confirmed with molecular data) of the genus *Ctenodrilus* in southern Africa. Additionally, work based on student research co-supervised by Prof Conrad Matthee, investigated aspects of dispersal and movement of polychaete pests of aquaculture, including natural dispersal by currents and artificial dispersal mediated by movement of molluscs and or shipping and how this is reflected by population genetics. Work lead by Dr Robinson and done in collaboration with SANBI and the University of Cape Town resulted in a unified terminology for marine invasion biology and the updating of the South African marine alien species lists. This publication was partnered by a review of marine invasion research in the region, enabling the identification of gaps in current knowledge and strategic planning of future research.

Systematics and molecular ecology

New research by postdoctoral fellow, Sara Andreotti in collaboration with Conrad Matthee and Sophie von der Heyden showed that the South African white shark population is in double jeopardy. Not only do these sharks have the lowest genetic diversity of all white shark populations worldwide; there are also only between 353 to 522 individuals left. The findings are based on six years of fieldwork in South Africa's shark mecca, Gansbaai, and along the South African coastline. It represents the largest field research study on South Africa's great white sharks undertaken to date. The results of the study were published in the journal *Marine Ecology Progress Series*.



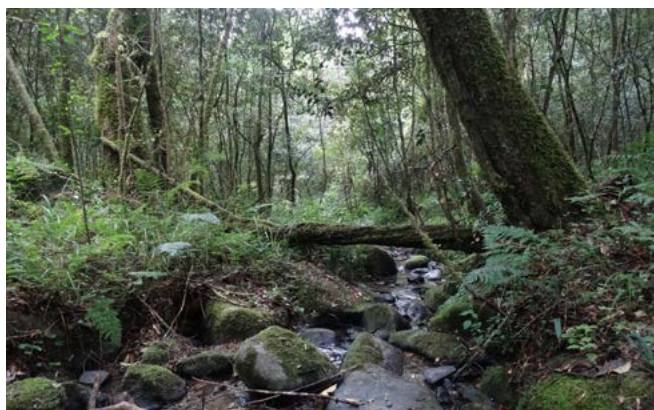
Between 2009 and 2011 researchers collected nearly 5 000 photographs of the dorsal fins of white sharks frequenting Gansbaai and these data was compared to a genetic analyses based on DNA samples from more than 300 individuals. Photo: Götz Froeschke

Major project to investigate unexplored Eastern Cape forests

The systematics and molecular ecology research group received a major biodiversity research grant to investigate forests in the Maputoland-Pondoland-Albany Biodiversity Hotspot.

The primary focus of the programme is to generate, mobilise, co-ordinate and make accessible foundational biodiversity knowledge in line with the needs of society, the Department of Science and Technology (DST) Global Change Programme and the bio-economy. The main approach is to fund large,

collaborative and integrated team projects which align with knowledge needs, or which involve participants along the entire value chain from knowledge generation to application for decision-making.



The Eastern Cape forest project is only the third major grant to be awarded under this programme. The core investigators on the project are Prof Michael Cherry, Prof Nox Makunga, Prof Savel Daniels and Dr Victor Rambau, all from Stellenbosch University.



RESEARCH PROFILE

Research and innovation

During 2016, members associated with the Department of Botany and Zoology published 196 ISI research articles in high-impact journals such as *Science*, *Nature Communications*, *Proceedings of the National Academy of Science*, *Frontiers in Ecology and the Environment*, *Land Degradation and Molecular Ecology*. All these journals ranked in the top 10% of their respective fields.

NRF-rated researchers

NRF-rated researchers	
Leading international researchers	
Prof D Richardson	Biological invasions and conservation biogeography
Prof T Robinson	Evolutionary genetics and phylogenomics of mammals
Prof G Midgley	Ecology and ecophysiology; Global Change ecology
Internationally acclaimed researchers	
Prof B Anderson	Plant-animal interactions
Prof C Matthee	Molecular systematics and phylogeography
Prof M Cherry	Behavioural ecology
Prof A Pauw	Evolutionary ecology of plants and their pollinators
Prof B van Wilgen	Terrestrial ecology

Established researchers	
Prof S Daniels	Molecular systematics, phylogeography and conservation of invertebrata
Prof L Dreyer	Evolution of Cape Flora
Dr N Makunga	Medicinal plant biotechnology
Prof PLN Mouton	Evolutionary ecology of lizards
Dr T Robinson	Drivers, patterns and impacts of marine invasions
Dr C Simon	Marine invertebrate reproduction and polychaete worm taxonomy
Prof A Valentine	molecular physiology of host-microbe interactions of legumes in phosphorus deficient soils
Promising Young Researchers	
Prof S Clusella-Trullas	Thermal adaptation of ectotherms and implications for climate change
Prof A Ellis	Evolutionary ecology of plants and insects
Prof J le Roux	Evolutionary biology and ecology of plant invaders
Prof S von der Heyden	Marine molecular ecology and conservation

COLLABORATION

Prof C Matthee

- Collaborating with prof Dmitry Apanaskevich, Georgia Southern University, USA.
Project: Evolutionary genetics and systematics of ticks
- Dr Leslie Nobel and Dr Catherine Jones, the University of Aberdeen, United Kingdom.
Project: White shark global genetics
- Claudine Montgelard, Centre de Ecologie Fonctionnelle et Evolutive (CEFE), Centre national de la recherche scientifique (CNRS), France.
Project: Rodent evolution and Genetics
- Dr Jessica Light, Wildlife and Fisheries Sciences, Texas A&M University, USA.
Project: Parasite host co-evolution

Dr V Rambau

- Collaborated with Prof Aurora Ruiz-Herrera Moreno, Department Biologia Cel·lular, Fisiologia i Immunologia Facultat de Biociències, Campus de la UAB, Barcelona, Spain.
Project: Impacts of recombination rates on chromosomal speciation of the vlei rat, *Otomys irroratus*.

Prof GJ Measey

- Collaborated with Prof Res Altwegg, Department of Statistical Sciences, University of Cape Town, and Dr David Borchers, School of Mathematics and Statistics, University of St Andrews, Scotland.
Project: Acoustic monitoring
- Collaborated with Prof Ben Evans, Biology Department, McMaster University.
Project: *Xenopus* genetics

Prof A Ellis

- Collaborated with Tommi Nyman, University of East Finland, Finland.
Project: Camouflage-driven diversification of southern Africa's unique lag-gravel biotas
- Collaborated with Beverley Glover, Cambridge University, United Kingdom.
Project: Hotspots of intraspecific diversity: how are morphologically distinct populations generated and maintained within a species?
- Collaborator: Peter Linder University of Zurich, Switzerland
Project: Linking plant and insect diversity and diversification in the Cape
- Collaborated with Eric Imbert, University of Montpellier, France.
Project: Longtongue fly pollination in Namaqualand

Prof M Cherry

- Collaborated with Asheigh Griffin, Oxford University, UK.
Project: Kin selection in birds
- Collaborated with Marcel Honza, Institute of Vertebrate Biology, Academy of Sciences, Czech Republic.
Project: Avian brood parasitism

Prof S Clusella-Trullas

- Collaborated with Danny Healwaters, Harvard University, USA.
Project: Parasites of *Harmonia axyridis*
- Collaborated with Prof Marshall McCue, St Mary's University, San Antonio, Texas, USA.
Project: Metabolic fuel use
- Collaborated with Tim Bonebrake, University of Hong Kong, China.
Project: Climate change implications of nocturnality and resource restriction in ectotherms
- Collaborates with Raymond Huey, University of Washington, and Don Miles, University of Ohio, USA.
Project: Lizard extinctions in a warming world
- Collaborates with Matthew Shawkey, Ghent University, Belgium
Project: The thermal properties of colored integument: mechanisms and evolution
- Collaborates with Mike Logan, Harvard University, USA
Project: Does behaviour mediate evolutionary trajectories to climate adaptation?
- Collaborates with Jeff Streicher, Natural History Museum, London, UK
Project: Does behaviour mediate evolutionary trajectories to climate adaptation?

Prof S Daniels

- Collaborates with Gonzalo Giribet, Harvard University, USA
Project: Transcriptomics in velvet worms
- Collaborates with Neil Cumberlidge, Northern Michigan University, USA
Project: Malagasy freshwater crab taxonomy
- Collaborates with Prashant Sharma, University of Michigan, USA
Project: Velvet worm conservation modeling

Prof L Dreyer

- Collaborates with Dr Roshwitha Schmickl, Czech Republic
Project: Next generation sequencing of *Oxalis* genome

Prof A Ellis

- Collaborates with Tommi Nyman, University of East Finland, Finland
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Project: Linking plant and insect diversity and diversification in the Cape
- Collaborator: Eric Imbert, Université de Montpellier, France
Project: Longtongue fly pollination in Namaqualand

Dr M Gaertner

- Collaborator: Prof Reinette Biggs, Centre for Complex Systems in Transition, Stellenbosch University, and Stockholm Resilience Centre, Stockholm University, Sweden.
Project: Regime shifts concepts and theories, modelling

Prof J Le Roux

- Collaborator: Prof. Ramiro Bustamante, University of Santiago, Chile
Project: Inferring demographic processes from invasive species distributions in New Zealand
- Collaborator: Prof. Phil Hulme, BioProtection Research Centre, Lincoln University, Lincoln, New Zealand
Project: Soil microbiome impacts of Australian acacias

Prof C Matthee

- Collaborator: Dmitry Apanaskevich, Georgia Southern University, USA
Project: Evolutionary genetics and systematics of ticks
- Collaborators: Les Nobel / Catherine Jones, University of Aberdeen, UK
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- Collaborator: Jessica Light, Texas A&M University, USA
Project: Parasite host co-evolution

Prof GJ Measey

- Collaborators: Prof. Res Altwegg, Department of Statistical Sciences, University of Cape Town, South Africa; and Dr David Borchers, School of Mathematics and Statistics, University of St Andrews, Scotland
Project: Acoustic monitoring

- Collaborator: Prof. Ben Evans, Biology Department, McMaster University
Project: Xenopus genetics

Dr V Rambau

- Collaborators: Prof Aurora Ruiz-Herrera Moreno, Department Biología Celular, Fisiología i Immunologia Facultat de Biociències, Campus de la UAB, Spain
Project: Impacts of recombination rates on chromosomal speciation of the vlei rat, *Otomys irroratus*

Prof D Richardson

- Collaborators: Errol Douwes, Thekwini Municipality, Durban, and Ulrike Irlich, Green Jobs Unit, City of Cape Town, Environmental Resource Management Department, Cape Town
Project: Urban invasions working group
- Collaborators: Tim Blackburn and Tom Evans, University College London, London; Jonathan Jeschke, Ecosystem Research, IGB Leibniz-Institut of Freshwater Ecology and Inland Fisheries, Germany; Sven Bacher, Department of Biology, University of Fribourg, Switzerland; Piero Genovesi, ISPRA (Institute for Environmental Protection and Research), Italy; John Wilson, SANBI and Centre for Invasion Biology, Stellenbosch University
Project: Environmental Impact Classification of Alien Taxa (EICAT)
- Collaborators: Sven Bacher, Department of Biology, University of Fribourg, Switzerland; Tom Evans, University College London, London; Zuzana Marková and Jan Pergl, Institute of Botany, Academy of Sciences of the Czech Republic; Petr Pyšek, Institute of Botany, Academy of Sciences of the Czech Republic and Department of Ecology, Faculty of Science, Charles University in Prague, Czech Republic; Montserrat Vilà, Estación Biológica de Doñana (EBD-CSIC), Sevilla, Spain; and Wolfgang Nentwig, Institute of Ecology and Evolution, University of Bern, Switzerland
Project: Generic Impact Scoring System
- Collaborators: SANBI, PPRI, DEA, DAFF, Rhodes University, CapeNature
Project: National Alien Cactus Working Group.
- Collaborators: Philip Ivey, Ingrid Nänni, Sebataolo Rahlao, Lyn Fish, SANBI; David le Maitre, CSIR; Kim Canavan, Rhodes University; Vernon Visser, UCT; Susan Canavan, C•I•B
Project: National Alien Grass Working Group (incl. bamboos)
- Collaborator: Prof. Petr Pyšek, Institute of Botany, The Czech Academy of Sciences, Průhonice, and Charles University, Prague
Project: Patterns and spread of plant invasions
- Collaborators: Sven Bacher, University of Fribourg, Switzerland ; Petr Pyšek, Institute of Botany, Academy of Sciences of the Czech Republic and Department of Ecology,

Charles University in Prague, Czech Republic; Montserrat Vilà, Estación Biológica de Doñana (EBD-CSIC), Sevilla, Spain; Wolfgang Nentwig, Institute of Ecology and Evolution, University of Bern, Switzerland; Piero Genovesi, ISPRA (Institute for Environmental Protection and Research), Italy; Tim Blackburn, University College London, London; Marc Kenis, CABI, Delemont, Switzerland; Wolfgang Rabitsch, Umweltbundesamt, Vienna, Austria; Jonathan Jeschke, Freie Universitaet Berlin, Germany; : Franz Essl, Umweltbundesamt, Vienna, Austria; Jaakko Heikkilä, Natural Resources Institute Finland (Luke), Helsinki, Finland; Glyn Jones, The Food and Environment Research Agency, UK; Reuben Keller, Institute of Environmental Sustainability, Loyola University Chicago, USA; Christoph Kueffer, Institute of Integrative Biology, ETH Zurich, Switzerland; Angeliki F. Martinou, Joint Services Health Unit, Cyprus; Jan Pergl, The Czech Academy of Sciences, Průhonice, Czech Republic; Helen E. Roy, Centre for Ecology and Hydrology, UK; Wolf-Christian Saul, Freie Universitaet Berlin, Germany; Riccardo Scalera, IUCN/SSC Invasive Species Specialist Group, Italy

Project: Socio-economic impact classification

- Collaborators: Errol Douwes, eThekweni Municipality, Durban; and Ulrike Irlich, City of Cape Town, Environmental Resource Management Department
- Project:* Urban invasions working group

Prof TB Robinson

- Prof Aurora Ruiz-Herrera Moreno, Universitat Autònoma de Barcelona, Spain
- Project:* Genome instability
- Collaborator: Halina Černohorská, Veterinary Research Institute, Czech Republic
- Project:* Bovid cytogenomics research

Dr T Robinson

- Collaborator: Marta Coll, Spanish National Research Council, Institute of Marine Science, Spain
- Project:* Ecopath modelling of rocky shores
- Collaborator: Dr Vernon Visser, University of Cape Town, South Africa
- Project:* Traits of marine invasive crabs

Dr C Simon

- Collaborator: Rodolfo Elias, University of Mar Del Plata, Argentina
- Project:* A revision of Southern Hemisphere *cirratulid polychaetes*
- Collaborator: Waka Sato-Okoshi, Tohoku University, Japan
- Project:* Taxonomic revision of *polychaetes* which are pests on molluscs
- Collaborator: , Elena Kupriyanova, Australia Museum, Australia

Project: A redescription of the indigenous serpulid worm, *Spirobranchus kraussii*

Prof A Valentine

- Collaborator: Huiming Zhang, China
- Project:* Phosphorylation of N assimilation enzymes in P stressed roots
- Collaborator: Yves Poirier, Switzerland
- Project:* Root phosphate transporter regulation under P stress
- Collaborator: Maria Perez-Fernandez, Spain
- Project:* Organic acid metabolism in P stressed nodules
- Collaborator: Alejandra Zuniga-Feest, Chile
- Project:* Carbon metabolism in cluster roots under P stress

Prof H van Wyk

- Collaborators: Marcos Perez Lopez, Toxicology Unit, Veterinary School, Avda de la Universidad s/n, Spain
- Project:* Environmental endocrine disruption in wildlife species
- Collaborators: Mónica Muñoz de Toro, Instituto de Salud y Ambiente del Litoral (ISAL, CONICET-UNL), Facultad de Bioquímica y Cs. Biológicas, UNL. , Argentina
- Project:* Does pollutants in the environment affect the reproductive success of farmed crocodilians?
- Collaborators: William Hughes, Evolution, Behaviour & Environment, University of Sussex, UK
- Project:* Environmental contaminants in White Shark tissue and potential endocrine disruption
- Collaborators: Hollings Marine Laboratory, Charleston, SC 29412, USA
- Project:* Cloning And Characterization Of Elasmobranch Nuclear Receptors
- Collaborators: John Bowden, National Institute of Standards and Technology, Environmental Chemical Sciences Group, Hollings Marine Laboratory, USA
- Project:* Environmental contaminants in White Shark tissue and potential endocrine disruption
- Collaborators: Oluwaseun Babalola, Ecotoxicology and Ecophysiology Research Group, Zoology and Environmental Biology Department, Lagos State University, Nigeria
- Project:* Ecotoxicology and endocrine disruption potential of selected herbicides

Prof B van Wilgen

- Collaborators: Dean Impson, CapeNature; Dr Martine Jordaan, CapeNature; Jeanne Gouws, CapeNature; Dr Darragh Woodford, Wits University; and Dr Brian Finlayson, California Fish and Game
- Project:* River Rehabilitation

Prof S von der Heyden

- Collaborators: Kimberly Selkoe, University of California, Santa Barbara, USA
Project: Seascape Genetics
- Collaborators: Giacomo Bernardi, University of California, Santa Cruz, USA
Project: Marine ecology
- Collaborators: Robert Toonen, Hawaii Institute of Marine Biology (HIMB), USA
Project: Marine genomics

Prof J Wilson

- Collaborators: Tim Blackburn and Tom Evans, University College London, London; Jonathan Jeschke, Ecosystem Research, IGB Leibniz-Institut of Freshwater Ecology and Inland Fisheries, Berlin, Germany; Sven Bacher, Department of Biology, University of Fribourg, Switzerland; Piero Genovesi, ISPRA (Institute for Environmental Protection and Research), Italy; John Wilson, SANBI and Centre for Invasion Biology, Stellenbosch University
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- Collaborators: Errol Douwes, eThekweni Municipality, Durban; and Ulrike Irlich, City of Cape Town, Environmental Resource Management Department
Project: Urban invasions working group

Prof J le Roux

- Collaborator: Prof. Ramiro Bustamante, University of Santiago, Chile
Project: Inferring demographic processes from invasive species distributions in New Zealand

- Collaborator: Prof. Phil Hulme, BioProtection Research Centre, Lincoln University, Lincoln, New Zealand
Project: Soil microbiome impacts of Australian acacias

ACADEMIC ACTIVITIES

Prof Dave Richardson presented several lectures as invited speaker at national and international conferences, including:

- Plenary lecture at the State of the World's Plants symposium which took place in May 2016 at Kew Gardens in the United Kingdom. The title of the lecture was 'Alien plant invasions and native plant extinctions';
- Opening plenary speaker at the third International Symposium on Tephritid workers of Europe, Africa and the Middle East (TEAM), April 2016, Stellenbosch, South Africa; and
- Keynote speaker at the annual conference of the South African Association of Botanists, Bloemfontein, in January 2016. Title of the lecture was 'Plant invasion science: Challenges and opportunities in South Africa'.

Prof Guy Midgley is involved with several national and international projects in the field of biodiversity and climate change, including:

- Lead researcher for the Global Environmental Fund's (GEF) SPARC (Stratosphere-troposphere Processes and their Role in Climate) project. Based in Washington D. C. , this is a core project of the World Climate Research Programme, and coordinates international efforts to bring knowledge of the atmosphere to bear on issues regarding climate variability and prediction;
- Co-coordinating lead author and review editor for the Inter-governmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), based in Bonn, Germany
- Chair of the third South Africa Global Change Conference, Durban
- Expert scientist at the Scoping Meeting for a special Inter-governmental Panel on Climate Change (IPCC) report on the global goal of 1.5 degrees Celsius, which took place in Geneva, Switzerland.

Prof Michael Cherry was elected as a Fellow of the African Academy of Sciences. Dr Marnel Mouton presented a paper entitled 'LCT to transverse the semantic gap from high school to first year biology' at the Scholarship of Teaching and Learning (SoTL) 2016 conference.

Dr Simon Carol attended the International Polychaete Conference in August 2016 at the National Museum in Cardiff.

Prof Nox Makunga was invited to deliver a talk at the Plant Omics and Biotechnology for Human Health Conference (International Symposium of the Phytochemical Society of Europe) held at the University of Ghent (Belgium) on the 21-24 November 2016. Her talk was entitled: 'Mining botanical treasures of South Africa with biotechnological tools'.

As part of the China SA bilateral programme, Prof Makunga, PhD student Mizpah Hoffma and Mr Brian Damonse, a traditional healer, visited China in April 2016. There they met with Mr Luo Ping, deputy director of the provincial science and technology department. The aim of the visit was to find common ground in the field of botanical medicinal development and traditional treatment. This will further strength existing collaboration with researchers from the Anhui Academy of Sciences in China.

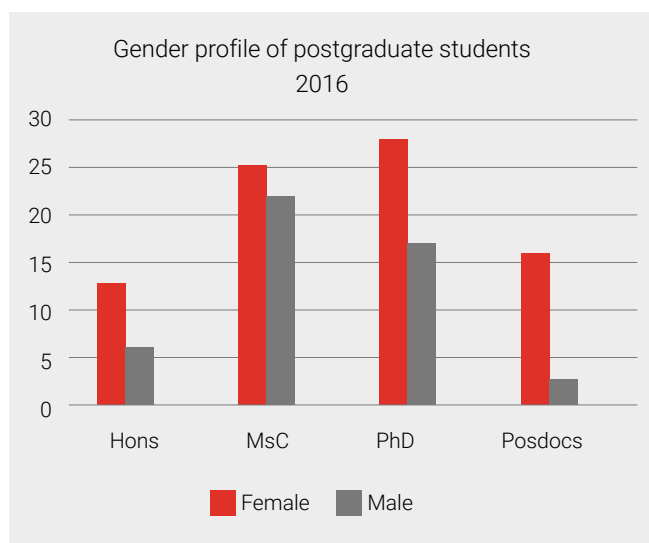
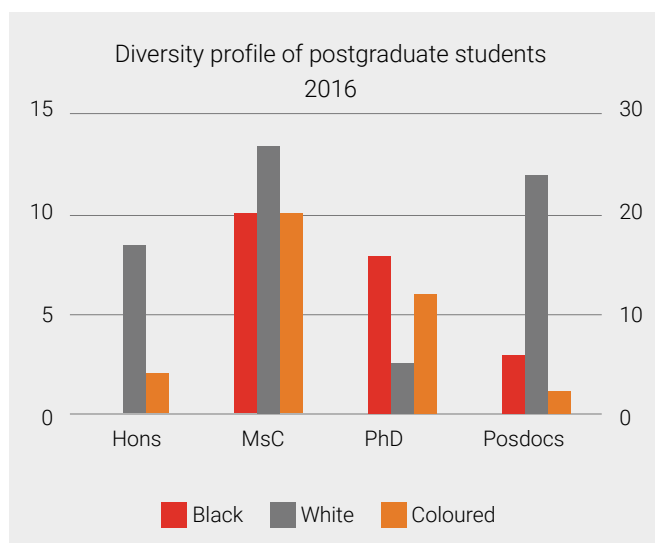
Prof Allan Ellis participated in the SPLAT (synthesis on pollen limitation and terrestrial biodiversity) working group, Synthesis Centre of Biodiversity Sciences (sDiv), in Germany. He was also invited to give a departmental research seminar at the University of East Finland, Finland on 3 February, with the

title 'Plant-herbivore and plant-pollinator interactions in South African biodiversity hotspots'.

Dr Rambau Victor attended a Bioacoustics workshop in February, hosted by the Department of Conservation Ecology and Entomology at SU.

Postgraduate students

The Department hosts a large cohort of postgraduate students, with 19 BScHons, 47 MSc and 45 PhD registered students in 2016, as well as 28 postdoctoral fellows. A total of 19 BScHons, 19 MSc and five PhD students graduated at the end of 2016.



National and international recognition

Prof. Brian van Wilgen, a leading conservation ecologist from the DST/NRF Centre for Invasion Biology (C-I-B) hosted by the Department of Botany and Zoology, was honoured with a Gold Medal Award from the Academy of Science of South Africa. ASSAf annually awards the ASSAf Science-for-Society Gold Medal for outstanding achievement in scientific thinking to the benefit of society. Prof Van Wilgen is regarded as a world leader in the fields of ecology and invasive species and his contributions to ecology in South Africa has been described as "immense".

The *Akademie vir Wetenskap en Kuns* awarded the Douw Greeff-prize to Prof Adriaan Reinecke, Prof Sophie Reinecke and BSc alumni Mia van Wyk vir hul artikel 'Kan die gevoeligheid van grondlewende organismes bydra om die volhoubaarheid van landbewerking van olieraffinadery afval te beoordeel?' The article was published in the *SA Tydskrif vir Natuurwetenskap en Tegnologie* (Vol 34, no. 1 (2015)).

Prof Léanne Dreyer has been honoured for her significant contributions to the study of the genus *Oxalis* by having a newly described species named after her. *Oxalis dreyeriae* is

one of ten new *Oxalis* species recently discovered in the arid Richtersveld – an area that was previously assumed to be relatively poor in diversity.

Our students also performed exceptionally well during 2016. PhD student Mr Ethan Newman was a recipient of the SU Chancellor's Medal for 2015. He was also featured as one of the 200 bright young South Africans in a special supplement in the *Mail & Guardian*.

PhD student Ms Lisa Mertens won the best novice presentation with a talk entitled: "The success secret behind a multi-country approach to promote ocean science online" at the Annual Conference of the Marine and Coastal Educators Network (MCEN) held in Hermanus. Postdoctoral student Dr Chris Broeckhoven received a best talk award at the SU Postdoctoral Society's 2016 conference which took place at Lanzerac Wine Estate.

Two researchers associated with the DST/NRF Centre of Excellence for Invasion Biology (C-I-B) were runners-ups in the South African leg of the international FameLab competition. They are Dr Claude Moshobane, a biosecurity specialist from SANBI doing his internship at the C-I-B, and Dr Savanna Nuwagaba



The Centre for Invasion Biology's Dr Savanna Nuwagaba (left) and Dr Claude Moshobane were runner-ups in the South African leg of the international FameLab competition.

“She also walked away with the award for the best oral presentation by an MSc student with a talk on ‘Investigating the potential of a traditional medicinal plant as an adjuvant remedy in the treatment of breast cancer’.”

PhD student Ms Koebraa Peters was awarded the Best PhD presentation at the C-I-B’s annual research meeting, while Ms Ingrid Minnaar was the runner-up for the same award. The Zoological Societies of Southern Africa (ZSSA) awards for 2016 went to Ms Lisa Skein (best Zoology Honours student) and Ms Celeste de Kock (best third year Zoology student).

Mr Marius Rossouw was a runner-up for the best oral paper at the SA Global Change Conference. Ms Andria Rautenbach gave the keynote address as the Best Young Scientist at the conference of the South African Association for Botanists in January 2016, Bloemfontein. She also walked away with the award for the best oral presentation by an MSc student with a talk on ‘Investigating the potential of a traditional medicinal plant as an adjuvant remedy in the treatment of breast cancer’.

COLLABORATION

The department hosted a number of national and international visitors:

- Dr Fritz Vollrath from the Department of Zoology at Oxford University delivered a departmental talk on the plight of the African elephant and what “Save the Elephants” is doing about it on 9 March 2016
- Prof Sven Bacher from the University of Fribourg in Switzerland presented a guest lecture entitled ‘Ecology and dynamics of small populations’ on 27 January 2016
- Prof Roger Butlin from Sheffield University gave a talk on local adaptation and speciation in *Littorina* on 17 February 2016.
- Dr Roberto Kiesling gave a talk on the situation of cactus species in Argentina on 1 April 2016
- Dr Guillaume Latombe gave a talk entitled ‘Complexity, emergence and the process pattern relationship in ecology’ on 6 April

- Guest seminar by Arne Witt from CABI East Africa on 'Livelihood and biodiversity threat of invasive plants in East Africa (Prof David Richardson) on 18 July
- Prof Rodolfo Elias, Marine Science Department of the Mar del Plata National University and the Institute of Marine and Coastal Research gave a talk on Polychaetes on 5 October
- Dr J Britton-Davidian, Université Montpellier, France, gave a talk on chromosomal evolution
- Dr A Ruiz-Herrera Moreno, Universitat Autònoma de Barcelona, Spain, gave a talk on genomic instability
- Dr H Černohorská, Veterinary Research Institute, Czech Republic, gave a talk about bovid cytogenomics research.

SERVICE TO THE SCIENTIFIC COMMUNITY

Prof B Anderson	External Moderator for three courses at UCT
Prof M Cherry	Leon postdoc scheme review convenor; Trustee Kalahari Research Trust; Board Fitzpatrick COE (Board Member); Review Panel FBIP
Dr S Clusella-Trullas	Examiner of one international MSc thesis and one MSc thesis from WITS
Prof S Daniels	External examiner for UCT and UKZN
Prof L Dreyer	DST/NRF Centre of Excellence in Tree Health Biotechnology (Core Member); Woordeboek van die Afrikaanse Taal (Consultant); External examiner of UKZN Hons programme
Prof A Ellis	Reviewer for proposal from the National Research Foundation of New Zealand and Israel; External Examiner for Rhodes University
Dr AFlemming	Scientist consultant, Oxford University Press (OUP)
Prof J le Roux	Member of the South African National Biodiversity Institute's (SANBI) Genetic Monitoring working group; Expert working group – European Plant Protection Agency (EPPO) France; Review panel for the NRF
Prof N Makunga	NRF Panel: Competitive Rated and Unrated Researchers; External examination for UCT, UKZN, UFS; Footprint Management Solutions; Natural Product Research Organisation; <i>Journal of Ethnopharmacology</i> (JEP) – setting standards for journal
Prof C Matthee	Advisor to the Endangered Wildlife Trust Drylands Conservation Programme; Serve of IUCN Lagomorph Specialist Group; NRF; SASSB council member
Prof G Midgley	NRF rating panel; NRF/DST chair global change committee; 2014 December Global Change Grand Challenge (GCGC) national committee; Intergovernmental Panel on Climate Change (IPCC) author

Prof LF Mouton	Rooi Cederberg Karoo Park (Advisory Board Member)
Prof A Pauw	Darling Wildflower Conservation Trust (Committee member); External Examiner University of Pretoria; Red Hill Conservation Group (Member); United Nations Representation
Dr V Rambau	NRF Panel Member (FBIP); External Examiner – WITS, UP, TUT
Dr TRobinson	Eskom Contract research; Co-supervising PhD student, UCT; NRF Research and Technology funding: Fisheries and Aquaculture (Panel Member); World Registry of Invasive Marine Species (Thematic Editor); External Examiner UCT, Rhodes University; Hosting NRF/ DST Intern
Dr C Simon	Zoological Society of Southern Africa (ZSSA) (Executive council member); Abalone (Professional Advisor); International Polychaete Conference (IPC) (African representative)
Prof A Valentine	NRF Reviewer; NRF Panel Bi-laterals; Institute of Plant Biology (IPB) honours external examiner; Moderator for UKZN, UCT
Prof H van Wyk	Junior Captain Scott Panel Member; Journal Peer Reviews; External for UP, KZN; Water Research Commission (WRC) steering committee; NRF Evaluations; SU Water Institute (host researcher- Spain)
Prof S von der Heyden	South African Network for Coastal and Oceanographic Research (SANCOR) steering committee; European Society for Evolutionary Biology (ESEB) Equality Committee; DipNet Steering Committee (member); AE Frontier for Young Minds; NBA Genetics working group member
Prof T Wossler	External Examiner for UWC, UP; City of Cape Town Protected Area Advisory Committee; Cosupervisor UP

Editorial activities

Prof M Cherry	<i>Emu</i> (Associate editor)
Dr S Clusella-Trullas	<i>Journal of Thermal Biology</i> (editorial board); <i>Frontiers in Insect Physiology</i> (editorial board); <i>Functional Ecology</i> (associate editor)
Prof A Ellis	<i>Biological Journal of the Linnaean Society</i> (associate editor)
Prof J le Roux	<i>Biological Invasions</i> (associate editor); <i>Conservation Genetics</i> (associate editor)
Prof N Makunga	<i>Frontiers in Plant Biotechnology</i> (assistant editor)
Prof C Matthee	<i>African Journal of Marine Science</i> (editorial board); <i>Koedoe</i> (editorial board); <i>Molecular Phylogenetics and Evolution</i> (associate editor)
Prof LF Mouton	<i>African Journal of Herpetology</i> (editorial board)
Dr M Mouton	<i>African Journal of Microbiology Research (AJMR)</i> , <i>Open Agriculture</i> (journal reviewer)
Prof A Pauw	<i>South African Journal of Botany</i> (sub-editor)
Dr V Rambau	<i>African Zoology</i> (section editor)
Prof D Richardson	<i>AoB Plants</i> (editorial board member); <i>Biological Invasions</i> (editorial board member); <i>Forest Ecosystems</i> (editorial board member); <i>Neobiota</i> (editorial board member)
Prof T Robinson	<i>Cytogenetic and Genome Research</i> (editorial board member); <i>Chromosome Research</i> (editorial board member)

Dr C Simon	<i>African Zoology</i> (co-editor in chief)
Prof A Valentine	<i>Science Reports</i> (subject editor); <i>SA Journal Plant Soil</i> (assistant editor)
Prof T Wossler	<i>African Zoology</i> (editor)

FUNDING

South Africa

- Africa Claude Leon Foundation
- Belmont Forum Scen Net
- National Research Foundation
- Department of Environmental Affairs: Natural Resource Management Programs
- National Research Foundation: South African Biodiversity Initiative
- NRF Incentive funding; DST/NRF Centre of Excellence in Tree Health Biotechnology
- NRF/DSTGlobal Change Grand Challenge Science for Sustainability
- NRF PhD Innovation Scholarship
- NRF SARChI Initiative
- Ostrich Business Chamber
- Sasscal
- Sasol
- South African Institute for Aquatic Biodiversity South African Malaria Initiative
- South African Medical Research Council
- Stellenbosch University
- WfW - Working for Water Programme

International

- Cambridge-Africa ALBORADA Research Fund
- European Union's Saturn project, Erasmus Mundus Action 2
- Faculty of Agriculture, Bonn University
- FPI Fellowship Mineco Spain
- GEF/Conservation International, USA
- Generalitat de Catalunya
- Hans Sigrist Foundation
- Harry Crossley Foundation

- International Foundation of Science Sweden
- International Postgraduate Research Scholarship from the Australian Government
- Japan Society for the Promotion of Science
- Landgard Foundation
- Leverhulme Trust
- Ministerio de Economía Y Competitividad Mineco Spain
- Ministerium für Klimaschutz Umwelt Landwirtschaft Natur und Verbraucherschutz des Landes Nordrhein Westfalen
- National Geographic, UK
- Natural Environment Research Council (UK)

SOCIAL IMPACT

Staff members actively participated in the Science Café Stellenbosch initiative this year. Prof Conrad Matthee moderated a talk on great white sharks presented by Dr Sara Andreotti and Michael Rutzen from Shark Diving Unlimited on Wednesday 17 August 2016. Dr Chris Broeckhoven presented a Science Café Stellenbosch talk on 10 November 2016 entitled 'Beneath the dragon's scales' about his research on the armadillo lizard. Prof Nox Makunga serves on the organising committee of Science Café Stellenbosch and moderated a number of talks during 2016. Science Café Stellenbosch is an initiative of the Faculty of Science to promote public discussions of science.

Prof Makunga delivered a popular talk entitled 'Medicinal and useful fynbos plants using biotechnology approaches' during the first Pint of Science event from 23 to 25 May 2016 in Cape Town. During the year she gave several other popular talks, inter alia:

- 'Getting tangled in a social network' talk at the plenary session of the annual Postdoctoral Research Conference in October 2016
- Serves on the Executive Committee of the Diocesan School for Girls
- Invited talk at the African Science Leadership Programme, University of Pretoria

Prof Makunga and Prof Allan Ellis both delivered research talks during the Indigenous Bulb Society of South Africa's (IBSA) meeting. Prof LeFras Mouton and Dr Marnel Mouton participated in the weekly RSG radio programme 'Hoe verklaar u dit?'

STAFF MATTERS

Dr Wendy Foden joined the Department in 2016 as a senior research scientist. Prof Anton Pauw was promoted to full professor from 1 January 2017.

Staff list:

Academic

- Prof Conrad Matthee (Executive head)

- Prof BC Anderson
- Prof MI Cherry
- Prof S Clusella-Trullas
- Prof SR Daniels
- Prof LL Dreyer
- Prof AG Ellis
- Dr AF Flemming
- Prof JJ le Roux
- Dr NP Makunga
- Prof PLN Mouton
- Dr MI Mouton
- Prof Anton Pauw
- Dr RV Rambau
- Prof DM Richardson
- Prof TJ Robinson
- Dr TB Robinson
- Dr CA Simon
- Prof AJ Valentine
- Prof JH Van Wyk
- Prof S von der Heyden
- Prof T Wossler

Centre of Excellence for Invasion Biology

- Prof DM Richardson
- Prof B van Wilgen
- Dr J Measey

Extraordinary professors

- Prof KJ Tolley
- Prof JRU Wilson

Support staff

- Ms S Jacobs
- Ms J Basson
- Mr A Fransman
- Ms F Gordon
- Ms RM Honing
- Ms S Johnson
- Ms DJD Julies
- Dr A Kleinert
- Ms J Law-Brown
- Mr R Robertson
- Ms MP Sauerman
- Mr M Siebritz
- Mr N Solomons
- Mr RC Thompson
- Mr JP Williams
- Mr H Witbooi

Centre of Excellence for Invasion Biology

- Ms Lorraine Cilliers
- Ms K Coombe-Davis
- Dr S Davies
- D du Plessis
- Dr M Gaertner
- Ms M Koordom
- Ms S Kritzing-Klopper
- Dr E Marais
- Ms C Momberg
- Ms R Moses
- Ms L Msomi
- Ms E Nortjé
- Ms Sophia Turner
- Ms M van der Vyver

Postdocs

- Dr JL Allen
- Dr S Andreotti
- Dr WJ Augustyn
- Dr M Barton
- Dr FC Boucher
- Dr T Charles-Dominique
- Dr JM Da Silva
- Dr ML de Jager
- Dr N du Toit
- Dr JM Fill
- Dr L Gallien
- Dr R Garcia
- Dr DT Guzha
- Dr RP Henriques
- Dr H Hirsch

- Dr HCP Kelstrup
- Dr M Logan
- Dr A Magadla
- Dr NP Mothapo
- Dr T Musvuugwa
- Dr AN Nunes
- Dr RT Shackleton
- Dr J Smid
- Dr GI Stafford
- Dr N Stevens
- Dr D Vosloh
- Dr KE Watermeyer
- Dr FA Yannelli Lucero

Academic staff: retired

- Prof V Smith
- Prof D Baird
- Prof J Gilomee
- Dr S Jackson
- Dr EGH Oliver
- Prof JAJ Nel
- Prof E Pool
- Prof AJ Reinecke
- Prof SA Reinecke
- Dr W Sirgel
- Prof E van Dijk
- Prof VR Smith
- Dr JAJ van der Heever

New appointments

- Dr W Foden



DEPARTMENT OF CHEMISTRY AND POLYMER SCIENCE

The Department of Chemistry and Polymer Science is one of the pre-eminent research departments in chemistry in South Africa.

We are engaged in a wide range of research areas, including the largest research effort in polymer science in the country. It is also the only department at a South African university offering a BSc degree with a focus on textile and polymer science.

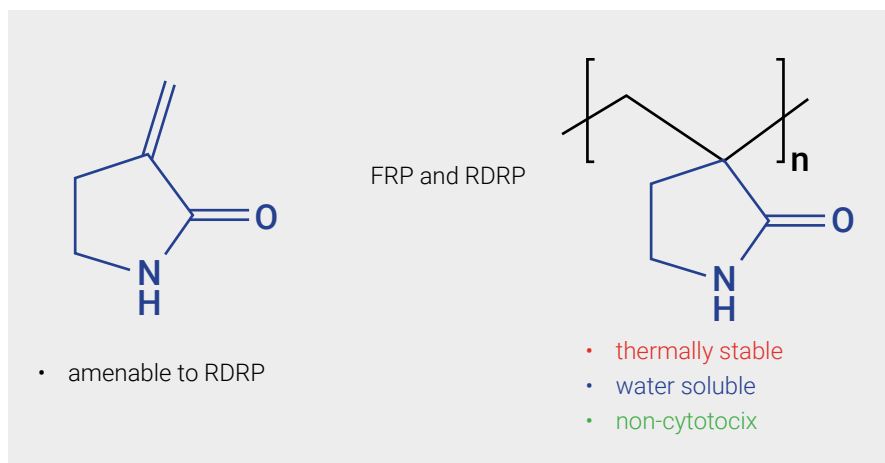
RESEARCH INTERESTS

- Organic chemistry and medicinal chemistry
- Inorganic chemistry and organometallic chemistry
- Analytical chemistry
- Polymer science
- Physical and computational chemistry
- Supramolecular chemistry and materials

RESEARCH HIGHLIGHTS

Patent application filed for new polymer - poly3M2P

Prof B Klumperman



In recent years it has become quite rare that a truly new polymer (i.e. based on a new monomer) gets designed and synthesized. PhD student Ms Ingrid Heyns has successfully accomplished this formidable task when synthesizing poly(3-methylene-2-pyrrolidone) (poly3M2P). Under the supervision of Prof Bert Klumperman and Dr Rueben Pfukwa she first synthesized the monomer (3M2P), which was then polymerized via various radical polymerization techniques.

The research was inspired by work on poly(tulapin-A), a polymer based on a monomer that is available through biosynthetic routes. The new poly3M2P turned out to be hardly soluble in any organic solvent, but very readily soluble in water.

In collaboration with Dr Ben Loos from the Department of Physiological Sciences it was established that the polymer is non-toxic to mammalian cells. As a consequence, poly3M2P may be an interesting alternative for well-known biocompatible polymers such as poly(ethylene glycol) (PEG) and poly(*N*-vinylpyrrolidone) (PVP).

A patent application has been filed and the work has been published in a peer-reviewed scientific journal *Biomacromolecules* 2016.

In a different project, Dr Paul Reader and Mr Simbarashe Jokonya investigated the bioconjugation of poly(*N*-vinylpyrrolidone) (PVP) with bio-active peptides. The bioconjugation requires the synthesis of PVP with two distinct end-groups that can separately be utilised in conjugation chemistry in a so-called orthogonal fashion. The



successful achievement of orthogonal end-group modification has been published in a cover article of one of the top journals in the field of polymer science, *Polymer Chemistry*.

Computational chemistry methods show gold can act as a hydrogen-bond acceptor

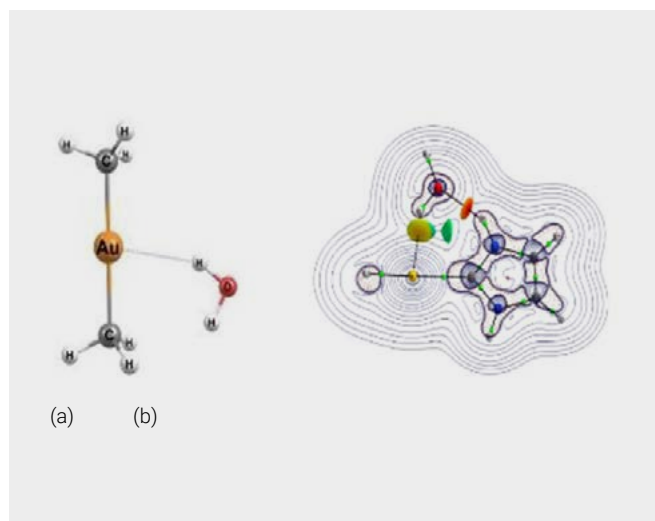
Prof C Esterhuysen

The ability of gold (I) to act as a hydrogen-bond acceptor runs counter to conventional wisdom that gold behaves as a Lewis acid, especially since interactions between Au (I) centres and hydrogen bond donors such as water have not unequivocally been confirmed due to the absence of measurable chemical or bonding influences and the presence of conventional neighbouring H-bonds that could lead to the positioning of the involved H atom.

In the recent article "Preparing Au^I for Interactions with Proton Donors – the Elusive [Au]×××HO Hydrogen Bond" published in the prestigious journal *Angewandte Chemie International Edition*, Ferdinand Groenewald, Jan Dillen, Helgard Raubenheimer and Catharine Esterhuysen used computational chemistry methods to convincingly show that reasonably strong hydrogen bonds do indeed form between isolated complexes of Au (I) and H₂O molecules.

Furthermore, this type of interaction is still sustainable, albeit weaker, even for neutral gold complexes especially in the presence of additional classical hydrogen bonds involving the ligands. The team was able to show that the origin of the ability of gold (I) to behave as a hydrogen-bond acceptor is the presence of relativistic effects, thus differentiating it from the other group 11 metal species copper (I) and silver (I).

The knowledge that gold (I) is able to act as a Lewis base is a new and useful bonding concept that has broad applications due to the widespread use of gold complexes in medicinal chemistry and catalysis and the importance of hydrogen bonding as a supramolecular synthon.



(a) Optimised structure of dimethylaurate interacting with H₂O; (b) Atoms and Molecules and Non-Covalent Interactions analyses of gold (I) imidazolylidene hydride showing the supporting strong classical N–HO hydrogen bond.

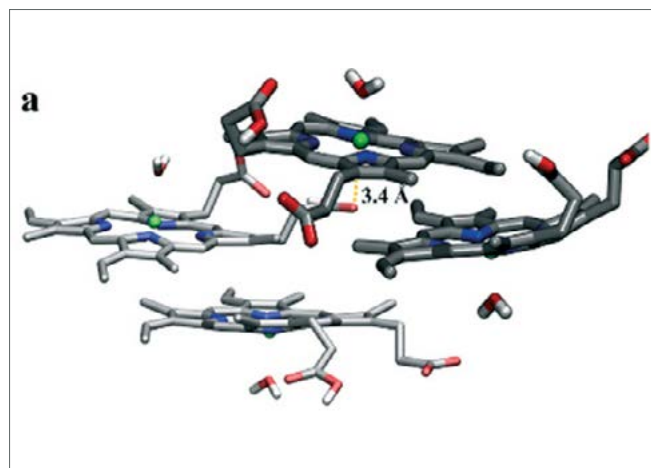
Computational insights into the crystallization of malaria pigment (haemozoin)

Dr K de Villiers

Related to our focus on understanding important structure-activity relationships that underpin the mechanism(s) of action of clinically-relevant antimalarial drugs, the Bioinorganic (Malaria) research group is also interested in the haem (iron (III) protoporphyrin IX) detoxification pathway leading to the formation of malaria pigment (haemozoin).

We made an important contribution in this regard in 2016 through the publication of an article entitled 'Insights into the initial stages of lipid-mediated haemozoin nucleation', published in *Crystal Engineering Communication*.

In this paper, both experimental and computational approaches were used to investigate lipid-mediated haemozoin formation. The initial stages of the process were investigated using molecular dynamics simulations which involved modelling two relevant ferrihaem dimer species, namely the π - π and μ -propionato dimers, at lipid-water interfaces. A representative glycerolipid (1, 2-dioleoyl-sn-glycerol (DOG)) and phospholipid (1, 2-dioleoyl-sn-glycero-3-phosphatidylcholine (DOPC)) were studied. The π - π dimers were observed to partition into both lipids, where they remained near the hydrated lipid-water interface. Dimer aggregation (see image below), which was only observed in DOG, is proposed to be crucial for nucleating haemozoin. Research was funded via ongoing grants from the National Research Foundation (Thuthuka) and the National Institutes of Health (United States of America).



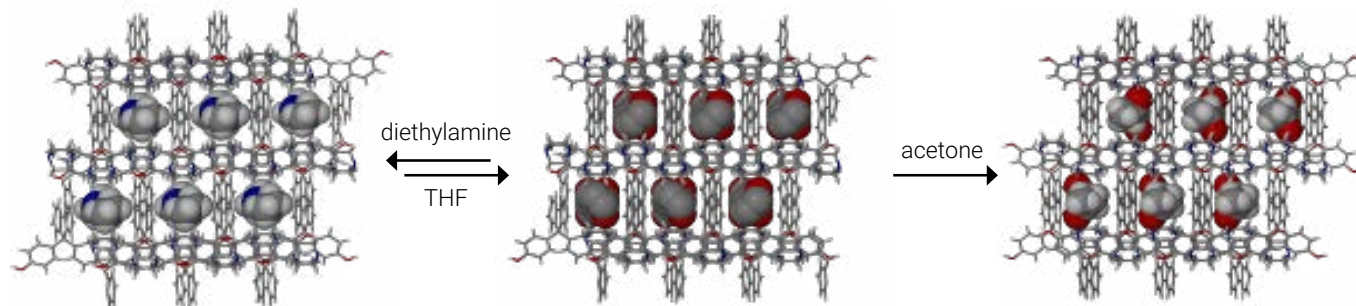
The π - π tetramer aggregate observed during molecular dynamics simulation at a 1, 2-dioleoyl glycerol (DOG)-water interface viewed perpendicular to the lipid surface.

Hydrogen-bonded organic frameworks

Dr T le Roex

Ongoing research into hydrogen-bonded organic framework materials resulted in an article entitled 'Structures and inclusion properties of hydrogen-bonded host frameworks formed by 4, 4'-(9-fluorenylidene) diphenol and diamines' published in *Crystal Growth and Design*.

Host molecule 4, 4'-(9-fluorenylidene) diphenol was combined with a small range of simple organic linkers and was shown to be a very successful and versatile building block for the formation of hydrogen-bonded organic frameworks, providing a range of structural types for the inclusion of small guest molecules. Inclusion of smaller guests was found to result in the framework containing smaller voids or cavities while larger guests resulted in more open frameworks with guests



located in channels. The architecture of these frameworks can therefore be controlled by careful choice of guest. The properties of the structures obtained were also investigated and one of the frameworks in particular was found to display very interesting properties, including guest exchange (depicted in the figure below) and preferential inclusion of acetone over THF. In addition, some of these solid-state forms could be obtained mechanochemically, by liquid-assisted grinding.

RESEARCH PROFILE

Research and innovation

During 2016 we continued to publish research articles in high-impact journals, some of them among the top 1% of the world's leading scientific journals such as *Chemical Communications*, *Analytical Chemistry*, *Angewandte Chemie International Edition* and *Inorganic Chemistry*.

The Faculty of Science's audited research output for publication years 2011 to 2014 shows that we are among the top three departments in the Faculty in terms of audited research outputs. A review of publications that appeared in 2013 and which qualified as being in the top 20% (or higher) in terms of impact factor within specific subcategories of research as defined in the Web of Science, also shows our Department among the top two.

Subsidised publications have steadily increased from 2010 to 2013, took a dip in 2014, but showed an upward swing again in 2015. We hope to see an increase on our previous year's publications in 2017. The number of articles over the last seven years are as follows: 2010 (65); 2011 (75); 2012 (86); 2013 (91); 2014 (73); 2015 (79); 2016 (59). The majority of the articles are in international journals and some are in extremely high impact factor journals.

NRF-rated researchers

Currently 18 (60%) of our academic staff members hold NRF-ratings and we are home to two of the four A-rated scientists in chemistry in South Africa – Prof Bert Klumperman and Prof Len Barbour. Prof Klumperman and Prof Barbour also hold two of the eight research chairs in the Faculty – the South African research chairs (SARChI) in Advanced Macromolecular Architectures and in Nano-structured Functional Materials. Research is carried out in all areas of traditional chemistry and is spread over four buildings.

NRF-rated researchers	
Leading international researchers	
Prof B Klumperman	Living radical polymerization and advanced macromolecular architectures
Prof LJ Barbour	Functional nanostructured materials
Internationally acclaimed researchers	
Prof BV Burger	Chemical communication in living organisms
Prof H Pasch	Analytical polymer science, multidimensional chromatography
Prof WAL van Otterlo	Organic synthesis and medicinal chemistry
Prof HG Raubenheimer	Ligand design aimed at applications in homogeneous catalysis; gold chemistry
Prof KR Koch	Multinuclear NMR spectroscopy and Platinum group metals chemistry
Prof AJ de Villiers	Separation science fundamentals and applications
Established researchers	
Prof PE Mallon	Complex polymer materials and polymer nano-composites
Prof DA Haynes	Crystal engineering, Chemistry - Main group elements
Prof SF Mapolie	Homogeneous catalysis via dendrimeric complexes
Prof C Esterhuysen	Intermolecular interactions
Prof IR Green	Small molecules syntheses for medicinal application
Prof E Jacobs	Membrane and process development
Prof AJ van Reenen	Structure-property relationships
Prof JLM Dillen	Structural/computational chemistry
Dr RC Luckay	Ligand design for metal ion coordination in industrial and medical applications
Dr GE Arnott	Inherently chiral calixarenes; asymmetric methodology
Promising Young Researcher	
Dr SC Pelly	Medicinal chemistry

National and international recognition

Our researchers continue to gain recognition through awards or from publications in the literature. The following were some of the awards and recognition of our researchers for 2016.

Prof Bert Klumperman (photo right), distinguished professor, received the NSTF/South 32 Lifetime Award for outstanding contribution to SET and innovation. The award recognises outstanding excellence in science, engineering, technology and innovation in South Africa. He was also a recipient of the 2016 SU Chancellor's Award for Excellence in Research.

Prof Catharine Esterhuysen received the Alexander von Humboldt follow-up fellowship and visited the Friedrich-Alexander Universität Erlangen-Nürnberg, Germany, from July to September 2016.

Dr Gareth Arnott and Prof Jan Dillen both received C ratings from the National Research Foundation. Dr Arnott was also nominated as the lecturer that impacted the most on the success of one of the top performing first year BSc students during 2015. Prof André de Villiers received a B-rating from the NRF and Dr Gareth Arnott and Prof Jan Dillen both received C-ratings.



Ms Inge Weideman (poster presentation), Ms Welmarie van Schalkwyk (oral presentation), and Ms Ingrid Heyns (oral presentation) received student awards at the APA 2016 conference in Mauritius.

National and international collaboration

During 2016 we collaborated with institutions from 25 countries – this includes co-authorship on research papers, research visits, staff and postgraduate student exchanges and other projects resulting from several bilateral agreements. While our footprint in South Africa (16) is large, we most often collaborated with institutions in Europe (particularly Germany) and the United States. More detailed information about our many collaborations follows below:

Prof PE Mallon

- Collaborated with Prof Eric Dargent, LECAP lab, University of Rouen, France

Project: Properties of electrospun polymer nanofibres

- Collaborated with Giuliana Magnacca, University of Torino (Italy) and Marco Sangermano, Politecnico di Torino (Italy); Anonio Arques, Unviersitat Politecnica de Valencia (Spain); Vittorio Boffa, Aalborg University (Denmark); Vasilios Sakkas, University of Loannina (Greece); Marta Cerruti, McGill University (Canada); Luciano Carlos, Le Plata University (Argentina)

Project: MAT4TREAT, Horizon 2020 (EU), Marie Skłodowska-Curie Project Research and Innovation Staff Exchange (RISE)

Prof AJ de Villiers

- Collaboration with Prof F Lynen, Department of Chemistry, University of Gent, Belgium

Project: Advances in liquid chromatography

- Informal collaboration with Prof T Gorecki, Department of Chemistry, University of Waterloo, Canada

Project: Comprehensive 2-dimensional GC analysis of South African natural products (GCxGC)

Dr K de Villiers

- Collaborated on a three-way National Institute of Health (NIH) funded research project (2014-2018) with Prof TJ Egan from the University of Cape Town (UCT) (South Africa) and Prof D Wright (VU)

Project: Plasmodium heme detoxification probes

Dr NP Gule

- Collaborating with Dr T Ndlovu, Department of Chemistry, University of Swaziland

Project: Rural water purification using inexpensive easily accessible materials. A study targeting the water stressed Lowveld region of Swaziland

- Working with Dr SP Malinga, Department of Applied Chemistry, University of Johannesburg, and Prof Kim Larsen, University of Aalborg, Denmark

Project: Antifouling nanostructured membrane systems embedded with hyperbranched polymers as hosts for immobilisation of nanocatalysts and effective water remediation

Prof DA Haynes

- Prof O. Q. Munro, University of the Witwatersrand, South Africa
- Prof J. Nenwa, University of Yaoude I, Cameroon
- Dr N Claiser, Prof C Lecomte, Prof M Souhassou, Laboratory of Crystallography, Nuclear Magnetic Resonance and Modelling, Université de Lorraine, France, as part of an NRF France/SA research cooperation agreement.

Project: Determination of spin-dependent electron density in dithiadiazolyl radicals

- Prof Krzysztof Woźniak, University of Warsaw, Poland

Project: Charge density studies of dithiadiazolyl co-crystals (not formally funded, mentioned in NRF project Functional materials from thiazyl radicals)

- Prof J Rawson, Department of Chemistry and Biochemistry, University of Windsor, Canada

Project: Novel materials from dithiadiazolyl radicals (not formally funded, mentioned in NRF project Functional materials from thiazyl radicals)

A Gericke

- Joint application for Horizons 2020 funding in collaboration with Dr-Ing Petra Franitz, Lodz University of Technology LUT, Poland

Project: Stimulation of Interaction between Science and Society for better understanding the meaning of social factor in creating Responsible Research and Innovative Textile Products (SISStex)

Prof L Klumperman

- Co-supervision of students with Prof Alan E. Rowan, Radboud University, Nijmegen, Netherlands

Project: Polyisocyanide-based hydrogels

- Prof C Barner-Kowollik, Karlsruhe Institute of Technology, Germany

Project: Surface characterization of modified nanofibers

- Prof A Laaksonen, Stockholm University, Sweden

Project: Modelling of polymer self-assembly

- Australian Institute for Bioengineering and Nanotechnology (AIBN), University of Queensland, Brisbane (Australia)

Project: Polyisocyanide-based hydrogels

- Informal collaboration with Prof J. A. Killian, Utrecht University (Netherlands)

Project: Poly(styrene-co-maleic anhydride) for stabilization of nanodiscs

- Collaborating with Dr J. P. G. Sluijter, Utrecht Medical Center (Netherlands)

Project: Delivery of miRNA therapeutics. *Project:* Delivery of miRNA therapeutics

- Collaborating with Prof I. Berindan-Neagoe, Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca (Romania)

Project: Polymeric drug delivery systems – Romania-South Africa bilateral

Prof C Esterhuysen

- Collaborated with Prof Tony Ford, Department of Chemistry, University of Kwa-Zulu Natal, South Africa
- Prof Tim Clark, Friedrich-Alexander Universität Erlangen-Nürnberg, Germany

- Prof F. Matthias Bickelhaupt, Vrije Universiteit, Amsterdam, Netherlands

Project: Collaboration on computational analysis of Au-containing complexes

- Prof G Frenking, Philipps-Universität Marburg, Germany

Project: Collaboration on the computational analysis of carbones

Dr M Lutz

- Prof L Tichagwa, Harare Institute of Technology, Department of Polymer Science, University of Harare, Zimbabwe

Project: The aim is to collaborate on the modification of natural polymers such as lignocellulose, cellulose, chitosan and clays in order to convert the polymers into low cost and “smart materials” like nano-composites with improved properties for various applications

Prof LJ Barbour

- NRF Bilateral agreement collaboration with Dr Consiglia Tedesco, Department of Chemistry, Ulsan National Institute of Science and Technology, South Korea

Project: Synthesis and characterisation of porous molecular solids

- NRF Bilateral agreement collaboration with Prof Wonyoung Choe, Department of Chemistry, Ulsan National Institute of Science and Technology, South Korea

Project: Synthesis and in-situ characterisation of porphyrinic metal-organic frameworks for gas capture

- Stellenbosch/Bath inter-university collaboration with Drs Janet Scott, Karen Edler, Lynne Thomas, Department of Chemistry, University of Bath, United Kingdom

Project: Porous materials

Prof SF Mapolie

- Informal continuation of a former NRF/Bilateral Agreement with Prof Ebbe Nordlander, Department of Chemical Physics, Lund University

Project: Development of novel catalysts based on PGM's

- Informal collaboration with Dr Archana Bhaw-Luximon, Centre for Biomedical and Biomaterials Research, University of Mauritius

Project: Ring opening polymerization of lactides using transition metal catalyst

Prof WAL van Otterlo and Dr SC Pelly

- NRF bilateral agreement Italy-RSA collaboration with Prof. A Evidente, Dr A Crimmino, Dipartimento di Scienze Chimiche, Università di Napoli Federico II, Italy

Project: Isolation and chemical and biological characterization of metabolites from South African bulbs

- Prof Dr D Rauh, Department of Chemistry and Chemical Biology, Technical University Dortmund, Germany
Project: Synthesis of irreversible kinase inhibitors
- Prof A Kornienko, Department of Chemistry and Biochemistry, State University Texas, United States of America
Project: Biologically inspired cytotoxic agents
- Prof R Kiss, Prof. V Mathieu, Prof F Lefranc, Laboratoire de Cancérologie et de Toxicologie Expérimentale, Faculté de Pharmacie, Université Libre de Bruxelles, Belgium
Project: Evaluation of novel cytotoxic agents
- Prof Van Otterlo is also collaborating with Prof L Brunsveld, Department of Chemical Biology, Technical University Eindhoven, The Netherlands
Project: Synthesis of THIQ-based selective estrogen receptor modulators

Dr MAL Blackie

- Prof J Franco, Department of Chemistry, Merrimack College, Massachusetts, USA
Project: Evaluation of known compounds as antimalarial agents
- Prof M Pollastri, Department of Chemistry, Northeastern University, Massachusetts, USA
Project: Use of large datasets in drug discovery for neglected tropical diseases
- Prof P Ashwin Lancaster University, Dr J McArthur, Lancaster University (United Kingdom) and Prof J Case, University of Cape Town
Project: Understanding Knowledge, Curriculum and Student Agency (UK-SA) Project

Prof H Pasch

- Prof Yonggang Liu, Changchun Institute of Applied Chemistry, China. NRF-bilateral Chinese Academy of Sciences
Project: Preparation and characterization of chitosan-decorated liposomes for drug delivery
- Dr Volker Joerres, Novolen GmbH, Mannheim, Germany
Project: Development of analytical methods for complex polyolefins
- Dr Celine Farcet, L'Oreal, Paris, France
Project: Characterization of natural polymers for cosmetic applications
- Dr S Udomsak, SCG Chemicals, Thailand
Project: Functional group analysis in polyolefin waxes
- Informal collaboration with Dr W Hiller and Dr M Hehn, Technical University Dortmund, Germany
Project: LC-NMR coupling for the analysis of complex polymers

- Informal collaboration with Dr T Klein and Dr T Howard, Postnova Analytics, Landsberg, Germany
Project: Field Flow Fractionation for polymer separation
- Informal collaboration with Prof A Pizzi Université Henri Poincaré - Nancy 1, France
Project: Analytical methods for tannine derivatives

Prof KR Koch

- Collaboration with Prof A Laaksonen, Arrhenius Institute, Stockholm University, Sweden
Project: Modelling of solvation and hydration effects in Platinum complexes as seen in 195PT NMR
- Prof Michael Buehl, Department of Chemistry, St Andrews University, Scotland
Project: Computations of Isotope effects in 195Pt NMR
- Prof Wolf Hiller, Dortmund University, Germany
Project: High-level NMR collaboration with a mobility grant from the NRF
- Dr Renat Hans, University of Namibia, Windhoek UNAM, Windhoek
Project: Capacity building of NMR spectroscopy for bio-prospecting of potentially active molecules in plants. Bilateral agreement two years 2014-2016
- Longstanding collaboration and exchange program with Prof E Hey-Hawkins and Prof S Berger, Department of Chemistry, University of Leipzig, Germany

ACADEMIC ACTIVITIES

Prof Klumperman acts as editor of Elsevier's *European Polymer Journal*, Editor-in-Chief of *Transactions of the Royal Society of South Africa*, and is a member of the Council of the Royal Society of South Africa. He delivered a number of invited lectures during 2016, including:

- First North American SMALP (Styrene Maleic Anhydride Polymer) Conference, Toronto, Canada 2016
- Seventh International Nanomedicine Conference, Sydney, Australia 2016
- Warwick Polymer Conference 2016, Coventry, United Kingdom
- Asian Polymer Association (APA) 2016 conference on Advanced Polymers, Biomaterials, Bioengineering and Nano Drug Delivery, Mauritius

Professor Peter Mallon presented a plenary lecture at the 24th World Forum on Advanced Materials (POLYCHAR 24) in Poland in May 2016 entitled: "Nanocomposite electrospun fibres with carbon nanomaterial". He is currently the Executive Secretary of the South African Chemical Institute (SACI) and a member of the International Scientific committee of the World Forum on Advanced Materials.

Professor Catharine Esterhuysen delivered several invited lectures and talks during 2016, including:

- Invited lecture entitled 'Gold as a Lewis base' presented during the Virtual Winterschool on Computational Chemistry, 3-9 February 2016;
- Keynote lecture on 'Gold as a Lewis base' presented at the ISXB-2 (2nd International Symposium on Halogen Bonding), Gothenburg, Sweden 6-10 June, 2016;
- During the European Crystallographic Meeting 30 at Basel, Switzerland, from 28 August to 1 September 2016, she presented an oral presentation on 'Gold as a hydrogen-bond acceptor'.
- On 11 July 2016 she delivered an invited lecture on gold as a Lewis base at Philipps-Universität Marburg, Germany.

Professor Delia Haynes was an invited speaker at the First Pan African Conference on Crystallography in Dschang, Cameroon,

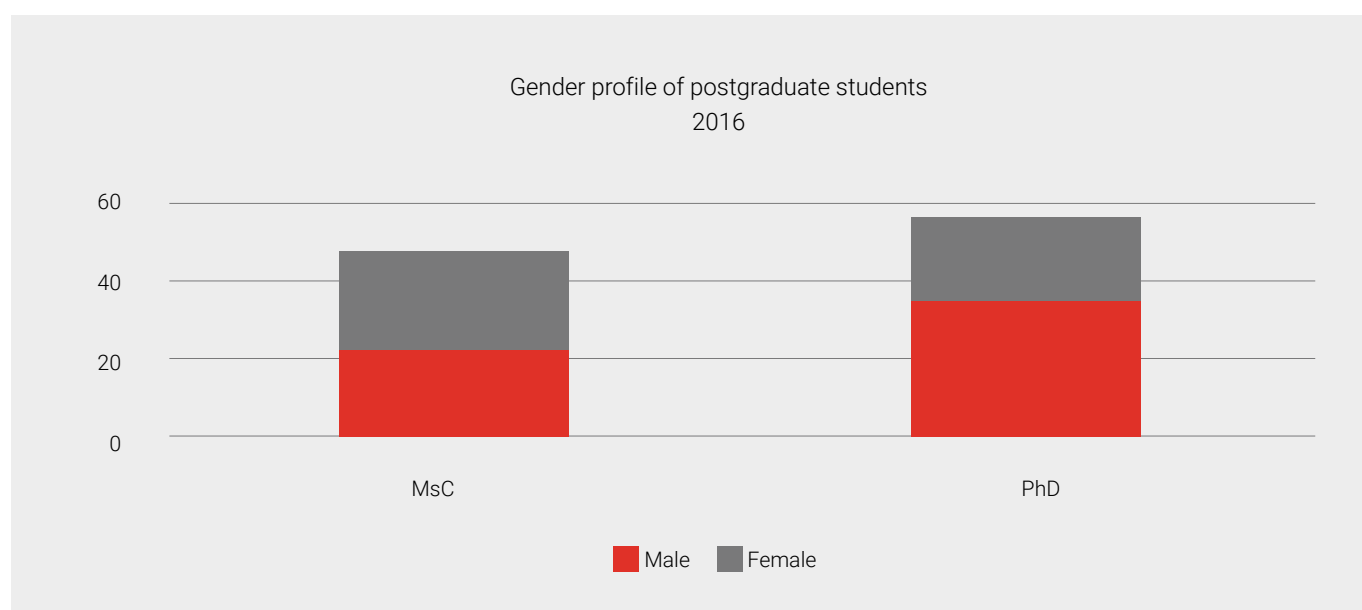
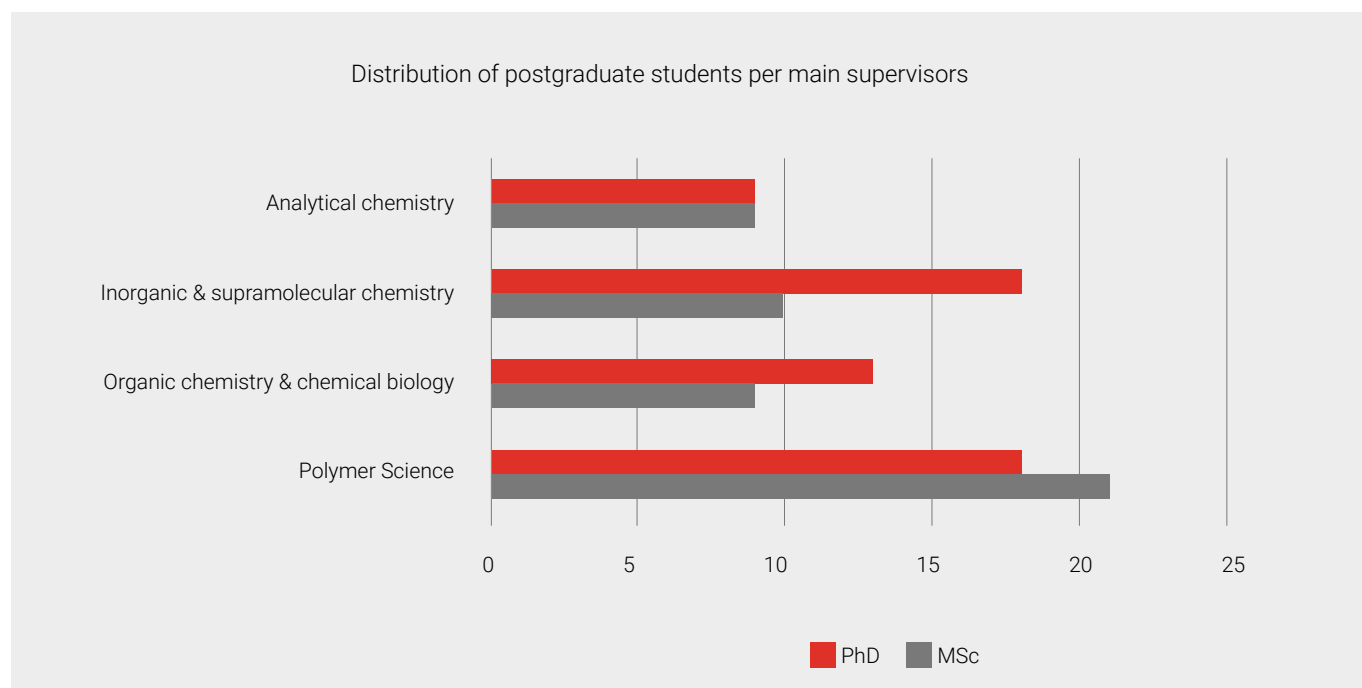
in October 2016. She was accompanied by PhD student Mr Bernard Dippenaar. Prof Haynes also attended the Gordon Research Conference on Crystal Engineering in the USA in June 2016. During 2016 she received a SASOL research grant to investigate complexes between metalloporphyrins and thiazyl radicals.

Dr Katherine de Villiers attended the Gordon Research Conference on the Chemistry and Biology of Tetrapyrroles, Salve Regina University, Newport, Rhode Island, USA (July 17-22, 2016).

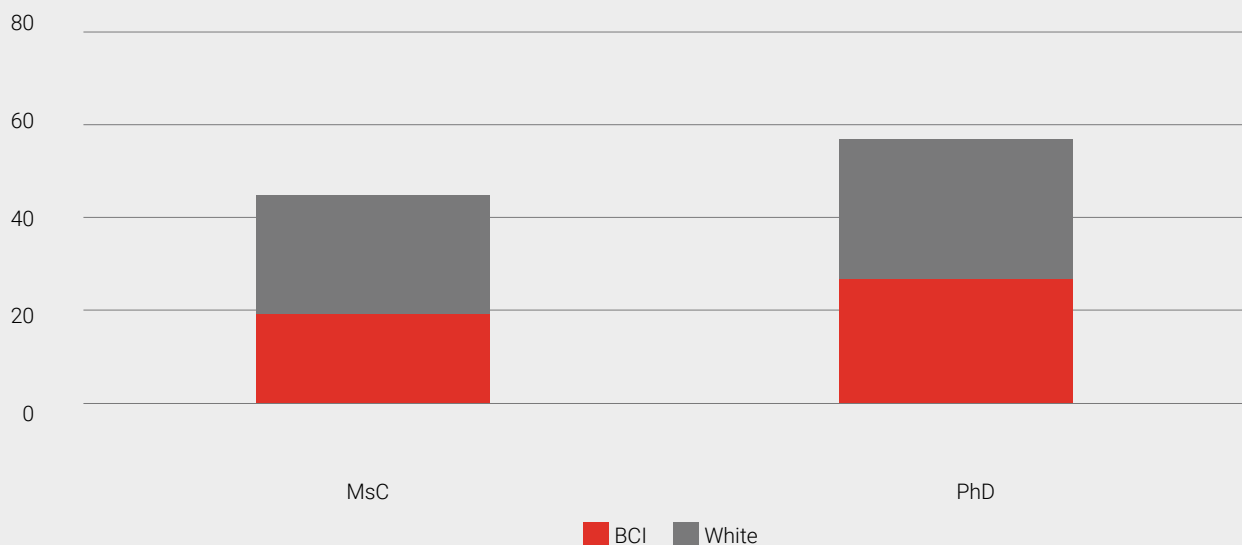
Prof Jan Dillen was an invited speaker at the Chembond 2016 conference in Dresden, Germany.

Focus on postgraduate students

The Department has a large cohort of 109 full-time postgraduate students – 49 MSc and 60 PhD students. During 2016 we delivered 16 MSc and 10 PhD graduates.



Diversity profile of postgraduate students
2016



During 2016, the Department hosted 19 postdoctoral fellows from South Africa (9), India (3), Italy (1), Libya (1), Lesotho (1), Germany (1), Namibia (1), Zimbabwe (1) and China (1).

SERVICE TO THE SCIENTIFIC COMMUNITY

Editorial activities

Prof L Barbour	<i>Comprehensive Supramolecular Chemistry</i> , a proposed nine volume reference work (Elsevier) (Co-editor in chief); <i>New Journal of Chemistry</i> (editorial board)
Prof WAL van Otterlo	<i>South African Journal of Chemistry</i> (editor)
Prof L Klumperman	<i>European Polymer Journal</i> (editor); <i>Transactions of the Royal Society of South Africa</i> (editor-in-chief & editorial advisory board)
Prof H Pasch	<i>International Journal of Polymer Analysis and Characterization</i> (JPAC) (editorial board); <i>Polymer International</i> (PI) (editorial board); Springer Laboratory book series (editor)

Other activities

Dr GE Arnott	Western Cape Branch of the South African Chemical Institute (committee member); National Research Foundation Thuthuka and Blue Skies panel member; NRF Competitive Programme for Rated Researchers panel; NRF Competitive Support for Unrated Researchers panel
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Prof AJ de Villiers	Western Cape Board of the Chromatographic Society of South Africa (ChromSA) (chair)
Prof C Esterhuysen	South African Crystallography Society (SACrS) (president); International Union of Crystallography Congress (South African representative); Member of the programme committee for the ISXB2 (International Symposium on Halogen Bonding) meeting, Gothenburg, Sweden, 6-10 June 2016
Prof DA Haynes and Dr MAL Blackie	Served on the Science Café Stellenbosch organising committee. Prof. Haynes also moderated a talk in November 2016
Prof KR Koch	International Conference on Coordination Chemistry (SA representative on executive planning committee)
Prof L Klumperman	Royal Dutch Chemical Society (member); American Chemical Society (member); South African Chemical Institute (member); International Society for Biomedical Polymers and Polymeric Biomaterials (member); Council of the Royal Society of South Africa (member); Nanotechnology/drug and vaccine development at the African Cancer Institute (focus area champion)

Dr R Malgas-Enus	National Research Foundation Innovation and Free-standing PhD and Postdoc applications (panel)
Prof PE Mallon	Western Cape Section of the South African Chemical Institute (member); 22nd World Forum on Advanced Materials POLYCHAR 22 (chair of the organising committee); National Council of the South African Chemical Institute (SACI) (member); International Scientific Committee of the World Forum on Advanced Materials (POLYCHAR) (member); NRF Blue Skies review panel (member)
Prof SF Mapolie	Catalysis Society of South Africa (executive committee)

Prof H Pasch	International Symposium on Polymer Analysis and Characterization (governing board)
Dr R Pfukwa	National Research Foundation Doctoral Scholarship Program (panel); National Research Foundation SA-Romania Research Cooperative (panel); South Africa-United Kingdom Scientific Seminar (organiser)
Prof AJ van Reenen	World Forum on Advanced Materials Conference POLYCHAR 22 (local organiser)

SOCIAL IMPACT

SU Chemistry Outreach Initiative – SUNCOI

The Department of Chemistry and Polymer Science aims to assist disadvantaged high schools with their prescribed chemistry practicals by inviting students to do their experimental work in one of the university's fully equipped laboratories, particularly at times when these are not utilised. The primary goals of this outreach program are as follows:

- To provide much needed infrastructure support by offering students and their teachers the necessary laboratory environment to work in;
- To develop a deeper understanding of the conceptually challenging topics of their prescribed syllabus (SUNCOI Practical with Purpose); and
- To collaborate with the Faculty of Education through involvement of pre-service teacher education students in practical work within-service teachers and their learners as well as postgraduate chemistry students and chemistry lecturer/researchers (SUNCOI Teaching the Teacher the Nuts and Bolts of Chemistry).

Many underprivileged schools have no lab space or chemicals, however, the teachers are expected to present and assess a prescribed practical to their grades 10-12 learners. These practicals are an essential part of the learner's assessment, so not having the infrastructure or resources to host these practicals pose a big problem to these teachers and subsequently to the learners.

During 2016 learners from Kylemore High, Pelican Park High, Zeekoeflei High, Kayamandi High and Cloeteville High completed their Grade 10 to 12 practical experiments in our laboratories.

SUNCOI at National Science Week

The West Coast Education District invited SU's Faculty of Science Faculty to take part in the National Science Week

(NSW) activities of 2016, to incite our youth with an interest in mathematics, science and technology at an early age. The Department of Chemistry and Polymer Science set-up mock labs in Malmesbury and Clanwilliam, accommodating 12 schools over three days. A total of 220 learners did four experiments each.



A team from the Department of Chemistry and Polymer Science supported National Science Week with activities from Grade 7 learners from schools along the West Coast. On the photo, from left to right, Mr Jabu Lukhele, Dr Prinessa Chellan, PhD student Jacquien October, Dr Rehana Malgas-Enus and PhD student Cassiem Joseph.

News from AlchemUS:

Annual magic show: Alice through the Erlenmeyer flask

Our well known and much anticipated magic show was a huge success!

The 'Alice through the Erlenmeyer flask' show was presented twice: once to the general public and then for Sun Valley Primary who brought a grade to come watch the show. The reactions of the learners were priceless as they watched explosions and colourful flames. Our wonderfully talented actors (postgraduates and undergraduates) brought the show to life.



Annual potjiekos competition

The Department's new 2016 honours students were again welcomed during the annual potjiekos competition. A selected panel of judges award the coveted trophy to the deserving team consisting of a mix of Hons, MSc, PhD students and academics.

Gravitational waves talk

This year AlchemUS teamed up with postgraduate students from the Department of Physics to present a popular science talk on the detection of gravitational waves by Prof Bruce Bassett. We had a huge turnout, with delicious food afterwards provided by the Department of Physics.

UCT versus SU pub quiz

The pub quiz is always an excellent evening and this year we decided to step up the competition and make it an intervarsity event, challenging chemistry student from the University of Cape Town. Sponsored by the South African Chemistry Institute (SACI), the Royal Society of Chemistry (RSC) and our own department, our promising Stellenbosch teams were bussed to UCT where Prof Peter Mallon was our pub quiz master. Unfortunately we were not the overall winners, but a great night with good sportsmanship (and chemistry puns) was had.

SACI Young Chemists' Symposium

2016 was Stellenbosch University's turn to host the South African Chemistry Institute's (SACI) Young Chemists' Symposium. This is an event which provides a platform for young chemists to present their research in a relaxed scientific environment. Fellow young chemists then had the opportunity to give feedback and ask questions. Posters and powerpoint presentations were at a very high standard this year and plenty of new connections were made.

Departmental research day

Dr Gareth Arnott requested that we help him expose second and third year students to the type of research carried out in the department. We did this in a form of a Departmental research day with short presentations by postgraduate students. The undergraduate students then voted on which presentation was the best (in terms of being the easiest to understand and which they found the most interesting) and the winners were presented with a cash prize.

Pub quiz in the quad

Ushering in the new AlchemUS committee, a pub quiz was organised in the quad of the De Beers Building with pizza and wine available at a small fee. With Mr Jabu Lukhele as our pub quiz master the evening was a great success and the new committee are expected to have an even better year!

STAFF MATTERS

Prof Ed Jacobs retired as associate professor as from 1 April 2016, after more than 25 years of service. Mr De Wet Groenewald, who joined the Department in 2004, retired as senior technical staff member on 31 December 2016. Mr. William Adonis retired as assistant technical staff member on 31 January 2017 after 42 years of service to the Department.

Staff list:

Head of department

- Prof PE Mallon

Academic staff

- Dr GE Arnott
- Prof LJ Barbour
- Dr MAL Blackie
- Dr L Cronje
- Prof AJ de Villiers
- Dr K de Villiers
- Prof JLM Dillen
- Prof C Esterhuysen
- Dr WJ Gerber
- Ms A Gericke
- Prof DA Haynes
- Prof EP Jacobs (retired March 2016)
- Prof L Klumperman
- Prof KR Koch
- Dr T le Roex
- Dr RC Luckay
- Dr M Lutz
- Dr R Malgas-Enus
- Prof SF Mapolie
- Prof H Pasch
- Dr SC Pelly (resigned June 2016)
- Prof WAL van Otterlo
- Prof AJ van Reenen
- Dr PFM Verhoeven
- Dr R Pfukwa
- Dr NP Gule
- Dr VJ Smith (resigned September 2016)
- Dr AGJ Tredoux

Extraordinary professor

- Prof WM Mackenroth

Extraordinary professor

- Prof A Rowan

Emeritus professor

- Prof IR Green

Extraordinary researcher

- Dr AE Smit

Emeritus professor

- Prof BV Burger

Emeritus professor

- Prof HG Raubenheimer

Support staff

- Mr JG Goldie
- Mr M Bickerstaff
- Ms MMG Cooper
- Ms DM Davids
- Ms M du Plessis
- Ms AE Fourie
- Ms C Hendrickse
- Ms DM Isaacs
- Ms MC Johnson
- Mr CW Maart
- Mr MG Marupula
- Ms SG May
- Ms CJ van Reenen
- Ms DC Wenn
- Mr GR Willemse

Technical staff

- Mr WJ Adonis (retired January 2017)
- Mr MC de Jongh
- Mr JD Groenewald (retired December 2016)
- Mr DJ Koen
- Mr EJ Lukhele
- Mr MA McLean
- Mr S Mohamed
- Mr JS Motshweni
- Ms PJ Steyn

New appointments

- Dr C Pretorius (May 2016, academic)
- Dr CH Kaschula (Jan 2017, academic)



DEPARTMENT OF EARTH SCIENCES

The Department of Earth Sciences is one of the oldest academic departments at Stellenbosch University, with a history that goes back to the teaching of 'elementary geology' at Stellenbosch School from 1849 to 1865. Today the Department maintains a prominent position in the fields of petrology, geochemistry, structural geology and tectonics.

RESEARCH INTERESTS

Geology

- Tectonics and orogenic processes
- Sedimentology and palaeontology
- Igneous petrogenesis
- Metamorphic petrology
- Experimental petrology
- Shear-zone hosted gold deposits
- Massive sulphide deposits
- Heavy mineral placer deposits
- Metallogenesis of mobile belts
- Geometallurgy

Environmental geochemistry

- Trace-element and isotope geochemistry
- Marine geochemistry
- Hydro-geochemistry
- Pollution
- Isotope hydrology

RESEARCH HIGHLIGHTS

Intriguing developments in West Coast geology

Prof JD Clemens

Orogenies are epochs within a region's geological history when tectonic forces cause compression of crustal rocks and throw up great chains of mountains.

The Saldania Orogeny in southern Africa produced rocks now exposed as small masses visible through windows in younger rock series. Thus, we have the Malmesbury Group, which was later intruded by magmas that crystallised to form the mostly Cambrian-aged Cape Granite Suite. All these rocks were eventually exposed by erosion and were, in turn, partly covered by the Ordovician to Silurian Cape Supergroup and the younger Karoo Supergroup sediments, themselves folded and thrust in yet another event known as the Cape Orogeny.

We study granitic rocks because they are mainly formed by partial melting of older crustal rocks, at depth. Often, the granites are our only window into the deep crust, and their compositions, textures, mineralogy and ages tell us a good deal about their crustal sources – rocks that we don't see at the surface. This information then feeds in to knowledge about how regions have developed geologically and tectonically, over vast tracts of time.

From earlier work, mostly done at Stellenbosch, we understood that the mainly granitic plutons of the Cape Granite Suite formed in four major pulses of magmatism,

“We study granitic rocks because they are mainly formed by partial melting of older crustal rocks, at depth.”

the last of which was thought to be volcanic. Scheepers and Nortjé (2000) and Scheepers and Armstrong (2002) were the first to recognise that the rocks of the Postberg Peninsula, in the West Coast National Park, were not intrusive things that crystallised at depth. Rather, in this case, the granitic magmas burst forth at Earth's surface in violent, gas-charged eruptions that covered the landscape with deadly flows of hot, glassy, volcanic ash. Such deposits are called ignimbrites and the most violent ignimbrite eruptions come not from volcanic mountains but instead from roughly circular depressions called calderas. Luckily, when all this happened on the West Coast, the only life on land would have been some blue-green slime.

Prof John Clemens came to Stellenbosch in 2007, with a background in studying ancient ignimbrite deposits in south-eastern Australia. Part of his PhD work was on such rocks. On a third-year field trip to the West Coast in 2008, he first saw some rocks on the north side of Saldanha Bay, at a place called Trekoskraal. One look told him that these were also ignimbrites, though they had never been recognised as such.

Prof Gary Stevens, who is the SARChI Chair in Experimental Petrology at SU, visited the area too and, independently, also thought that these rocks are volcanic rather than intrusive.

Thus, Stevens and Clemens jointly supervised MSc student Mr Cedric Joseph to work here. His sampling and analyses, together with follow-up field and laboratory work by Stevens and Clemens, identified classic volcanic features such as fine, laminated and sometimes cross-bedded ash deposits called tuffs, at the base of the sequence (see picture below).



A coastal outcrop at Trekoskraal showing the finely layered tuff deposits at the base of the Saldanha sequence, overlain by the base of the true ignimbrite, which does not show any visible layering. Photo: JC Clemens

In one horizon, they even found ash pellets formed in the moist gas cloud of the initial eruption, in which electrostatic forces caused the ash to grow in layers, somewhat like the structure of hail stones. These tuffs pass upward into true ignimbrites in which very beautiful pumice fragments can be identified. Initial results of the work are reported in Clemens and Stevens (2016).



Photomicrograph of a slice (0.03 mm thick) of rock from the base of the Saldanha ignimbrite pile. You can see the broken fragments of crystals (shattered in the explosive eruption), tiny fork-shaped glass shards that were welded together by the heat in the flow, and a beautifully preserved former pumice fragment. Image courtesy of JC Clemens

Most investigators had examined the hard, recrystallised middle parts of the ignimbrite flows, where heat and fluids locked in the volcanic pile caused devitrification and the growth of crystals that progressively destroyed the fine tell-tale features that remain preserved near the base. So now we have a huge volcanic cauldron complex, centred on Saldanha Bay, with ignimbrite deposits on both sides. Further work has shown that the two eruption centres (at Postberg and Saldanha) are of similar age, were erupting simultaneously for part of the time and were erupting magmas that were quite different in composition from each other. Re-dating of the rocks is now showing that there were, after all, only three periods of granitic magmatism in the Cape Granite Suite because these ignimbrites in the north of the region fall within the same age bracket as the plutonic S-type granite magmas that formed the Stellenbosch and Peninsula plutons. Things are becoming much clearer, and work continues on further characterising these fascinating deposits from the West Coast's violent prehistory.

Amani gold mineralisation, Tanzania

Dr B von der Heyden

Previous research conducted by BSc Hons student Rikard Taljaard in 2013 reported large dendritic gold nuggets in soil profiles in the Amani area in southern Tanzania.

Since the low temperature (bio)geochemical cycle of gold is still incompletely understood, the Amani mineralisation represented a perfect natural laboratory for further investigation of the controls on gold mobilisation and secondary gold precipitation. Dr Bjorn von der Heyden and BSc Hons student Stephan Dunn conducted a site visit from 4 to 12 September 2016. In order to understand the controls on secondary gold processing, gold nuggets and flakes were collected by panning river sediment and soil profiles were collected from mineralised horizons.

To augment the work on the secondary gold, field mapping and quartz vein sampling were conducted to gain a handle on the style of the primary gold mineralisation. All elements of this work (e.g., investigation in organic, inorganic and biological

controls on Au cycling) will be continued between 2017 and 2019. The study is funded by the NRF.



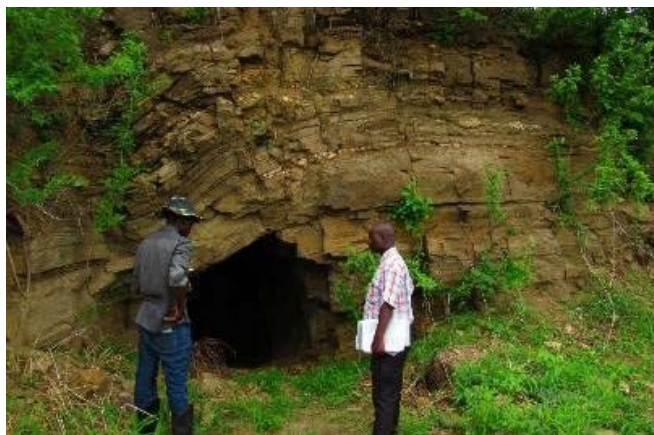
BScHons student Stephan Dunn uses a compass to take geological field measurements of the dip and strike at an outcrop in the Amani area, Tanzania. Photo: B von der Heyden

Gold mineralisation in the Kirk Range, Malawi

Dr B von der Heyden

Artisanal miners have won gold from the Manondo-Choma area in southern Malawi for over a century, yet to date the geology of the primary mineralisation has not been defined.

In December 2016, Dr Bjorn von der Heyden and PhD student Joshua Chisambi conducted geological mapping in the area to understand the field relationships associated with the gold mineralisation. Quartz veins were sampled in order to determine the properties of the mineralising fluid. This ongoing research is funded by the World Bank.



PhD student Joshua Chisambi (left) at the entrance to the abandoned Breeze's mine in the Manondo-Choma area in southern Malawi. Minor deformation is observed in the host rocks (background). Photo: B von der Heyden

Distribution of deleterious elements in base metal sulphide: Aggenys ore district, RSA

Dr B von der Heyden

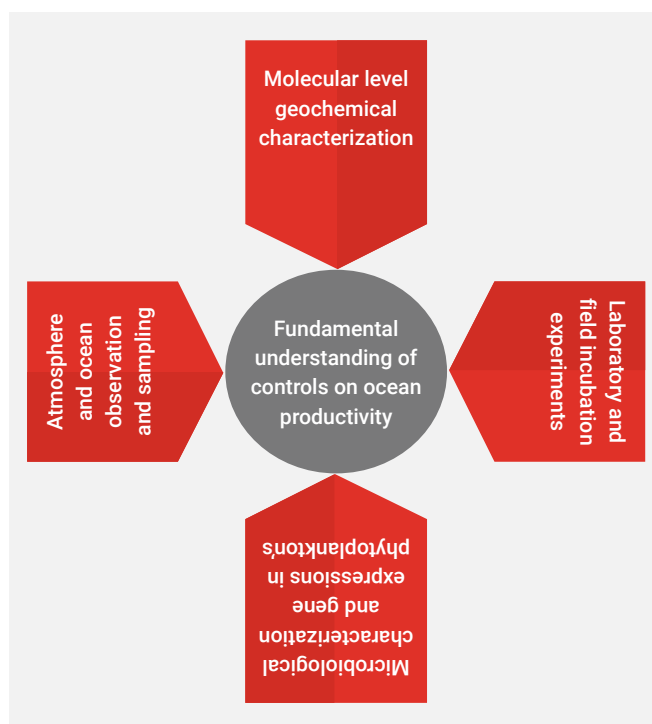
High concentrations of deleterious elements (e.g., cobalt, cadmium and bismuth) can have negative impacts on the economic viability of base metal sulphide ores. Two BSc Hons

students, Mia-Lee van Zyl and Courtney Ukena, investigated the distribution of these elements in the different sulphide minerals at the Swartberg ore deposit and found that certain minerals can host large (>2000 ppm) concentrations of these elements as cation substituents within their mineral structure.

For example, cadmium was identified at concentrations of up to 5324 ppm in sphalerite (ZnS) crystals in the Lower Ore Body at the Swartberg Mine. Future experimental work, in collaboration with Dr Margreth Tadiein SU's Department of Process Engineering, will investigate the effects that cation substituents have on the structure and chemistry of sulphide minerals, and how this affects the subsequent down-stream beneficiation of the ore. This work will be undertaken by MSc student Lebogang Babedi and is supported by a grant from the DST/NRF Centre of Excellence for Integrated Mineral and Energy Resource Analysis (CIMERA).

Major research grant for the Centre for Trace and Experimental Biogeochemistry

Prof A Roychoudhury received a grant of US\$1.33M towards the establishment of a multi-disciplinary research centre focusing on the biogeochemistry of the Southern Ocean. Using its geographical advantage the centre intends to apply cutting-edge chemical and microbiological techniques to gain a fundamental understanding of controls over Southern Ocean primary productivity. Significant progress has already been made towards establishing methods to measure ultra-trace micronutrients in ocean waters, a first in Africa. Initial results suggest seasonal and spatial differences in the supply and chemical speciation of micronutrients to the surface ocean thereby helping better understand the Southern Ocean paradox.



The Centre for Trace and Experimental Biogeochemistry's approach includes multi-disciplinary research for a holistic understanding of the Southern Ocean paradox.

Large Igneous Provinces across southern Africa

Dr Martin Klausen

The three-year NRF CSUR grant towards our research on mafic intrusions across southern Africa, which were emplaced across older cratons during major magmatic events and typically form so-called Large Igneous Provinces, came to an end in 2016.

This work was done in collaboration with geochronologists at Lund University (Sweden) as well as paleomagnetists at the University of Johannesburg and the universities of Yale and Texas (USA). In this collaboration, Dr Klausen and his postgraduate students focused on the structural and petrological (including bulk rock geochemical) aspects of these mafic intrusions; i.e., how mafic magmas formed in the mantle and subsequently were emplaced and differentiated within the crust.

Past collaborative research on the Kaapvaal Craton has made great strides towards identifying dyke and sills swarms belonging mainly to nearly three Ga Dominion-Pongola, ~2.7 Ga Ventersdorp, 2.05 Ga Bushveld, ~1.9 Ga Hartley-Soutpansberg, ~1.1 Ga Umkondo and ~0.18 Ga Karoo events.

Dr Klausen presented a review at the 35th International Geological Congress in Cape Town, where he recognised that most Large Igneous Provinces across the Kaapvaal Craton – with the exception of its Phanerozoic Karoo LIP – arguably were emplaced during supercontinental amalgamation rather than break-up. If so, then many Precambrian mafic records should perhaps be viewed as a distinct subgroup of Large Igneous Back Arc Provinces (LIBAPs).

Dr Klausen's research is currently progressing farther northwards, into more centrally located African craton blocks that

make up a poorly-investigated Greater Congo Craton. This is done together with postgraduate students and in collaboration with the Department of Geology at Lumbubashi University (DRC), as well as through continued new support from Anglo American.



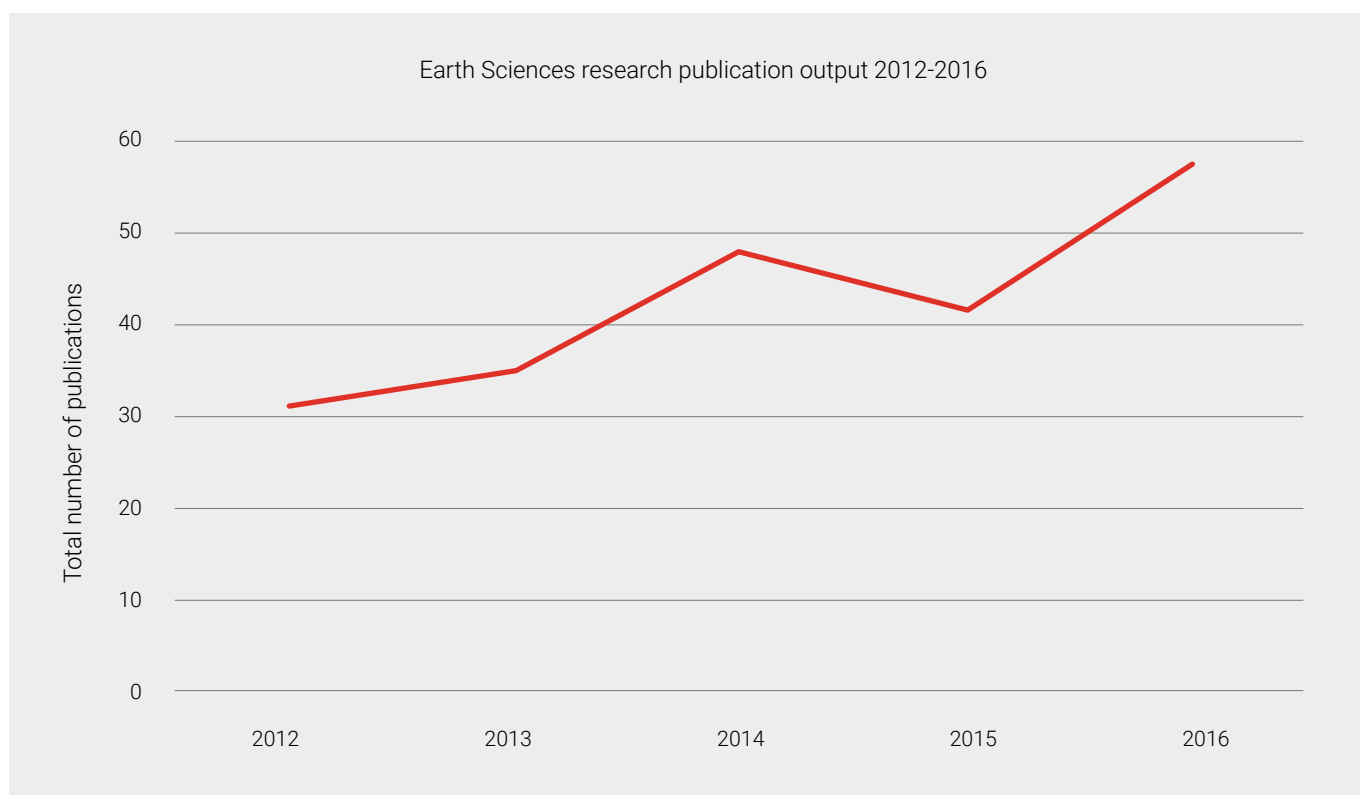
Dr Martin Klausen doing field work in 2016 with postgraduate students on a layered intrusion within the Karoo LIP in South West Zimbabwe.

Photos: M Klausen

RESEARCH PROFILE

Research output

The Department is known for its high impact research in the field of Earth Sciences. In 2016 49 articles were published in accredited international journals and in the last five years a number of publications have appeared in high impact journals (impact factor of 8 to 34), including international journals such as *Science* and *Nature*. Ten of the publications were cited more than 30 times (one 91 times) within the last five years (Scopus 6/2017).



National and international collaboration

Prof Roychoudhury

- Mr Manan Saha, an electronic engineer from PRL, India visited Prof Roychoudhury's lab
Project: Collaborative project on automating a flow injection analysis system for measurement of dissolved iron in ocean waters. He spent his time creating a hardware-software interface and training students on the software interface
- Active collaboration with Prof S Myneni, Princeton University, and Phoebe Lam, University of California
Project: Nanoparticle characterization
- Collaboration with Prof J Routh, Linköping University, Sweden
Project: Biomarker proxies for determining paleoclimate change

Dr S Fietz

- Research visit to Norwegian University of Science and Technology (NTNU), within the South Africa/Norway Research Cooperation Programme (SANCOOP)
- Co-principal investigator on a NRF-CSUR project led by Dr Sarah Fawcett at the University of Cape Town
Project: Late Quaternary ocean-climate interactions: palaeo-science training through palaeo-climate

Other collaborators

South Africa

- University of Cape Town
- Council for Geosciences
- Nuclear Energy Corporation of South Africa (NECSA)

Africa

- University of Namibia, Namibia

International

- McGill University, Canada
- Lausanne University, Switzerland
- Institute for Nuclear Sciences, Hungarian Academy of Sciences, Hungary
- Princeton University, USA
- University of California, USA
- Linköping University, Sweden

Other research activities

Prof Gary Stevens and MSc student Matthew Mayne published RCrust, a new software tool for phase equilibrium modelling in rock systems with changing bulk composition.

Dr Jodie Miller received a sabbatical grant from the *Fondation Herbette* to visit the University of Lausanne for three months between March and June to work with Prof Torsten Vennemann

on groundwater hydrochemistry in the Namib-Naukluft region of Namibia.

Dr Bjorn von der Heyden received an unrated researcher grant from the NRF for the study of low temperature bio-geochemical cycling of gold. He also received an NRF-CIMERA grant for project and student support for the geo-metallurgical study of the impacts of cation substitution in sulphide mineral structures.

Dr Von der Heyden was awarded a SU FIRTLL (Fund for Innovation and Research in Teaching and Learning) grant for a project that combines blended learning approaches with elements of near-peer learning. It is anticipated that Honours' students will engage during their field school as they will be expected to prepare short videos of their experiences and learnings during this important component of their work. The prepared videos will be used as a blended teaching medium in a subsequent third year module, where it is anticipated that undergraduate learning will be enhanced by the footage of real-world examples presented by anchors with whom they can easily relate.

Dr Susanne Fietz received new incubators for cultivation of algae and bacteria in Southern Ocean conditions (that is, under very cold water temperatures).

Well-known palaeontologist Dr Ray Rogers delivered a public lecture as a part of the 19th Biannual Meeting of the Palaeontological Society of Southern Africa, which was hosted by SU' Department of Earth Sciences.

Other activities include:

Prof JD Clemens

- Presented a paper at the Igneous and Metamorphic Studies Group (IMSG) 2017 meeting organised by the University of Cape Town (UCT)
- Attended and presented a paper at the European Geosciences Union General Assembly in Vienna, Austria
- Officiated at the Igneous and Metamorphic Studies Group (IMSG) meeting as founder President

Prof AN Roychoudhury

- Co-author on three papers presented at the 34th SCAR Biennial Meeting, Kuala Lumpur, Malaysia, August 22 – 26, 2016
- Co-author on three papers presented at the SANAP Symposium, Pretoria, South Africa, July 27 – 29, 2016
- Co-author on a paper 'Response of Southern Ocean Phytoplankton Communities to Trace Metal and Light Availability' at the Ocean Sciences Meeting, New Orleans, USA February 21 – 26, 2016
- Invited talk, entitled 'Beyond iron-age: bioactive trace elements in the Southern ocean' as part of the SANCOR seminar series.

Dr S Fietz

- Attended the ASLO (Association for the Sciences of Limnology and Oceanography) Ocean Science Meeting in February in New Orleans, USA

- Attended the Synthesis Workshop on Biogeochemical Cycling of Trace Elements within the Ocean in June 2016 in New York, USA
- Attended the Benguela Symposium in November 2016, Cape Town
- Attended the South Africa-Norway Science Week, November 2016, Cape Town
- Co-authored a paper presented at the American Geophysical Union (AGU) Fall Meeting, December 2016, San Francisco, USA
- Several of Dr S Fietz' students presented at national and international conferences. MSc student Mr Kaurae Kanguuehi and BSc Hons student Mr Johan Viljoen presented their work at the South African Antarctic Programme (SANAP) Symposium in June 2016 in Pretoria. Mr Kanguuehi also attended the SCAR Open Science Meeting in August 2016, Kuala-Lumpur, Malaysia, as well as the South African Society for Atmospheric Sciences (SASAS) annual conference in November 2016, Cape Town. BSc Hons student Mr Reuben Lazarus presented his work at the Global Change Conference, December 2016, Durban.

Dr JA Miller

- Attended the 15th Water Rock Interaction meeting in Evora Portugal along with PhD student Andrew Watson and presented on groundwater modelling and isotope tracing of salt movement in the Verlorenvlei estuary on the west coast of South Africa
- Participated in the International Geological Congress in Cape Town in August and contributed to eight presentations on a variety of topics. Six of Dr Miller's PhD and MSc students also participated and presented papers
- Two of Dr Miller's MSc students, Anya Eilers and Thendo Sigidi, attended the 43rd International Association of Hydrogeologists Congress in Montpellier, France, where they presented on their work tracing salt movement in the tributaries to the Verlorenvlei estuary.

Dr M Klausen

- Attended the 35th International Geological Congress in Cape Town (IGC) together with postgraduate students Thendo Netshidzivhe, Wean Welgemoed and Riaan Bothma
- Attended the annual Igneous and Metamorphic Studies Group Meeting in Langebaan.

Several PhD students in Prof Gary Stevens' group presented at the 35th International Geological Congress (IGC) 2016 in Cape Town. This is the principal event of the International Union of Geological Sciences. Sara Burness, Nonkuselo Madlakana and Matthew Mayne also presented at the Igneous and Metamorphic Study Group Meeting hosted by the University of Cape Town

Awards to staff and students

We are particularly pleased to report that two of our students, Jean Look and Matthew Mayne, received national awards

from the Geological Society of South Africa for the best theses in Earth Sciences in 2015:

Jean Look - GSSA award for the best fourth year student in geology

Jean's thesis examined climate change by studying bio-active trace metal concentrations in the Southern Ocean and defining the growth stress induced by low concentrations on marine phytoplankton. He graduated cum laude and is now working on his MSc at Stellenbosch, under the supervision of Prof Roychoudhury. He presented results from his thesis at a symposium of the South African National Antarctic Program (SANAP) at the end of July and again at the International Ocean Science Conference of the Scientific Committee on Antarctic Research (SCAR), in Malaysia, in August.

Matthew Mayne - John Handley award for the best MSc thesis in geology

As part of his thesis, Matt created a software tool, called Rcrust, which enables a new concept in modelling known as 'path dependence'. This allows researchers to investigate multi-step processes that are crucial to the formation of metamorphic rocks. Matt also graduated cum laude and is now working on his PhD under the supervision of Prof Gary Stevens. Based on his MSc work, he recently published an article in the *Journal of Metamorphic Geology*. In July he presented at the Workshop on the Origin and Evolution of Plate Tectonics in Locarno, Switzerland, and will also present in August at the International Geological Congress in Cape Town.

Awards to Ryan Cloete and Jean C Look at SCAR conference

Congratulations to Jean Look and Ryan Cloete who have won best oral presentation and best poster presentation, respectively, at the SCAR (the Scientific Committee on Antarctic Research) conference held in Malaysia. They presented their MSc research so far on the Southern Ocean work and were competing with all postgraduate registered students for the accolades.

Funding

- South African Minerals to Metals Research Initiative (SAMMRI)
- Water Research Commission
- Durr Bottling
- Fondation Herbette, University of Lausanne

ACADEMIC AFFAIRS

This year we had a BScHonours cohort of 24 students, which is impressive in the context of our small staff complement. Feedback from external examiners suggests that we have the highest-quality BScHonours students of any earth sciences or geology department in the country. We had 27 MSc and 9 PhD students registered in the Department, as well as two postdoctoral fellows.

Despite the large undergraduate classes, the Department strives to provide hands-on teaching in a highly applied field. To ensure the practical competencies of our students, an unusually large number of contact hours are allocated to field skills (288 hours from first year to honours), of which the honours students' annual mines tour is one of the highlights. Our students benefit from learning in a collegial environment from our cohort of highly competitive and diverse staff.

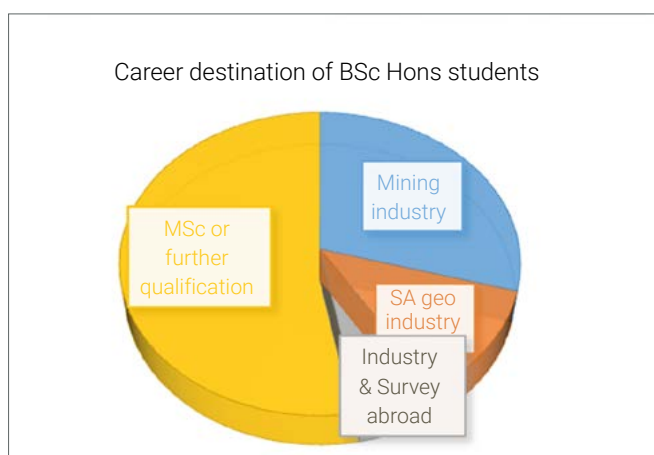


Second year students enjoyed a field trip to the Rooi Els estuary to analyse parameters controlling water composition and water quality.

Focus on postgraduate students

The undergraduate programme is aligned with the Department's mission: "To serve South African society by producing graduates equipped with the high-level skills needed to take our minerals and energy industry forward, in terms of exploration, mining, minerals processing, and environmental monitoring, design and remediation".

Honours graduates are trained for either direct entry into the industry or research oriented career (see pie chart). More students from our honours cohort are opting to pursue postgraduate degrees within the department and are thus highly sought after by the industry.



SERVICE TO THE SCIENTIFIC COMMUNITY

Prof JD Clemens	Officiated at the Igneous and Metamorphic Studies Group annual meeting as founder President
Prof AN Roychoudhury	GEOTRACES programme (South African representative and steering committee member); Council for the International Association of GeoChemistry (member); Africa Earth Observatory Network (AEON) (founder member); Marine Research Institute, University of Cape Town (member); Applied Centre for Climate and Earth Systems Science (ACCESS) (steering committee); National Oceanographic Equipment and Planning Committee; External examiner for University of the Free State

Dr B von der Heyden	Affiliated with CIMERA (DST-NRF Centre of Excellence for Integrated Mineral and Energy Resource Analysis)
Prof G Stevens	Organised the Cape Granites field trip for the 35 th IGC along with Prof JD Clemens; Assessor for the Australian Research Council; Fellow of the African Academy of Sciences
Dr JA Miller	Council member International Association of GeoChemistry (IAGC); External moderator for Nelson Mandela Metropolitan University (NMMU)
Dr S Fietz	External Examiner University of the Free State Reviewer for DFG (German Research Foundation) and NRF projects

Editorial activities

Prof AN Roychoudhury	Associate editor of <i>Frontiers in Environmental Sciences: Groundwater Resources and Management</i> ; Review editor for <i>Frontiers in Marine Science: Ocean Observation</i>
Dr S Fietz	Editor of <i>International Review of Hydrobiology</i>
Prof G Stevens	Served on the editorial board of <i>Journal of Metamorphic Geology</i>
Dr M Klausen	Guest editor for Special Volume 183 in GFF (<i>Scandinavian Journal of Geology</i>)

SOCIAL OUTREACH

Dr S Fietz gave lectures for the Regional Graduate Network in Oceanography (RGNO), African Discovery Camp for Research-based Training in May 2016.

Dr Ryan Tucker gathered donations for the Maphutseng School(s) for acquiring science-based books and general teaching materials. He also visited and gave public lectures at the Spark Lynedoch Primary School and United Heralia Schools. Spark schools is a network of primary schools dedicated to delivering accessible, high quality education.

STAFF MATTERS

Academic

- Prof IS Buick
- Prof JD Clemens
- Dr S Fietz
- Dr R Heyn
- Prof A Kisters
- Dr M Klausen
- Dr J Miller
- Prof A Roychoudhury (Head of Department)
- Prof G Stevens
- Dr R Tucker
- Dr B von der Heyden

Extraordinary professors

- Dr I Basson
- Prof D Frei
- Dr N Phillips

Support staff

- Ms L Conradie
- Ms M Frei
- G Olivier
- F Timney

Emeritus professor

- Prof A Rozendaal

Postdoctoral fellows

- Dr J Taylor
- Dr V van Schijndel

DEPARTMENT OF MATHEMATICAL SCIENCES

Together the divisions of Applied Mathematics, Computer Science and Mathematics form the Department of Mathematical Sciences at Stellenbosch University.

“The department is producing a sustained research output that can certainly compete with every mathematics and computer science departments in South Africa both in terms of quality and quantity”

RESEARCH INTERESTS

Applied Mathematics Division

- Computer vision, pattern recognition, machine learning
- Fluid dynamics & modelling
- Numerical analysis and scientific computing
- Applied discrete mathematics

Computer Science Division

- System software verification
- Software engineering
- Machine learning and computer vision
- Automata theory and formal languages
- IP networks

Mathematics Division

- Algebra
- Algebraic number theory and arithmetic algebraic geometry
- Discrete mathematics and algorithms
- Foundations of mathematics
- Topology
- Functional analysis
- Biomathematics and computational biology

RESEARCH HIGHLIGHTS

Over the past year there have been many research highlights in the department. The ratings received by our researchers are a clear indication of their excellent international standing, and the publications listed in the research output, which include papers in some very prestigious journals, exhibit both the breadth and depth of our research.

The department is producing a sustained research output that can certainly compete with every mathematics and computer science departments in South Africa both in terms of quality and quantity, and we have been fortunate enough to attract a number of excellent postgraduate students.

Our researchers attended the following congresses:

Dr Bruce Bartlett

- Invited speaker at the Oberwolfach Mini-Workshop on New Interactions between homotopical algebra and quantum field theory in Germany from 18 to 23 December 2016. The Oberwolfach Research Institute for Mathematics is a research institute and meeting point for the world's leading mathematicians to exchange ideas about the most recent developments in their field

- Invited speaker at the Leeds Workshop on Modelling topological phases of matter, 5-8 July in Leeds, United Kingdom
- Invited speaker at the Georgia Topology Conference, 25-29 May 2016, University of Georgia, United States of America
- Invited speaker at the Edinburgh Mathematical Physics Group Seminar, March 2016, Herriot-Watt University, Scotland
- Edinburgh Geometry Seminar, March 2016, University of Edinburgh, Scotland
- Oxford North Meets South Colloquium, Mathematical Institute, University of Oxford, May 2016

Dr JRA Gray

- ATC 2016, University of Cape Town

Dr R Heymann

- Attended the AGFA and International Academy of Astronautics (IAA) Workshop at the Heinrich Fabri Institute in Blaubeuren, where she delivered a talk titled 'A Jacobs-de Leeuw-Glicksberg Type Decomposition of a Multiplication Operator on a Bochner Space'

Dr K-T Howell

- Attended the Discrete Mathematics Conference, Italy, July 2016

Prof C Hui

- Presented an invited session at the Annual Zoological Society Conference in America

Prof Z Janelidze

- Invited talk at the 4th Workshop on Categorical Methods in Non-Abelian Algebra at the Centre for Mathematics of the University of Coimbra, May 30 to June 1 2016

Dr R Roux

- Attended the Gdańsk Workshop on Graph Theory in Gdańsk, Poland in June 2016

Prof GJF Smit

- Co-delivered a presentation entitled 'On the prediction of fragment distribution of naturally fragmenting warheads: a machine learning approach' at the 29th International symposium on ballistics, Edinburgh, Scotland, UK, May 9–13, 2016

Prof S Wagner and PhD student K Durant

- Attended the ANALCO/ALENEX/SODA 2016 in Arlington, USA, 10-12 January 2016

Prof S Wagner

- Attended the DFG-AIMS Workshop and Next Einstein Forum in Dakar, Senegal, 6-10 March 2016
- Invited talk in the mini symposium 'Structures in trees' of the Society for Industrial and Applied Mathematics (SIAM) Conference on Discrete Mathematics (DM16), Atlanta, USA, 6-10 June 2016
- Plenary talk titled 'Teaching mathematical problem solving' at the 22nd Annual National Congress of the Association for

Mathematics Education of South Africa, Nelspruit, 27 June - 1 July 2016

- Attended the 27th International Meeting on Probabilistic, Combinatorial, and Asymptotic Methods for the Analysis of Algorithms (AofA'16), Kraków, Poland, 4-8 July 2016
- Attended the Workshop in Analytic and Probabilistic Combinatorics, Banff International Research Station, Banff, Canada, 24-28 October 2016

Prof JAC Weideman

- Invited talk in honour of Annie Cuyt at her 60th birthday celebrations in Italy, titled 'Annie@60. A life in approximation' and published in a special edition of *Dolomites Research Notes in Approximation* Vol 10 (2017)

Dr S Fidder-Woudberg

- Co-presented a paper titled 'Analytical determination of the effect of biofilm growth on the pressure drop over a biofilter' at the World Congress on Momentum, Heat and Mass Transfer, Prague, Czech Republic, 4-5 April 2016

The 59th Annual Congress of the South African Mathematical Society which took place in Cape Town from 2 to 4 November 2016 was attended by many colleagues and postgraduate students in Mathematics.

Substantial research visits

B Bartlett was a research fellow in the Topology group at the Mathematical Institute, University of Oxford, June 2016. Dr R Benjamin, the nGAP lecturer in Mathematics, was a postdoctoral research fellow at Leiden University, September 2016 to June 2017. Dr S Fidder-Woudberg spent her research leave from January to June 2016 at the Rijksuniversiteit Groningen in The Netherlands where she was hosted by Prof J.Th.M. de Hosson.

Prof L van Wyk visited prof Michal Ziemkowski at the Warsaw University of Technology during his research leave in October 2016, and gave a talk at the mentioned university, as well as one at the University of Warsaw, entitled 'Commutative subalgebras and Lie nilpotent subalgebras of $Mn(F)$, F any field' and 'The maximum dimension of a Lie nilpotent subalgebra of $Mn(F)$ of index m '.

During his year-long research leave, Prof WC Visser gave eight invited talks:

- 'Analyzing ICSE 2016 Submission and Survey Data', International Federation for Information Processing (IFIP) Working Group 2.4 Victoria, Canada, April 2016
- 'The Analytical Perspective on Mutations and Coverage', Georgia Tech, United States of America, August 2016
- 'The Analytical Perspective on Mutations and Coverage', Singapore National University, Singapore, September 2016
- 'The Analytical Perspective on Mutations and Coverage', University of Nebraska at Lincoln, United States of America, October 2016

- 'What I did this year at NASA', National Aeronautics and Space Administration (NASA) Ames Research Center, Mountain View, CA, November 2016
- 'The Analytical Perspective on Mutations and Coverage', University of Washington, Seattle, United States of America, November 2016
- 'The Analytical Perspective on Mutations and Coverage', Oregon State University, Corvallis, United States of America, November 2016
- 'Model Counting and its Applications to Software Analysis', Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea, December 2016

International visitors hosted

Prof B Fischer

- Hosted Prof. Dr. Ing Ina Schäfer from the Institute of Software Engineering and Automotive Informatics, Technische Universität Braunschweig
Project: Software engineering

Prof AE Krzesinski

- Hosted Dr Johannes Goebel from the University of Hamburg
Project: Networks

Prof B Fischer

- Hosted Prof. Dr.-Ing. Stefan Jänichen from the Institut für Softwaretechnik und Theoretische Informatik, Technische Universität Berlin
Project: Software Engineering

Prof S Wagner and Prof H Prodinger

- Hosted Prof. Dr Clemens Heuberger and Benjamin Hackl from the *Institut für Mathematik, Alpen-Adria-Universität Klagenfurt*, Austria, during February and March 2016
- Project: Working on research projects concerned with the enumeration and study of parameters of different types of trees and lattice paths

Prof S Wagner

- Hosted Prof Marcin Krzywkowski, Gdansk (Poland) and research fellow at the University of Johannesburg in November 2016
- Project: Wrote a joint paper on bounds for the number of total dominating sets in graphs
- Hosted Prof Cecilia Holmgren from Uppsala University, Sweden
- Project: Working on two projects related to random trees: one is the Maximum Agreement Subtree (MAST) problem from phylogenetics, the other is concerned with so-called additive parameters in random trees of different kinds, for which we aim to prove strong general limit theorems

Dr M Cloete was visited by Prof Pawel Kosinski from the University of Bergen, Norway, her research host during her post-doctoral studies in Norway.

RESEARCH PROFILE

It is clear from the publication record of the Computer Science Division that much of our research work is carried out in collaboration with colleagues at other institutions. It is simply not possible to conduct our work in isolation. South African universities are quite well-partitioned with respect to Computer Science research and by necessity this means that these relationships are international. The work of students and staff alike benefit from this wider exposure.

While it is difficult to assess the value of a specific collaboration appropriately, it is clear that mathematical research is becoming more and more globalised, and exchange of ideas on an international level thus increasingly important. Research collaborations have contributed significantly to the division's research output, and many successful projects would never even have been started without them.

Collaboration with industry provides actual real life problems that influence our research in Applied Mathematics. The unique cutting edge problems posed by the industry challenge us to incorporate multi-disciplinary fields in order to find solutions, e.g., the combination of machine learning and computational fluid dynamics in river run-off modelling; experimental methods, long-wave analyses and image processing in long-wave transmission through breakwaters studies.

It is the view in the department that for every academic to excel, grow, and compete successfully internationally, that individual needs to be an active and dedicated researcher who is able to identify significant research problems, publish in leading specialist journals, participate in international conferences, collaborate within a network of internationally recognised researchers at leading research institutions, and source research funding.

NRF-rated researchers

Prof Willem Visser became only the second computer scientist in South Africa to receive an A-rating from the NRF. His field of research is software engineering. Prof Zurab Janelidze received a B-rating. His field of research is categorical algebra (category theory)

NRF-rated researchers	
Leading international researchers	
Prof H Prodinger	Analysis of algorithms, number theory and combinatorics
Prof W Visser	Software failure, software engineering and software development
Internationally acclaimed researchers	
Prof B Fischer	Software engineering
Prof Z Janelidze	
Prof L Van Wyk	Ring theory and matrix algebras
Prof S Wagner	Graph theory and combinatorics
Prof JAC Weideman	Numerical analysis and scientific computing

NRF-rated researchers	
Established researchers	
Prof F Breuer	Number theory
Dr J Geldenhuys	Software engineering and specifically model checking and process algebra
Prof B Herbst	Computer vision and machine learning
Prof S Mouton	Banach algebras and spectral theory
Prof F Nyabadza	Mathematical biology
Prof I Rewitzky	Mathematics of computer science
Prof AB van der Merwe	Automata theory
Prof L van Zijl	Theoretical computer science and assistive technologies
Promising Young Researcher	
Dr G Boxall	
Dr J Gray	
Dr Nick Hale	Numerical analysis and scientific computing
Dr K-T Howell	
P-rating	
Dr C Hui	Mathematical and theoretical physical biosciences

Collaboration

The different research groups are all well connected internationally. This has led to exchanges of postgraduate students and joint research projects with international collaborators that also involved some of our postgraduate students.

International

- Academia Sinica, Taiwan
- Alpen-Adria Universität Klagenfurt, Austria
- ETH-Zurich
- Georgia Southern University, USA
- Joint Institute for Nuclear Research, Russia
- Leipzig University, Germany
- Oxford University, UK
- Telemark University College, Norway
- University College of Southeast Norway, Norway
- University of Antananarivo, Madagascar
- University of Aveiro, Portugal
- University of Central Lancashire, UK
- University of Colorado at Boulder, USA
- Universitat de Girona, Barcelona, Spain

- University of Dublin, Ireland
- University of South Carolina, USA
- Uppsala University, Sweden
- University of Bergen, Norway
- University of Coimbra in Portugal
- University of Louvain-la-Neuve, Belgium
- University of Notre Dame, France
- University of Novi Sad, Serbia
- Université Paris Sud, France
- University of Stockholm, Sweden
- University of Trento, Italy
- University of Tübingen, Germany
- University of Umeå, Sweden.
- University of Victoria, Canada
- University of Warsaw, Warsaw
- University of Warwick, UK
- Warsaw University of Technology, Warsaw

National

- CSIR
- eThekweni Municipality,
- Rheinmetall Denel Munitions (Pty Ltd)
- Rhodes University
- University of Limpopo
- University of Johannesburg
- University of the Western Cape
- University of the Witwatersrand

The department has also maintained a strong link with the African Institute of Mathematical Sciences (AIMS-SA) in Muizenberg by presenting AIMS courses, supervising AIMS essays, and participating in workshops, thereby contributing to the growth of mathematical sciences in the broader Africa.

Funding

- Australian Research Council Grant
- Bilateral with South Korea
- DRD Travel Grant
- DST/NRF Centre of Excellence for Invasion Biology
- GEO, Groups of Earth Observation, Switzerland
- HB & MJ Thom sabbatical grant
- NRF SARCHi Grant
- NRF Competitive Program for Rated Researchers
- NRF Rated Researcher Incentive Funding
- NSFC, National Science Foundation China
- Oppenheimer Memorial Trust sabbatical grant
- Sub-committee B and faculty funding for young researchers
- University of Central Lancashire

Awards to staff and students

Prof H Prodinge was awarded a DSc in Science and the SU Chancellor's award for research excellence.

Prof F Breuer, P Crous and Dr D Ralaivaosaona were recognized at the First-year Prestige Dinner in April 2016 for their contributions to inspiring the top first year students in 2015.

Our postgraduate students also performed well:

- F. K. Van Niekerk, an MSc student of Prof Z Janelidze, was awarded the Harrey Crossley bursary for pursuing MSc research on the application of the theory of forms in categorical foundations of finite group theory
- M. Hoefnagel, another MSc student of Prof Janelidze, was awarded an NRF Freestanding, Innovation and Scarce Skills Development Bursary for pursuing MSc research in categorical aspects of universal algebra
- Drs AM Abdalla and E Mehdinezhad, post-doctoral fellows hosted by Prof Janelidze in 2016, were funded via his NRF CPRR (Competitive Programme for Rated Researchers) grant
- Dr L Demangos, a postdoctoral fellow hosted by Prof F Breuer, received a Subcommittee B PostDoc grant
- Honours student Dylan Nelson won a Second Prize in the International Mathematics Competition in Blagoevgrad (Bulgaria), marking the first time an SU student won a prize at this competition. The Stellenbosch team also managed to beat our rivals from UCT in the team ranking.

At the annual SATMO (South African Tertiary Mathematics Olympiad), our students also did very well, with four of them in the top ten: Dylan Nelson (2nd), Petri-Johan Last and Sarah Selkirk (tied 4th) and René Spoerer (10th).

Each division awards the top achieving undergraduate and honours students with a sponsored book or monetary prize.

ACADEMIC AFFAIRS

Computer Science Division

The student numbers in Computer Science are strong and trending upwards. In 2016, a record number of 244 students enrolled for Computer Science 114. From 2017, Computer Science 113 will be introduced as a compulsory course for Actuarial Science students, and the total number of first-year students studying Computer Science is expected to surpass 300. This reflects the growing demand for software developers in the Western Cape and a general worldwide trend in the growth of the popularity of Computer Science.

However, rapid growth presents challenges of scale. Even if an increased teaching load might justify an extra appointment, the Faculty and SU is constrained by the subsidy window and the vicissitudes of university funding. Moreover, laboratory facilities are limited and creative scheduling is required to ensure that we maintain the quality of our teaching. The distribution of

weak and strong students seems to stay roughly constant and Computer Science welcomes the opportunity to increase the size of our stream. The increase in first-years is expected to flow through to second- and third-years and, ultimately, to our postgraduate numbers.

The Computer Science Division offers a Bridging Course aimed at those first-years students who plan to study Computer Science but who did not take some form of computer studies as a school subject. These students constitute a significant proportion of the students enrolled for Computer Science 114 and it is critical that the disparity between the students who have and who have not studied programming is leveled as much as possible. The Bridging Course is presented over five days, with six hours of instruction per day, a few weeks before the start of the academic year. It is well attended: 320, 321, 295 students in 2014, 2015, 2016, respectively. These numbers include Engineering students who take a first-year programming course.

Mathematics division

There are a number of initiatives in first-year Mathematics to address the jump from the first year to the senior years, although the effect may not be seen yet. A big change this year has been in making tutorials compulsory only for weaker students, thereby making each student responsible for his/her own learning. Stronger students have the space to request help if it is needed and weaker students have the option of working harder to move up to the group where they have more independence. We have also introduced mini-projects, where the students work on harder problems that consolidate the work and foster better problem-solving skills. In the second semester we move away from memos, instead encouraging students to struggle with questions on their own before consulting a solution.

Teaching and learning

Differentiated tutorial support has been offered since 2014 in scheduled tutorial slots to cater for the varying levels of preparedness of our first-year students, even those who achieved good grade 12 results. This has been offered for Mathematics 114, 144, Mathematics (Bio)124, Applied Mathematics 144, Computer Science 114 and 144.

The department has benefited from the Teaching Assistant Programme of the faculty, funded through the Teaching Development Grant from the Department of Higher Education and Training (DHET) from 2014 to 2016.

Blended learning is used to varying extents for a number of modules via the SUNLearn learning management system of the university. For example, for Applied Mathematics modules, apart from using SUNLearn as a repository for study material, etc., videos on the module content are also uploaded on SUNLearn. Small computer tasks are used in some modules during tutorials or smaller computer projects, to enhance understanding with assistance from demonstrators and lecturers.

The undergraduate module Foundations of Abstract Mathematics has served as an inspiration for the introduction of the module Set-Theoretic Foundations at the Faculty of Military Science. This module was presented for the first time in 2016 at the Military Academy jointly by A Prins (Military Academy) and Z Janelidze (by correspondence).

All three divisions are involved with initiatives to inspire students to pursue studies in Mathematical Sciences, for example,

The Computer Science Division arranges internship programmes for graduate students with Google and Amazon; programmes with IBM and Microsoft are being negotiated, and many smaller companies offer similar opportunities.

The Mathematics Division coordinates enrichment of mostly first year students where topics of broad mathematical interest are discussed. Meetings take place in the evenings and usually take the form of a lecture by staff or senior students.

Currently the department has a cohort of over 75 postgraduate student. Of these, 18 were in the Computer Science Division, six in the Applied Mathematics Division and 51 in Mathematics. While the gender and race profile of our postgraduate students remain a challenge, we are confident this will improve as the gender and race profile of the students in the undergraduate Mathematical Science programme improves.

SERVICE TO THE SCIENTIFIC COMMUNITY

SANUM meeting (SA Numerical and Applied Mathematics Symposium), the flagship meeting of Applied Mathematics, held its 40th anniversary in Stellenbosch in 2016 with plenary speakers such as Prof. Dr. Folkmar Bornemann from the Zentrum Mathematik, Technische Universität München, Germany; Prof Nick Higham, School of Mathematics, University of Manchester, United Kingdom; Prof Beatrice Pelloni, deputy director: Mathematics of Planet Earth Centre for Doctoral Training, University of Reading, United Kingdom; Prof Nick Trefethen, head of the Numerical Analysis Group at the Mathematical Institute, Oxford University; and Prof Walter van Assche, Department of Mathematics, Katholieke Universiteit (KU) te Leuven.

The AIMS Public Lecture hosted by our department on 13 June 2016 was a great success. In his talk 'Is mathematics useful?' Prof Martin Grötschel, President of the Berlin-Brandenburg Academy of Sciences and Humanities and a world-renowned expert in combinatorial optimisation, showcased many examples of how mathematics affects everyone in their daily lives.

The Applied Mathematics Division is involved in research projects for industry and offers consultation services to the public and private sectors through the Bureau of Industrial Mathematics at SU (BIMUS), which facilitates research collaboration with industry primarily for researchers in this division.

Academic staff are also involved in discipline-focussed research journals, organisations, associations, and institutions:

G Boxall	Association for Symbolic Logic's committee for Logic in Africa
Z. Janelidze	Associate member of the Andrea Razmadze Mathematical Institute in Tbilisi, Georgia
I Rewitzky	AIMS-SA Executive Team
L van Zijl	Human Language Technology expert panel
WC Visser	SAICSIT Board; ACM SIGSOFT Committee

Editorial activities

F Breuer	<i>Journal of Number Theory</i> (associate editor)
Z Janelidze	<i>Cahiers de Topologie et Géométrie Différentielle Catégoriques</i> (editorial board member); Editorial board member for the special issue 'Homological and Homotopical Algebra and Category Theory' of <i>Mathematics</i>
I Rewitzky	Associate Editor of <i>Quaestiones Mathematicae</i>
L van Zijl	Editor of the <i>Journal of Universal Computer Science</i>
AB van der Merwe	Editor of the <i>Journal of Universal Computer Science</i>
WC Visser	Editor of <i>ACM Transactions of Software Engineering and Methodology</i>
S Wagner	Editorial boards of <i>Afrika Matematika</i> , <i>Applicable Analysis and Discrete Mathematics</i> ; <i>Communications in Combinatorics and Optimization</i> ; <i>Journal of Integer Sequences</i> ; <i>MATCH Communications in Mathematical and in Computer Chemistry</i> ; <i>Quaestiones Mathematicae</i>

SOCIAL IMPACT

Academic staff and students are involved with several knowledge-based interactions that impact directly or indirectly on the broader community in South Africa and in Africa.

Mathematics Olympiad training classes for Stellenbosch learners

The Mathematics Division offers biweekly Olympiad training classes for interested high school learners from the Stellenbosch area. The aim of these classes, coordinated by Dr D Basson, is to introduce the learners to interesting and clever mathematical ideas and techniques that are not taught at high school, to improve their problem solving skills, and to nurture their passion for the subject. On average, about 20 learners attended the classes; they are divided into a Senior (Grade 10 and up) and Junior (Grade 9 and below) group.

25th Annual Stellenbosch camp

Our department plays a key role in the national training programme for Mathematical Olympiads that is run by the South African Mathematics Foundation (SAMF). The annual Stellenbosch Camp celebrated its 25th edition in December 2016. It is the largest and longest-running of a series of camps that form the core of the selection and training process for the teams that represent South Africa in international mathematical competitions, namely the International Mathematical Olympiad (IMO) and the Pan-African Mathematics Olympiad (PAMO).

The approximately 50-60 learners participating in the week-long camp are selected from all over South Africa based on their achievements in the South African Mathematics Olympiad, the Mathematics Talent Search, and other mathematical activities. Prof Stephan Wagner has been the main organiser of the camp since 2008, and Dr Dirk Basson is currently in charge of the scientific programme.

Moreover, a number of our Stellenbosch undergraduate and postgraduate students have been involved in the camp as coaches over the years. It certainly is a privilege for our university to host some of the country's brightest young minds on our campus each year, and we believe that the camp, as part of a larger initiative, is making an important contribution to building the next generation of mathematicians.

Support for SA's participation in international mathematics olympiads

Staff and students from the Mathematics Division have been repeatedly involved in South Africa's participation in international competitions, notably the IMO and the Pan-African Mathematics Olympiad (PAMO). At the IMO 2016, D Basson was a team leader and S Wagner served as coordinator, by invitation of the host country Hong Kong. L Baker and D Nelson, two current graduate students in the Mathematics Division, were PAMO team leader and deputy in 2016.

Computer Science division involved with programming competitions

The Computer Science Division encourages participation by students in programming competitions such as the Standard Bank IT Challenge, the ACM (Association for Computing Machinery) Inter-collegiate Programming Competition (ICPC), and the Google CodeJam. Staff also spend time training students in extra-curricular work as preparation for these competitions, which typically involve 15 to 30 students each year.

Mathematical contest in modelling

The Mathematical Contest in Modelling (MCM) challenges teams of Applied Mathematics students to clarify, analyse and propose solutions to open-ended problems. The Division of Applied Mathematics has taken part in this competition for

many years by enlisting one or two teams of three third year students every year.

Computer Science annual career day

The Computer Science Division received many enquiries from companies looking for potential employees. Since it is not feasible to organise interaction with students on a company-by-company basis, the division organised an annual Career Day in August 2016 where interested companies set up branded stations and where their representatives are available to chat to students. Although open to all, it is attended mostly by Computer Science students.

Other outreach activities

There are several enrichment activities hosted by individuals or groups of staff and students.

- Educational Programming Project to expose Grade 8 and Grade 9 learners to programming is the inspiring intervention of two honours students – C Coetzee and M Hoefnagel
- Visits to local schools, coordinated by K-T Howell
- Outreach talks, offered by G Boxall, to Grade 12 learners from Masiyile High School on 25 May 2016 and to Grade 6 learners from Sun Valley Primary School on 8 September 2016.
- Participation in the annual Maties Science Winter Week in June
- Teaching of Cambridge A- and AS-level Mathematics (mechanics part) after hours at Parel Vallei High School

STAFF MATTERS

The new division heads, as from 1 January 2016, are Prof Stephan Wagner (Mathematics), Prof Jaco Geldenhuys (Computer Science) and Prof Francois Smit (Applied Mathematics).

New appointments joining the Department are Dr Ronald Benjamin (lecture, Mathematics), Dr Marè Cloete and Dr Nick Hale (lecturer and senior lecturer, Applied Mathematics).

From January 2016 Dr Gareth Boxall is promoted from lecturer to senior lecturer in Mathematics, and Dr Jacques Swanepoel from junior lecturer to lecturer in Applied Mathematics.

At the end of 2016 Dr Jacques Swanepoel (lecturer, Applied Mathematics) and Ms Liezl Rabie (departmental officer, Mathematics) resigned. The Department also took leave of two long-serving staff members, Prof Andrew Fransman (1999-2016) and Ms Maretha van Niekerk (1998-2016).

The appointment of Dr Bubacarr Bah as the Humboldt sponsored senior lecturer in Big Data Analysis at AIMS-SA and the Department of Mathematical Sciences will strengthen our research and supervision capacity in this important field. The appointee will have academic rank of Senior Lecturer in Applied Mathematics.

STAFF

Academic

- Dr B Bartlett
- Dr DJ Basson
- Dr R Benjamin
- Mr W Bester
- Dr G Boxall
- Prof F Breuer
- Dr W Brink
- Mrs EJ Burger
- Dr H Coetzer
- Dr M Cloete
- Dr H Diedericks
- Dr S Fidder-Woudberg
- Prof B Fischer
- Prof A Fransman
- Prof J Geldenhuys (Division Head: Computer Science)
- Dr JRA Gray
- Dr P Grobler
- Dr N Hale
- Prof B Herbst
- Dr R Heymann
- Dr K-T Howell
- Prof C Hui (SARCHI)
- Dr CP Inngs
- Dr Z Janelidze
- Dr A Keet
- Dr S Kroon
- Dr MF Maritz
- Mr J Masuret
- Prof S Mouton
- Dr C Naude
- Prof F Nyabadza
- Prof H Prodinge

- Dr D Ralaivaosaona
- Prof IM Rewitzky (Executive Head)
- Dr R Riana
- Prof F Smit (Division Head: Applied Mathematics)
- Prof AB van der Merwe
- Prof L van Wyk
- Prof L van Zijl
- Prof WC Visser
- Prof S Wagner (Division Head: Mathematics)
- Prof JAC Weideman
- Ms L Wessels
- Prof M Wild

Extraordinary professors

- Prof AE Krzesinski
- Dr M Hoffmann
- Prof MB Dwyer
- Prof H-E Porst

Support staff

- Mrs L Adams
- Mrs H du Plessis
- Mrs V du Plessis
- Mrs W Isaacs
- Mr B Jacobs
- Mrs L Rabie
- Mr A Roman
- Mr D Stephanus
- Mrs M van Niekerk

Postdoctoral Fellows

- Dr Abdurahman M. Abdalla
- Dr Elham Mehdinezhad
- Dr Luca Demangos

DEPARTMENT OF MICROBIOLOGY

The Department of Microbiology's historical roots can be traced back to 1918 when plant pathology was recognised as a field of expertise in the then Faculty of Agricultural Sciences. Today, the Department's eight research groups each work in their own state-of-the-art laboratories.

“We currently employ high-throughput technologies such whole-genome next generation sequencing and LC-MS/MS-based proteomics, to generate comparative genome-wide QTL/SNP and proteome datasets, respectively.”

RESEARCH HIGHLIGHTS

Functional bioinformatics approaches to study yeast physiology

Dr Heinrich Volschenk

High-throughput technologies are generating vast amounts of multi-dimensional biological data on the genomics, proteomics and metabolomics fronts. There is an ever-growing need for the functional analysis and integration of these complex datasets to refine our interpretation of complex biological systems and redefine our understanding of the dynamic relationship between an organism's physiology (phenome) and its genomic make-up, responsive transcriptome and expressed proteome.

Our research group employ functional bioinformatics approaches to study yeast physiology. This involves comparative molecular profiling of yeast genome sequences and transcriptome/proteome profiles, combined with pattern detection and network analyses to generate a molecular portrait of specific physiological responses in yeast.

We currently employ high-throughput technologies such whole-genome next generation sequencing and LC-MS/MS-based proteomics, to generate comparative genome-wide QTL/SNP and proteome datasets, respectively. These molecular profiles are computationally analysed, by integrating data on the behaviour and interaction of thousands of genes and/or proteins, for their correlation and functional relationships related to specific physiological traits.

The comprehensive new insight of yeast physiology will in future be applied to:

- reverse engineering of industry-specific tailored yeast strains using a true systems biological approach;
- discover uncharted paths to antifungal drug target discovery; and
- new function prediction of (un)characterised yeast genes/proteins

Main projects include:

- Polygenic phenotype analysis of *S. cerevisiae* for improved inhibitor tolerance; and
- Advancing the field of natural product research: a case study investigating the physiological responses of human pathogenic fungi to antifungal medicinal South African plant extracts.

Rainwater-harvesting in informal settlements

Through funding from the Water Research Commission and the National Research Foundation, Dr Wesaal Khan and her research team designed and constructed small-scale and large-scale domestic rainwater harvesting solar pasteurization treatment systems in Enkanini informal settlement, Stellenbosch.

The fundamental aim of the research was to provide communities in urban informal settlements and ultimately rural areas with a sustainable solution to water shortage and availability, by the utilisation of the under-exploited and natural resource, rainwater. The operational sustainability and chemical and microbial quality of the treated water produced by these systems was monitored in 2016 and in total ten households participated in the research phase of the project.

RESEARCH PROFILE

Overview of research groups

- Bioprocessing of agricultural products bioprospecting of enzymes, enzyme engineering and bioinformatics; genetic manipulation of yeasts to convert plant material to bioethanol, nutraceuticals and production of enzymes in yeast and fungi.
- Development of probiotic lactic acid bacteria for humans and animals taxonomy of lactic acid bacteria characterisation of antimicrobial peptides (including bacteriocins) produced by lactic acid bacteria and their industrial application; industrial and medical microbiology.
- Microbial communities from fynbos soil; taxonomy and biology of soil fungi, indoor air quality monitoring and fungal detection. Microbial community analyses of various organisms' GIT.
- The interactions between yeast and their biological, chemical and physical environment.
- Microbial biofilm ecology, and application of this knowledge to manage microbial aggregates in engineered, industrial and clinical settings
- Development and application of rainwater harvesting treatment systems; Optimisation and monitoring of cost-effective

point of use rainwater harvesting treatment systems; Biosurfactant compounds for the prevention and reduction of biofouling on various materials utilised for water conveyance.

Research outputs

Micro-organisms represent more than 50% of live biomass on earth and is omnipresent. During 2016 the relevance of our publications is reflected by the diversity of the microbes we study, as they play a role in nature, renewable energy, human health and modern nanotechnology.

Research from Prof K Jacobs' laboratory describes the discovery of new fungi in Fynbos, as well as the role of microbes for sustainable agriculture. From Profs Wolfaardt, Khan and Cloete's research groups, there comes new methods for tracking dangerous microbes from harvested rainwater in informal settlements, the existence of antibiotic-resistant microbes in biofilms and the treatment of acid mine-water. Prof Van Zyl and Bloom show progress in the manipulation of yeasts. Prof Dicks' research group illustrates the control of pathogenic microbes by means of probiotic bacteria and the production of nanofibers for medical application, while Prof Alf Botha's research group explored the natural habitat of potentially pathogenic yeasts.

NRF-rated researchers

NRF-rated researchers	
Internationally acclaimed researchers	
Prof LMT Dicks	Lactic acid bacteria: Antimicrobial peptides, probiotics, taxonomy
Prof WH van Zyl	Fungal Biotechnology/BioEnergy
Prof GM Wolfaardt	Microbial ecology
Prof A Botha	Yeast ecology
Established researchers	
Prof H Volschenk	Yeast niotechnology
Prof K Jacobs	Microbial ecology and fungal taxonomy
Dr W Khan	Rainwater; bacterial pathogens; EMA-qPCR; biosurfactants; rhamnolipid and surfactin
Prof M Viljoen-Bloom	Agro-bioprocessing, Fungal biotechnology

Collaboration

Dr Wesaal Khan was approached by Prof Kevin McGuigan (Royal College of Surgeons in Ireland) to collaborate on a European Commission Horizon 2020 project. The application was successful (funded from 2016 to 2020) and is titled Water: Sustainable Point-of-Use Treatment Technologies (WATERSPOUTT). The project officially launched in 2016 and is a collaboration between 18 research institutes based in Europe and Africa (including Prof Khan's research group at Stellenbosch University). The research conducted will specifically focus on designing, developing and piloting new integrated solar technologies for point-of-use drinking water treatment for rural communities without access to safe drinking water throughout the world.

Funding

- Casidra
- Cipla Medpro
- Claude Leon Foundation
- Department of Science and Technology, South Africa
- East Rand Water Company
- European Commission Horizon 2020
- National Research Foundation
- NRF SARChI research chair for biofuels
- South African Biosystematics Initiative
- South African National Energy Research Institute

- Stellenbosch University
- Water Research Commission

Awards to staff and students

Ms Penelop Stevens (Dobrowsky) was a recipient of the Loreal-UNESCO for Women in Science Sub-Saharan Regional Fellowship 2016.



Prof Alf Botha was honoured by some of the foremost yeast ecologists in the world by naming a newly discovered yeast species, *Saturnisporabothae*, after him in recognition of his contributions to the study of yeast ecology.

ACADEMIC ACTIVITIES

Prof Emile van Zyl was one of 24 international experts invited to participate in the Lorentz workshop: Bridging Technological and Social Innovation for a Biobased Economy which took place from 18 to 22 January 2016 at the Dutch Royal Academy's Netherland Institute for Advanced Study (NIAS) in Leiden. The purpose of the workshop was to define key leverage actions to enable the establishment of a biobased economy in order to mitigate the impacts of climate change and support sustainable development. Prof Van Zyl is holder of the South African research chair in Biofuel and other clean alternative fuels.

Prof Van Zyl was also an invited speaker at the Eco-Bio 2016 conference which took place from 5 to 9 March 2016 in Rotterdam, The Netherlands; and a keynote speaker at both the International Conference on Metabolic Science (ICMS 2016) (20-23 Oct 2016) in Shanghai, China and the 17th International Biotechnology Symposium and Exhibition (IBS2016) (24 - 27 Oct 2016) in Melbourne, Australia.

In January 2016, postgraduate students and staff from the Department of Microbiology presented papers and posters at the South African Society for Microbiology Biennial Congress in Durban. MSc student Ms Kim Durrell won first prize for the best MSc oral presentation, while MSc student Mr Brandon Reyneke won third prize in the same category. MSc student Ms Thobeka Mhlongwe was awarded first prize for best poster presentation.

Dr Wesaal Khan was invited to present a keynote address on the WATERSPOUTT Horizon 2020 European Union project at the Pan African Chemistry Network (PACN) Congress on Sustainability in Africa which took place in Nairobi, Kenya, and organised by the Royal Society of Chemistry (London).

Dr H Volschenk organised a Faculty of Science training workshop on proteomics data analysis using R/Bioconductor from 25-27 October 2016. The workshop was co-presented by leading experts in the field: Prof Laurent Gatto from the Department of Biochemistry, Computational Proteomics Unit, University of Cambridge, United Kingdom, and Prof David Tabb, Division of Molecular Biology and Human Genetics, Stellenbosch University.

ACADEMIC AFFAIRS

During 2016 the Department had a cohort of 56 postgraduate students, of which 13 BScHons, 25 MSc and 18 PhD registered students. Four MSc and four PhD students graduated during 2016.

SERVICE TO THE SCIENTIFIC COMMUNITY

Prof LMT Dicks served on the editorial boards of several academic journals, including *Probiotics and Antimicrobial Proteins* (as associate editor from 2008 to present); *Beneficial Microbes* (associate editor from 2008 to present); *Bioscience of Microbiota, Food and Health* (BMFH), the joint scientific journal of the Japan Bifidus Foundation; the Japanese Association for Food Immunology and the Japan Society for Lactic Acid Bacteria (2011 to present); *Annals of Microbiology* (2013 to present). He is also chief editor of the S.A. *Journal of Enology and Viticulture* and has been editor since 2005). He is also a member of the Subcommittee on *Bifidobacterium, Lactobacillus* and Related Organisms of the International Committee on Systematic Bacteriology of the International Union of Microbiological Societies (IUMS), as well as the ScientificBifodan Advisory Board (Denmark) on probiotics.

SOCIAL IMPACT

Talk on the human microbiome at Wordfees

Prof Gideon Wolfaardt participated in a Science Café Stellenbosch event at Wordfees on the topic of the human microbiome and the latest research on how it affects our health and our newly-born babies. Science Café Stellenbosch

is an initiative by the Faculty of Science to promote public conversations about scientific issues. The talk was moderated by the well-known environmentalist.



Prof Gideon Wolfaardt (right) in conversation with the well-known environmentalist Dave Pepler during a Science Café Stellenbosch talk at Woordfees 2016.

STAFF

Academic

- Prof A Botha
- Prof TE Cloete (vice-rector: research and innovation)
- Prof LM Dicks (Distinguished Professor)
- Prof K Jacobs
- T Jansen
- Dr W Kahn
- Prof WH Van Zyl (Departmental chair, Distinguished Professor, Biofuels Research Chair)
- Prof M Viljoen-Bloom
- Dr H Volschenk
- Prof GM Wolfaardt (Director, Stellenbosch University Water Institute and ERWAT Chair in Water Research)

Extraordinary professors

- Prof L Lynd
- Prof BA Prior
- Prof J Thevelein

Emeritus

- Prof Doug Rawlings

Affiliated

- Prof TE Cloete (vice-rector: research and innovation)

Support staff

- J Daniels
- LJ Daniels
- J de Kock
- M Gey van Pittius
- M Stuurman
- T van der Merwe
- L van der Westhuizen
- W Wentzel

Postdoctoral fellows and researchers

- Dr Adnan Cavka
- Dr Kim Bester
- Dr Michael Bester
- Dr Elana Bester
- Dr Jayesh Ahire
- Dr Wendy Stone
- Dr Marelize Botes
- Dr Shaunita Rose
- Dr Shelley Deane
- Dr Lalie Kossatz
- Dr Lisa Warburg
- Dr Maria Garcia Aparicio

DEPARTMENT OF PHYSICS

The Department of Physics at Stellenbosch University has a proud history in physics, producing outstanding research and many excellent graduates since 1903. We offer focussed study programmes in nuclear, radiation and health physics, theoretical physics and laser physics on undergraduate and postgraduate level.

“The observation of this phenomenon would imply that an oscillation of a small portion of neutron-rich nuclear matter relative to the rest of the nucleus is responsible for the generation of pygmy resonances.”

RESEARCH INTERESTS

Theoretical Physics

- Condensed matter
- Complexity

Nuclear Physics

- Nuclear structure
- Nuclear reaction mechanisms
- Radiation and health physics
- Applied nuclear physics
- Physics education

Laser Physics

- Spectroscopy
- Ultrafast science

RESEARCH HIGHLIGHTS

Nuclear physics

A better look at the sixth 0+ state in Oxygen-16

A number of experiments were successfully performed this year. Locally, experimental data were collected for PhD student Wiggert Brummer using pick up reaction $^{26}\text{Mg}(\rho,t)$ at $E_{\text{lab}} = 100$ MeV with the K600 spectrometer and the silicon detector array CAKE (Coincidence Array for K600 Experiments).

BAGEL gamma spectrometer

Prof Paul Papka contributed to the implementation of the BAGEL gamma spectrometer at the K600 facility at iThemba LABS. Excited states in ^{31}P using the $(^3\text{He},t)$ reaction and the silicon detector array were investigated. The data collected from this experiment was used to study the nature of the pigmy dipole resonance in ^{154}Sm . Pygmy resonance is considered to be a strongly clustering of dipole transitions. The observation of this phenomenon would imply that an oscillation of a small portion of neutron-rich nuclear matter relative to the rest of the nucleus is responsible for the generation of pygmy resonances.

Establishment of the Centre for Nuclear Safety and Security

Prof Richard Newman and Shaun Wyngaardt in the Nuclear, Radiation and Health Physics division in the Department of Physics assisted in the establishment of the first Centre of Excellence for Nuclear Safety and Security (CNSS).

This facility was established to support the activities of the National Nuclear Regulator (NNR) in light of the developments in the possible expansion of the South African

Nuclear energy sector. With its focus areas of research in fundamental nuclear physics, radiation monitoring, detector development and radiological modelling, the Division for Nuclear Physics has been earmarked as one of the research spokes in the CNSS with the University of Pretoria hosting the administrative hub of the centre.

The Centre was developed by the NNR in partnership with other local and international academic institutions including the North Carolina State University and University of Michigan. Dr Bismarck Tyobeka, chief executive officer of the NNR, highlighted that the centre was established to address the many challenges faced by the regulator making it difficult for the regulator to perform its mandate of protecting persons, property and the environment. Most importantly, the combination of facilities and diverse expertise will complement and significantly expand the nuclear research and education capability of South Africa's academic institutions.



MSc Student, Ratsimandresy Miora, operating the wide-field fluorescence microscope which was fashioned on a repurposed Zeiss Axiovert 100.

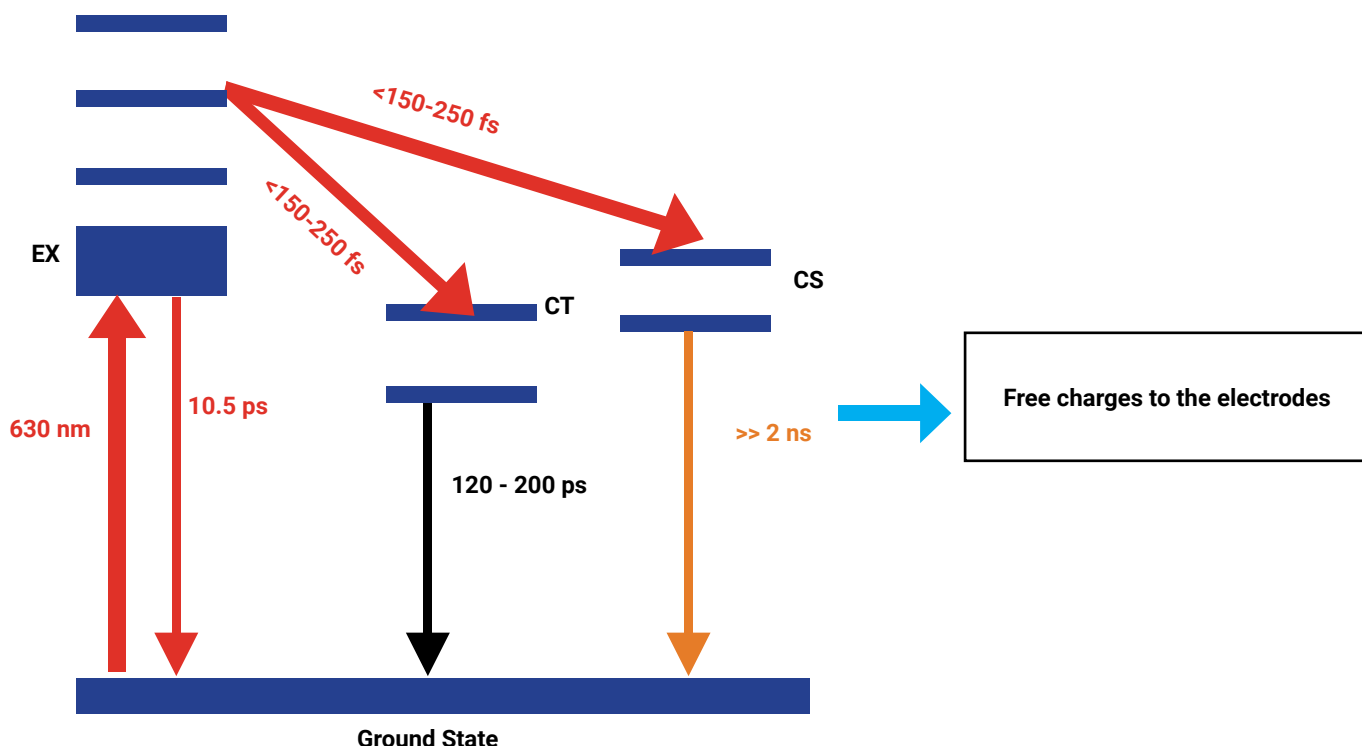
Laser physics:

New research on super resolution microscopy

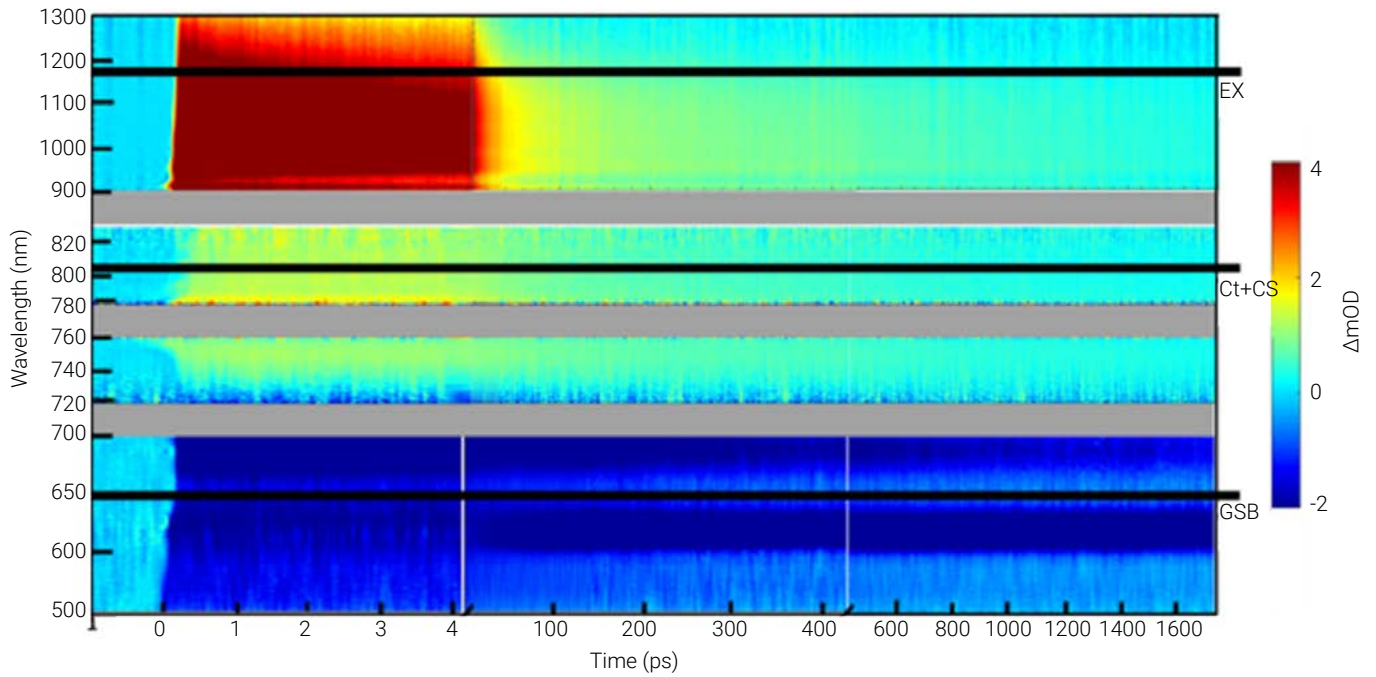
Dr Gurthwin Bosman has started a new research direction on Super Resolution Microscopy during 2015 and made good progress during 2016. In this project an epi-geometry wide-field illuminated fluorescence microscope capable of detecting the single fluorescing molecules has been developed and will be used to investigate diffusional mechanism of molecules in novel thin polymer films and crowded liquids such as those inside cells.

New research into solar cell materials

The new research project of PhD student Ms Newayemedhin Tegegne, under supervision of Prof Heinrich Schworer, has produced its first results. The project is the investigation of isoindigo based copolymer-carbon nano-sphere solar cell substances. The concept of this study is to employ a copolymer, consisting of a donator unit and an acceptor unit, to produce new solar cell material at reduced cost. The first result observed showed the loss in these solar cells is mainly due to the intermixing of the copolymer with the carbon-based bucky ball acceptor material.



Excitons (EX) split into Bound charges (CT) and free charges (CS). Finally the free charges will proceed into electrodes to be collected in the external circuit.

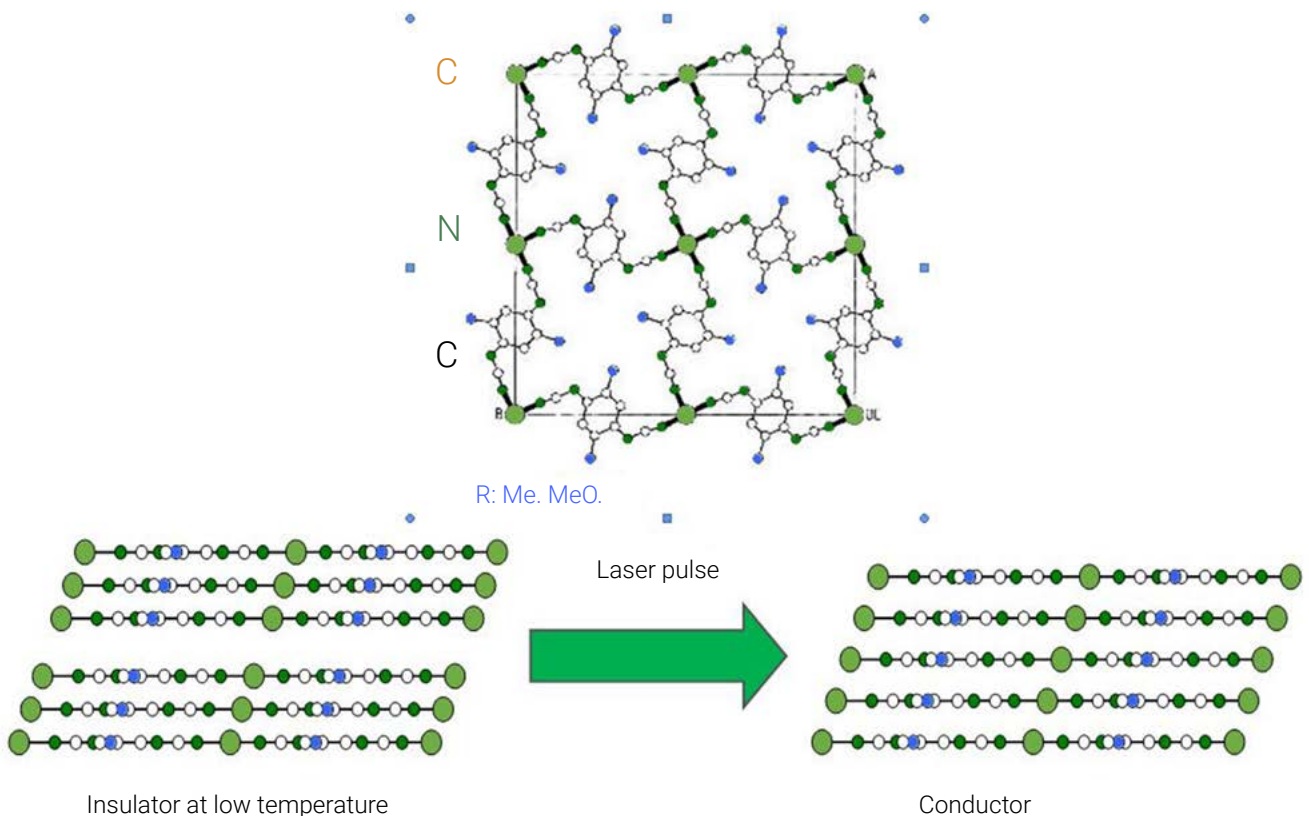


Dynamics in Copolymer-Bucky ball blended solar cell

Light pulse switches crystal form electric insulator to conductor

Prof Heinrich Schwörer's research group has achieved significant breakthroughs in the project on ultrafast phase transitions in organic molecular crystals. This progress in the experiment and data analysis enabled two major

steps towards the goal to observe structural dynamics, the observation of cooling the crystal and the obvious initiation of changes upon exciting them with light. The specific crystals that are investigated undergoes a structural change and switch from an electric insulator to a conductor when excited by a laser pulse



Using laser spectroscopy to investigate antibacterial peptides

As part of a new project on antibacterial peptides developed by Dr Pieter Neethling, MSc student Cathrine Pfukwa spent a large part of 2016 at the Rutherford Appleton Laboratory in the United Kingdom. With funding from the Newton Fund, she investigated the structural changes of the peptides as they aggregate on surfaces, using laser spectroscopy techniques. This project forms part of a collaboration with Prof Marina Rautenbach from the Department of Biochemistry. Prof Rautenbach is a world expert on anti-microbial peptides and provides the samples as well as the relevant biochemical analysis.

Electromagnetic trapping of ions now a routine procedure

Dr Hermann Uys

The CSIR's trapped ion physics group joined SU's Department of Physics in the middle of 2015. The first year was dedicated to

reassembling our laboratory, and improving key components. In 2016 this work paid off when we became the first group to trap ions in Africa. Trapping single atoms is now routine procedure.

The trapped ions' dynamical behaviour can be fully described only by the laws of quantum mechanics. As such atomic ion traps have become an important work horse for studying, among other things, quantum physics, quantum feedback, improved atomic clocks, ultrasensitive magnetic field sensing and quantum computing.

The rest of the year was dedicated to preparing the laboratory to implement quantum control of the ions. This entailed setting up acousto-optical modulating switches for fast switching of the lasers. In addition, electro-optical modulators were incorporated to allow addressing of all appropriate transitions in the hyperfine structure of our ytterbium ions. Finally, a field-programmable gate array (FPGA) system has been programmed for fast electronic control of the setup and we are now ready to do interesting physics in 2017.



From left to right, light scattering from one, two and three ytterbium ions captured in our ion trap. Image: Hermann Uys

Theoretical physics:

International collaborations

Prof Kristian Müller-Nedebock spent part of his sabbatical working at the University of Bristol in the group of Prof TB Liverpool. He also worked on self-healing networks at the Leibniz Institute for Polymer Research in Dresden, Germany.

With support from the SA-UK Newton Fund, Prof Müller-Nedebock established a new collaboration with Profs Stan Botchway and Tony Parker, Drs Andy Ward and Jorge Bernardino de la Serna at the Rutherford Appleton Laboratory in the United Kingdom. The project is studying the cytoskeletal and intra-cellular dynamics in cells by modelling and experimentation, leading to predictions about the geometry, alignment and arrangement of actin filaments or microtubules in cells.

Planning has commenced for a series of experiments on synthetic cell mechanics and structures that will run in early January 2017, with more experimental time granted in the future.

RESEARCH PROFILE

Research publications

In terms of research output, a number of papers were published and others were submitted. Dr V Kheswa submitted an article to *Physics Letters B* based on data he collected in Norway.

The productivity of the Laser Research Institute (LRI) during 2016 is reflected in 27 research papers from researchers, postgraduate students and extra-ordinary staff. In addition two papers in international conference proceedings and 17 contributions to the 61st Annual Conference of the South African Institute of Physics were delivered.

The final and comprehensive results on the long running project on photo induced charge dynamics in indoline dye sensitised solar cells were published in the Royal Society for Chemistry's journal *Physical Chemistry Chemical Physics (PCCP)*. *PCCP* is an international journal for the publication of cutting-edge original work in physical chemistry, chemical physics and

biophysical chemistry. The title of the article is ‘Identification of different pathways of electron injection in dye-sensitised solar cells of electrodeposited ZnO using an indolinesensitiser’.

The results from excellent ultrafast electron diffraction experiments on a photo induced transition between two non-symmetry related structural phases in tantalumdiselenite has finally been published in the journal of the American Physical Society (APS) *Physical Review Letters (PRL)*. *PRL* is regarded as the world’s premier physics letter journal, publishing short, high quality reports of significant and notable results in fundamental and interdisciplinary physics research. The title of the article is ‘Ultrafast Metamorphosis of a Complex Charge-Density Wave’.

International visitors

Prof John Gilligan, Dean of the School of Engineering at the University of North Carolina State (UNCS) in the United States of America visited Prof Richard Newman and Shaun Wyngaardt. The purpose of the visit was to discuss possible collaboration between UNCS and the Centre for Nuclear Safety and Security (CNSSS) partner institutions, which includes Stellenbosch University.

Prof Günther Wunner from the University of Stuttgart, Germany, visited the theory group in the first quarter continuing his successful collaboration with Prof Dieter Heiss

Prof Herbert Stafast from the Institute for Photonic Technology in Jena, Germany, visited the Laser Research Institute for three weeks to work on the project ‘Investigation of and free carrier absorption in thin silicon membranes and charge carrier dynamics across the silicon-silicon dioxide interface under femtosecond laser irradiation’.

Other research visits were by:

- Dr Alex Heidt (University of Bern), Prof Tony Parker (Rutherford Appleton Laboratory)
- Profs Stan Botchway, Donaldson and Dr Bernardino De La Serna from Rutherford Appleton Laboratory (RAL)
- Prof Julian Moger from the University of Exeter, United Kingdom, and Prof Halina Rubinsztein-Dunlop, director of the Quantum Science Laboratory in the School of Mathematics and Physics at the University of Queensland, Australia
- Prof Michael Hamblin, Principal Investigator at the Wellman Center for Photomedicine at Massachusetts General Hospital and an Associate Professor of Dermatology at Harvard Medical School. These visitors contributed to the African Laser Centre (ALC) Workshop on Laser Based Imaging and the ALC Student Workshop. They also gave good input into the LRI project on white light generation and spatial light modulation for imaging and microscopy. The recent focus of the project has been to use compressed broadband output from all normal dispersion (ANDi) photonic crystal fibre (PCF) for nonlinear microscopy applications. The techniques of time domain ptychography and “Ptychographic Iterative Reconstruction of Temporal Pulses” (PIRANA) developed give us a powerful tool for

source development. Photonic crystal fibres are a cost effective method of ultrashort few cycle optical pulse generation. The pulse characterization tools we developed allow us to investigate models which describe the pulse broadening in photonic crystal fibres.

- Prof Tony Parker (Rutherford Appleton Laboratories) is also collaborating on a project on examining structural changes in anti-microbial peptides using Surface Enhanced Raman Spectroscopy, with the aim of correlating these structural changes to the bio-activity of the peptides.

NRF-rated researchers

Prof Paul Papka received a C1-rating from the National Research Foundation in 2016.

NRF-rated researchers	
Leading international researchers	
Prof A Cowley	Mechanism of proton-induced pre-equilibrium nuclear reactions, alpha-particle clusters in atomic nuclei and light-ion transfer reactions
Prof H Geyer	Quantum mechanics and the quantum mechanical many-body problem
Prof D Heiss	Physical effects and significance of spectral singularities
Prof H Touchette	Applying the theory of large deviations to predict and understand the response and fluctuations of many-particle systems driven away from equilibrium by forces or external reservoirs
Prof H Weigel	Quantum field theories emphasising on many different scenarios in which standard perturbative treatments cannot be applied. This comprises field configurations with localized energy densities, known as solitons or solitary waves. They have innumerable applications in physics, ranging from properties of subatomic particles via condensed matter phenomena to cosmological defects
Prof F Scholtz	Non-commutative quantum mechanics and quantum field theory
Prof H Schwoerer	Ultrafast charge and energy dynamics in organic matter, organic photovoltaics, structural dynamics in strongly correlated materials
Prof M Kastner	Quantum many-body physics; geometric and topological aspects of (quantum) phase transitions; magnetism and spin systems; quantum statistical physics applied to atomic physics (as it is of relevance for atom- or ion-trap-based quantum simulators of many-body systems)

Established researchers	
Dr F Cinti	Quantum many-body problems: superconductivity, superfluidity, supersolidity and Bose condensation in condensed matter systems and ultra-cold quantum gases
Prof H Eggers	Bayesian analysis in physics, data analysis, experimental high energy physics
Prof P Papka	Clustering in nuclei is observed for a wide range of masses but particularly well in light nuclei. My research focuses on a selection of light $N=Z$ nuclei for which clustering has structural implications and plays a crucial role in nucleosynthesis scenarios
Prof B van der Ventel	Description of nuclear scattering reactions using a relativistic formalism; mathematical description of biological systems; technology in education
Prof E Rohwer	Laser development, laser techniques and applications, laser spectroscopy and microscopy
Prof R Newman	Radionuclide metrology, environmental radioactivity, dosimetry, radiation transport modelling, radiation safety, elemental analysis, physics education
Dr C Steenkamp	Laser spectroscopy of atoms and molecules, nonlinear optics, laser sources and laser spectroscopy in the vacuum ultraviolet, surface second harmonic generation, laser cooling of atoms and ions
Prof S Wyngaardt	Theoretical investigation of clustering phenomenon in nuclear matter; relativistic formulation of spin polarized proton induced nuclear reactions; development of a low level underground radiation facility in the Huguenot tunnel
Dr JJ van Zyl	The study of the reaction mechanisms governing the emission of light alpha and He-3 clusters from the interactions of medium energy protons; alpha-particle clustering in nuclei such as Ne-20 by means of an array of detectors at iThemba LABS
Young upcoming researcher	
Dr P Neethling	Using linear and nonlinear spectroscopic techniques to address problems in solid state physics, biochemistry and chemistry

Awards to staff and students

Xavier von Stein received the prestigious S_2A_3 medal for the best MSc student in the field of natural sciences, engineering and medical and health sciences at Stellenbosch University.

The Southern Africa Association for the Advancement of Science (S_2A_3), annually offers a bronze medal to each South African university for the best MSc study in these fields. He also received a book prize for the MSc student in Physics at SU.



MSc student Xavier von Stein, winner of the prestigious S_2A_3 medal for the best MSc student in the field of natural sciences, engineering and medical and health sciences at Stellenbosch University.

Scott Cameron received a book prize for the best third year student in Physics, JC Louw received the Meiring Naudé Medal for the best Honours student in Physics.

Our students performed exceptionally well at the annual conference of the South African Institute of Physics:

- Ruan Viljoen received the Airbus DS Optronics award for best oral presentation by an MSc student in Laser Spectroscopy
- Bart Smit received the SAIP award for best oral presentation by a PhD student in Photonics
- Anneke Erasmus received the NTL Lemnis Africa award for best technology achievement in Photonics
- Christiaan Brits won the award for the best oral presentation by an MSc student in Nuclear, Particles and Radiation
- Prof Paul Papka received the iThemba LABS award for an outstanding contribution to science.

RESEARCH ACTIVITIES

Prof Shaun Wyngaardt attended the 10th anniversary celebration of the South Africa – Joint Institute for Nuclear Physics Collaboration, hosted by the Department of Science and Technology, from 28 November to 1 December 2016 at the CSIR Convention Centre in Pretoria.

Prof Richard Newman was invited to the third Nuclear Industry Congress Africa 2016 meeting that took place from 2 to

3 February 2016, where he gave a presentation entitled 'Nuclear physics research at Stellenbosch University and potential linkages with South Africa's Nuclear Power Programme'.

Prof Herbert Weigel presented talks at conferences on Baryon Spectroscopy in Bled, Slovenia, and on Non-perturbative Quantum Theory in Tomsk, Russia.

Prof Hans Eggers organised a successful workshop on 'Bayesian Analysis in Physics and Astronomy' hosted by the Department of Physics during November 2016.

PhD students Iulia Minda and Bart Smit presented posters at the International Conference on Ultrafast Phenomena in Santa Fe, United States of America, in July 2016.

Seventeen postgraduate students attended the annual meeting of the South African Institute of Physics at the University of Cape Town.

PhD student Neway Tegegne attended the Frontiers in Optics Conference of the Optical Society of America in Rochester in October 2016.

Prof John L Wood at sixth 'Taste for nuclear physics' school

The nuclear, radiation and health physics research group organised the sixth 'Taste for Nuclear Physics' school at Stellenbosch

University. The aim of the school is to provide a forum to improve the skills of our postgraduate students concerning advanced mathematics, nuclear physics and astrophysics.

One of the speakers was the famous physicist Prof John L Wood, emeritus professor at the Georgia Institute of Technology in the United States of America and co-author of the book, *Fundamentals of nuclear models* (World Scientific, 2012) and lectures. A wide range of nuclear physics topics were covered: from experimental to theoretical, nuclear astrophysics, shape coexistence, clustering, giant resonances and many others.

Prof Wood then visited the Nuclear Physics division and presented an additional series of lectures on nuclear structure physics which was directed towards the establishment of the South African Isotope Facility at iThemba LABS.

Laser physics workshops

LRI members organised a number of scientific workshops. Prof Heinrich Schworer and PhD students Iulia Minda and Bart Smit organised the fourth productive New Trends and Faces workshops with the topic 'Photophysics in Organic Materials'. The LRI hosted two African Laser Centre workshops during November: the annual ALC Student Workshop and a Workshop on Laser Imaging. Prof Piet Walters, Dr Pieter Neethling, Dr Gurthwin Bosman and Prof Erich Rohwer earn the credit for these well-organised and well-received workshops.



The ninth African Laser Centre Student Workshop, hosted by the Laser Research Institute at Stellenbosch University, was attended by 54 delegates from 22 different countries.

Other activities include:

- Prof Richard Newman served on the iThemba LABS Physics Advisory Committee which evaluates and advises the director of the laboratory on the proposed experiments which would be performed at the iThemba LABS cyclotron facility.
- Prof Heinrich Schworer obtained a position as scientist and group leader (W2 equivalent) at the Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany. He was also elected onto the editorial board of the Institute of Physics' *Journal of Physics B*.

- Prof Erich Rohwer, Drr Pieter Neethling, Gurthwin Bosman, Christine Steenkamp and Hermann Uys serve on the management committee of the Photonics Specialist Group of the South African Institute of Physics.
- Prof Paul Papka acted as the iThemba LABS users committee chair during 2016. The duties of the chairperson of the users committee included membership of the iThemba LABS directors' council.
- Proff Shaun Wyngaardt, Richard Newman and Paul Papka assisted in reviewing the articles presented at the Nuclear Physics section of the SAIP in 2016.

SU radiation safety committee

As part of a more coordinated, centralised management of radiation safety at SU, stock of radioactive sources and legislative requirements, a Radiation Safety Committee (SURSC) was established in June 2016. This initiative is still in its early stages, however some important steps are already underway. The committee is chaired by Dr Deon van Zyl (Campus Health Service). Dr JJ van Zyl from the Department of Physics will act as Chief Radiation Protection Officer (RPO) of SU. The committee decided to appoint Ryno Botha as a Radiation Safety Intern to assist with the university-wide roll-out of a radiation safety management programme.

ACADEMIC AFFAIRS

Online resource for first years physics students

Dr Christine Steenkamp had a FIRLT grant since 2015 for development of an online resource for main stream first year physics students. The Fund for Innovation and Research into Learning and Teaching (FIRLT) was established in 2005 to provide support to academic staff in their role as lecturers and to make a positive contribution to the enhancement of teaching and learning at SU. The resource has been implemented for the first time during 2016 and the results were presented at the ninth Annual Conference on the Scholarship of Teaching

and Learning offered by SU. The online resource is used again during 2017.

New physics module for first year engineering students

During 2016 a new Physics module was introduced to the first year engineering students. This was done at the request of the Faculty of Engineering. All first year engineering students are required to take the subject. The subject covers Physics topics not typically seen by students during their school curriculum, or the rest of their engineering curriculum. As such the course serves as an enrichment module, exposing the students to interesting aspects with which they may not have been familiar. Physics 113 also contains a practical component. All the students are required to perform three different experiments throughout the semester. It is the only first year module in engineering with a practical component. There was initially some resistance from the first years, which accounts for the course feedback mark of 54.3, but the course did achieve a high pass rate of ~92%.

The Engineering Physics 152 module catered for first year Civil Engineering students. This module, which continued from the Introductory Engineering Physics 113 module, provided the students with a general introduction to topics in modern physics, such as special relativity, introductory quantum mechanics, atomic physics, and nuclear physics. Students seemed to respond positively to the content presented in the course.

Postgraduate students

One of the highlights of 2016 was the graduation of five PhD students associated with the Laser Research Institute: Roelof Botha, Liesl Burger, Alem Gebru, Wayne Koen and Charles Rigby, at the March graduation ceremony. Another two PhD dissertations were submitted during 2016, by Wilfrid Ndebeka and Attie Hendriks, as well as four MSc theses. 3



PhD graduandi and promoters from the Department of Physics at the March 2016 graduation ceremony. At the back, from left to right, Prof Hubertus von Bergmann, Prof Shaun Wyngaardt, Dr Christine Steenkamp, Dr Hencharl Strauss, Prof Erich Rohwer. In front, from left to right: Dr Ndajishimje Joram (nuclear physics), Dr Charles Rigby, Dr Liesl Burger, Dr Wayne Koen and Dr Roelof Botha (all in laser physics). Dr AlemGebru received his PhD degree in absentia. Photo: Anton Jordaan

There were four postdoctoral fellows in the LRI during 2016. The number of postgraduate students who were associated with the LRI during 2016 are: 16 PhD students (three at the CSIR), 10 MSc students (one at the CSIR), four Honours students, and two visiting students.

During 2016 the Department delivered 7 Honours graduates and 10 MSc and 4 PhD graduates.

SOCIAL OUTREACH

Members of the public were again treated to an open lecture and guided lab tours during our Physics Open Day on 3 May 2016. Prof. Paul Papka delivered the open lecture with the title 'The atomic nucleus is in good shape'.

Prof Bruce Basset from the Department of Mathematics and Applied Mathematics at the University of Cape Town delivered a talk on 'Gravitational Waves - Einstein's Final Legacy and a Revolution for Astronomy' in April 2016.

During National Science Week in August, SU's Dr Gillian Arendse spoke to a general audience about 'Physics in Everyday Life'.

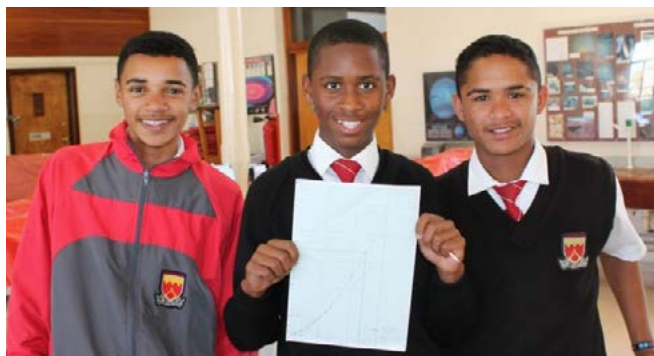
Nobel lectures

For the first time, three departments in the Faculty of Science worked together to provide brief explanations of the work of the scientists who received Nobel Prize awards for physics, chemistry and medicine (physiological sciences).

The speakers were Prof KK Müller-Nedebock from the Department of Physics, Prof L Barbour from the Department of Chemistry and Polymer Science, and Dr B Loos from the Department of Physiological Sciences. The lectures were attended by SU staff and the public. Due to the huge success of this event, it will be repeated in 2017.

Physics and chemistry outreach join forces

The SU Chemistry Outreach Initiative (SUNCHOI) and the SU Physics Outreach Initiative (SUNPHOI) teamed up in September 2016 to welcome grade 10 learners from six neighbouring schools, namely Kylemore, Cloeteville, Khayamandi, Zeekoevlei, Pelican Park and Masiyile. During the event learners were given the opportunity to conduct chemistry and physics based experiments which formed part of their formal assessment tasks.



Three learners from Cloeteville High School proudly portraying their results.

Workshop for teachers in physical sciences

November 2016 saw SUNPHOI hosting the first teachers' workshop for Physical Science Educators. The workshop was designed to assist the teachers in preparing for a specific physics grade 12 practical which has been identified as being particularly challenging.

More than 50 high school science educators from the Western Cape Educational District and Metropolitan South Educational District areas attended. During the workshop some of the background fundamental theory was discussed, followed by hands-on demonstrations on how to conduct the experiments. The educators also conducted the experiments followed by discussions on possible difficulties the learners will experience.



Medieval cart with solar power on the Rooi Plein

On 15 April 2016 Prof Paul Papka and students from the nuclear physics group, in collaboration with staff and students from the Centre for Renewable and Sustainable Energy Studies erected a massive medieval cart with a parabolic structure mounted on top of it to concentrate sunlight. It was the centre of attraction on the Rooi Plain at the University's main campus. This massive mirror structure, which was used to prepare woks on a smaller solar panel, along with other science and engineering demonstrations, were used to promote physics and engineering in the broader community.



'Capture their attention while they are still young' project

In June 2016 Dr JJ van Zyl, in collaboration with the iThemba LABS Outreach staff, organised the 'Capture their interest while they are still young' project.

About 30 youngsters from Die Wingerd Pre-Primary school in Somerset West were treated to a science outing to the national accelerator facility, iThemba LABS near Faure. Dr JJ van Zyl from the Department of Physics demonstrated some exciting physics phenomena to a lively and eager group of five to six year olds.

The motto was "feel it, see it, do it" as each had an opportunity to feel the static electricity jump from the charged Van de Graaff generator onto their fingers or raise their hair, taste the shrunken marshmallows once swollen in the vacuum chamber, hear the tin can implode as the atmospheric pressure squashed it, see the brittle rose, frozen in minus 179 degrees C liquid nitrogen, shatter when touched, and navigate the laser maze without interrupting the many laser beams keeping the music playing.

After all the excitement, the youngsters were taken over the roof of the massive cyclotron to the grass outside for a picnic where they could see the roaming zebras.

Postgraduate student annual road trip

The 2016 road trip organised by the Laser Student Chapter went to ten schools on the West Coast, where the students gave shows to over 400 learners. The annual road trip, as well as other outreach activities, are sponsored by OSA (Optical Society) and SPIE (the international society for optics and photonics). During these activities, postgraduate students from the Department of Physics and the National Institute for Theoretical Physics (NITheP) act as true ambassadors for the department and SU.



The 2016 road trip team from the Department of Physics and NITheP. At the back: Anneke Erasmus (MSc student Laser Physics), Bart Smit (PhD Laser). Middle: Iulia Minda (PhD Laser), Ishmael Takyi (PhD Theoretical), Monica Farrell (BSc(hons) Nuclear), Li Wang (MSc Theoretical), Essraa Ahmed (MSc Laser), Christa Philander (SUNCEP), Paul Williams (PhD Theoretical). Front: George Dwapanyin (PhD Laser) and Riyaadh Jamodien (Hons Theoretical).

Dr Christine Steenkamp and Ms Wilma Wagener, academic adviser for the Faculty of Science, participated in Stellenbosch High School's Career Expo. They interacted with approximately 100 learners, addressing them and answering questions on what a career in science entails and the qualifications and abilities that one needs to launch a career in science.

15 December 2016 Prof Paul Papka also arranged a public lecture that was relatively well attended by Prof Langanke from GSI Helmholtzzentrum für Schwerionenforschung in Germany.

Collaboration

South Africa

- Prof Andrew Forbes, CSIR National Laser Centre
- Dr Kessie Govender, Cape Peninsula University of Technology
- iThemba LABS
- Dr Karel von Eschwege, Department of Chemistry, University of the Free State
- University of Johannesburg
- Prof Thomas Konrad, University of KwaZulu Natal
- University of the Western Cape
- Prof Mervin Naidoo, University of the Witwatersrand (WITS)
- University of Zululand

Africa

- Dr Mammo Wendimagne in Addis Ababa, Ethiopia
- Dr Peter Baricholo, Department of Applied Physics, University of Science and Technology (NUST), Bulawayo, Zimbabwe

International

- Sofia University, Bulgaria
- Bradley Siwick, McGill University, Canada
- Peking University, Chinese Atomic Energy Agency, Beihang University, Shandong University, China
- Prof Herbert Stafast and Prof Hartmut Bartelt, Institut für Photonische Technologien (IPHT Jena), Germany
- Prof Derck Schlettwein, University of Giessen, Germany
- Prof Markus Schwoerer, University of Bayreuth, Germany
- Prof Jens Pflaum, University of Würzburg, Germany
- Profs Jure Demsar and Maximilian Eichberger, University of Konstanz, Germany
- Dr Kai Rossnagel, University of Kiel, Germany
- Research Centre for Nuclear Physics, Japan
- Joint Institute for Nuclear Research, Dubna International University, Moscow State University, Russia
- Dr Mikkel Brydegard, University of Lund, Sweden
- Prof Thomas Feuer, University of Bern, Switzerland
- Dr Alex Heidt, University of Bern, Switzerland
- Prof Tony Parker and Prof Stanley Botchway, Central Laser Facility, Rutherford Appleton Institute, UK

- Prof Tanniemola Liverpool, Department of Mathematics, University of Bristol, UK
- Dr John Bollinger, NIST, Boulder, Colorado, United States of America
- Georgia Tech, USA
- Prof M. Cristina Marchetti, Department of Physics, Syracuse University, USA

Funding

- CSIR
- African Laser Centre (ALC)
- CSIR/SU joint venture chair
- National Photonics Strategy (PISA)
- CSIR National Laser Centre Rental pool
- Newton Fund Rutherford Appleton collaboration
- National Research Foundation funding:
- SARChI Chair in Photonics
- SA-Joint Institute for Nuclear Research (JINR) travel grant
- SA-China bilateral collaboration funding
- Stellenbosch University funding:

STAFF MATTERS

Dr Noel Mkaza from ARMSCOR was appointed as an extraordinary academic staff member, while Dr Hannes Kriel was promoted to senior lecturer. Dr Daphney Bucher and Mr Obed Shirinda were appointed as part time lecturers in collaboration with iThemba LABS.

Mr Stanley February was appointed as an administrative officer and Mr Patrick Bentley as assistant technical officer.

Staff list:

Academic

- Prof EG Rohwer (Executive head)
- Dr GW Bosman
- Dr D Bucher
- Prof HC Eggers
- Mr D Geduld
- Prof HB Geyer
- Dr H Kriel
- Prof KK Müller-Nedebock
- Prof PH Neethling
- Prof RT Newman
- Prof P Papka
- Prof FG Scholtz
- Prof HPH Schwoerer
- Dr O Shirinda
- Dr CM Steenkamp

- Dr H Uys
- Prof BIS van der Ventel
- Dr JJ van Zyl
- Prof H Weigel
- Prof SM Wyngaardt

Extraordinary Professors

- Prof AA Cowley
- Prof A Forbes
- Prof WD Heiss
- Dr N Mkaza
- Prof J Meng
- Prof T Parker
- Prof H Stafast
- Prof HM von Bergmann

Professors Emeritus

- Prof PE Walters
- Prof PR de Kock

Support staff

- Ms C April
- Mr C Pool
- Ms C Ruperti
- Ms E Bosch
- Mr SH February

Technical staff

- Mr P Benting
- Mr J Burns
- Mr PC Cornelissen
- Mr JM Germishuizen
- Mr GJ Louwrens
- Mr DP Pool
- Mr EJ Shields
- Mr MC Botha

Postdoctoral fellows

- P Adsley
- AJ Anslyn
- NB Khanyile
- SNT Majola
- WI Ndebeka
- D Nickelsen
- OO Olaoye
- D Spangenberg



DEPARTMENT OF PHYSIOLOGICAL SCIENCES

At the Department of Physiological Sciences we investigate and develop innovative solutions to health issues that pose a serious challenge to society. We follow an integrative approach that spans all levels of organisations, from the molecule to the whole organism.

RESEARCH INTERESTS

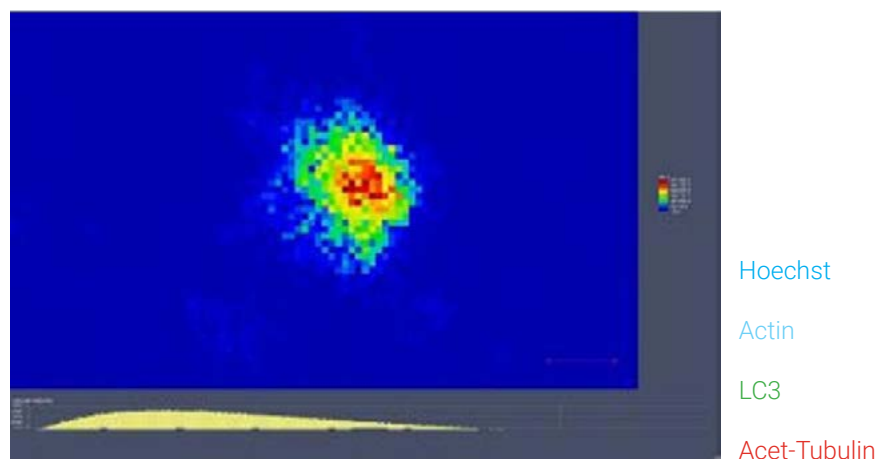
- Multi-disciplinary stress biology
- Neuro-disease signalling
- Metabolic syndrome
- Cardio-vascular diseases
- Cancer signalling mechanisms & pathways
- Muscle biology
- Clinical epidemiology & urbanisation
- Body composition
- Cardio-oncology

RESEARCH HIGHLIGHTS

Neuroscience and imaging techniques

Dr B Loos

A transgenic amyloid pathology *in vitro* model has been set up to serve as tool for the study of Alzheimer's disease. With the support of the Central Analytical Facility's Cell Imaging Unit, headed by Lize Engelbrecht, we acquired the first super-resolution stochastic optical reconstruction microscopy (STORM) micrographs, to assess tubulin function and protein clusters in autophagy dysfunction. Also the first 4-colour super-resolution structured illumination microscopy (SR-SIM) data have been generated, providing an enhanced ultrastructural background information data set. Several research articles have been published, many of which in journals with high global visibility and impact.



Four-colour SR-SIM (left) and STORM data revealing ultrastructural (left) and molecular density (right) information at a nano-scale resolution in *in-vitro* models of neurodegeneration. Images: Dr Ben Loos

“A transgenic amyloid pathology *in vitro* model has been set up to serve as tool for the study of Alzheimer's disease.”

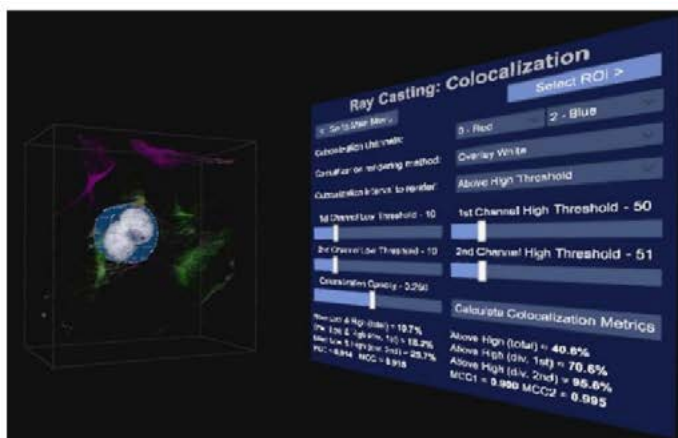
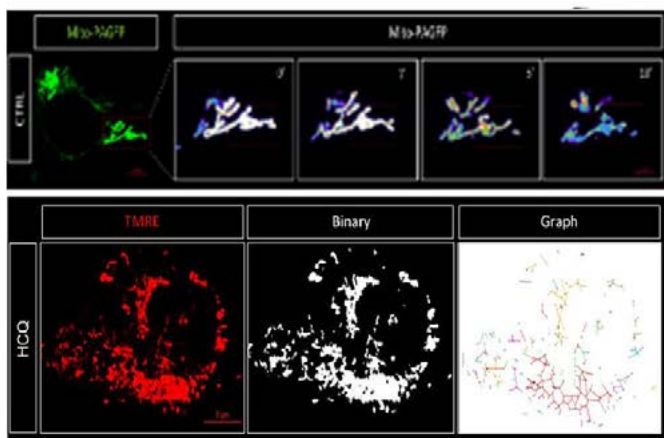
Unique collaboration with physics and electronic engineering

Through two unique joint projects, a collaboration with Prof Kristian Müller-Nedebock, a theoretical physicist in SU's Department of Physics, and Prof Thomas Niesler, SU's Department of Electrical and Electronic Engineering, two MSc projects were completed.

MSc student JurgenKriel combined principles of graph theory (often used in theoretical physics) and live cell imaging techniques, such as photo-activation, to better quantify and measure mitochondrial network properties.

MSc Engineering student RensuTheart developed a 3D image virtual analysis navigation and image analysis tool.

This tool allows advanced sample control, by enabling precise region of interest selection and analysis in the 3-dimensional space. Z-stack image frames were provided, to navigate in that manner through the cell, with a virtual reality component. Becoming one with the data set allows here an advanced understanding of spatial molecular relationships.



Mitochondrial connectivity properties described through microscopy and theoretical physics tools (left), and a virtual reality 3D image analysis tool for 3D colocalization (right).

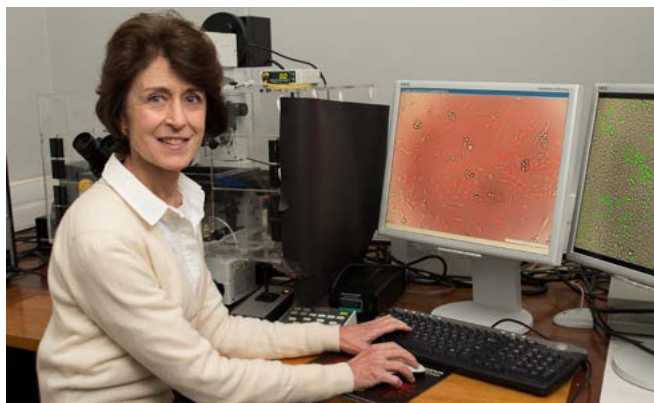
New microfluidics system

Prof Carine Smith's research group in multidisciplinary stress biology acquired a new microfluidics system which is compatible with CAF's high-tech microscopy equipment. It will be used for the study of particularly cell migration in the context of inflammation. A particular benefit of this system is that it creates physiologically relevant conditions of shear flow in combination with the ability for live cell tracking and imaging, so that cell mechanics may be studied in a more directly applicable model.

RESEACH PROFILE

New research chair

Prof Kathy Myburgh, distinguished professor, was awarded the *DST/NRF South African Research Chair for Integrative Skeletal Muscle Physiology, Biology and Biotechnology for 2016 to 2020.*



Prof Kathy Myburgh. Photo: Anton Jordaan

Bursaries and new grants awarded

Dr T Nell received SU's Knowledge Interchange and Collaboration (KIC) grant and the Division of Research Development (DRD) Travel Grants for international collaborator's visit. He will visit the EpiMetS research group at the Physiological Sciences Department early in 2017 to work on refining the Annexin A1 ELISA method.

Dr B Sishi received several grants during 2016 from the following institutions: the Medical Research Council's Self-initiated Research (SIR) grants programme; the National Research Foundation's Thuthuka programme, and from SU's Subcommittee B and the Faculty of Science.

Collaboration

Prof KH Myburgh established collaboration with Ass Prof Isabelle Richard, Genethon Research Institute, Paris, France, working on the project 'Using CRISPR technology to enhance our understanding of myoblast fusion'.

Dr B Loos hosted Prof Esther Wong, Nanyang Technological University, Singapore, as part of an international collaboration working on understanding of chaperone mediated autophagy.

Prof C Smith established a new collaboration with Dr Simon Johnston, Sheffield University, United Kingdom. Dr Johnston will facilitate planning on a new project related to the NRF Blue Skies project currently ongoing in Prof Smith's laboratory. PhD student Johan Visser will visit Sheffield University in mid-2017 for initiation of experiments there. The research is related to the use of macrophages in drug delivery

South Africa

- University of Cape Town
- University of the Orange Free State
- University of Pretoria
- University of KwaZulu-Natal

Africa

- University of Botswana, Sport and Recreation Department
- University of Zimbabwe, Physiology Department

France

- University of La Reunion
- Genethon, Paris

United Kingdom

- John Moore’s University, Liverpool
- Sheffield University
- Bath University
- Coventry University
- Loughborough University

Spain

- University of Zaragoza

United States of America

- Mayo Clinic

NRF-rated researchers

NRF-rated researchers	
Internationally acclaimed researchers	
Prof KH Myburgh	Integrative muscle biology, physiology and biotechnology
Established researchers	
Prof MF Essop	Cardio-metabolic
Prof A-M Engelbrecht	Chemotherapy and tumour resistance
Prof C Smith:	Multidisciplinary stress biology
Promising Young Researcher	
Dr B Loos	Autophagy and cell death control in neurodegeneration and gliomas

Awards to staff and students

Prof Anna-Mart Engelbrecht has received the Lasec Award for Excellence in Physiology Research from the Physiological Society of Southern Africa (PSSA). Prof Carine Smith was

awarded the Rector’s award for Service Excellence and Dr Loos also received a Rectors Award for Research performance.

Two PhD students of Prof Engelbrecht, Tanja Davis and Jenelle Govender, were the winner and runner-up of the Wyndham competition, respectively. The award is presented to a young researcher for the best oral presentation in the Physiological Sciences at the Annual PSSA Conference.



Jenelle Govender (left) and Tanja Davis with their supervisor, Prof Anna-Mart Engelbrecht. Photo: Wiida Basson

PhD student Natasha Driescher, supervised by Prof MF Essop, was awarded the first prize in the Van der Walt Poster competition during the Physiological Society of Southern Africa’s congress. MSc student JG Visser, supervised by Prof C Smith, came third in the student presentation of the Wyndham competition and shared the first prize for best technique used.

Three postgraduate students from Dr Loos’ lab won prizes for their research at the annual microscopy conference, hosted by the Microscopy Society of Southern Africa (MSSA) in Port Elisabeth in Dec 2016. The students all employed innovative microscopy techniques to unravel research questions around Alzheimer’s disease and neuronal cell death as well as brain cancer. Dumisile Lumkwana received the ‘Wirsam Light Microscopy Prize - Best presentation’ for presenting data of her PhD work; Jurgen Kriel was awarded the Wirsam Scientific Prize - Best Student Paper Life Sciences for his MSc research and Yigael Powrie received the SA Scientific Award – Best Presentation Confocal Microscopy for his MSc work.



From left to right, postgraduate students Jurgen Kriel, Dumisile Lumkwana and Yigael Powrie with their awards at the annual microscopy conference, hosted by the Microscopy Society of Southern Africa (MSSA).

PhD student Toni Goldswain, supervised by Dr B Sishi, won the first prize in the general poster competition at PSSA 2016, while Honours students Carmelita Abrahams, Dana Becks and Kirsten Scott earned a joint second place for the above category. At the Indian Ocean Rim Muscle Colloquium in Perth, Australia, our students also performed well: Chris Reeves (first place poster) and Kelly Peterson (second place oral presentation)

Funding

- Cancer Association of South Africa (CANSA)
- Cape Peninsula University of Technology, Functional food Unit
- CSIR
- Department of Science and Technology (DST) Technology Innovation Agency
- South African Medical Research Council
- National Research Foundation (NRF)

SERVICE TO THE SCIENTIFIC COMMUNITY

Prof KH Myburgh

- *Chairperson of the Organising Committee for the Indian Ocean Rim Muscle Colloquium 2016, Stellenbosch, South Africa, January 2016*
- Attended the European Muscle Conference, September 2016

Prof MF Essop

- Invited speaker at CYROI, University de la Reunion. 29 April 2016, Reunion, France, with a talk entitled 'Glucotoxicity and the onset of heart disease'.
- Invited speaker at the 3rd World Congress on Maillard Reaction and Glycation. 26-27 May 2016, Budapest, Hungary, with the talk 'Glycation abolishes the cardio protective effects of albumin during ischemia-reperfusion'.
- Invited speaker at the 7th International Congresses of the African Association of Physiological Sciences and 36th Physiological Society of Nigeria. 5-8 September 2016, Lagos, Nigeria, with the talk 'Metabolic perturbations and the onset of heart diseases'.
- Co-supervisor of PhD student registered and based at the University of La Reunion (France).

Prof C Smith

- *Indian Ocean Rim Muscle colloquium 2016, Stellenbosch, South Africa, January 2016. Two of her students won prizes: Kelly Petersen (MSc) won runner-up in student presentation competition, and Chris Reeves (MSc) won the prize for the best poster*
- Xth Congreso de Fitoterapia Ciudad de Oviedo – Jornada de Fitoterapia de SEFIT, Oviedo, Spain, June 2016
- Cosupervisor for PhD student registered and based at University of Zaragoza, Spain

- Plenary speaker at the Physiological Society of South Africa (PSSA) 2016 annual conference in Cape Town. The title of her talk was 'Oxidative stress and inflammation: consequences of the modern lifestyle'
- Chair of session at Physiology 2016 in Ireland
- Made two contributions to the ninth Joint Natural Products Conference, Copenhagen, Denmark, June 2016. Both abstracts were chosen for publication in a peer-reviewed issue of *Planta Medica*.

Dr B Sishi

- Attended and presented at the *Indian Ocean Rim Muscle colloquium 2016, Stellenbosch, South Africa, January 2016*. The title was 'Getting to the HEART of the problem: Cell based therapy for the treatment of chemotherapy-induced cardiotoxicity'.
- Attended and presented at the 26th World Society of Cardiothoracic Surgeons 2016 Congress Combined with South African Heart Association Annual Meeting, Cape Town, South Africa. Title of her presentation was 'Getting to the heart of the problem: where cardiology meets oncology'.
- Attended the 44th Physiological Society of Southern Africa congress hosted by the University of Cape Town with five students. All students performed well. They are Toni Goldswain (PhD – Best general poster), Temitope Ogundipe (MSc-Honourable mention for presentation); Carmelita Abrahams (Honours-Runner up in general poster); Dana Becks (Honours-Runner up in general poster), Kirsten Scott (Honours-Runner up in general poster).

ACADEMIC AFFAIRS

The Department is home to a large cohort of postgraduate students – 22 Hons, 20 MSc and 16 PhD registered students. During 2016 six MSc and one PhD student successfully graduated.

SERVICE TO THE SCIENTIFIC COMMUNITY

Prof KH Myburgh

- Member of the Stellenbosch University Institutional Forum
- Hosted the Indian Ocean Rim Muscle Colloquium in Stellenbosch, January 2016
- Editor-in-Chief of *Biomed Central Physiology*

Dr T Nell

- Member of the Humanoria Research Ethics Committee

Prof Carine Smith

- Serves as research consultant to Verve Dynamics Pty Ltd (national) and Botanical Resource Holdings (international)
- Serves on the editorial board of *Inflammopharmacology*

Prof Anna-Mart Engelbrecht

- Serves on the Governing Board of African Cancer Institute (ACI)

- Serves on the Governing Board of the Institute of Sport and Exercise Medicine (ISEM)
- Member of the Science Café Stellenbosch committee
- Editorial board of the *International Journal of Biomedical Sciences*

Dr B Sishi

- Serves as the secretary/treasurer of the Physiological Society of Southern Africa (PSSA)
- Executive member of the South African Society for Cardiovascular Research (SASCAR)

Prof Essop

- Elected council member of the South African Society of Cardiovascular Research
- Visiting professor at the University of La Reunion (France)
- Appointed as chairperson of the Research Advisory Committee of the Heart and Stroke Foundation of South Africa
- Appointed as member of Stellenbosch University's Employment Equity Advisory Committee (as representative of the Faculty of Science)
- Elected as vice-president of the African Association of Physiological Sciences
- Re-elected as President of the Physiological Society of Southern Africa
- Editorial board of the *American Journal of Physiology Heart & Circulatory Physiology*, *Advanced Biomedical Research*, *Journal of African Association of Physiological Sciences*, *International Journal of Clinical & Experimental Physiology*
- Academic editor of *PLoS ONE* journal

Dr B Loos

- Served as editor for Life Sciences section of the proceedings - Microscopy Society of Southern Africa (MSSA)
- Elected to serve on the MSSA executive committee

SOCIAL IMPACT

Postgraduate students from Dr B Loos' research group visited Grade 12 learners at Kayamandi High School, Stellenbosch, to encourage them to study the relevant subjects required for a research career in the life sciences field.

Every year postgraduate students present their findings to final year students that have Physiology as one of their main subjects. This gives an opportunity to the postgraduates to present their work to a wider audience in a professional manner and also exposes the research conducted within the department to the final year students. This is one way in which the department attracts students and tries to convince them into considering postgraduate studies.

Other activities include:

- Dr B Sishi participated in the PhD orientation workshop and the Maties Science Winter Week's 'Date with a Scientist 2016'

- After the publication of Gustav van Niekerk's article 'Autophagy-A free meal in sickness-associated anorexia' in the high impact journal *Autophagy*, he was interviewed by RSG and Health 24
- Dr B Loos participated as a speaker in a joint initiative between the Departments of Physiological Sciences, Chemistry and Polymer Science and Physics, to present open talks about the research which led to the Nobel prizes for the respective fields. Dr Loos presented a lecture on autophagy after Prof Yoshinori Ohsumi was awarded the Nobel Prize in Medicine.
- Prof KH Myburgh presented at the Tygerberg Campus Post-doctoral Fellow's Society workshop on career perspectives and served as a discussant in the open forum that followed.

STAFF MATTERS

Dr B Sishi served on the appointments committee for Vice-Rector: Social Impact, Transformation and Personnel. Both Dr and Dr T Nell were promoted to senior lecturers.

Staff

Academic

- Prof A-M Engelbrecht (HOD)
- Prof MF Essop
- Prof C Smith
- Dr B Loos
- Dr B Sishi
- Dr T Nell
- Dr JADW Strauss

Extraordinary professors

- Prof KH Myburgh

Support staff

- Dr L Lacerda (Technical)
- Dr A Krygsman (Technical)
- Mr A Isaacs (Technical)
- Ms G Simon (Administrative)
- Mr J Isaacs (Assistant)

Postdoctoral fellows

- Dr P Durcan
- Dr M Kruger
- Dr A Brand
- Dr C Swart
- Dr D Joseph
- Dr G Deshpande



LIST OF PUBLICATIONS

DEPARTMENT OF EARTH SCIENCES

Journal Articles (subsidised)

- ALBERT C, FARINA F, LANA C, STEVENS G, STOREY C, GERDES A, DOPICO CM.** Archean crustal evolution in the Southern São Francisco craton (Brazil): constraints from U-Pb, Lu-Hf and O isotope analyses. *Lithos* 2016; 266-267:64-86.
- ARENAS R, MARTÍNEZ SS, FERNÁNDEZ RD, GERDES A, ABATI J, FERNÁNDEZ-SUÁREZ J, ANDONAEGUI P, CUADRA PG, CARMONA AL, ALBERT R, FUENLABRADA J M, PASCUAL FJR.** Allochthonous terranes involved in the Variscan suture of NW Iberia: A review of their origin and tectonothermal evolution. *Earth-Science Reviews* 2016; 161:140-178.
- BAKER A, ROUTH J, ROYCHOUDHURY AN.** Biomarker records of palaeoenvironmental variations in subtropical Southern Africa since the late Pleistocene: Evidences from a coastal peatland. *Palaeogeography, Palaeoclimatology, Palaeoecology* 2016; 451:1-12.
- BAKER AR, LANDING WM, BUCCIARELLI E, CHEIZE M, FIETZ S, HAYES CT, KADKO D, MORTON PL, ROGAN N, SARTHOU G, SHELLEY RU, SHI Z, SHILLER A, VAN HULTEN MMP.** Trace Element and Isotope Deposition across the Air – Sea Interface: Progress and Research Needs. *Philosophical Transactions of the Royal Society A – Mathematical, Physical and Engineering Sciences* 2016; 374(2016):1-17.
- BARTELS A, NILSSON MKM, KLAUSEN MB, SÖDERLUND U.** Mesoproterozoic dykes in the Timmiarmiit area, Southeast Greenland: evidence for a continuous Gardar dyke swarm across Greenland's North Atlantic Craton. *GFF* 2016; 138:255-275.
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- BASSON IJ, MUNTINGH JA, JELICOE BC, ANTHONISSEN CJ.** Structural interpretation of the Steenkampskraal Monazite Mine, Western Cape, South Africa. *Journal of African Earth Sciences* 2016; 121:301-315.
- CHATZARAS V, DÖRR W, GERDES A, KRAHL J, XYPOLIAS P, ZULAUFG.** Tracking the late Palaeozoic to early Mesozoic margin of northern Gondwana in the Hellenides: paleotectonic constraints from U-Pb detrital zircon ages. *International Journal of Earth Sciences* 2016; 105:1881-1899.
- CLEMENS JD, BUICK IS, STEVENS G.** Fluids, melting, granulites and granites: a commentary. *Precambrian Research* 2016; 278:394-399.
- CLEMENS JD, ELBURG M.** Possible spatial variability in the Selwyn Block of Central Victoria: evidence from Late Devonian felsic igneous rocks. *Australian Journal of Earth Sciences* 2016; 63(2):187-192.
- CLEMENS JD, MAAS R, WAIGHT TE, KUNNEKE LK.** Genesis of felsic plutonic magmas and their igneous enclaves: The Cobaw batholith of SE Australia. *Journal of Geology* 2016; 124(3):293-311.
- CLEMENS JD, REGMI K, NICHOLLS A, WEINBERG R, MAAS R.** The Tynong pluton, its mafic synplutonic sheets and igneous microgranular enclaves: the nature of the mantle connection in I-type granitic magmas. *Contributions to Mineralogy and Petrology* 2016; 171(4):35, 17 pages.
- CLEMENS JD, STEVENS G.** Melt segregation and magma interactions during crustal melting: Breaking out of the matrix. *Earth-Science Reviews* 2016; 160:333-349.
- CLEMENS JD, STEVENS G.** The Saldanha Bay Volcanic Complex: clarifying the Cambrian geology of the Postberg – Saldanha Bay, West Coast, South Africa. *South African Journal of Geology* 2016; 119(2):347-358.
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- GARDE AA, KLAUSEN MB.** A centennial reappraisal of the Vredefort pseudotachylytes: shaken, not stirred by meteorite impact. *Journal of the Geological Society* 2016; 173:954-965.
- GÄRTNER A, VILLENEUVE M, LINNEMANN U, GERDES A, YOUBI N, GUILLOU O, RJIMATI EC.** History of the West African Neoproterozoic Ocean: Key to the geotectonic history of circum-Atlantic Peri-Gondwana (Adrar Souttouf Massif, Moroccan Sahara). *Gondwana Research* 2016; 29:220-233.
- GÄRTNER A, VILLENEUVE M, LINNEMANN U, GERDES A, YOUBI N, HOFMANN M.** Similar crustal evolution in the western units of the Adrar Souttouf Massif (Moroccan Sahara) and the Avalonian terranes: Insights from Hf isotope data. *Tectonophysics* 2016; 681:305-317.
- GEE DG, ANDRÉASSON PG, LORENZ H, FREI D, MAJKA J.** Reply to Åke Johansson "Detrital zircon signatures of the Baltoscandian margin along the Arctic Circle Caledonides in Sweden: The Sveconorwegian connection". *Precambrian Research* 2016; 276:236-237.
- GEORGIEV N, FROITZHEIM N, CHERNEVA Z, FREI D, GROZDEV V, JAHN-AWE S, NAGEL TJ.** Reply to: Bonev N., Spikings R. & Marchev P (2016) Comment on Georgiev et al. "Structure and U-Pb zircon geochronology of an Alpine nappe stack telescoped by extensional detachment faulting (Kulidzhik area, Eastern Rhodopes, Bulgaria)". *International Journal of Earth Sciences* 2016; 105:2171-2173.
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- GONÇALVES GO, LANA C, SCHOLZ R, BUICK IS, GERDES A, KAMO SL, CORFU F, MARINHO MM, CHAVES AO, VALERIANO C, NALINI JR HA.** An assessment of monazite from the Itambé pegmatite district for use as U–Pb isotope reference material for microanalysis and implications for the origin of the "Moacyr" monazite. *Chemical Geology* 2016; 424:30-50.
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- HALL DJ, KISTERS AFM.** From steep feeders to tabular plutons – emplacement controls of syntectonic plutons in the Damara Belt, Namibia. *Journal of African Earth Sciences* 2016; 113:51-64.
- HUTHMANN FM, YUDOVSKAYA MA, FREI D, KINNAIRD JA.** Geochronological evidence for an extension of the Northern Lobe of the Bushveld Complex, Limpopo Province, South Africa. *Precambrian Research* 2016; 280:61-75.
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- KRUGER TM, KISTERS AFM.** Magma accumulation and segregation during regional-scale folding: the Holland's dome granite injection complex, Damara belt, Namibia. *JOURNAL OF STRUCTURAL GEOLOGY* 2016; 89:1-18.
- LE ROUX SG, MILLER JA, DUNFORD AJ, CLARKE CE.** The dissolution kinetics of atacamite in the acid range and the stability of atacamite containing soils from Namaqualand, South Africa. *Applied Geochemistry* 2016; 64:22-29.
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- MOORE AE, COTTERILL FPD, WINTERBACH CW, WINTERBACH HEK, ANTUNES A, O'BRIAN SJ.** Genetic evidence for contrasting wetland and savannah habitat specializations in different populations of lions (*Panthera leo*). *Journal of Heredity* 2016; 107(2):101-103.
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- NAGY B, COTTERILL FPD, BELLSTEDT DU.** *Nothobranchius sainthousei*, a new species of annual killifish from the Luapula River drainage in northern Zambia (*Teleostei: Cyprinodontiformes*). *Ichthyological Exploration of Freshwaters* 2016; 27(3):233-254.
- NICOLI G, MOYEN J-F, STEVENS G.** Diversity of burial rates in convergent settings decreased as Earth aged. *Scientific Reports* 2016; 6:1-10.
- OLSSON JR, KLAUSEN MB, HAMILTON MA, MÄRZ N, SÖDERLUND U, ROBERTS RJ.** Baddeleyite U–Pb ages and geochemistry of the 1875–1835 Ma Black Hills Dyke Swarm across northeastern South Africa: Part of a trans-Kalahari Craton back-arc setting? *Journal of the Geological Society of Sweden (GFF)* 2016; 138:183-202.
- RICHTER F, LANA C, STEVENS G, BUICK IS, PEDROSA-SOARES AC, ALKMIN FF, CUTTS K.** Sedimentation, metamorphism and granite generation in a back-arc region: records from the Ediacaran Nova Venécia Complex- Araçuaí Orogen, Southeastern Brazil. *Precambrian Research* 2016; 272:78-100.
- SAHA L, FREI D, GERDES A, PATI JK, SARKAR S, PATOLE V, BHANDARI A, NASIPURI P.** Crustal geodynamics from the Archean Bundelkhand Craton India: constraints from zircon U-Pb-Hf isotope studies. *Geological Magazine* 2016; 153:179-192.
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- WABO H, DE KOCK MO, KLAUSEN MB, SÖDERLUND U, BEUKES NJ.** Paleomagnetism and chronology of B-1 marginal sills of the Bushveld Complex from the eastern Kaapvaal Craton, South Africa. *GFF* 2016; 138:133-151.
- WABO H, OLSSON JR, DE KOCK MO, HUMBERT F, SÖDERLUND U, KLAUSEN MB.** New U–Pb age and paleomagnetic constraints from the Uitkomst Complex, South Africa: clues to the timing of intrusion. *GFF* 2016; 138:152-163.
- ZOLEIKHAEI Y, FREI D, MORTON AC, ZAMANZADEH SM.** Roundness of heavy minerals (zircon and apatite) as a provenance tool for unraveling recycling: A case study from the Sefidrud and Sarbaz rivers in N and SE Iran. *Sedimentary Geology* 2016; 342:106-117.

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Proceedings International

- BAM L, MILLER JA, BECKER M, DE BEER FC, BASSON IJ.** *X-ray computed tomography – Determination of rapid scanning parameters for geometallurgical analysis of iron ores.* In: Dominy S, O'Connor L (eds.) The third international AUSIMM Geometallurgy Conference, Perth, 15-16th June, Perth, Australia, The Australasian Institute of Mining and Metallurgy 2016: 209-219.
- BECKER M, JARDINE MA, MILLER JA, HARRIS M.** *X-Ray computed tomography – a geometallurgical tool for the 3D textural analysis of drill core?* In: Dominy S, O'Connor L (eds.) The third international AUSIMM Geometallurgy Conference, Perth, 15-16th June, pp. 231-240. Perth, Australia, The Australasian Institute of Mining and Metallurgy 2016: 231-240.

Research Reports

- KLAUSEN MB, NILSSON MKM, BARTELS A.** *Post-orogenic Proterozoic dyke swarms. Chapter 12 in Kolb, J., Stensgaard, B.M. & Kokfelt, T.F. (eds.) Geology and Mineral Potential of South-East Greenland.* 2016: 8 pp.
- KLAUSEN MB, NILSSON MKM, BOTHMA R.** *Palaeoproterozoic dykes. Chapter 7 in Kolb, J., Stensgaard, B.M. & Kokfelt, T.F. (eds.) Geology and Mineral Potential of South-East Greenland.* 2016: 12 pp.
- KOKFELT TF, KLAUSEN MB.** *Geochronology of the Skjoldungen Alkaline province, South-East Greenland.* 2016: 122 pp.
- KOKFELT TF, TRANE C, KLAUSEN MB, TEGNER C.** *Skjoldungen alkaline province. Chapter 2 in Kolb, J., Stensgaard, B.M. & Kokfelt, T.F. (eds.) Geology and Mineral Potential of South-East Greenland.* 2016: 9 pp.
- WEATHERLEY S, KLEIDING JK, KLAUSEN MB, KOKFELT TF, LESHER C, TEGNER C, ULRICH T.** *Late Cretaceous to Palaeogene rocks. Chapter 13 in Kolb, J., Stensgaard, B.M. & Kokfelt, T.F. (eds.) Geology and Mineral Potential of South-East Greenland.* 2016: 16 pp.

Doctoral completed

- BAKER A.** *Bulk geochemical, biomarker and leaf wax isotope records of Mfabeni peatland, KwaZulu Natal, South Africa since the late Pleistocene.* PhD, 2106. 135 pp.
- GONZAGA DE MELO M.** *Repeated partial melting events in polymetamorphic Carlos Chagas batholith: implications for tectono-*

metamorphic evolution of the Araçuaí Orogen, Southeastern Brazil. PhD, 2016. 236 pp.

HALL DJ. *The processes of melt segregation, magma ascent and pluton emplacement in the continental crust of the Damara Belt, Namibia.* PhD, 2016. 98 pp.

KOEGELENBERG C. *Geology, structural evolution and controls of hydrothermal gold mineralization in the Eastern Karagwe-Ankole fold belt, North Western Tanzania.* PhD, 2016. 115 pp.

MULIDZI AR. *The effect of winery wastewater irrigation on the properties of selected soils from the South African wine region.* PhD, 2016. 162 pp.

VEZINET AJC. *Differentiation and stabilization of the Archean continental crust: The example of the northern edge of the Kaapvaal craton, South Africa.* PhD, 2016. 364 pp.

Masters completed

ANGOMBE MT. *The lithostratigraphy and structural components of the Eureka Shear Zone, southern Namibia.* MSc, 2016. 104 pp.

COETZEE A. *The geometry of Karoo dolerite dykes and saucers in the Highveld Coalfield: constraints on emplacement processes of mafic magmas in the shallow crust.* MSc, 2016. 47 pp.

DUNFORD AJ. *Relationship of historical copper mining to the transport and accumulation of trace metals and salts in semi-arid environments: An example from the Buffels River, Northern Cape, South Africa.* MSc, 2106. 119 pp.

KRUGER TM. *Magma accumulation and segregation during regional-scale folding: the Holland's dome granite injection complex, Damara belt, Namibia.* MSc, 2016. 36 pp.

MADLAKANA N. *Disequilibrium melting of plagioclase during biotite fluid-absent anatexis of metapelites in the South Marginal Zone of the Limpopo belt, South Africa.* MSc, 2016. 173 pp.

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RUDNICK T. *The Genesis of the Swartberg Base-Metal Sulphide Deposit, South Africa.* MSc, 2016. 221 pp.

SWANA KA. *Application of hydrochemistry and residence time constraints to distinguish groundwater systems in the Karoo Basin prior to shale-gas exploration.* MSc, 2016. 111 pp.

ZARREBINI SK. *An experimental investigation into the 'fate' of entrained peritectic minerals in I-type granite magmas intruded at below 2kbar.* MSc, 2016. 124 pp.

AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES (AIMS)

Journal Articles (subsidised)

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DEPARTMENT OF BIOCHEMISTRY

Journal Articles (subsidised)

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GEHRKE B, KANDZIORA M, PIRIE MD. The evolution of dwarf shrubs in alpine environments: a case study of *Alchemilla* in Africa. *Annals of Botany* 2016; 117:121-131.

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