

09

Faculty of
Natural and Agricultural Sciences

Annual Report





**Faculty of Natural and
Agricultural Sciences
Annual Report 2009**

Contact details

Acting Dean

Prof. Neil Heideman
+27 51 401 2322
heidemannj@ufs.ac.za

Office of the dean

Ms René Bloem
+27 51 401 2322
bloemr@ufs.ac.za

Faculty manager

Mr Johan Kruger
+27 51 401 2490
krugerjd.sci@ufs.ac.za

Marketing and Liaison

Ms Stefanie Naborn
+27 51 401 2531
nabornsa.sci@ufs.ac.za

Physical address of the office of the dean

Room 9A, Biology Building, Main Campus,
Bloemfontein

Postal address

University of the Free State
PO Box 339
Bloemfontein
South Africa
9300

Fax: +27 51 401 3728
Email: natagri.sci@ufs.ac.za
Faculty website: www.ufs.ac.za/natagri

Issued by

Faculty of Natural and Agricultural Sciences
University of the Free State

Editorial compilation

Sonja Buhrmann
Word Wizard

Language revision

Corrie Geldenhuys

Revision of bibliographical data

Mercia Coetzee

Layout and cover design

Chrysalis advertising and publishing

Photographers

Leonie Bolleurs
Stephen Collett
Reinier Brönn

Printing

Bloemfontein Repro Services

The Afrikaans version is available on the
university's website at www.ufs.ac.za

Contents	iii
Preface	1
Departments:	
Agricultural Sciences	3
- Agricultural Economics	5
- Animal, Wildlife and Grassland Sciences	15
- Plant Sciences	27
- Soil, Crop and Climate Sciences	39
Building Sciences	53
- Architecture	55
- Quantity Surveying and Construction Management	65
- Urban and Regional Planning	73
Natural Sciences	79
- Chemistry	81
- Computer Science and Informatics	103
- Genetics	113
- Geography	121
- Geology	129
- Mathematical Statistics and Actuarial Science	139
- Mathematics and Applied Mathematics	147
- Microbial, Biochemical and Food Biotechnology	153
- Physics	169
- Plant Sciences	27
- Zoology and Entomology	183
Centres:	197
- Disaster Management Training and Education Centre for Africa (DIMTEC)	199
- Environmental Management	209
- Lengau Agricultural Development Centre	219
- Microscopy	225
- Sustainable Agriculture and Rural Development	233
Experimental Farm	241
- Paradys Experimental Farm	243
Institute	249
- Groundwater Studies	251
Statistical Data	257
Glossary	261

Contents



Preface

From the Dean's Office

It is with great pride and gratitude that I write this preface to the 2009 Annual Report of the Faculty of Natural and Agricultural Sciences because in spite of the ramifications of the global economic downturn on the core business of institutions of higher learning across the world, the Faculty remained steadily on course with respect to its vision and mission. Through dedication and hard work staff and students continued to excel, once again with some notable special achievements, of which a few are highlighted below.

Our student enrolments continued to rise as young men and women both nationally and from other parts of Africa and the rest of the world remain attracted to the diverse and high quality training and research opportunities we offer. To mention but a few, our expertise in plant pathology, lipid biotechnology and nanoscience is world renown, and we are one of only a few South African universities involved in forensic science. We do training and research in disaster risk management and mitigation, and offer a postgraduate course with the largest footprint in Africa. Agriculturally

we have the most specialized group servicing the farming industry, including capacity building programmes for newly settled and prospective emerging commercial farmers. Our building science departments are leaders in the country and are consistently successful in accreditation processes (often unconditionally) by national and international professional bodies.

The highly successful equipment strategy remained on track as we systematically continued to grow our capacity in state-of-the-art equipment, bearing fruit in further improving the quality and quantity of research and training outputs. We are also grateful for a substantial grant received from the Department of Higher Education and Training which will enable us to relieve some of the pressure on our physical facilities and better equip several laboratories. Our cadre of NRF-rated researchers grew including the attainment of B-ratings by a number of staff members. The Strategic Academic Clusters (Water Management in Water-scarce Areas, Technologies for Sustainable Crop Industries in Semi-arid Regions, Materials and Nanosciences,

and Advanced Biomolecular Sciences) also continued to gain momentum as vibrant hubs of multidisciplinary research and training, focusing on key Southern African problems and the expanding of knowledge for greater technological advancement and innovation.

As mentioned earlier, staff and students were once again prominent in focusing national and international attention on the faculty as recipients of significant research awards, the sharing of expertise, their election to high profile academic bodies and the organization of special events. I highlight but a few of these:

- Prof. Esta van Heerden (Department of Microbial, Biochemical and Food Biotechnology) won the 2009 Third World Academy of Science Young Scientist Award.
- At the congress of the South African Society for Plant Pathology Prof. Neal McLaren (Department Plant of Sciences) received the society's award for applied plant pathology research, while Prof. Zakkie Pretorius received the C.H. Persoon medal

(gold), which is the highest award for contributions to this field of study in South Africa. It was only the fifth time since its inception that the award was made.

- Under the leadership of Prof. Jo van As (Department of Zoology and Entomology) a highly successful year long public scientific programme was offered to commemorate Charles Darwin's birthday and the publication of his book, *The Origin of Species*, 150 years ago. It involved lectures by staff from several departments within our faculty, from other faculties, the National Museum (Bloemfontein) and the Central University of Technology.
- Prof. Marian Tredoux (Department of Geology) was nominated Fellow of the Geological Society of South Africa.
- Prof. Gideon Steyl (Department of Chemistry) was awarded the first Jan Boeyens medal for outstanding work in theoretical Chemistry/Physics by a young scientist (younger than 40 years) in the process outclassing nominees from WITS, UP, US and UCT at the locally held international INDABA congress. Prof. André Roodt, Departmental Chairperson, was elected Vice-president of the European Crystallographic Association which has approximately 45 member countries from Europe, Africa and the Middle East.
- Prof. Hendrik Swart, Departmental Chairperson, and Dr Martin Ntwaeaborwa (Department of Physics) were both recipients of NSTF awards, the former for Research Capacity Development and the latter as a Distinguished Young

Black Researcher. At the South African Institute of Physics congress Ms A Dhlamini received the Publication Award for the best publication in a scientific journal, originating from a Ph.D. thesis (Promoters, Proff. HC Swart and JJ Terblans) while Mr. WA Jordaan received it for the best publication in a scientific journal, originating from an MSc. dissertation (Supervisors, Proff. JJ Terblans and HC Swart).

- Prof. Johan Greyling (Department of Animal, Wildlife and Grassland Sciences) received a silver medal for his contribution to research at the Annual Meeting of the SA Society for Animal Sciences in November 2008 and was also re-elected to the SASAS Council. Prof. Hennie Snyman was named Free State's Agriculturalist of the Year by the Central Agricultural Writers Association.
- From the Department of Soil, Crop and Climate Sciences Prof. Cornie van Huyssteen was elected President and Dr. Piet le Roux as Council Member of the Soil Science Society of South Africa.
- Mr. Andries Jordaan, Head of the Disaster Management Training and Education Centre for Africa (DiMTEC) was approached by the government of the Republic of the Congo for assistance with their national disaster management plan, focusing specifically on Brazzaville, as well as the establishment of a disaster management centre.
- The Department of Quantity Surveying and Construction Management received unconditional accreditation

for construction management from the Chartered Institute of Building, as well as confirmation that they complied with the requirements for recognition as an accredited centre. Prof. Verster, the Departmental Chairperson, was elected Vice-President (Education) of the CIOB (Africa).

- The Department of Architecture brought out a special edition of the academic publication *Architecture South Africa*. Craig Atkins was among the top ten students on the shortlist for the Africa Thesis Awards.

The faculty and the university are greatly indebted to these and all the staff members and students who again worked tirelessly to excel and further raise the academic stature of our institution both nationally and internationally. As a faculty we also express our sincere gratitude to our former Dean, Prof. Herman van Schalkwyk, who once again led us with great distinction in 2009. It is now my pleasure to present to you this Annual Report with the hope that it will not only make for informative and stimulating reading but that it will also open up possibilities for mutually beneficial and productive collaboration.



Prof. N.J.L. Heideman
Acting Dean

Faculty of Natural and
Agricultural Sciences
University of the Free State

Departments in

Natural Sciences



08 Chemistry

Overview

The Department of Chemistry at the University of the Free State (UFS) celebrated its centenary as an independent department in 2009. This special occasion was commemorated with special events throughout the year. One of the highlights was the hosting of INORG2009, the Biennial Inorganic Chemistry Meeting of the South African Chemical Institute, in collaboration with the Royal Society of Chemistry in the United Kingdom.

Some 160 delegates from 40 institutions and 14 countries participated in this international meeting. The organising committee consisted of international scientists and Profs. Jannie Swarts, Deon Visser,

Gideon Steyl, Walter Purcell, Dr Johan Venter, Ms Marietjie Schutte and students of the Inorganic Chemistry group. Prof. André Roodt was the chairperson of the organising and scientific committees.

The centenary of Chemistry at the UFS was also celebrated with the launch of the UFS Cluster initiative in November 2009. The department actively participates in two research clusters.

We are proud of our continued quality and excellence in pursuit of the strategic priorities of the UFS and the Faculty of Natural and Agricultural Sciences under difficult infrastructural circumstances. Six postdoctoral fellows, 20 M.Sc. and 34 Ph.D. students in different sub-



“We are proud of our continued quality and excellence in pursuit of the strategic priorities of the UFS and the Faculty of Natural and Agricultural Sciences.”

– Prof. André Roodt.



Evaporating solvents to obtain pure products are, from left: third-year student Rikus Peens, Ph.D. student Leo Kirsten and M.Sc. student Kina van der Merwe



disciplines produced a significant and sustained research output for 2009. This is manifested in 55 research articles which were published in international accredited journals and five preliminary patents that were issued. Furthermore, numerous local and international conference presentations were made.

The upgrading of the Moerdyk and annexed buildings that house the department on the Main Campus continued. The overall project to the value of more than R50 million will be completed over a four-year period. This unprecedented investment in Chemistry by university management underlines the commitment to create a highly competitive teaching and research unit. Interruptions due to the renovation process posed a range of unique problems in terms of practical classes, theory and research and placed significant stress on the department. In spite of this, the enthusiasm and commitment of the department's personnel were illustrated by the fact that most activities were continued without significant interruptions throughout the year. However, most high-pressure experiments, pivotal to in the catalytic work, could not be performed due to the associated safety risks involved.

Although the renovation process of the Chemistry building suffered a setback it was, however, set back on track fairly quickly due to the pro-active intervention from management.



Thus, the support of senior management and particularly at faculty level from Prof. Herman van Schalkwyk, Dean of the Faculty of Natural and Agricultural Sciences, as well as faculty colleagues who provided office and laboratory space and other support to Chemistry under- and postgraduate students during 2009 is gratefully acknowledged.

The further upgrading of the department's research equipment continued to contribute to a sustained high research output. This new equipment strategy forms part of the UFS vision to be internationally visible with quality research outputs in niche areas, to provide leadership in advanced training to the African continent student corps and to establish it as an important player amongst South African universities as well as a competitor internationally.

A new agreement between the UFS and SASOL for the 2009/2010 year, worth R9 million, was concluded. According to this agreement, process technology, research development catalysis and surface studies reside in the department in collaboration with Prof. Hendrik Swart from the Department of Physics. This agreement is further supported by the extended secondment of Prof. Ben Bezuidenhout to the department. An achievement under this agreement is the successful application of "Applied Process Chemistry" to the South African National Research Foundation's (NRF) Technology and Human Resources for Industry Programme (THRIP) from combined inputs of Inorganic, Physical and Organic Chemistry (Profs. Roodt, Swarts and Bezuidenhout). This has sourced an additional R4,5 million for

Ph.D. student Matthew Achilonu in the laboratory purifying solvents by fractional distillation

the upgrade of equipment and the development of extended capacity.

As always, teaching aspects at undergraduate level have been a prime focus of the department. The continued teaching in parallel medium on the Main Campus was quite demanding on individuals and challenged the lecturers to improve constantly, also with respect to using more sophisticated teaching methods and computers during classes. The enthusiasm in terms of lecturing in Chemistry theory and practical classes on both the Main and Qwaqwa Campuses is noted and gratefully acknowledged.

Teaching at the Qwaqwa Campus generally went well, with the main challenges being infrastructural problems with the laboratories still being inadequate and a lack of senior staff. The poor quality of students that are attracted is still a big problem, posing a real challenge to maintain the expected standards without having too low a pass rate. The pass rates of the department are still low at first-year level, but significantly higher at second- and third-year levels because of the filtering out of academically weak students.

Advanced topics were introduced and refined by outside scholars in a number of courses in the B.Sc. honours programme, exposing the chemistry students to international teachers. These included lectures in the biosynthesis and organic chemistry of secondary metabolites in plants by Prof. Ferreira, industrial and organometallic chemistry by Prof. Bezuidenhoudt, and computational chemistry by Dr Petrie Steynberg from

SASOL and Profs. Gideon Steyl and Jeanet Conradie from the UFS in the standard honours courses in Organic, Inorganic and Physical Chemistry. The honours course saw the further refinement of advanced topics and heterogeneous catalysis by Drs Thys Botha and Philip Gibson from SASOL.

Activities and achievements

Many colleagues served on faculty and UFS committees, acted as external reviewers for the NRF and for various international chemistry journals. Still others made their contributions as external examiners for a number of universities at undergraduate and postgraduate level and represented the UFS on international research councils.

The **Organic Chemistry** division is headed by Profs. Jan van der Westhuizen, Ben Bezuidenhoudt and Andrew Marston, with Dr Susan Bonnet as senior lecturer and Ms Anke Wilhelm as lecturer. During 2009 they were assisted by Mrs Annette Alleman as technical officer and 15 M.Sc. and Ph.D. students.

Prof. Van der Westhuizen was on sabbatical from February to July 2009 at Cambridge University in the United Kingdom as a visiting academic with Prof. Steven Lay. He studied flow chemistry and innovative technologies. During his stay at Cambridge University he also paid a visit to the University of Bayreuth in Germany.

Dr Louis Ackerman, retired from the Council for Scientific and Industrial Research's (CSIR) bioprospecting and essential oils programme, visited UFS

Chemistry regularly to assist with post-graduate training.

Prof. Andrew Marston is investigating the family of the Amaryllidaceae, which is rich in alkaloids and known inhibitors of the enzyme acetylcholinesterase as part of his natural products programme. Screening of various species has led to the selection of the genus *Nerine* for further study. A series of compounds, both alkaloidal and non-alkaloidal, have been isolated as candidates for potential therapeutic agents for the treatment of Alzheimer's disease.

During 2009 Prof. Marston contributed widely to his research discipline in a number of ways. This included acting as chairperson of the Society for Medicinal Plant and Natural Product Research Travel Grants Committee in Germany, being member of the Scientific Committees of the Saponins meeting in Nancy, France in July and of the Society for Medicinal Plant and Natural Product Research Annual Meeting in Geneva, Switzerland. He also attended a number of meetings during the course of 2009, such as the Applied Biosystems Seminar in Bloemfontein in March 2009, the International Organisation for Chemical Sciences in Development Biodiversity meeting in Mombasa, Kenya, the Department of Science and Technology's (DST) Bioprospection Workshop in Pretoria and the Indigenous Plant Use Forum in Stellenbosch. He gave invited lectures at the CSIR in Pretoria in March, the SA Chromatographic Society lecture in Stellenbosch during July, as well as at the 5th International Conference on Pharmaceutical and Pharmacological Sciences held in Potchefstroom during

September. Furthermore, he presented a poster at the Society for Medicinal Plant and Natural Product Research Annual Meeting in Geneva, Switzerland in August; organised the Prof. Hostettmann retirement symposium in Geneva in September and attended a preparatory meeting for a European Funding Programme Seven (FP7) project application in Oslo, Norway in December 2009.

Dr Gabre Kemp was transferred from the Organic Chemistry division to head the newly established mass spectrometry

unit of the UFS, managed under the UFS Cluster on Advanced Biomolecular Systems. The Organic Chemistry section played an important role in the establishment of this unit.

The **Process Chemistry** thrust, which was established in early 2006, is headed by Prof. Ben Bezuidenhout, SASOL-seconded chairperson in Organic Chemistry.

The group consisted of three M.Sc. and five Ph.D. students in 2009 with Dr

Marais as post-doctoral assistant and Mrs Bernadette van Tonder as technical assistant. Ms Ellen Kuo was awarded a prestige bursary from the UFS Cluster on Materials and Nano-sciences.

A new solvent drying system to the value of R350 000 and two high-quality glove boxes valued at R980 000 were acquired by the Bezuidenhout group during 2009. The Maldi-Toff mass spectrometer of R1,8 million that was previously acquired, will be coupled to one of the glove boxes, making it only



INORG2009, the biennial conference of the South African Chemical Institute (SACI), was hosted on the Main Campus of the UFS in Bloemfontein in September 2009. From the left are: Prof. Jannie Swarts, Department of Chemistry at the UFS and member of the organising committee and plenary lecturer at the conference; Prof. André Roodt, Chairperson of the Department of Chemistry at the UFS and Chairperson of the organising and scientific committees of INORG2009; Prof. Jan Boeyens, University of Pretoria and plenary lecturer; Dr Jaco Erasmus, Delta EMD and session chairperson; Prof. Roger Alberto, University of Zürich, Switzerland and plenary lecturer; Prof. Peter Tasker, University of Edinburgh, Scotland, Joint Chairperson of the organising committee and plenary lecturer; and Prof. Peter Comba, University of Heidelberg, Germany and plenary lecturer. Photo: Stephen Collett

the second facility globally with this setup for analysing compounds under virtually entirely oxygen-free conditions.

The **Polymer Science** research area is headed by Prof. Riaan Luyt at the Qwaqwa Campus. He is C1-rated by the NRF. His group focuses on physical properties of polymer/wax mixtures, polymer/natural fibre composites and polymer nano-composites. Chemistry at the Qwaqwa Campus again did exceptionally well in terms of research, given the infrastructure shortage and condition of the laboratories.

Seven masters and eight doctoral students were registered for Chemistry on the Qwaqwa Campus in 2009. A post-doctoral research fellow, Dr Stephen Ochigbo and a visiting scientist, Dr Vladimir Djoković, spent twelve months and three months at the Qwaqwa research laboratories, respectively. During 2009 the staff and students in the department contributed to 20 research papers and made a number of conference contributions at local and international events.

The Luyt group is part of three official bilateral collaborative research projects. These are with Prof. Massimo Messori at the University of Modena and Reggio Emilia in Italy, Dr Jozsef Kovacs at the Budapest University of Technology and Economics in Hungary and Dr Igor Krupa at the Polymer Institute of the Slovak Academy of Sciences. Moreover, the group is collaborating nationally and internationally with Prof. Walter Focke of the Institute for Applied Materials at the University of Pretoria, Dr Sinha Ray of the Nano-technology Research Group of the CSIR, Dr Andrew de Vries of the Polymers and Bioceramics Research

Group of the CSIR in Pretoria, Prof. Tibor Czigany from the Budapest University of Technology and Engineering in Hungary and Prof. Sabu Thomas, Mahatma Gandhi University in Kottayam, India. Several staff members and students from these groups visited the Chemistry group at the Qwaqwa Campus, while Prof. Luyt and several of his students visited different institutions in Italy, Hungary and Slovakia.

Prof. Luyt received NRF-IRDP funding, while Ms Moipone Mokoena, Ms Montahi Masiangoako and Mrs Mpondi Molefe received NRF Thuthuka funding during 2009. The Polymer Research Group is currently involved in 24 research projects within the fields of polymer/wax blends for phase-change materials, polymer/natural-fibre composites and polymer nano-composites. Mrs Molefe is busy with her Ph.D. in the field of physical Inorganic Chemistry. Prof. Luyt is also the leader of one of the University's NRF-funded research niche areas, namely modified polymers, as well as one of the focus areas within the university's Research Cluster 5, namely Material and Nano Sciences.

The **Physical Chemistry** division has two research groups headed by Profs. Jannie Swarts and Jeanet Conradie, respectively. Dr Ernie Langner completed his Ph.D. in 2009 and Dr Lizette Erasmus was appointed as lecturer.

Prof. Swarts is C1-rated by the NRF and Prof. Conradie C3. Both held NRF research grants, while Dr Langner is the holder of a ThuThuka NRF grant. The Swarts group was also funded by THRIP, by industry research grants from SASOL and internationally by a

grant jointly sponsored by the Deutsche Forschungsgemeinschaft (DFG) and the South African NRF.

Both Profs. Conradie and Swarts were reviewers for the NRF in evaluating the quality of the research outputs of other researchers and for advanced bursary applications. Prof. Swarts also contributed in the same way to the Irish Health Board. Both also frequently evaluated international publications as peer reviewers, are external examiners for M.Sc. and Ph.D. degrees of candidates at other universities and act as moderators for third-year and honours courses at other universities.

The main research question of the Swarts research group concerns synthetic and physical chemistry aspects of multinuclear metallocenes. The group currently focuses on five projects, i.e., porphyrin and phthalocyanine compounds bearing metallocene substituents; titanocene, zirconocene, hafnocene, ferrocene, ruthenocene and osmium derivatives, especially in association with rhodium, iridium, silver, gold and copper; electrochemical, kinetic and thermal analyses of these complexes; medicinal aspects of these complexes; and industrial studies on carboxylato complexes in collaboration with SASOL.

The Conradie research group focuses on the characterisation of known and unknown transition metal complexes and intermediates by means of synthetic and computational chemistry. The following classes of compounds are currently being investigated: Transition metal porphyrin and related compounds; O,O'-Chelated titanocene and titanium complexes; Beta-diketonato-carbonyl



Signing of the overarching contract with SASOL, which forms part of the SASOL-supported and UFS senior management's revitalisation of Chemistry to more than R100 million over the past four and a half years. Pictured are, from the left: Prof. Herman van Schalkwyk, Dean of the Faculty of Natural and Agricultural Sciences, Prof. Tienie Crous (Acting Vice-Rector: Academic Operations), Prof. Jannie Swarts, (Physical Chemistry), Prof. Theuns Verschoor (Acting Rector and Vice-Chancellor), Dr Glen Taylor (UFS Research Development), Dr Sven Godorr (Manager of Research and Development, Sasol Technology), Prof. André Roodt, (Inorganic Chemistry and Chairperson of the Department of Chemistry), Mr Johann Nel (Manager of Technology Contracting at Sasol) and Prof. Ben Bezuidenhoudt (SASOL-seconded professor in Organic Chemistry).

complexes of rhodium(I) and rhodium(III) and Dithizonato compounds of transition metal complexes.

The Swarts and Conradie groups collaborate internationally with Profs. Abhik Ghosh (University of Tromsø, Norway), Todd C. Harrop (University of Georgia, Athens, USA), Stephen J. Lippard (Massachusetts Institute of Technology, Cambridge, USA), Mike Cook (University of East Anglia, Norwich, England); Manuel Aquino (Saint Francis Xavier University, Canada), Bill Geiger (Uni-

versity of Vermont, USA) and Henry Lang (Chemnitz Technical University, Germany).

During research visits to Europe, Prof. Swarts gave lectures at the Universities of Bayreuth and Regensburg in Germany. He also paid research visits to Profs. Henry Lang at Chemnitz, Germany and Hans Niemantsverdriet in Eindhoven in The Netherlands. During November 2009, Prof. Swarts visited the Bruker instrument factories in Germany at Karlsruhe and Bremen.

Mr Chris Joubert visited Prof. Henry Lang at Chemnitz, Germany, while Prof. Conradie paid research visits to the University of Tromsø, Norway during May and September 2009 and presented three lectures. She also established relations with Prof. Tom Ziegler of the University of Calgary, a co-developer of the Amsterdam Density Function (ADF) software suit of programmes and paid a short visit to Prof. Hans Niemantsverdriet in Eindhoven, The Netherlands. Dr Langner went for six months' sabbatical leave to Prof. Hans Niemantsverdriet at Eindhoven and Dr Lizette Erasmus spent three months' sabbatical leave at the same institution.

The industry research collaboration of the Swarts group led to visits to the UFS by Drs Thys Botha and Philip Gibson, both from Sasol, on various industry research issues with respect to heterogeneous catalysis.

Highlights from the Physical Chemistry Division include Prof. Swarts's article *Triple-decker cadmium phthalocyanine sandwich complexes: self-assembled EPR active complexes* in the *Journal of Porphyrins and Phthalocyanines*, which reached the front page of this journal. Furthermore, two articles were accepted and published back-to-back in the international flagship journal, *Dalton Transactions*, of the Royal Society of Chemistry; one of which also reached the front page. A chapter entitled *Electronic Structure of Transition Metal-NO Complexes* by Prof. Conradie for the book *Encyclopedia of Inorganic Chemistry: Computational Inorganic and Bioinorganic Chemistry* testifies to her international recognition in the field of Computational Chemistry. She also published

an article in the leading journal, *Nature*. Ms Marianne Conradie (Ph.D. student) won the prize for best poster at the international conference INORG2009 (Conference of the South African Chemical Institute – SACI), as well as first prize for her Afrikaans lecture at the Afrikaans Student Symposium for Natural Sciences at the University of the Free State in October 2009.

Research in **Inorganic Chemistry** concentrates on Coordination Chemistry with the primary focus on an integrated investigation of reaction mechanisms through the use of crystallography, spectroscopy, computational chemistry and reaction kinetics. Two research thrusts focus on *industrial reactions/homogeneous catalysis/applied process chemistry* and *applications to medicine* (radiopharmaceutical and chemotherapeutic agents). This research in the group of Prof. Roodt (NRF B3-rated) continued and the infrastructure was expanded, supported by Profs. Deon Visser, Gideon Steyl (NRF Y2-rated) (Computational Chemistry), Dr Johan Venter and 16 postgraduate students. The Roodt group members contributed to more than 30 research articles in international chemistry literature, and presented more than 20 invited lectures and conference posters, of which ten invited oral presentations.

The homogeneous catalysis research in the Inorganic group is driven in close collaboration with SASOL and the Department of Science and Technology at the University of Cape Town's Centre for Excellence in Catalysis, c*change. The focus of the research is on the conversion of simple feedstock molecules

into value-added products and includes studies of classical reaction types such as carbonylation (synthesis of acetic acid and other products from methanol and carbon monoxide), hydroformylation (aldehydes and alcohols from olefins and synthesis gas) and oligomerisation (ethene). Collaboration with SASOL, the North-West University, the Universities of Johannesburg, Cape Town, the Western Cape, and Lund (Sweden) forms part of this thrust. Significant funding was sourced under the "Applied Process Chemistry" theme as noted above.

The medical research focus in the Roodt group, in collaboration with the Universities of Missouri, USA (Dr Hendrik Engelbrecht), Lund, Sweden (Profs. Ola Wendt, Ake Oskarsson and Lars Ivar Elding) and Zürich, Switzerland (Prof. Roger Alberto), as well as with CANSA (Prof. Connie Medlen, Pharmacology, University of Pretoria) and PETLabs Pharmaceuticals (Dr Gerdus Kemp) showed good progress and several research reports and articles in international accredited journals were published. Moreover, the project entitled *Development of Novel Nuclear Pharmaceuticals* from Profs. Roodt and Medlen sourced another R1,55 million from PETLabs Pharmaceuticals and THRIP.

The equipment in the group was further expanded by the acquisition of an advanced powder X-ray diffractometer, high-pressure reactors and chromatographic equipment to the value of more than R5 million with funding obtained from SASOL (Drs Desmond Young and Petrie Steynberg), PETLabs Pharmaceuticals (Dr Kemp), the THRIP programme, CANSA and the NRF.

As indicated above, the Inorganic section was primarily responsible for hosting INORG2009, the Biennial Inorganic Chemistry meeting of the South African Chemical Institute, in collaboration with the Royal Society of Chemistry in the United Kingdom.

The collaboration of the Inorganic group with the group of Prof. Ola Wendt from Lund, Sweden, under the Swedish International Development Agency (SIDA) programme, enabled four students from the department, Mss Truidie Venter, Tania Hill, Alice Brink and Mr Ricky Kotze to visit Lund during 2009 for periods of two to three months each for research on different projects.

Prof. Deon Visser visited NECSA and PETLabs in Pretoria on collaborative projects and continued to co-supervise eight M.Sc. and Ph.D. students in the Inorganic group. He also attended the 18th International Symposium on Pharmaceutical Sciences in Edmonton, Alberta and presented a poster there. Prof. Visser also presented an invited lecture to the group of Prof. Chris Orvig at the University of British Columbia in Vancouver, Canada.

Prof. Gideon Steyl undertook a research and training visit to the USA and took part in geochemical and geographic information systems training in Boulder and Golden Colorado, respectively. He subsequently gave an invited lecture on light non-aqueous phase liquids at the United States Geological Survey (USGS) located in San Diego, California. In addition to this, he also completed a regional site visit to the Bakersfield area in California to investigate petroleum-water interactions and the likelihood of



ment of SASOL as part of the agreement between the UFS and SASOL.

The use of **Computational Chemistry** currently forms an invaluable and integral part of many aspects of the chemical sciences. Prof. Jeanet Conradie from Physical Chemistry is the current chairperson of the UFS High Performance Computing (HPC) special interest group with Prof. Gideon Steyl from Inorganic Chemistry a major initiator of and contributor to this facility. The HPC is further supported by a number of other groups, which include Mathematics, Medical Physics, Physics, Computer Services, Microbiology, Biochemistry and Food Biotechnology.

The initiative and input from Profs. Jeanet Conradie and Gideon Steyl over the past decade to establish this facility deserve special mention and recognition. Since the bulk of activities of the HPC for 2009 stems from their initiative, it is primarily reported under UFS Chemistry. In this regard, the technical support by Mr Albert van Eck is sincerely acknowledged for providing a facility that is currently leading in South Africa.

The outputs originating from the HPC facility and associated collaborative initiatives, consisted of 11 publications in the international literature as well as nine oral and two poster conference contributions. The hardware consists of 26 nodes and 208 cores and utilisation is defined in terms of central processing unit (CPU) hours. Software available includes ADF, Gaussian G03, GaussView, Crystal and Gamess US/UK (Chemistry), BeamNRC (Medical Physics), Blast (Bio-informatics), Gate (Medical Physics) and R (Mathematics).

future research projects on this subject. He concluded his visit to the USA with a seminar on solid-state chemistry and the effect it has on catalyst design at the University of North Texas, Denton in the USA.

Prof. André Roodt gave an invited lecture at Lund University in Sweden and visited Prof. Roger Alberto from the University of Zürich in Switzerland to discuss collaborative research. He also gave an invited lecture at Pelindaba at the Nuclear Energy Corporation of South Africa, as well as the c*change symposium on Homogeneous Catalysis

in Port Elizabeth in June 2009. Prof. Roodt was convener and chair of the micro-symposium on Coordination Chemistry at the 25th European Crystallographic meeting held in Istanbul, Turkey. He also attended the annual c*change planning committee meeting in July in Port Elizabeth as principal member and presented a lecture on transition state activation at the annual c*change symposium in November at Goudini Spa, Rawsonville. Ms Ilana Engelbrecht also presented a lecture at this event. Prof. Roodt had various consulting sessions with the manage-

During 2009 the HPC cluster performed 7703 jobs and had 26 users, utilising the equivalent of 239 years of computing time compared to a single personal computer. The five top users of the HPC facility were from the Inorganic group, including Prof. Gideon Steyl (559 jobs, 268821 CPU hours), Tania Hill (542 jobs, 975142 CPU hours), Nicoline Cloete (295 jobs, 265073 CPU hours), Truidie Venter (175 jobs, 169043 CPU hours) and Magnus Johnson (85 jobs, 152691 CPU hours).

The HPC cluster held an open day of the facility in March 2009 that included a presentation by Dr Bruce Becker, coordinator of the South African National Grid from the Meraka Institute, CSIR, on *Where South Africa currently stands with regard to the national computing grid and what the future holds*. Presentations from cluster users included *Before computers to super-computers (BC to SC): The chemistry between atoms by Prof. Jeanet Conradie and HPC and Organometallics: an industrial approach* by Prof. Gideon Steyl.

Direct outputs under the **Computational Chemistry** initiative from the Conradie group come from the main area of the research entitled *The characterisation of known and unknown transition metal complexes and reaction-intermediates by means of synthetic and computational chemistry*. Students in the group using computational chemistry as part of their research are Mss Marianne Conradie (Ph.D.), Mpondi Stuurman (Ph.D.), Ellen Kuo (Ph.D.), Mr Ebrahiem Botha (M.Sc.) and Dr Annemarie Kühn (post-doctoral).

The international collaboration with Prof. Abhik Ghosh of the Department



Distilling explosive solvents under the watchful eye of Prof. Ben Bezuidenhout (center) are M.Sc. student Rudi Swart (left) and Ph.D. student Brad Miller (right).

of Chemistry and Center for Theoretical and Computational Chemistry (CCTC), University of Tromsø, Norway, made it possible for two of the group members to use the HPC facility at the CCTC, utilising as single users up to 1 200 processors at a time to calculate results on the Norwegian high-performance computer cluster. The computational chemistry output of the Conradie group is mainly due to the use of the Norwegian HPC facility. Visits to international institutions and meetings include the CCTC, University of Tromsø, Norway, the Schuit Institute of Catalysis,

Technische Universiteit at Eindhoven, The Netherlands, CCTC Joint Researcher Meeting, at Sommarøy, Norway, the 7th Annual Meeting on High Performance Computing and Infrastructure as well as an ADF workshop, both in Trondheim, Norway.

The **Computational Chemistry** initiative in the Inorganic group is managed by Prof. Gideon Steyl, who visited the group of Prof. Roger Alberto at the University of Zürich and collaborated with Prof. Alberto and Dr Fabio Zobi by providing computational expertise and results obtained at the UFS computer cluster.



Prof. Gideon Steyl also visited Prof. Tom Cundari at the University of North Texas, USA, and established collaboration projects between UFS Inorganic Chemistry, the University of Zürich (Switzerland), Lund University (Sweden) and the University of North Texas (Denton, USA). Publications from 2009 include papers in international flagship journals such as *Inorganic Chemistry*, and technical reports regarding catalytic process and computational chemistry have been submitted to SASOL and the South African Nuclear Energy Corporation (NECSA). Training initiated

by Prof. Steyl in the Inorganic group includes Introductory Linux, Basic Shell Scripting, Advanced Shell Programming, Programming in Fortran and Programming in Matlab for Scientists. All these courses are enthusiastically supported by the National Centre for High Performance Computing (CHPC), Meraka Institute, since the university is currently the only institution that delivers such a range of courses aimed at high performance computing.

Mr Magnus Johnson, a Swedish Ph.D. student, spent a two-month period in

Bloemfontein during the first semester, gaining experience in Computational Chemistry under supervision of Prof. Gideon Steyl. This is a feather in the cap of UFS Chemistry to be recognised by international groups to such an extent as to send Ph.D. students to Bloemfontein to provide this kind of expertise.

The **Analytical Chemistry** division currently consists of Prof. Walter Purcell (NRF C3-rated researcher), Dr Karel von Eschwege and Ms Rebotsamang Shago and is supported by one Ph.D. and six M.Sc. students.

The Analytical Chemistry group was involved in a number of analytical and inorganic projects during 2009. These involved the dissolution, quantification and method validation of a number of inorganic and ore samples such as zircon, tantalite and columbite to establish methods to accurately identify and quantify the different elements in these samples. Some of these projects are done in close cooperation with industrial partners such as NECSA (Advanced Metals Initiative of the SA Government Department of Science and Technology (DST)) and Thuthuka Group Limited. Microwave and acid dissolution procedures were also employed while Inductively Coupled Plasma Optical Emission Spectroscopy (ICPOES), Atomic Absorption Spectroscopy (AAS) and Graphite Furnace AAS, Ultraviolet/visible and Infrared spectroscopy were used for the identification and quantification of the different elements, with ISO 17025 criteria as benchmark. Techniques such as X-ray diffraction and X-ray fluorescence (Department of Geology, UFS), Differential Scanning Calorimetry (DSC) and Thermal Gravimetric Analysis (TGA) were also used during these studies. Elements which are currently being investigated are niobium, tantalum, zirconium and rhodium. In another project the removal of heavy elements (especially arsenic), the base of the contamination of natural water sources, by means of natural and synthetic zeolites are being investigated and are partially funded by the Water Management in Water-Scarce Areas Cluster at the UFS. Soil samples were also analysed for a researcher in the Department of Zoology and Entomology who is currently studying the Kalahari

Gemsbok's interesting soil eating habits. Numerous samples were also analysed for private individuals as well as local and national companies.

The group is also involved in different Inorganic Chemistry projects, i.e., kinetic and structural studies of organometallic complexes of Iridium (I) and Rhodium (I) oxidative addition reactions, kinetic and structural studies of Rhenium(V) and Osmium(VI) cyano complexes as well as some Cobalt and Chromium aqueous chemistry.

Prof. Purcell continued cooperation with NECSA and they are currently funding four students to do research on the establishment of digestion methods and element quantification in plasma dissociated and natural zircon as well as tantalite minerals. Cooperation with the Thuthuka Group Limited was established and routine analysis is carried out on samples supplied by them. They also granted a bursary to a M.Sc. student specialising in Analytical Chemistry.

Dr Von Eschwege's research was awarded an IRDP Research Grant for the second consecutive two-year cycle, as part of the Nanotechnology niche area, and he paid two research visits to the Laser Research Institute (LRI) at Stellenbosch University. He did extensive investigations into photochemistry fields related to his primary focus area, namely metal dithizonate photochromic compounds and also attended a CHPC workshop at the University of KwaZulu-Natal on Quantum Computational Chemistry and Gauss-View. Another study involves the investigation of photochromic reactions in different transition metal complexes, with

potential applications in high density optical molecular switching mechanisms. Instrumental techniques such as Pulsed Laser, UV/visible, IR, NMR, Cyclic-Voltammetry, Quantum Computational Chemistry (ADF & Gaussian) and X-ray Crystallography are employed in these studies.

Prof. Purcell and Dr Von Eschwege contributed to different Eskom Science Expo projects which were held at the UFS Main Campus in July/August 2009.

Additional research-related outputs:

Different researchers of the Department of Chemistry participated in the UFS research cluster initiative, i.e., the Material and Nanosciences Cluster (MNS). Profs. Riaan Luyt, Jannie Swarts and Andreas Roodt are three of the four focus-area leaders, and Prof. Roodt is the interim cluster coordinator appointed by the UFS. Seven students were supported from the MNS Cluster during 2009, which yielded more than 20 research papers. Prof. Jan van der Westhuizen participates in the Advanced Biomolecular research cluster of the UFS. Marietjie Schutte and Alice Brink (Advanced Biomolecular Research Cluster) and Ellen Kuo (MNS Cluster) received prestigious Ph.D. scholarships under this initiative.

The UFS Cluster initiative was launched in November 2009, where the six cluster entities were officially established. The Materials and Nanosciences Cluster presented a symposium with eight speakers (three international) spanning the focus areas of Petrochemicals, Nanomaterials and Polymers, attended by some 50

delegates. At the overarching launch the managing director of Sasol Technology Research and Development, Mr Willem Louw, delivered the plenary lecture.

Prof. Swarts was coordinator and principle negotiator for new apparatus purchases for research for the Faculty of Agricultural and Natural Science. A highlight was the NRF award of R6 million and Sasol award of R3 million to Prof. Swarts. This enabled the UFS to deploy the X-ray photon spectroscope (XPS) as a national facility.

Prof. Roodt, as member of the Executive Committee of the European Crystallographic Association (ECA), attended the Executive Meetings in Budapest, Hungary (February 2008) and Istanbul, Turkey, as member of the International Scientific Committee of 25th European Crystallographic Meeting and chaired a plenary session on this occasion. He was also elected as vice-president of the ECA (50 member countries in Europe, Middle East and Africa) and acted as Chair of the 4th Max Perutz Prize committee of the ECA as well as the Poster Prize committee at ECM25. Prof. Roodt was appointed as chairperson of the organising committee of CATSA 2010, the annual conference of the Catalytic Society of South Africa, to be hosted in Bloemfontein in 2010. Prof. Roodt also served as committee member on the Jan Boeyens medal prize committee as well as on the international editorial of the Journal of Coordination Chemistry. He also acted as external evaluator for both the full B.Sc. Honours programme as well as the Chemistry content of the B. Ed. programme at the North-West University's Potchefstroom Campus.

Prof. Purcell was a committee member for organising the INORG2009 and the Student Symposium of the Academy for Science and Arts, while Dr Von Eschwege served as judge.

Finally, an honour was bestowed on the department at INDABA6 in September 2009 in the Kruger National Park, when Prof. Gideon Steyl became the recipient of the first Jan Boeyens medal for outstanding young scientists (younger than 40 years) in theoretical Chemistry/Physics. The panel of judges consisted of two international and four local scientists. The international INDABA series of conferences/workshops, sponsored by the International Union of Crystallography, has been held every third year since 1992, and usually attracts 100+ scientists from more than 20 countries from Physics, Chemistry, Biological sciences, Mathematics and Applied Mathematics. Prof. Steyl also presented an invited lecture at INDABA6.

Networking

More than 20 prominent international scientists visited the department. They presented lectures and held research discussions with researchers and post-graduate students at INORG2009 and in the departmental research seminar programme, which continued very successfully with approximately thirty research presentations during 2009.

They are Profs. Ola Wendt and Lars Ivar Elding (Lund University, Sweden), Daneel Ferreira (University of Mississippi, United States) Henry Laing (Technical University of Chemnitz, Germany), Peter Comba (University of Heidelberg, Germany), Roger Alberto (University of Zürich,

Switzerland), Peter Tasker (University of Edinburgh, Scotland), Bert Klumperman (Polymer Science, Stellenbosch University, South Africa), Hartmut Frank (University of Bayreuth, Germany), Sylvestre Bonnet (Utrecht University, The Netherlands), Debabrata Chatterjee (Dugarpur, India), Neil Champness (University of Nottingham, United Kingdom) and Drs Ettiene Snyders, Johann Nel and Jan Rijn Zeevaart (Nuclear Energy Corporation of South African (NECSA)), Desmond Young, Philip Gibson and Thys Botha (SASOL), Frank Gafner (Induchem, Volketswil, Zürich), David Reid (University of Cambridge, United Kingdom), Vladimir Djoković (Vinca Institute, Belgrade, Serbia), Igor Krupa (Polymer Institute, Bratislava, Slovak Republic), Tibor Czigany and Jozef Kovács (Budapest University of Technology and Engineering, Hungary), and Mr Willem Louw (Managing Director, SASOL Technology Research and Development).

Community service

Prof. Jannie Swarts and Mrs Ina du Plessis organised the 15th successive science quiz competition, MINQUIZ, one of the faculty's five community service flagships and jointly sponsored by the UFS and MINTEK. A group of some 200 pupils, comprising the three top physical science learners of each secondary school in the Free State Province, visited the Main Campus during April 2009 where they were exposed to information on career opportunities in Chemistry, Physics and Geology. Six winning schools in two categories were awarded financial prizes to enhance their school science laboratory.

Prof. Deon Visser and Dr Johan Venter presented the Chemistry Magic Show on eight occasions at different Bloemfontein schools and other venues. This initiative illustrates different aspects of simple but exciting experiments in a tangible way to further create awareness for Chemistry and to inspire primary and secondary school learners and teachers for the subject.

Prof. Jeanet Conradie assisted learners at the South Campus of the UFS with expo projects. They received gold and silver medals in the Free State Expo and bronze at the National Expo in Pretoria. She also continued to organise and handle the ILEARN programme which provides question and answer quizzes for computer-guided First-year Physical Chemistry revision. To further fulfil the need of especially previously disadvantaged students in terms of the use of computers and organising

experimental results scientifically, Prof. Conradie presented an introductory and advanced course in computer skills.

Mr Tsietsi Tsoetsi from the Qwaqwa Campus was involved in a School Support Programme under the UFS-Kagiso Trust project. Together with Mrs Moipone Mokoena, Mrs Mpondi Molefe, Mr Mphiso Mngomezulu and Mr Tswafu Motaung they attended a number of workshops offered by the UFS Centre for Higher Education Studies and Development (CHESD), as well as skills development in terms of the utilisation of computer programmes. Mr Tsoetsi also registered for the Facilitation Learning in Practice (FLIP) short course offered by CHESD.

Most lecturers were involved in continuous career guidance and laboratory demonstration sessions to individuals and school group learners. Colleagues at both campuses contributed to the university's open and Expo days.

Staff matters

Prof. Andrew Marston, natural products specialist from the University of Geneva, Switzerland, joined the department on a three-year contract. Prof. Gideon Steyl was appointed as associate professor in Inorganic Chemistry, while Ms Maryam Jordaan was appointed as lecturer in Organic Chemistry at the Qwaqwa Campus and Ms Anke Wilhelm as lecturer in Organic Chemistry at the Main Campus. Dr Susan Bonnet was promoted to senior lecturer, while Profs. Fanie Otto from Sasol and Connie Medlen were appointed as affiliated associate professor and affiliated professor, respectively. Unfortunately, Drs Buyiswe Jacobs and Thato Mtshali left the UFS to pursue other opportunities.

Profs. Andrew Marston (B3) and Riaan Luyt (C1) received higher ratings from the NRF.

Research outputs

Research articles

- Bem, D.B., Luyt, A.S., Dejene, F.B., Botha, J.R. & Swart, H.C.** 2009. Structural, luminescent and thermal properties of blue $\text{SrAl}_2\text{O}_4:\text{Eu}^{2+}$, Dy^{3+} phosphor filled low-density polyethylene composites. *Physica B* 404: 4504-4508.
- Brink, A., Roodt, A. & Visser, H.G.** 2009. 2-(*m*-Tolyliminomethyl)phenol. *Acta Crystallographica Section E* E65: o3175-o3176.
- Bungu, P.N. & Otto, S.** 2009. 2-Isobutyl-2-phosphabicyclo[3.3.1]nonane 2-selenide. *Acta Crystallographica Section E* E65: o560-o561.
- Bungu, P.N. & Otto, S.** 2009. *cis*-Dichloridobis{dimethyl[3-(9-phosphabicyclo[3.3.1]non-9-yl)propyl]amine- κ P}platinum(II). *Acta Crystallographica Section C* C65: m152-m155.
- Chambrier, I., Swarts, J.C., Hughes, D.L. & Cook, M.J.** 2009. Triple-decker cadmium phthalocyanine sandwich complexes: Self-assembled EPR active complexes. *Journal of Porphyrins and Phthalocyanines* 13: 175-187.
- Cloete, N., Visser, H.G., Roodt, A. & Gabrielli, W.F.** 2009. *N,N*-Bis(diphenylphosphine)ethylamine. *Acta Crystallographica Section E* E65: o3081.
- Conradie, J.** 2009. A computational study and fragment analysis of the back-bonding in Titanocenyl Complexes containing a five-member L,L' -cyclic ligand, $L,L' = O,O'$; S,S' or Se,Se' . *Journal of Molecular Structure THEOCHEM* 915: 51-57.
- Conradie, J. & Swarts, J.C.** 2009. Oxidative addition of CH_3I and CO migratory insertion in a series of Ferrocene-containing Carbonyl Phosphine β -Diketonato Rhodium(I) Complexes. *Organometallics* 28: 1018-1026.
- Conradie, M. & Conradie, J.** 2009. Stereochemistry of the reaction products of the oxidative addition reaction of methyl iodide to $[\text{Rh}((\text{C}_4\text{H}_3\text{S})\text{CO})\text{CHCOR}(\text{CO})(\text{PPh}_3)]$: A NMR and computational study. $R = \text{CF}_3, \text{C}_6\text{H}_5, \text{C}_4\text{H}_3\text{S}$. *Inorganica Chimica Acta* 362: 519-530.
- Conradie, M.M. & Conradie, J.** 2009. 'n Eksperimentele en kwantum-berekeningschemie-studie van die reaksie tussen die karbonileringskatalisator $[\text{Rh}((\text{C}_5\text{H}_5\text{S})\text{CO})\text{CHCOR}(\text{C}_6\text{H}_5)(\text{PPh}_3)]$ en metieljodied ($R = \text{CF}_3, \text{C}_6\text{H}_5, \text{C}_4\text{H}_3\text{S}$). *Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie* 28: 241-242.
- Cook, M.J., Chambrier, I., White, G.F., Fourie, E. & Swarts, J.C.** 2009. Electrochemical and EPR studies of two substituted bis-cadmium trisphthalocyanine complexes: Elucidation of unexpectedly different free-radical character. *Dalton Transactions*: 1136-1144.
- Dikobe, D.G. & Luyt, A.S.** 2009. Morphology and properties of polypropylene/ethylene vinyl acetate copolymer/wood powder blend composites. *eXPRESS Polymer Letters* 3: 190-199.
- Fourie, E., Swarts, J.C., Chambrier, I. & Cook, M.J.** 2009. Electrochemical and spectroscopic detection of self-association of octaalkyl phthalocyaninato cadmium compounds into dimeric species. *Dalton Transactions*: 1145-1154.
- Goetz, B.I., Wang, P., Shields, H.W., Basu, S., Grubina, R., Haug, J., Conradie, J., Huang, Z., Jeffers, A., Jiang, A., He, X., Azarov, I., Seibert, R., Mehta, A., Patel, R., King, S.B., Ghosh, A., Hogg, N., Gladwin, M.T. & Kim-Shapiro, D.B.** 2009. Nitrite-methemoglobin inadequate for hypoxic vasodilation (Correspondence). *Nature Chemical Biology* 5: 366-367.
- Grobelaar, E., Lötter, S., Visser, D., Conradie, J. & Purcell, W.** 2009. Investigation of the electron density of Iridium(I) Vaska-type complexes using DFT calculations and structural results: Structure of trans-carbonylchloro-bis(tricyclohexylphosphine)-iridium(I). *Inorganica Chimica Acta* 362: 3949-3954.
- Hopmann, K.H. & Conradie, J.** 2009. A density functional theory study of substitution at the Square-Planar Acetylacetonato-dicarbonylrhodium(I) complex. *Organometallics* 28: 3710-3715.
- Hopmann, K.H., Conradie, J. & Ghosh, A.** 2009. Broken-symmetry DFT spin densities of Iron Nitrosyls, including Roussin's red and black salts: Striking differences between pure and hybrid functionals. *Journal of Physical Chemistry B* 113: 10540-10547.
- Kirsten, L. & Steyl, G.** 2009. Dibromidobis(triphenylarsine)-palladium(II). *Acta Crystallographica Section E* E65: m218.
- Kirsten, L. & Steyl, G.** 2009. *Trans*-Dibromidobis[tris(4-chlorophenyl)phosphine]palladium(II). *Acta Crystallographica Section E* E65: m1565.
- Kirsten, L., Steyl, G. & Roodt, A.** 2009. *Trans*-Dibromidobis(tri-*p*-tolylarsine)-palladium(II). *Acta Crystallographica Section E* E65: m1449.
- Kirsten, L., Steyl, G. & Roodt, A.** 2009. *Trans*-Dibromidobis(diphenyl(*p*-tolyl)-phosphine)palladium(II). *Acta Crystallographica Section E* E65: m1564.
- Kuhn, A., Muller, A. & Conradie, J.** 2009. Syntheses, crystal structure

- and theoretical modeling of tetrahedral mono- β -diketonato titanocenyl complexes. *Polyhedron* 28: 966-974.
- Kuhn, A., Tsotetsi, T.A., Muller, A. & Conradie, J.** 2009. Isomer distribution and structure of (2,2'-biphenyldiolato)bis(β -diketonato)titanium(IV) complexes: A single crystal X-ray, solution NMR and computational study. *Inorganica Chimica Acta* 362: 3088-3096.
- Lötter, S., Purcell, W. & Nel, J.T.** 2009. Die vertering en kwantifisering van onsuiverhede in sirkoon en plas-magedissosieerde sirkoon (pdz). *Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie* 28: 252-253.
- Luyt, A.S. & Krupa, I.** 2009. Phase change materials formed by uv curable epoxy matrix and Fischer-Tropsch paraffin wax. *Energy Conversion and Management* 50: 57-61.
- Luyt, A.S., Dramićanin, M.D., Antić, Ž. & Djoković, V.** 2009. Morphology, mechanical and thermal properties of composites of polypropylene and nanostructured wollastonite filler. *Polymer Testing* 28: 348-356.
- Marston, A., Van der Westhuizen, J.H. & Zietsman, P.** 2009. Investigation of South African Amaryllidaceae for inhibitors of acetylcholinesterase. *Planta Medica* 75: 877-1094.
- Matabola, K.P., De Vries, A.R., Moolman, F.S. & Luyt, A.S.** 2009. Single polymer composites: a review. *Journal of Material Science* 44: 6213-6222.
- Meera, A.P., Said, S., Grohens, Y., Luyt, A.S. & Thomas, S.** 2009. Tensile stress relaxation studies of TiO₂ and natural rubber composites. *Industrial & Engineering Chemistry Research* 48: 3410-3416.
- Meijboom, R., Bowen, R.J. & Berner-Price, S.J.** 2009. Coordination complexes of silver(I) with tertiary phosphine and related ligands. *Coordination Chemistry Reviews* 253: 325-342.
- Meijboom, R., Dhirori, P. & Mavunkal, I.J.** 2009. Synthesis and characterization of an unusual equatorially substituted di-manganese compound. The first structural determination of a phosphate compound of type [Mn₂(CO)₉P]. *Inorganica Chimica Acta* 362: 617-620.
- Mishra, S.B. & Luyt, A.S.** 2009. Effect of organic peroxides on the morphology and properties of EVA/Cloisite 15A Nanocomposites. *Journal of Applied Polymer Science* 112: 218-225.
- Molefi, J.A., Luyt, A.S. & Krupa, I.** 2009. Comparison of the influence of Cu micro- and nano-particles on the thermal properties of polyethylene/Cu composites. *eXPRESS Polymer Letters* 3: 639-649.
- Ochigbo, S.S., Luyt, A.S. & Focke, W.W.** 2009. Latex derived blends of poly(vinyl acetate) and natural rubber: Thermal and mechanical properties. *Journal of Material Science* 44: 3248-3254.
- Omondi, B., Venter, G.J.S., Roodt, A. & Meijboom, R.** 2009. Isomorphism in monomeric 1:3 complexes of silver(I) salts with tri-*p*-tolylphosphine. *Acta Crystallographica Section B* B65: 699-706.
- Otto, S., Roodt, A. & Elding, K.I.** 2009. Bridge-splitting of *trans*-[PtCl₂(η^2 -CH₂=CH₂)₂] by weak nucleophiles: Crystal and molecular structure of *trans*-[PtCl₂(η^2 -CH₂=CH₂)(MeCN)]. *Inorganic Chemistry Communications* 12: 766-768.
- Ramontja, J., Ray, S.S., Pillai, S.K. & Luyt, A.S.** 2009. High-performance carbon nanotube-reinforced bioplastic. *Macromolecular Materials and Engineering* 294: 839-846.
- Schutte, M., Visser, H.G. & Brink, A.** 2009. [*N,N*-Bis(diphenylphosphino)propylamine- κ^2P,P]bromidotricarbonylrhenium(I). *Acta Crystallographica Section E* E65: m1575-m1576.
- Steyl, G.** 2009. Bis[tris(4-fluorophenyl)phosphine- κP]- (tropolonato- κ^2O,O')copper(I). *Acta Crystallographica Section E* E65: m448.
- Steyl, G.** 2009. Nitratotris(triphenylphosphine)copper(I) methanol solvate. *Acta Crystallographica Section E* E65: m272.
- Steyl, G. & Hill, T.N.** 2009. (3,5,7-Tribromotropolonato- κ^2O,O')tris-(triphenylphosphine- κP)silver(I). *Acta Crystallographica Section E* E65: m191.
- Steyl, G. & Hill, T.N.** 2009. Bis(triphenylphosphine- κP)(tropolonato- κ^2O,O')silver(I) dichloromethane solvate. *Acta Crystallographica Section E* E65: m233.
- Stuurman, N.F. & Conradie, J.** 2009. Iodomethane oxidative addition and CO migratory insertion in monocarbonylphosphine complexes of the type [Rh((C₆H₅)COCHCO((CH₂)₃CH₃))(CO)(PPh₃)]: Steric and electronic effects. *Journal of Organometallic Chemistry* 694: 259-268.
- Suthiram, J., Mhlaba, K., Zeevaart, J.R., Visser, H.G. & Roodt, A.** 2009. Tetraethylammonium tricarbo-nylchlorido(pyrazine-2-carboxylato-*N',O'*)rhenate(I). *Acta Crystallographica Section E* E65: m1395.
- Swarts, J.C., Nafady, A., Roudebush, J.H., Trupia, S. & Geiger, W.E.** 2009. One-Electron oxidation of Ruthenocene: Reactions of the Ruthenocenium Ion in gentle electrolyte media. *Inorganic Chemistry* 48: 2156-2165.
- Tsotetsi, T.A., Kuhn, A., Muller, A. & Conradie, J.** 2009. Substitution kinetics of biphenol at dichlorobis(acetylacetonato-*O,O'*)titanium(IV): Isolation, characterization, crystal structure and enhanced hydrolytic stability of the product bis(acetylacetonato-*O,O'*)titanium(IV). *Polyhedron* 28: 209-214.
- Van der Merwe, K.A., Visser, H.G. & Venter, J.A.** 2009. Diammonium diaquabis(methylenediphosphonato- κ^2O,O')cobaltate(II). *Acta Crystallographica Section E* E65: m1394.
- Van Tonder, J.H., Bezuidenhout, B.C.B. & Janse van Rensburg, J.M.** 2009. Tricarbonyl(η^6 -flavone)chromium(O). *Acta Crystallographica Section E* E65: m1346.
- Van Tonder, J.H., Bezuidenhout, B.C.B. & Janse van Rensburg, J.M.** 2009. Tricarbonyl(η^6 -4',7-dimethoxyflavone)chromium(O). *Acta Crystallographica Section E* E65: m1343.
- Venter, G.J.S., Roodt, A. & Meijboom, R.** 2009. Polymorphism in iodotris(tri-*p*-tolylphosphine)silver(I). *Acta Crystallographica Section B* B65: 182-188.
- Venter, G.J.S., Roodt, A. & Meijboom, R.** 2009. Self-assembly in tetrameric 1:1 silver(I) halide-tri-*p*-tolylphosphine complexes: An in-depth structural investigation. *Inorganica Chimica Acta* 362: 2475-2479.
- Venter, G.J.S., Steyl, G. & Roodt, A.** 2009. Carbonyl[4-(2,3-dimethylphenylamino)-pent-3-en-2-onato- κ^2N,O](triphenylphosphine- κP)rhodium(I). *Acta Crystallographica Section E* E65: m1321-1322.
- Venter, G.J.S., Steyl, G. & Roodt, A.** 2009. Carbonyl[4-(2,6-dimethylphenylamino)pent-3-en-2-onato- κ^2N,O](triphenylphosphine- κP)rhodium(I) acetone hemisolvate. *Acta Crystallographica Section E* E65: m1606-m1607.
- Venter, J.A., Purcell, W. & Visser, H.G.** 2009. Di- μ -iodido-bis[acetyl(4-methyl-2,6,7-trioxo-1-phosphabicyclo[2.2.2]octane)(*N*-nitroso-*N*-oxidoaniline- κ^2O,O')rhodium(III)]. *Acta Crystallographica Section E* E65: m1528-m1529.
- Venter, J.A., Purcell, W., Visser, H.G. & Muller, T.J.** 2009. Carbonyl(*N*-nitroso-*N*-oxido-1-naphthylamine- κ^2O,O')(triphenylphosphine- κP)rhodium(I) acetone solvate. *Acta Crystallographica Section E* E65: m1578.
- Viljoen, J.A., Visser, H.G., Roodt, A. & Steyn, M.** 2009. Di- μ -hydroxido-bis[tris(1,1,1,5,5,5-hexafluoroacetylacetonato- κ^2O,O')hafnium(IV) acetone solvate.

Acta Crystallographica Section E E65: m1367-m1368.

Viljoen, J.A., Visser, H.G., Roodt, A. & Steyn, M. 2009. Tetrakis(quinolin-8-olato- κ^2N,O)-hafnium(IV) toluene disolvate. *Acta Crystallographica Section E* E65: m1514-m1515.

Von Eschwege, K.G. & Muller, A. 2009. 2,3-Bis(2-methoxyphenyl)tetrazolium-5-thiolate-acetone-dichloromethane (1/0.4/0.1). *Acta Crystallographica Section E* E65: o2.

Von Eschwege, K.G. & Muller, A. 2009. 2,3-Bis(3-fluorophenyl)tetrazolium-5-thiolate. *Acta Crystallographica Section E* E65: o1864.

Zobi, F., Blacque, O., Steyl, G., Spingler, B. & Alberto, R. 2009. Formation and reactivity of [(tacn)-N-CO-Re^{III}Br(CO)₂]⁺ in Water: A theoretical and experimental study. *Inorganic Chemistry* 48: 4963-4970.

Book

Ghosh, A., Conradie, J. & Hopmann, K.H. 2009. Electronic structure of transition Metal-NO Complexes. In *Computational Inorganic and Bioinorganic Chemistry*, part 3 of the *Encyclopedia of Inorganic Chemistry*; edited by Edward I. Solomon, Robert A. Scott and R. Bruce King. Chichester, UK: John Wiley & Sons. pp. 389-410.

Patents

Achilonu, M.C., Bonnet, S.L. & Van der Westhuizen. 2009. *Method for the preparation of C-4 coupled flavonoids, proanthocyanidins and analogues thereof.* PCT Application number PCT/IB2009/052396.

Van der Westhuizen, J.H., Ferreira, D. & Joubert, E. 2009. *Method for the synthesis of asphalatin and analogues thereof.* Method A: 2009/08304 (with the South African Medical Research Council).

Van der Westhuizen, J.H., Ferreira, D. & Joubert, E. 2009. *Method for the synthesis of asphalatin and analogues*

thereof. Method B: 2009/08308 (with the South African Medical Research Council).

Van der Westhuizen, J.H., Ferreira, D. & Joubert, E. 2009. *Method for the synthesis of asphalatin and analogues thereof.* Method C: 2009/08309 (with the South African Medical Research Council).

Achilonu, M.C., Bonnet, S.L. & Van der Westhuizen, J.H. 2009. *The synthesis of 3-Aryl flavones and C-3 Coupled Biflavonoids.* Patent number 2009/05765.

Conference contributions

Bem, D.B., Swart, H.C., Luyt, A.S., Biggs, M.M. & Dejene, F.B. 2009. *Synthesis and characterization of long persistent strontium and barium aluminates.* Poster presented at the 54th Annual Conference of the South African Institute of Physics (SAIP), University of KwaZulu-Natal, Westville Campus, Durban, South Africa. 7-10 July.

Botha, E., Von Eschwege, K.G. & Conradie, J. 2009. *Study of Mercury Dithione Analogues utilizing Quantum Computational and Electrochemical methods.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Brink, A., Roodt, A. & Visser, H.G. 2009. *Interesting observations in the synthesis of Re(CO)₃ complexes: A crystallographic and synthetic study.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Brink, A., Visser, H.G., Wendt, O.F. & Roodt, A. 2009. *Steric and electronic effects of group 15 ligands on rhodium(I) betadiketone complexes.*

Poster presented at the 18th EuCheMS International Conference on Organometallic Chemistry, Göteborg, Sweden. 22-25 June.

Buitendach, B.E., Bezuidenhout, B.C.B. & Swarts, J.C. 2009. *Synthesis and characterization of long-chain substituted manganese and zinc phthalocyanines.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Chiweshe, T., Purcell, W., Venter, J.A. & Mtshali, T. 2009. *The effect of acid concentration on the percentage recovery of rhodium in inorganic compounds using ICP-OES.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Chiweshe, T.T., Purcell, W., Venter, J.A. & Mtshali, T. 2009. *The effect of acid concentration on the percentage recovery of rhodium in inorganic compounds using ICP-OES.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Cloete, N., Visser, H.G. & Roodt, A. 2009. *Ethylene tetramerisation: Structural investigation of the metal-based catalyst precursors.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Coetzee, M.P., Purcell, W. & Venter, J.A. 2009. *Characterization and oxidative addition reactions of different rhodium(I) carbonyl diphenyl-2-pyridylphosphine complexes.* Poster

- presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.
- Coetzee, M.P., Purcell, W. & Venter, J.A.** 2009. *Characterization and oxidative addition: Reactions of different rhodium(I) carbonyl diphenyl-2-pyridylphosphine complexes.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.
- Conradie, J.** 2009. *Molecular and electronic structure of high valent Mn-corrolazine complexes.* Paper presented at the Japan Society for the Promotion of Science (JSPS) and the National Research Foundation (NRF) Joint Research Project Workshop, Rhodes University, Grahamstown, South Africa. 10-11 February.
- Conradie, J. & Botha, E.** 2009. *'n Kwantumberekenings- en elektrochemie-onderzoek van Ditisonatokwik(II)-komplekse.* Paper presented at the Student Symposium on Natural Science, University of the Free State, Bloemfontein, South Africa. 29-30 October.
- Conradie, J., Tangen, E., Lippard, S. & Ghosh, A.** 2009. *The novel electronic structures of open-shell {MNO}⁶ complexes.* Paper presented at the Center for Theoretical and Computational Chemistry (CTCC) Joint Researcher Meeting, Sommarøy, Norway. 8-9 May.
- Conradie, J., Tangen, E., Lippard, S. & Ghosh, A.** 2009. *The novel electronic structures of open-shell transition metal {MNO}⁶ and {MNO}⁷ complexes.* Paper presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.
- Conradie, M.M. & Conradie, J.** 2009. *The oxidative addition of Methyl iodide to [Rh(acac)(P(OPh)₃)]₂: A density functional theory study.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.
- Conradie, M.M. & Conradie, J.** 2009. *Vereenvoudigde chemiese modellering van rodium katalisator – Wen of Verloor?* Paper presented at the Student Symposium on Natural Science, University of the Free State, Bloemfontein, South Africa. 29-30 October.
- Engelbrecht, I., Muller, A.J. & Roodt, A.** 2009. *Olefin hydroformylation model reactions: Kinetic reactivity of iridium (acetylacetonato) complex.* Paper presented at the DST-NRF c*change Symposium, Rawsonville, South Africa. 6-8 November.
- Engelbrecht, I., Roodt, A. & Visser, H.G.** 2009. *Kinetic investigation of model iridium systems for reactions in olefin hydroformylation.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.
- Engelbrecht, I., Roodt, A. & Visser, H.G.** 2009. *Kinetic reactivity of model iridium systems for use in olefin hydroformylation.* Poster presented at the Conference of the Catalysis Society of South Africa, Rawsonville, South Africa. 8-11 November.
- Erasmus, E. & Swarts, J.C.** 2009. *Ferrocene and ruthenocene-containing titanium(IV) complexes.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.
- Erasmus, E. & Swarts, J.C.** 2009. *Ferrocene and ruthenocene-containing titanium(IV) complexes.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.
- Erasmus, E. & Swarts, J.C.** 2009. *Ferrocene and ruthenocene-containing titanium(IV) complexes.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.
- Hill, T., Roodt, A. & Steyl, G.** 2009. *Cyclo-octadiene Interactions with late transition metal centers.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.
- Kirsten, L., Steyl, G. & Roodt, A.** 2009. *Structural investigation and correlation of square-planar Palladium complexes.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.
- Kotze, P.D. & Roodt, A.** 2009. *Iodomethane oxidative addition to mono- and dicarbonyl rhodium(I) S,O-thiourea complexes.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.
- Kuhn, A. & Conradie, J.** 2009. *Intra- and inter-molecular rearrangement in fluorinated-diketonato complexes of Titanium(IV).* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.
- Lotter, S., Purcell, W., Nell, J.T., Snyders, E. & Potgieter, I.M.** 2009. *Simultaneous analysis of major and trace components of zircon ore and plasma dissociated zircon (PDZ) by ICP-OES.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.
- Luyt, A.S., Dramićanin, M.D., Andrić, Ž. & Djoković, V.** 2009. *Morphology and properties of composites of polypropylene and a nanostructured wollastonite filler.* Invited lecture at the 4th NanoAfrica International Conference on Nanoscience and Nanotechnology, Pretoria, South Africa. 1-4 February.
- Marston, A., Van der Westhuizen J., & Zietsman, P.** 2009. *Investigation of South African Amaryllidaceae for inhibitors of acetylcholinesterase.* Poster presented at the 57th International Congress and Annual Meeting of the Society for Medicinal Plant and Natural Product Research, Geneva, Switzerland. 16-20 August.
- Molefi, J.A., Luyt, A.S. & Krupa, I.** 2009. *Thermal and mechanical properties of phase change conductive polymer composite materials.* Interactive presentation at the 17th International Conference on Composite Materials (ICCM-17), Edinburgh International Convention Centre (EICC), Edinburgh, Scotland. 27-31 July.
- Motaung, T.E. & Luyt, A.S.** 2009. *Morphology and properties of sol-gel prepared LDPE-silica nanocomposites.* Paper presented at the International Conference on Physics of Optical Material and Devices (ICOM 2009), Hotel Plaža, Herceg Novi, Montenegro. 27-30 August.
- Muller, T.J., Steyl, G. & Roodt, A.** 2009. *Copper based oxidation catalysis.* Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Nete, M., Purcell, W., Nell, J.T. & Snyders, E. 2009. *ICP-OES and XRF analyses of niobium containing ore*. Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Roodt, A. 2009. *Electro-Steric characteristics of Phosphine ligands*. Invited paper presented at Indaba 6, Crystallography Society of South Africa, Berg-en-Dal, Kruger National Park, South Africa. 31 August-4 September.

Schutte, M., Visser, H.G. & Roodt, A. 2009. *Kinetic study of the reactions of different Re(I) complexes*. Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Shago, R.F. & Swarts, J.C. 2009. *Syntheses and group electronegativity implications on the spectroscopic and electrochemical properties of multi-ferrocenyl meso-substituted porphyrins*. Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Steyl, G. 2009. *From water to crystallography – Application of solid state principles from macro to nano science*. Invited paper presented at Indaba 6, Crystallography Society of South Africa, Berg-en-Dal, Kruger National Park, South Africa. 31 August-4 September.

Steyl, G. 2009. *The use of computational chemistry in transition metal chemistry – Prediction of geometrical and electronic parameters*

for Cu, Rh, Re, Tc. Invited paper presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Steyn, M., Visser, H.G. & Roodt, A. 2009. *Mechanistic study of oxine coordination at Zirconium(IV)*. Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Steyn, M., Visser, H.G. & Roodt, A. 2009. *Preliminary kinetic study of the formation reactions of $[Zr(ox)_2]$* . Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Steyn, M., Visser, H.G. & Roodt, A. 2009. *Stepwise bidentate ligand coordination at Zirconium(IV)*. Paper presented at the Advanced Metals Initiative Conference 2009, Mintek, Johannesburg, South Africa. 9 July.

Swarts, J.C. 2009. *Synthesis and properties of macromolecular metal porphyrinic complexes: A bird's eye view from electrochemical, EPR and DSC vantage points*. Paper presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Theron, T.A. & Purcell, W. 2009. *Dissolution and quantification of tantalum metal and various other Ta-containing compounds including Tantalite*. Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry,

Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Theron, T.A. & Purcell, W. 2009. *Vertering en kwantifisering van tantaal-metall en verskeie ander Ta-bevattende verbindings, insluitende tantalite-erts*. Poster presentation at the 9th "Simposium van die Suid-Afrikaanse Akademie vir Wetenskap en Kuns", University of the Free State, Bloemfontein, South Africa. 29-30 October.

Van der Merwe, K.A., Visser, H.G., Venter, J.A. & Roodt, A. 2009. *Coordination chemistry of a series of diphosphonate metal complexes*. Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Venter, G.J.S., Steyl, G. & Roodt, A. 2009. *N,O-Bidentate ligands, $[Rh(N,O-Bid)(CO)_2]$ complexes and their PPh_3 derivatives*. Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Venter, G.J.S., Steyl, G., Wendt, O.F. & Roodt, A. 2009. *N,O-Bidentate ligands, $[Rh(N,O-Bid)(CO)_2]$ complexes and their PPh_3 derivatives*. Poster presented at the 18th EuCheMS International Conference on Organometallic Chemistry, Göteborg, Sweden. 22-25 June.

Venter, J.A., Purcell, W. & Muller, A.J. 2009. *Characterisation and oxidative addition reactions of different rhodium and iridium triazole complexes*. Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Viljoen, J.A., Roodt, A. & Visser, H.G. 2009. *Formation kinetics of tetrakis (8-quinolinolato-N,O)-hafnium(IV)*. Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Viljoen, J.A., Roodt, A. & Visser, H.G. 2009. *Mechanistic study of oxine coordination at Hafnium(IV)*. Paper presented at the Advanced Metals Initiative Conference 2009, Mintek, Johannesburg, South Africa. 9 July.

Viljoen, J.A., Roodt, A. & Visser, H.G. 2009. *Stepwise bidentate ligands coordination at Hafnium(IV)*. Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Visser, H.G., Roodt, A., Schutte, M. & Kemp, G. 2009. *A Structural and kinetic investigation on selected*

Rhenium(I) tricarbonyl complexes. Poster presentation at the 18th International Symposium on Radio-pharmaceutical Chemistry (ISRC), Edmonton, Alberta, Canada. 12-16 July.

Von Eschwege, K. 2009. *Electrochemical and structural aspects of Hg & Co complexes of Dithizon*. Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Young, C., Roodt, A. & Bezuidenhoudt, B.C.B. 2009. *Bridged square planar complexes of palladium(II) and platinum(II) as model catalysts*. Poster presented at INORG2009, the Biennial Meeting of the South African Chemical Institute (SACI) and the Royal Society of Chemistry: INORGANIC Chemistry, Bains Game Lodge, Bloemfontein, South Africa. 13-17 September.

Contact details

Prof. André Roodt

Faculty of Natural and Agricultural Sciences
Department of Chemistry
University of the Free State
PO Box 339
Bloemfontein
South Africa
9300

Telephone: +27 51 401 9212

Fax: + 27 51 444 6384

E-mail: roodta@ufs.ac.za

Website: <http://www.ufs.ac.za/chem>.

Staff

Main Campus:

Professors: Profs. André Roodt, Jannie Swarts, Andrew Marston

Affiliated Professors: Profs. Daneel Ferreira, Louis Ackerman

Associate Professors: Profs. Walter Purcell, Robert Dennis, Jan van der Westhuizen, Jeanet Conradie, Deon Visser, Gideon Steyl

Affiliated Associate Professor: Prof. Fanie Otto

Senior Lecturers: Ms Susan Bonnet

Lecturers: Drs Karel von Eschwege, Johan Venter, Ernie Langner, Lizette Erasmus and Ms Anke Wilhelm

Subject Coordinators: Dr Marietjie Versteeg, Ms Rina Meintjes

Qwaqwa Campus:

Professor: Prof. Riaan Luyt

Lecturers: Mss Moipone Mokoena, Buyiswe Jacobs, Maryam Jordaan, Mss Dorine Dikobe, Mpondi Molefe, Tsietsi Tsotetsi

Junior Lecturers: Mr Rantooa Moji



09

Computer Science and Informatics

Overview

The core focus of the Department of Computer Science and Informatics is on IT-related training, research and community service. The department is involved with two major undergraduate learning programmes, namely B.Com. (IT) and B.Sc. (IT).

B.Com. (IT) forms part of the Private Sector Management Programme introduced by the Faculty of Economic and Management Sciences. The B.Sc. (IT) programme delivers highly trained information technologists. During the course of these three-year programmes, students are trained to develop complete, usable software solutions through modules in hardware, programming,

website development and Internet programming, database and network management, software engineering and user interfaces. Various industries benefit from the department's training programmes.

Within the B.Sc. (IT) learning programme, students can specialise to apply their IT skills in Mathematics, Industry and Mining, Geographical Information Systems or IT Management. The powerful combination of Computer Science with Mathematics and/or Mathematical Statistics provides the student with a solid knowledge base for a career as information technologist in the IT industry or at research institutions such

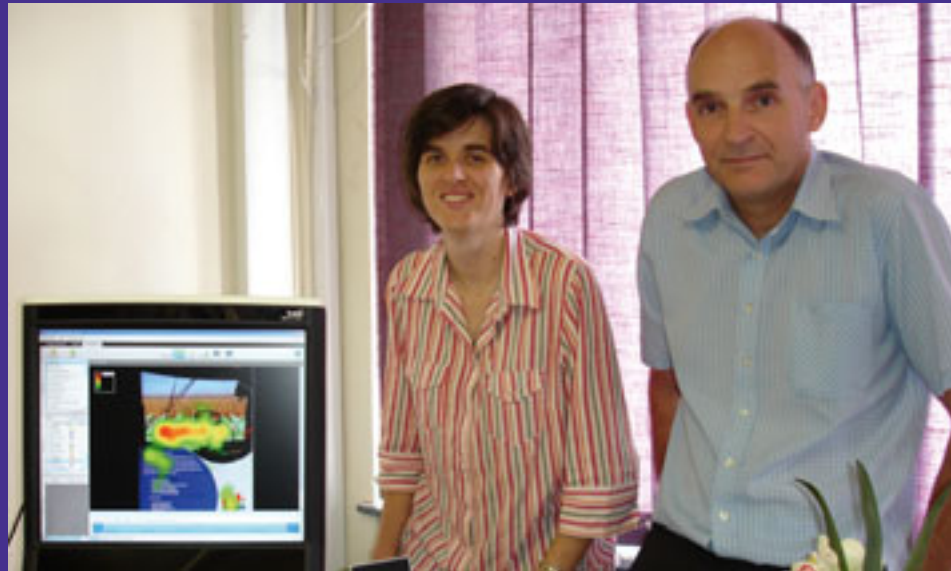


“Various industries benefit from the department’s training programmes.”

- Dr Annelize van Biljon



From the left: Ms Tanya Beelders and Prof. Pieter Blignaut next to eye-tracking equipment.



as universities. For specialisation in Industry and Mining, the student can combine IT with the physical and/or geosciences to open up a career in the Manufacturing, Chemical, Mining, Geology, or Mineralogy sectors.

The connection of Geographical Information Systems and Computer Technology prepares a student for a challenging career in diverse fields such as defence, planning, agriculture, tourism, the environment and resource management. Specialisation in IT Management enables individuals in the science and commercial sectors to understand and speak one another's language. It is directed towards preparing a student for a career as IT manager in both the public and private sectors.

New modules were presented in 2009. In the second semester Computer Literacy (BRC111) was offered at the South Campus while the modules Software Design (RIS274) and Information Technology Service Learning (RIS242) were presented at the Main and Qwaqwa Campuses.

During 2009, a few students short of 300 were registered at the Main Campus for the mainstream IT courses at first-year level. About 55 second-year students and 73 third-year students completed the undergraduate component at the Main Campus. A further 85 first-year students, 20 second-year students and nine third-year students were registered at the Qwaqwa Campus. At



Ms Tanya Beelders with her thesis, *Graphics, text and language in a word processor interface*, which has been published in book format by a German publisher.

postgraduate level there were three Ph.D. students, ten masters and 40 honours students registered in 2009.

Activities and achievements

During 2009 staff members attended and delivered papers at various national and international conferences and conferences. During June 2009, Ms Tanya Beelders attended the International Conference on Human-Computer Interaction in San Diego, California in the United States of America (USA) where she presented a paper based on the research for her master's degree that focused on the effect that language, different icons and tooltips have on user performance in a word processor. Afrikaans and Sesotho were included in a word processor interface and new icons were developed in order to determine whether these affect user performance in any way.

Her thesis, *Graphics, text and language in a word processor interface*, was published in book format by a German publisher. Ms Beelders concentrated on the impact of graphics, text and language on the usability of a word processor. These facets were tested and a number of recommendations concerning the usability of a word processor are proposed, based on both statistical analysis and observation of user interaction.

Ms Engela Dednam presented a paper at the Southern African Computer Lecturers Association (SACLA) conference that was held from 29 June to 2 July 2009 at Mpekweni Beach Resort near Port Alfred. The conference was hosted by the Department of Information Systems and

the Department of Computer Science at Rhodes University. The theme of the conference was *Connecting Students to the Future*.

Ms Dednam's paper entitled *Away with Computer Literacy Modules at Universities, or Not?* reported on an investigation into students' computer literacy profiles and the need for university students to be computer literate. It was concluded that it is still necessary for the University of the Free State (UFS) and other tertiary institutions to continue to present computer literacy modules because large numbers of students still do not have sufficient computer knowledge to apply during their studies and later on in the work place.

In November 2009, Dr Liezel Nel was part of a delegation from the Faculty of Natural and Agricultural Sciences that visited the University of Minnesota (UMN) in the USA. The main aim of this visit was to extend the current memorandum of agreement that already existed between departments at the two institutions. During the visit, Dr Nel met with UMN staff members from the Centre for Teaching and Learning, the Office of Information Technology and various lecturers who are involved in Teaching and Learning research in their own disciplines.

During these meetings, further insight was gained with regard to the various strategies employed at UMN to improve teaching and learning at the institution. The tools that are used to gather student feedback and the programmes that are in place to better prepare first-time lecturers, were especially interesting. Of great interest was the way

in which different types of education technologies are used to enhance the students' learning experiences at UMN. The delegation also had the opportunity to attend a class that was presented in one of the technologically enhanced classrooms at the St Paul Campus of UMN.

Contributions by Ms Tanya Beelders, Messrs Wynand Nel, Andries Burger and one of our students, Ms Nelia Oosthuysen, were accepted at the Student Symposium of the South African Academy for Science and Art. Mr Wynand Nel attended a Security+ workshop and obtained a Security+ Certified professional qualification.

Staff members of the department received various awards during 2009. Dr Liezel Nel received the Institutional Award for Excellence in E-learning during the second Prestige Forum for Teaching and Learning held at the UFS. Dr Lizette de Wet received the faculty award for Teaching and Learning. Mrs Marina Botha was named the Best MSDN (Microsoft Developer Network) Administrator at a South African Institution of Higher Education.

Two of our staff members at the Qwaqwa Campus, Messrs Gavin Dollman and Frederick Mudavanhu, completed their B.Sc. (Hons) during 2009. Mr Brian Campbell, technical assistant at the Main Campus, completed a B.Sc. degree.

The department attended a two-day strategic planning session, facilitated by the dean of the faculty, Prof. Herman van Schalkwyk and Ms Cheryl Lombard. Long-term, medium-term and short-term targets were set for the department as a

whole and for staff members individually and possible new directions with regard to the computer science programme were discussed.

From the department's research outputs for 2009 it is evident that an active research programme was followed. Although funding is very limited and often lacking, external funds are generated by using our modern eye-tracking equipment and the Centre of Excellence (COE). The projects undertaken by the COE are funded by an industry partner. These projects are research related and are implemented to develop and provide assistance to postgraduate students.

New eye-tracking equipment was acquired to enable the department to do usability studies on a highly competitive level. Prof. Pieter Blignaut and Ms Tanya Beelders have undertaken various projects both on and off the campus involving staff members and members of the public. The following usability studies were conducted in the usability laboratory:

- The PeopleSoft application designed to facilitate leave applications for university personnel was tested using user testing, complemented with eye-tracking and questionnaires.
- The PeopleSoft student registration portal underwent rigorous user testing during the second semester registration period. The eye-tracker was used to capture additional data to complement the usability study. Changes were made according to the results of the user testing.

Great insights pertaining to the department's modern eye-tracking capability were obtained through marketing re-



Dr Liezel Nel (left) received the Institutional Award for Excellence in E-learning and Dr Lizette de Wet (right) received the faculty award for Teaching and Learning.

search studies that have been conducted during 2009. Nine promotional advertisements aimed at sports fans were tested by inserting them into sports videos. Viewer retention, attention and enjoyment were tested for each promotional advertisement. Additionally, within the same study, the advertising elements contained within normal sports broadcasts were investigated to evaluate viewer retention and attention. A number of honours students also conducted research for mini-dissertations within their respective fields of study using the eye-tracker.

The department was actively involved in various events during the Darwin celebration year. Transport was arranged for school children from schools in and around Bloemfontein to also attend some of these events. A display that showed the evolution of modern operating systems from the early 1980s through to 2009 was set up at the Centenary Complex on the Main Campus and Ms Tanya Beelders presented a talk on the proliferation of technology and how technology has advanced over the years to become part of everyday life. Mr Brian Campbell gave a brief talk on electronic waste and how less developed countries, especially China and some African countries (Ghana and Nigeria in particular) are negatively affected.

As part of Dr Liezel Nel's research on the use of educational technologies in higher-education classrooms, she started with an initiative to make podcast and/or video recordings of a few undergraduate lectures. These recordings were made available to students on the UFS learning management system and also to the Qwaqwa lecturers.

Networking

Two of our staff members, Prof. Pieter Blignaut and Dr Anelize van Biljon, paid a visit to the IT departments of various universities in South Africa to establish positive relationships and to exchange ideas. Prof. Pieter Blignaut also lectured to the postgraduate students at UCT about research possibilities in eye-tracking.

Prof. Gurdeep Hura, chairperson of the Department of Mathematics and Computer Science at the University of Maryland Eastern Shore in the United States, paid a visit to the department to discuss the possibility of research on cyber infrastructure and other related fields. He also proposed an exchange programme for staff and students at the two universities.

The department also received a visit from Prof. Hennie Kruger from the Department of Computer Science and Information Systems at the North-West University (Potchefstroom Campus) and Ms Marthi Harmse from Sasol (Secunda). During this visit, operational research and other relevant topics were discussed. Staff members from other departments in the faculty also attended the discussions.

Community service

Community service is regarded a high priority in the department. It also showcases the department to future students and the general public. One of our most successful projects of 2009

was the computer training programme presented by students from the service learning module of the department, in collaboration with the Mangaung/University of the Free State Community Partnership Programme (MUCPP), to a group of unemployed persons from previously disadvantaged population groups. The classes were presented at the South Campus during the second semester. At the end of the programme a ceremony was held where the successful individuals were recognised and received a certificate.

Dr Anelize van Biljon is involved in developing mathematics in Grade 7 learners who wish to participate in Olympiads. She accompanied four learners to the Philippines where they took part in an International Olympiad. She is also actively involved in the Nautilus Mathematics Project (Grade 10 learners) and serves on the senior national committee for the South African Mathematics Olympiad.

Facilities

Staff members from the department used to occupy offices in two buildings, namely the Mathematical Sciences Building and the West Block. During 2009 more offices became available in the Mathematical Sciences Building, resulting in all staff members now being located in the same building.

The department has computer laboratories at every campus of the UFS where

our students receive practical training. Computers in these laboratories are always state-of-the-art since computers are replaced every year. The “old” computers are donated to schools in and around Bloemfontein as part of the department’s community service plan. During 2009 computers were donated to Petunia and Heatherdale Secondary Schools, another school at Fouriesburg and MUCPP.

There are two laboratories in the Mathematical Sciences Building with a capacity for 59 and 35 students, respectively. The Sasol Laboratory, where the BRS students are accommodated, hosts a total of 109 computers. There are three laboratories at the Qwaqwa Campus and they can accommodate 72, 54 and 30 students respectively. At the South Campus we have two laboratories, accommodating 85 and 20 students, respectively.

Staff matters

Prof. Pieter Blignaut was elected departmental chairperson at the end of 2008. Following his resignation as departmental chairperson during October 2009, Dr Anelize van Biljon has been acting as departmental chairperson until a new departmental head is elected. New staff appointments included the appointment of Dr Eduan Kotze as senior lecturer with effect from 1 January 2010. Mr Frederick Mudavanhu was appointed as the subject head at the Qwaqwa Campus, following the resignation of Mr Benedict Sebastian.

Research outputs

Research articles

Blignaut, P. 2009. A bilateral perspective on the digital divide in South Africa. *Perspectives on Global Development and Technology* 8: 581-601.

Blignaut, P. 2009. Fixation identification: The optimum threshold for a dispersion algorithm. *Perception & Psychophysics* 71(4): 881-895.

Blignaut, P. & Beelders, T. 2009. The effect of fixational eye movements on fixation identification with a dispersion-based fixation detection algorithm. *Jahrbuch der Absatz- und Verbrauchsforschung* 2(5): 1-14.

Blignaut, P. & McDonald, T. 2009. The effect of experience and socio-economic status on web searching performance: A South African perspective. *Behaviour & Information Technology* 28(3): 1-12.

Molupi, M. & McDonald, T. 2009. An investigation into the access and usage of the internet in Lesotho. *Journal for New Generation Sciences* 7(2): 201-217.

Book

Beelders, T. 2009. *Graphics, text and language in a word processor interface: A comparative study on the usability of different interface elements*. Saarbrücken: VDM Verlag Dr. Müller.

Reports

Beelders, T. 2009. *Usability report on the electronic leave application system developed by computer services*. Report to the Department Information and Communication Services, University of Free State, Bloemfontein, South Africa. Report number: 2009/001.

Blignaut, P. 2009. *Eye-tracking study on the viewing behaviour during broadcasting of high profile sports events*. Report to Sports Marketing Surveys,

Sandton, Johannesburg, South Africa. Report number: 2009/002.

Blignaut, P. & Beelders, T. 2009. *Saliency of promotional material on television and the effect it has on the recall ability of viewers*. Report to Sports Marketing Surveys, Sandton, Johannesburg, South Africa. Report number: 2009/002.

Blignaut, P. & Beelders, T. 2009. *Usability report: Online student registration for students at the University of the Free State*. Report to the Department Information and Communication Services, University of Free State, Bloemfontein, South Africa. Report number: 2009/004.

Conference contributions

Beelders, T., Blignaut, P., McDonald, T. & Dednam, E. 2009. *Measuring user performance for different interfaces using a word processor prototype*. Paper presented at the 13th International Conference on Human Computer Interaction (HCI International 2009), San Diego, California, USA. 19-24 July.

Blignaut, P. & Beelders, T. 2009. *'n Multimodale koppelvlak vir 'n wilde woordverwerkingspakket*. Paper presented at the "Studente Simposium van die Suid-Afrikaanse Akademie vir Wetenskap en Kuns", University of the Free State, Bloemfontein, South Africa. 29-30 October.

Burger, A., Blignaut, P. & De Wet, L. 2009. *Die lewensvatbaarheid van 'n kwantitatiewe model om die bruikbaarheid van webwerwe te meet*. Paper presented at the "Studente Simposium van die Suid-Afrikaanse Akademie vir Wetenskap en Kuns", University of the Free State, Bloemfontein, South Africa. 29-30 October.

Dednam, E. 2009. *Away with computer literacy modules at Universities,*

or not? Proceedings of SACLA 2009: The 2009 Annual Conference of the Southern African Computer Lecturers' Association: Connecting students to the future, Rhodes University, Eastern Cape, South Africa. 29 June-2 July. pp. 23-32.

McDonald, T. & Breytenbach, J. 2009. *Search engine coverage bias in a developing country*. Proceedings of the 11th Annual Conference on World Wide Web Applications (ZA WWW2009), Port Elizabeth, South Africa. 2-4 September. pp. 4-12.

Mosebi, M. & McDonald, T. 2009. *Business intelligence in South African Government - Subsidised bus companies*. Proceedings of the 28th Annual Southern African Transport Conference and Exhibition (SATC 2009): Sustainable transport, Pretoria, South Africa. 6-9 July. pp. 499-506.

Ndeya-ndereya, C. & Nel, E. 2009. *Enhancing social presence to humanise the online learning environment*. Proceedings of the Higher Education Learning and Teaching Association of Southern Africa (HELTASA) Conference: Risk and resilience in Higher Education, University of Johannesburg, Johannesburg, South Africa. 25-27 November. p. 8.

Ndeya-ndereya, C. & Nel, E. 2009. *Online collaboration: Facilitating to fulfill cognitive & social objectives*. Paper presented at the 2009 Africa User Conference, University of the Free State, Bloemfontein, South Africa. 16-17 April.

Nel, W. & McDonald, T. 2009. *Vergelyking van soekenjins en gebruikerinteraksie met betrekking tot dubbelsinnige Web-soekstringe*. Paper presented at the "Studente Simposium van die Suid-Afrikaanse Akademie vir Wetenskap en Kuns", University of the Free State, Bloemfontein, South Africa. 29-30 October.

- Oosthuysen, C. & Blignaut, P.** 2009. *'n Bruikbaarheid- en funksionaliteit-studie van intranette aan Suid-Afrikaanse universiteite*. Paper presented at the "Studente Simposium van die Suid-Afrikaanse Akademie vir Wetenskap en Kuns", University of the Free State, Bloemfontein, South Africa. 29-30 October.
- Smart, A., Van der Linde, L., Wilkinson, A. & Nel, E.** 2009. *From barriers to implementation: A case study in implementing E-learning on a campus*. Paper presented at the 2009 Africa User Conference, University of the Free State, Bloemfontein, South Africa. 16-17 April.
- Van Biljon, A.** 2009. *Quartiles and percentiles: Which formula?* Proceedings of the 15th Annual Congress of the Association for Mathematics Education of South Africa (AMESA 2009): Mathematical knowledge for teaching, University of the Free State, Bloemfontein, South Africa. 29 June-3 July. pp. 210-216.
- Van Jaarsveldt, D. & Nel, E.** 2009. *Culture and technology: A challenge for higher education*. Poster presented at the New Generation University Conference, Vanderbijlpark, South Africa. 17-19 November.
- Van Tonder, A., Blignaut, P. & Atagana, I.** 2009. *An investigation into biochemistry students' graphical literacy*. Proceedings of the New Zealand Association for Research in Education (NZARE) Conference 2009: This is our research, this is why it matters and this is what should happen next - NZ Educational Research in 2009, Distinction Hotel, Rotorua, New Zealand. 30 November-4 December. p. 73.

Contact details

Dr Annelize van Biljon

Faculty of Natural and Agricultural Sciences
Department of Computer Science
and Informatics
University of the Free State
PO Box 339
Bloemfontein
South Africa
9300

Telephone: +27 51 401 2605

Fax: +27 51 401 2754

E-mail: anelize@ufs.ac.za

Website: www.ufs.ac.za/cs



Mrs Marina Botha was named the Best MSDN (Microsoft Developer Network) Administrator at a South African Institution of Higher Education.

Staff

Main Campus:

Professors: Profs. Pieter Blignaut, Theo McDonald, Janse Tolmie

Affiliated Professor: Prof. Hans Messerschmidt

Senior Lecturers: Drs Anelize van Biljon, Lizette de Wet

Lecturers: Dr Liezel Nel, Mss Tanya Beelders, Engela Dednam, Nancy de Sousa, Messrs Andries Burger, Bertram Haskins, Dana Kotze, Eduan Kotze, Wynand Nel, Casper Wessels, Frank van der Ling

Junior Lecturers: Messrs Rouxan Fouche, Jaco Marais

Administrative Officers: Mss Marina Botha, Erna Dippenaar, Suezette Opperman, Mr Nico van Zyl

Technical Officer: Mr Brian Campbell

Qwaqwa Campus:

Junior Lecturers: Ms Ruth Wario, Messrs Ben Mase, Thabo Mosia, Frederick Mudavanhu, Fani Radebe, Benedict Sebastian, Gavin Dollman

Administrative Officer: Ms Bless

Technical Officer: Mr Teboho Lesesa

South Campus:

Lecturer: Mr Ronnie Brown

Administrative Officer: Mrs Suretha de Klerk

Technical Officer: Mr Emrys Hart

10 Genetics

Overview

The Department of Genetics aims to acquire and disseminate knowledge of Genetics to the benefit of all. This is done by research and education at undergraduate and postgraduate levels.

Activities and achievements

Staff members were active in various organisations and Prof. Spies is currently the chairperson of the Clivia Society. Prof. Grobler acts as Adjunct Associate Professor for the Department of Fisheries and Wildlife Sciences at the Virginia Polytechnic Institute and State University (Virginia Tech), Blacksburg, United States of America (USA). He is also a council member of the Southern

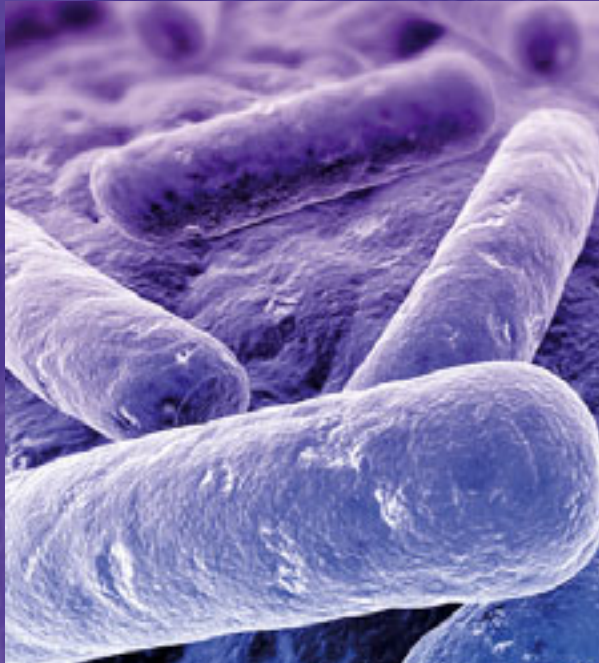
African Wildlife Management Association (SAWMA). He is the genetics subeditor for the *Southern African Journal of Aquatic Sciences* and he reviewed manuscripts for *Mammalian Biology* and the *South African Journal of Wildlife Research* during 2009.

Prof. Antoinette Kotzé is currently also a council member of SAWMA, chairperson of the African Association of Zoos and Aquariums Research and Monitoring Working Group and chairperson of the National Zoological Gardens of South Africa's Research and Ethics Committee. She also serves on the Board of Directors of the Mabula Ground Hornbill Research and Conservation Project



“Students find Behavioural Genetics very exciting and it is the most popular choice for honours studies.”

- Prof. Johan Spies



At the bridge over Kafue River, Zambia. Enjoying nature during vervet monkey expedition, are, from the left: Ms Elzet Van Aswegen and Mr Riël Coetzer (M.Sc. students), Ms Micah Beller (USA), Prof. Trudy Turner (UWM), Ms Jennifer Danzy and Mr James Pampush (M.Sc. students, UWM, USA) and Dr Mumba (Veterinarian, University of Zambia).



and the Institute for the Breeding of Rare and Endangered African Mammals (IBREAM SA). She is also a member of the National Cheetah Conservation Forum and a management member of the Vulture Conservation Programme.

Various national and international conferences were attended during the year. At international level, Prof. Johan Spies delivered the keynote address at the Annual General Meeting of the Clivia Society. In September 2009, Profs. Grobler and Kotzé, Ms Karen Ehlers and Miss Jonker visited the University of Kaposvar, Hungary, where Prof. Grobler presented an invited lecture. He also co-authored a contribution on a forensic study on cheetah that was presented at the 7th International Conference on Behaviour, Physiology and Genetics of Wildlife in Berlin, Germany during September 2009.

Prof. Grobler chaired the organising committee for the Annual General Meeting of SAWMA at the Black Mountain Hotel that was held from 13-16 September 2009. He was assisted by Ms Karen Ehlers. Prof. Grobler was co-author of three presentations at this conference. Prof. Antoinette Kotzé also attended this event. Prof. Grobler participated in the annual symposium of the Primate Ecology and Genetics Group (PEGG) in Pretoria during June 2009.

The animal genetics team comprising Profs. Grobler and Kotzé and Ms Ehlers is involved with a number of projects, including the following:

- a project that aims to investigate the nature and extent of hybridisation between blue and black wildebeest in South Africa in collaboration with the University of Pretoria, the National Zoological Gardens in Pretoria, the National Museum in Bloemfontein and conservation officers from the Free State and Kwa-Zulu-Natal Provinces;
- DNA profiling of black rhino in the Weenen Game Reserve in conjunction with KaZulu-Natal Wildlife;
- conservation and genetics of white rhino in collaboration with the Mpumalanga Tourism and Parks Agency;
- the genetic management of baboon populations together with the Gauteng Department of Agriculture;
- the National Genetic Database for cheetah in association with the National Zoological Gardens in Pretoria; Department of Genetics at the University of Pretoria, De Wildt Cheetah and Wildlife Trust, Hillsdale College in the USA and the University of Vienna, Austria;
- population management of crane species with the National Zoological Gardens in Pretoria and the Endangered Wildlife Trust;
- genetic and population studies on ground hornbills with the National Zoological Gardens in Pretoria, the Endangered Wildlife Trust, the Ground Hornbill Working Group, the Mabula Ground Hornbill Research and Conservation Project, the University of Pretoria and the Natural History Museum in Paris, France;
- the compilation of an atlas for haemoglobin profiles in collaboration with BIORAD, Germany, SANParks and the University of Limpopo; and
- the genetic diversity of freshwater mussels in the USA and the geographic genetic structure of vervet monkey populations to enable the regulated release of captive vervet monkeys from sanctuaries with the University of California, the University of Wisconsin-Milwaukee and Virginia Polytech, USA.



Profs. Paul Grobler and Trudy Turner near Mole Nature Reserve, Ghana.

Prof. Trudy Turner from the Department of Physical Anthropology at the University of Milwaukee-Wisconsin (UWM), USA, visited the department twice during 2009. During the January visit she conducted a joint field trip with Prof. Paul Grobler and two M.Sc. students to collect vervet monkey samples near

St. Lucia in KwaZulu-Natal. The collaboration between Profs. Grobler and Turner was strengthened by also participating in a project with Prof. Nelson Freimer from UCLA. The project is aimed at the use of vervet monkeys as model systems for integrated genetic and genomic research. As part of this project Profs. Grobler and Turner and four M.Sc. students (two from UFS and two from UWM) did extensive field work in Botswana (Chobe), Zambia (Kafue and Lusaka areas), Ghana (Mole National Park) and Ethiopia (Awash National Park and various other localities).

The behavioural genetics team (Prof. Spies and Miss Odendaal) is busy with a study on genes involved in aggressive behaviour. The initial part of this study focuses on the localisation of genes associated with aggression in different dog breeds. If this part is completed the presence of these genes in humans will be investigated. Miss Odendaal visited the Departments of Behavioral Genetics and Psychology at the University of Minnesota during November 2009.

The plant genetic team (Prof. Spies, Mr Maleka and Mrs Spies) are concentrating their studies on *Clivia*. A number of M.Sc. students are working on genetic diversity in different *Clivia* species and the possible application of these results in forensics is currently being investigated. Research on the genes involved in the formation of flower colour in *Clivia* has already identified four genes in the anthocyanin pathway and their expression in different cultivars was tested.

Mr Maleka was awarded a National Research Foundation (NRF) Thuthuka grant

under the sub-programme Researchers-in-Training (RiT). The sub-programme is aimed at providing support for entry-level researchers to obtain doctoral degrees. Therefore the funds are being used by Mr Maleka to conduct research that forms part of his doctoral research on *Clivias*. His research is on ornamental flower crops that are sold worldwide in the floriculture industry. In particular, the current research aims to include the identification and characterisation of genes involved in flower pigmentation in *Clivias*. Initially, *Clivia* flower tepals were harvested, immediately frozen using liquid nitrogen and stored at ultralow temperatures. Subsequently, total RNA was isolated from ground tepal tissues and used to synthesise double-stranded complementary DNA (ds-cDNA). A high-throughput sequencing technology (Illumina Genome Analyser) was used to sequence the flower-derived ds-cDNA molecules. Altogether, more than 37 000 gene sequences (termed contigs) have been generated and are currently being analysed. The analysis is aiming to identify various genes (i.e. structural and regulatory) involved in the biosynthesis of flower pigments including anthocyanins and carotenoids.

The department received a visit from a Hungarian delegation from the University of Kaposvár during December 2009. This visit forms part of a South African-Hungarian research collaboration initiative and is done in collaboration with the National Zoological Gardens in Pretoria. The visit was preceded by a visit in September to Hungary by Profs. Grobler, Kotzé, Ms Ehlers and Miss Jonker, all from the Department of Genetics, as

well as two representatives from the National Zoological Gardens of South Africa. Prof. Kotzé also visited the University of Vienna and the Wildlife Institute in Vienna, Austria and the London Zoo and Zoological Society of London in the United Kingdom during September and October 2009.

In 2009, Mr Maleka undertook two visits to external institutions for research purposes. The first visit was to the laboratory of Prof. Rees at the Department of Biotechnology, University of the Western Cape. The purpose of the visit was to gain access to the high-throughput sequencing platform that was referred to above. The visit was completed in two trips that were undertaken during April and July 2009, respectively.

The second visit was to Orlando, Florida in the USA. The purpose of the visit was to attend a workshop on the use of the software programme BLAST2GO. The workshop, organised and presented by the software designers, was important because various issues relating to the use of the software to analyse large-scale data were discussed.

Prof. Johan Spies acts as information officer for the distribution of knowledge obtained during the research on *Clivia* and handles many enquiries from *Clivia* breeders. Profs. Grobler and Kotzé participated in radio and television programmes.

Staff matters

During 2009 Ms Zurika Odendaal joined the department as a junior lecturer in Behavioural Genetics.

Research outputs

Research articles

Espie, I.W., Hlokwé, T.M., Gey van Pittius, N.C., Lane, E., Tordiffe, A.S.W., Michel, A.L., Muller, A., Kotze, A. & Van Helden, P.D. 2009. Pulmonary infection due to *Mycobacterium bovis* in black rhinoceros (*Diceros bicornis bicornis*) in South Africa. *Journal of Wildlife Diseases* 45(4): 1187-1193.

Junker, K., Lane, E.P., Dlamini, B., Kotze, A. & Boomker, J. 2009. Post mortem identification of *Kalichephalus colubri colubri* (Nematoda: Diaphanoccephalidae) in a captive Mole snake (*Pseudaspis cana*) in South Africa. *South African Journal of Veterinary Association* 80(1): 54-56.

Kleynhans, R., Spies, J.J. & Spies, P. 2009. Cross-ability in *Lachenalia*. *Acta Horticulturae* 813: 385-392.

Pieters, A., Van Marle-Koster, E., Visser, C. & Kotze, A. 2009. South African developed meat type goats: A forgotten animal genetic resource. *Animal Genetic Resources Information* 44: 33-43.

Plantan, T.B., Howitt, M.J., Le Roux, A., Heymans, J.A., Kotzé, A. & Gaines, M.S. 2009. The capture of a large number of Red-billed Oxpeckers *Buphagus erythrorhynchus* and their subsequent maintenance and behaviour. *Ostrich* 80(2): 103-107.

Spies, J.J. & Van der Westhuizen, H. 2009. Polyploidy in *Clivia*. *Clivia* 11: 17-21.

Spies, J.J., Spies, P., Minnaar, A., Reinecke, S.M.C., Du Preez, J.L. & Kleynhans, R. 2009. *Lachenalia*. In: *IAPT/IOPB chromosome data 8*, edited by K. Marhold. *Taxon* 58: 1282-1283.

Report

Grobler, J.P. & Jonker, L. 2009. *Report on possible hybridization in*

black wildebeest (Connochaetes gnou) on reserves in the Free State Province. Report to the Game Reduction Meeting, Bloemfontein, South Africa.

Conference contributions

Charruau, P., Fernandes, C., Kotze, A., Walzer, C. & Burger, P. 2009. *A single amino acid deletion in the mitochondrial gene ND5 separates the two East African cheetah subspecies (Acynonyx jubatus soemmeringii and Acynonyx jubatus raineyi)*. Poster presented at the 7th International Conference on Behaviour, Physiology & Genetics of Wildlife, Bundesinstitut für Risikobewertung Conference Centre, Berlin, Germany. 21-24 September.

Coetzer, W.G., Grobler, J.P. & Turner, T.E. 2009. *Genetic variation among Vervet Monkeys (Chlorocebus aethiops) in the south-eastern parts of South Africa*. Poster presented at the Annual Southern African Wildlife Management Association Symposium (SAWMA): Wildlife Management: Ensuring Sustainability, Protea Hotel Black Mountain, Thaba 'Nchu, South Africa. 13-16 September.

Dawood, A., Stam, E. & Kotze, A. 2009. *Science in zoos: transforming from menageries to science-based conservation bodies*. Paper presented at the 50th Anniversary Conference of the Zoological Society of Southern Africa: 50 years of Zoological Research: Reflection and insights, Natalia, Illovo Beach, KwaZulu-Natal, Durban, South Africa. 21-25 July.

De Castro, M.H., Creux, N.M., Ranik, M., Maleka, M.F. & Myburg, A.A. 2009. *Molecular evolution of the promoter regions of cellulose synthase genes in Eucalyptus*. Poster presented at the International Union of Forest Research Organizations (IUFRO) Tree Biotech-

nology Conference, Whistler, British Columbia, Canada. 28 June-2 July.

Grobler, J.P. 2009. *Research in conservation genetics at the UFS*. Paper presented at the University of Kaposvar, Hungary. 24 September.

Grobler, J.P., Ehlers, K. & Kotze, A. 2009. *Application and limitations of assignment methods in conservation genetics: determining the geographic origin of translocated cheetah (Acynonyx jubatus)*. Poster presented at the 7th International Conference on Behaviour, Physiology & Genetics of Wildlife, Bundesinstitut für Risikobewertung Conference Centre, Berlin, Germany. 21-24 September.

Jonker, L., Kotze, A., Ehlers, K., Vrahimis, S. & Grobler, P. 2009. *First results from the application of two cross-species markers to identify hybrid wildebeest*. Poster presented at the Annual Southern African Wildlife Management Association Symposium (SAWMA): Wildlife Management: Ensuring Sustainability, Protea Hotel Black Mountain, Thaba 'Nchu, South Africa. 13-16 September.

Kotze, A., Lehoczy, I., Grobler, J.P., Molnar, T., Nagy, J., Ehlers, K., Lekgethisho, D., Lanszki, J., Nxomani, C., Spies, J.J. & Horn, P. 2009. *A comparison between differentially managed wildlife populations in South Africa and Hungary*. Poster presented at the Annual Southern African Wildlife Management Association Symposium (SAWMA): Wildlife Management: Ensuring Sustainability, Protea Hotel Black Mountain, Thaba 'Nchu, South Africa. 13-16 September.

Lane, E.P., Barrows, M., Gey van Pittius, N.C., Hlokwé, T., Kotze, A., Koepfel, K. & Michel, A. 2009. *Articular Mycobacteriosis in Painted Reed Frogs (Hyperolius viridiflavus) from the Johannesburg Zoo, South*

Africa. Paper presented at the 60th Annual Meeting of the American College of Veterinary Pathologists, Monterey Convention Centre, Monterey Marriott Hotel, Monterey, California, USA. 5-9 December.

Lane, E.P., Dalton, D.L., Henton, M., Kotze, A., Mbatha, K.R., Rehse, T.P.R., Stam, E.M. & Tordiffe, A.S.W. 2009. *Necrobacillosis in captive springboks (Antidorcas marsupialis) at the National Zoological Gardens of South Africa*. Poster presented at the 60th Annual Meeting of the American College of Veterinary Pathologists, Monterey Convention Centre, Monterey Marriott Hotel, Monterey, California, USA. 5-9 December.

Lane, E.P., Dalton, D.L., Kotze, A., Mbatha, K., Rankin, J., Rehse, T., Thabelo, M. & Tordiffe, A.S.W. 2009. *Pemphigus foliaceus in a*

group of Arabian Oryx at the National Zoological Gardens of South Africa. Paper presented at the 60th Annual Meeting of the American College of Veterinary Pathologists, Monterey Convention Centre, Monterey Marriott Hotel, Monterey, California, USA. 5-9 December.

Naidoo, V., Kotze, A., Botha, C.J. & Wolter, K. 2009. *Whole blood lead concentrations in southern African Vultures*. Poster presented at the 7th Congress of Toxicology in Developing Countries (7CTDC): Harmonization of Toxicology Issues Between Developed and Developing Countries, Sun City, South Africa. 6-10 September.

Spies, J.J. 2009. *The delimitation of species in Clivia*. Paper presented at the Annual General Meeting of the Clivia Society, Cape Town, South Africa. 16 May.

Contact details

Prof. Johan Spies

Faculty of Natural and Agricultural Sciences
Department of Genetics
University of the Free State
PO Box 339
Bloemfontein
South Africa
9300

Telephone: +27 51 401 2595

Fax: +27 86 418 7317

E-mail: Spiesjj@ufs.ac.za

Website: www.ufs.ac.za

Staff

Professor: Prof. Johan Spies

Associate Professor: Prof. Paul Grobler

Affiliated Associate Professor: Prof. Antoinette Kotzé

Lecturers: Ms Karen Ehlers, Ms Paula Spies, Mr Frank Maleka

Junior Lecturer: Ms Zurika Odendaal

Senior Professional Officer: Ms Susan Reinecke



Prof. Paul Grobler (right) and Mr Riël Coetzer in front of the Biology Building, University of Addis Ababa, Ethiopia.



Overview

Academic interest in the field of Geography is growing, as is evident from the considerable growth in student numbers that the Department of Geography at the University of the Free State (UFS) is experiencing. 2009 saw undergraduate student numbers grow to a level where the departmental resources were taxed to the limit. Tremendous growth in student numbers occurred at both the Main and Qwaqwa Campuses.

Two of the department's master's students obtained their degrees. Ms KT Jacobs completed her master's degree on *Climate Variability and Flood Risk in the Upington area* and Mr M Rammoko

completed his master's thesis on *The Development of Spatial Data Infrastructure in Lesotho*. Dr Rod Douglas, co-supervised by Prof. Peter Holmes and Prof. Marian Tredoux (Geology), obtained his Ph.D. degree for his thesis entitled *A New Perspective on the Geohydrological and Surface Processes Controlling the Depositional Environment at the Florisbad Archaeozoological Site*.

Activities and achievements

Associate professor Gustav Visser obtained a well-deserved promotion to full professor. He has also completed his term of office as President of the Society of South African Geographers.



“Tremendous growth in student numbers occurred on both the Main and Qwaqwa Campuses.”

- Prof. Peter Holmes



At the SANPAD workshop in Durban are, from left to right, postgraduate students Sureiya Hassan (UFS), Mngqobi Ngubane (UFS) and Jayshree Govender (UKZN).



During his term of office, the society strengthened its position considerably. Ms Sandra Brits continues to serve as the society's administrative officer.

Prof. Peter Holmes and Dr Charles Barker attended the 7th International Conference on Geomorphology in Melbourne, Australia where both presented papers. Prof. Gustav Visser presented papers at the RGS/IBG conference in Manchester, United Kingdom (UK) and the Quality of Life Conference in Florence, Italy. Dr Shirley Brooks presented papers at the Annual Conference of the Canadian Association of African Studies, Kingston, Ontario and the Annual Meeting of the Association of American Geographers, Las Vegas, United States of America (USA). She also presented versions of this work by invitation to audiences at the Wits seminar series on Social and Historical Enquiry and the History and African Studies seminar series at the University of KwaZulu-Natal (UKZN).

The full contingent of academic staff of the Main Campus attended the 8th Biennial Conference of the Society of Southern African Geographers with the theme *Geography for a Better World* that was held at the St George's Hotel in Centurion, Gauteng. Dr Tom Ruhiga represented the Qwaqwa Campus at this conference. The department also had an excellent turnout of honours students at the annual Student Conference held at the same venue.

Prof. Holmes and Ms Rabumbulu presented papers at the Southern African Society for Quaternary Research (SASQUA) XVIII Biennial Conference in



Dr Marja Spierenburg of the Vrije Universiteit Amsterdam and Dr Shirley Brooks from the Department of Geography, UFS.

Knysna, where Prof. Holmes was also elected to the SASQUA Committee. This conference was jointly organised by the Department of Geography at the UFS and the Department of Environmental and Geographical Science at the University of Cape Town. A significant number of foreign participants gave the conference a true international flavour.

Mr Alex Adjei presented a paper at the Free State Provincial Route Summit that was held in Bethlehem in the Free State. Prof. Gustav Visser and Dr Shirley Brooks presented a public lecture entitled *Misapplying Darwin: Social Darwinism, Demography and South African History* as part of the UFS's lecture series commemorating the work of Charles Darwin.

Dr Brooks is involved in collaborative research on the social and environmental impacts of private game farming in KwaZulu-Natal and the Eastern Cape with Dr Marja Spierenburg of the Vrije Universiteit Amsterdam, The Netherlands. She hosted Dr Spierenburg in Bloemfontein and organised a research trip to game farms in the Midlands of KwaZulu-Natal.

Networking

Dr Brooks organised a postgraduate workshop in Durban for students involved in the SANPAD project of which she is Project Leader. Academics involved included Dr Spierenburg and Norwegian colleague, Dr Knut Nustad.

Prof. Martha Richmond, Director of Environmental Studies at Suffolk University, Boston, USA visited the Main and Qwaqwa Campuses in August 2009. This was her second visit in as many

years. She presented a number of lectures in environmental management and biodiversity to staff and students at the both campuses.

Dr Ruhiiga received a research grant from the University's Research Development Fund under the Strategic Cluster New Frontiers in Poverty Reduction and Sustainable Development. Two master's students were accommodated under this grant.

Prof. Holmes continues to be part of ongoing research initiatives collaborating with colleagues from Oxford (aeolian processes in the Western Free State) and Sheffield, Leicester and Wollongong (palaeo-environments of the Southern Cape coast).

Staff matters

Towards the end of 2009 Dr Tom Ruhiiga from the Qwaqwa Campus resigned.

At the beginning of the 2010 academic year, the department gained two new staff members in Dr Geoffrey Mukwada from the University of the Western Cape (UWC) and Ms Merle Naidoo. Dr Shirley Brooks joined the staff at the Main Campus from UKZN as a senior lecturer at the beginning of 2009 and Ms Mulalo Rabumbulu was appointed as a junior lecturer under the *Grow our Own Timber* (GOOT) programme on the Main Campus.



Research outputs

Research articles

Hoogendoorn, G., Marais, L. & Visser, G.E. 2009. Changing country sides, changing villages: Reflections on second homes in Rhodes, South Africa. *South African Geographical Journal* 91: 75-83.

Msilimba, G.G. & Holmes, P.J. 2009. Landslides in northern and central Malawi: Awareness, perceptions and coping strategies. *South African Geographical Journal* 91: 38-45.

Nana Adu-Pipim Boaduo, F.R.C., Milondzo, K.S. & Adjei, A. 2009. Parent-community involvement in school governance and its effects on teacher effectiveness and improvement of learner performance: Study of selected primary and secondary schools in Botswana. *Educational Research and Review* 4: 96-105.

Nana Adu-Pipim Boaduo, F.R.C., Milondzo, K.S. & Adjei, A. 2009. Genesis of peace education in an era of xenophobia and terrorism: The case of South Africa. *Journal of Pan African Studies* 2(9):260-274.

Pienaar, J.J. & Visser, G.E. 2009. The thorny issue of identifying second

homes in South Africa. *Urban Forum* 20: 445-469.

Rex, R. & Visser, G.E. 2009. Residential desegregation in the South African city of Bloemfontein. *Urban Forum* 20: 335-361.

Roberts, D.L., Bateman, M.D., Murray-Wallace, C.V., Carr, A.S. & Holmes, P.J. 2009. West coast dune plumes: Climate driven contrasts in dunefield morphogenesis along the western and southern South African coasts. *Palaeogeography, Palaeoclimatology, Palaeoecology* 271: 24-38.

Visser, G.E. 2009. Tourism geographies and the South African National Research Foundation's researcher rating system: International connections and local disjunctures. *Tourism Geographies* 11: 43-72.

Conference contributions

Barker, C.H. 2009. *The applicability of SRTM data for topographical modelling in South Africa*. Poster presented at the 7th International Conference on Geomorphology: Ancient Landscapes – Modern Perspectives, Melbourne, Australia. 6-11 July.

Barker, C.H. 2009. *Using geomorphic variables and –modelling as an aid to manage water allocation in non-perennial catchments*. Paper presented at the 7th International Conference on Geomorphology: Ancient Landscapes – Modern Perspectives, Melbourne, Australia. 6-11 July.

Brooks, S. 2009. *Private game farming, conservation partnerships and community 'stewardship' in KwaZulu-Natal*. Paper presented at the 8th Biennial Meeting of the Society for South African Geographers and Student Conference: Geography for a Better World, Saint George Hotel, Kemptonpark, Pretoria, South Africa. 30 August-3 September.

Brooks, S. & Spierenburg, M. 2009. *Social justice and agrarian transformation: The spatial politics of private game farming in KwaZulu-Natal*. Paper presented at the Annual Conference of the Canadian Association of African Studies (CAAS): Communities and transformations in Africa and African Studies, Queen's University, Kingston, Ontario, Canada. 4-7 May.

Brooks, S. & Spierenburg, M. 2009. *Creating third nature in the South*

African Countryside: The spatial politics of private game farming in KwaZulu-Natal. Paper presented at the Annual Meeting of the Association of American Geographers (AAG), Las Vegas, Nevada, USA. 22-27 March.

Holmes, P.J. & Wiggs, G.W. 2009. *Current sediment mobility as an analogue for aeolian palaeoenvironments over the Western Free State Panfield.* Paper presented at the Southern African Society for Quaternary Research (SASQUA) 2009 Congress: Understanding Quaternary Change – Southern Hemisphere Perspectives, Phantom View River Resort and Conference Venue, Knysna, South Africa. 6-10 September.

Holmes, P.J. & Wiggs, G.W. 2009. *Aeolian sediment mobility on pans and ploughed land on the South African Highveld.* Paper presented at the 8th Biennial Meeting of the Society for South African Geographers and Student Conference: Geography for a Better World, Saint George Hotel, Kemptonpark, Pretoria, South Africa. 30 August - 3 September.

Holmes, P.J. & Wiggs, G.W. 2009. *Aeolian sediment mobility on pans and ploughed land on the South African*

Highveld. Paper presented at the 7th International Conference on Geomorphology: Ancient Landscapes – Modern Perspectives, Melbourne, Australia. 6-11 July.

Hoogendoorn, G. & Visser, G. 2009. *Second home development in Small Town South Africa.* Paper presented at the RGS-IBG Annual International Conference of the Royal Geographical Society with the Institute of British Geographers, Manchester, United Kingdom. 26–28 August.

Hoogendoorn, G. & Visser, G. 2009. *Second home development: Curse or blessing?* Paper presented at the 9th Conference of the International Society of Quality of Life Studies Conference (ISQOLS), Florence, Italy. 19-23 July.

Hoogendoorn, G. & Visser, G. 2009. *Second homes and local (economic) development issues in small town South Africa.* Paper presented at the 8th Biennial Meeting of the Society for South African Geographers and Student Conference: Geography for a Better World, Saint George Hotel, Kemptonpark, Pretoria, South Africa. 30 August-3 September.

Contact details

Prof. Peter Holmes

Faculty of Natural and Agricultural Sciences
Department of Geography
University of the Free State
PO Box 339
Bloemfontein
South Africa
9300

Telephone: +27 51 401 2255
Fax: +27 51 401 3816
E-mail: holmespj@ufs.ac.za
Website: www.ufs.ac.za

Staff

Main Campus:

Professors: Profs Peter Holmes, Gustav Visser

Senior Lecturers: Drs Charles Barker and Shirley Brooks

Lecturers: Mss Eldalize Kruger, Tobeka Mehlomakhulu, Sheila Vrahimis

Junior Lecturer: Ms Mulalo Rabumbulu

Professional Officers: Mss Sandra Brits, Nolene van Dyk

Owaqwa Campus:

Senior Lecturer: Dr Hennie Claassen

Lecturers: Mr Alex Adjei, Dr Geoffrey Mukwada, Ms Merle Naidoo

Junior Lecturer: Mr Pululu Mahasa



12 Geology

Overview

2009 was a good year for the Department of Geology. The department was involved in numerous activities, including teaching, research and community service. The first-year module, GWS114, attracted a record number of 351 first-year students. Second-year students were subjected to a selection process in order to manage student numbers. However, 80 second-year students were still enrolled. The third-year class was also the biggest in the history of the department and some modules accommodated 85 students. The Honours class numbered more than 20 students. Measures are currently being introduced to further curb student numbers to ensure continued quality teaching.

Therefore a selection process will from now on be applied from the first year onward. The reason for this is to ensure that student numbers do not exceed the capacity of the infrastructure and the staff involved.

The number of Master's students also increased in 2009 and the department now boasts a broad research base covering a diverse range of research topics. Research outputs are also increasing and there is much interest in conducting research to obtain higher qualifications. The increase in post-graduate student numbers could be ascribed to the downturn in the economy with students better qualifying



“Many students have, after being involved in the Mineral Resource Management programme, effected significant improvements in their respective environments.”

- Prof. Willem van der Westhuizen



Honours students (mineralogy) during a visit to Mintek. Annegret Lombard from Mintek acted as host and on her right is Huibrie Pretorius (lecturer).



themselves for the future. Subjects related to the minerals industry are especially sensitive to economic fluctuations.

The course in Mineral Resource Management is becoming more popular with a slow but steady increase in student numbers. Workshops in relation to some of the modules are planned from 2010 onwards as a service to the mining community and to stimulate further awareness of the course in order to increase student numbers. Many students have, after being involved in the programme, effected significant improvements in their respective environments. Workshops for students were conducted during April and August 2009 and oral examinations, all at the facilities of the Council for Geoscience in Pretoria, took place during November 2009.

A two-day strategic planning session was conducted during November 2009 under the leadership of the Dean of the Faculty of Natural and Agricultural Sciences, Prof. Herman van Schalkwyk. Future planning for research, teaching and community service were the most important aspects that were discussed.

Activities and achievements

During 2009 a Ph.D. was conferred upon Mr Rodney Douglas for his thesis entitled *A new perspective on the geohydrological and surface processes*



Prof. Christoph Gauert during a visit to Rand-Uranium in front of the headgear of the shaft.

controlling the depositional environment at the Florisbad archaeozoological site.

Profs. Marian Tredoux and Peter Holmes (Department of Geography) acted as supervisors. Four M.Sc. degrees were conferred upon the following students: Sebastian Fuchs (Prof. Christoph Gauert), Jens Kirste (Prof. Gauert), Ulrike Rantzsch (Profs. Gauert and Willem van der Westhuizen), Alida Litthauer (Profs. Van der Westhuizen and Tredoux). MRM degrees were conferred upon Johnfass Sanga from Tanzania, Augustinus Mungunda from Namibia and Richard Hatton, Leon Grobler, Brendan Botha and Adelle Mossop from South Africa.

Prof. Marian Tredoux attended the !Khure Africa annual meeting in Paris, France, from 6 to 8 July 2009. She also visited the Martin Luther University of Halle-Wittenburg, Halle, Germany from 13 to 15 July 2009 to confirm the memorandum of understanding (MOU) with the Faculty of Natural and Agricultural Sciences of the University of the Free State (UFS).

She participated in the annual SAGA meeting (incorporating the Inkaba annual meeting) from 15 to 18 September 2009 in Swaziland as well as the UNESCO meeting about "Earth Science education in Africa" in Cape Town from 26 to 27 November 2009. Other visits include the Mountain University in Leoben, Austria from 17 to 21 July 2009 where she visited their microprobe unit as well as research visits to the University of Bonn, Germany from 22 to 23 July 2009 and the French National Centre for Scientific Research (CNRS ()) in Nancy, France on 24 July 2009.



Honours students at Harmony exploration camp inspecting drill core.

Prof. Tredoux also undertook a field excursion to Mookhopong (Pt mineralisation) with members of the German Federal Survey of Geology from Hannover, Germany from 19 to 20 September 2009. This visit is part of the research under the Inkaba ye Africa programme. Prof. Tredoux further participated in a radio talk show on the Afrikaans radio station *Radio Sonder Grense* (RSG) called *Hoe verklaar u dit?* She also contributed to articles in Media24 under the title *Science Today*.

Prof. Christoph Gauert visited Cape Town in January 2009 to attend the Inkaba 2 meeting with delegates from GFZ Potsdam, BGR, AEON and the University of Cape Town (UCT) to discuss research matters relating to the project. He also attended the South African igneous and metamorphic petrology meeting attended by Geological Departments from South Africa during January 2009 at the University of Pretoria. He also visited the GeoForschungs Zentrum in Potsdam from 22 to 23 June

2009 to meet with Dr Bob Trumbull and Prof. Charly Kaufmann, respectively. On 15 July 2009 Prof. Gauert visited the Institute for Mineralogy and Crystallography where he discussed research projects with Prof. Kloess. From 14 to 17 September he attended the South African Geophysical Association (SAGA) conference in Mbabane, Swaziland where he authored two presentations.

Dr Sommer attended the annual Goldschmidt meeting in Davos, Switzer-



Mr. Johnfas Sanga from Tanzania receiving his Mineral Resource Management degree. Mr Sanga is employed by Tanzanite One, the main producer of the mineral Tanzanite. With him is Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences at the UFS.

land with four presentations (posters). He also convened one of the sessions. He organised a diamond workshop at the Department of Geology, UFS with the following invited speakers: Mss Debbie Bowen (Gem Diamonds), Claire Palmer (Gem Diamonds) and Mr Ramon Ferraras (Consultant). Dr Sommer also presented workshops relating to mantle processes and diamond genesis at Letseng (Lesotho), Koffiefontein, Jagersfontein, Voorspoed, Cullinan and Kimberley.

The annual AngloGold Ashanti competition for bursars from all the universities took place in January 2010 and students from the Department of Geology at the UFS excelled by obtaining the following positions: Mr Donovan Pienaar (Honours student) won the competition for Geology students with Mr Cornu van Niekerk in second position. Donovan also won the overall competition that included other disciplines such as metallurgy and engineering as well.

A delegation of students attended the Geoforum student congress that was held in Johannesburg, Gauteng from 8 to 11 July 2009. The following students attended the congress: Mss J Potgieter, B Kennedy, C Veldsman, M Purchase, T Lekgetlo, E Magnus, F Madala, and Messers D Pienaar, J Ras, C Mphatse, M Mtebe and N Chabangu.

The following excursions took place during 2009:

Mrs Pretorius accompanied the honours students in mineralogy to Mintek and the University of Pretoria (UP) to introduce them to aspects of analytical mineralogy and crystallography.

Prof. Colliston and Dr Praekelt conducted a number of excursions to the Edenburg District to teach second-year students the intricacies of field mapping techniques.

Prof. Colliston conducted his annual mine-mapping excursion to Tshepong Mine from 9 to 13 March 2009 for the Honours students studying structural geology.

The first-year students were entertained on a field excursion to the Reddersburg District to study aspects of dolerite intrusions and sedimentology of the Karoo Supergroup.

Prof. Haschke undertook a visit to Kimberley to discuss aspects relating to petrology with third-year students on 7 May 2009.

Prof. Tredoux again conducted her excursion for third-year students (GLG354/374) to the Vredefort Impact structure on 17 and 18 May 2009.

From 30 April until 5 May 2009 Honours students studying petrology joined Prof. Haschke on an excursion to Paternoster.

During September 2009 Drs Praekelt, Loock and Mrs Pretorius took students (GLG202) on an excursion to the Barclay

East environs to study volcanic deposits as well as sedimentology of the Karoo Supergroup.

As part of the course in economic geology, Prof. Gauert paid a visit to Harmony Mine to introduce students to aspects of the Witwatersrand gold deposits.

Dr Loock also conducted an excursion to Austins Post with two groups of students on 16 and 17 October 2009.

Mr Nel performed the sedimentological practical (GLG222) on a visit to the Brandfort area in September 2009.

Networking

Drs Christoph Hauenberger, Juergen Konzett and Lucas Konrad visited the department during the first semester to discuss projects relating to kimberlite geology with Dr Sommer of the department.

In January 2010, a team under the leadership of Prof. Vincent Courtillot from the Institute for Physics of the Globe in Paris, France, returned once more to the department for logistical aid and discussions pertaining to their field work in Lesotho as part of the !Khure Africa cooperation programme.

The department also received a visit from Dr Robert Trumbull from the GFZ in Potsdam to discuss joint research. His visit was in terms of the international agreement that the department is involved in, namely the Inkaba ye Afrika Germany-South Africa collaboration.

Community service

Ms Mariette Erwee, Prof. Marian Tredoux and Mrs Huibrie Pretorius conducted two workshops for teachers at the Science Centre at the Boyden Observatory and one workshop at the Department of Geology. The aim of these workshops is to provide teachers (intermediate and senior phase) with the necessary content knowledge of earth and space science. This knowledge will enable the teachers to impart science knowledge to the learners in Grades 4 to 7. A road show was also conducted in Kroonstad where the learners of five schools were exposed to interactive science exhibitions. The faculty benefited in terms of exposure in that different subjects such as chemistry, entomology, botany, geology and geography were exhibited. The department also had exposure during the Scifest in Grahamstown and the Sasol and Nampo exhibitions.

Research outputs

Research articles

Ahmadian, J., Haschke, M., McDonald, I., Regelous, M., Ghorbani, M., Emami, M. & Murata, M. 2009. High magmatic flux during Alpine-Himalayan collision: Constraints from the Kal-e-Kafi complex, central Iran. *Geological Society of America Bulletin* 121(5/6): 857-868.

Kottke-Levin, J., Tredoux, M. & Gräbe, P.-J. 2009. An investigation of the geochemistry of the Middle Group of the eastern Bushveld complex, South Africa. Part 1 – The chromitite layers. *Applied Earth Science: Transactions of the Institute for Mineralogy and Metallurgy, Part B* 118(3/4):111-130.

Shafiei, B., Haschke, M. & Shahabpour, J. 2009. Recycling of orogenic arc crust triggers porphyry Cu-mineralization in Kerman Cenozoic arc rocks, southeastern Iran. *Mineralium Deposita* 44(3): 265-283.

Sommer, H. 2009. "Wet" low angle subduction: A possible mechanism below the Tanzania craton 2 Ga ago. *Mineralogy and Petrology* 96: 113-120.

Conference contributions

Ahmadian, J., Haschke, M., McDonald, I., Ghorbani, M., Emami, M. & Murata, M. 2009. *High magmatic flux during Alpine-Himalayan collision: The Kal-e-Kafi Complex, Iran.* Proceedings of the 10th Biennial Meeting of the Society for Geology Applied to Mineral Deposits (SGA), Townsville, North Queensland, Australia. 17-20 August. Extended abstract # 299.

Erhardt, S. & Sommer, H. 2009. *Formation of water-bearing 2D-defects: An intended case study on xenoliths from the Letseng mine.* Poster presented at the 19th Annual V.M. Goldschmidt Conference: Our

volatile earth, Davos, Switzerland. 21-26 June.

Erwee, M., Tredoux, M. & Joubert, H. 2009. *An evaluation of the educational impact of the EarthWise teacher training project.* Proceedings of the 11th SAGA Biennial Technical Meeting and Exhibition: Ancient rocks to modern techniques, Royal Swazi Spa, Swaziland. 14-18 September. p. 608-610.

Fuchs, S. & Gauert, C. 2009. *Bushveld complex main zone at Phoshiri: Geochemical evidence for convection-triggered lithological variation in a replenished but marginally fractionated magmatic system.* Proceedings of the Annual Meeting of the German Mineralogical Society (DMG), Halle/Saale, Germany. 13-17 September. p.143.

Haschke, M., Ahmadian, J. & McDonald, I. 2009. *Cu-mineralization and arc-root delamination during the Alpine-Himalayan collision, Iran.* Proceedings of the 10th Biennial Meeting of the Society for Geology Applied to Mineral Deposits (SGA), Townsville, North Queensland, Australia. 17-20 August. Extended abstract # 281.

Haschke, M., Andriessen, P. & Persano, C. 2009. *Exhumation under extreme topographic gradients at propagating plateau rims: Constraints from apatite fission track and apatite (U-Th)/He ages.* Poster presented at the 99th Annual Meeting of the Geologische Vereinigung: Earth control on planetary life and environment, Göttingen, Germany. 5-7 October.

Jacobson, L., De Beer, F. & Van der Westhuizen, W.A. 2009. *The application of X-ray Fluorescence and X-Ray Tomography to the physical analysis of southern African ceramics and their relevance to provenancing problems.* Paper presented at the Cera-

mics Workshop, University of Pretoria, Pretoria, South Africa. 5-6 March.

Lekgetho, T.B., Deshenthree, C. & Tredoux, M. 2009. *Investigation of the behaviour of platinum-group minerals and base metals sulphides during flotation of UG2 ore.* Proceedings of the 11th SAGA Biennial Technical Meeting and Exhibition: Ancient rocks to modern techniques, Royal Swazi Spa, Swaziland. 14-18 September. p. 608-610.

MacDonald, N., Clark, J.H.A., Holmes, P.G. & Gauert, C. 2009. *Aspects of palaeo-terrace formation and stream sediment petrography of the Orange and Vaal River confluence in the Douglas area.* Proceedings of the 11th SAGA Biennial Technical Meeting and Exhibition: Ancient rocks to modern techniques, Royal Swazi Spa, Swaziland. 14-18 September. p. 608-610.

MacLennan, S.A., Moodley, L., Weckmann, U., Ritter, O., Nube, A., Chen, X., Deacon, J., Willkommen, G., Barth, R., Streich, R., Tietze, K. & De Wit, M.J. 2009. *Magnetotelluric experiment across southern Barberton Greenstone Belt: a students' perspective of the field work.* Proceedings of the 11th SAGA Biennial Technical Meeting and Exhibition: Ancient rocks to modern techniques, Royal Swazi Spa, Swaziland. 14-18 September. p. 608-610.

Madala, F. & Tredoux, M. 2009. *The Nickel Deposit at Bon Accord, Barberton, South Africa.* Proceedings of the 11th SAGA Biennial Technical Meeting and Exhibition: Ancient rocks to modern techniques, Royal Swazi Spa, Swaziland. 14-18 September. p. 608-610.

Mphatse, C.T., Gauert, C.D.K., Denge, E. & Maluma, M. 2009. *Mineralogy of the Middle Group chromitite cumulates at the Tweefontein*

Chrome Mine section, central Critical Zone, eastern Bushveld Complex. Proceedings of the 11th SAGA Biennial Technical Meeting and Exhibition: Ancient rocks to modern techniques, Royal Swazi Spa, Swaziland. 14-18 September. p. 613-615.

Nube, A., Weckmann, U., Ritter, O., Chen, X., Deacon, J., MacLennan, S.A., Moodley, L., De Wit, M., Willkommen, G., Barth, R., Streich, R. & Tietze, K. 2009. *Magnetotelluric measurements across the southern Barberton greenstone belt: Data analysis.* Proceedings of the 11th SAGA Biennial Technical Meeting and Exhibition: Ancient rocks to modern techniques, Royal Swazi Spa, Swaziland. 14-18 September. p. 608-610.

Potgieter, J., Sommer, H., Regenauer-Lieb, K., Gasharova, B. & Purchase, M. 2009. *OH and CO₂ diffusion profiles in garnets from eclogitic xenoliths from the Rovic diamond mine, South Africa (UNESCO IGCP 557).* Proceedings of the 19th Annual V.M. Goldschmidt Conference: Our volatile earth, Davos, Switzerland. 21-26 June. *Geochimica et Cosmochimica Acta* 73(13): A1046-A1046.

Pretorius, H., Andreoli, M.A.G., Faanhof, A. & Tredoux, M. 2009. *The behaviour of radionuclides in the groundwater of Vaalputs, Namaqualand, South Africa.* Proceedings of the Biennial Groundwater Conference: Groundwater - Pushing the limits, NH The Lord Charles, Somerset West, South Africa. 16-18 November. p. 125.

Purchase, M., Sommer, H., Regenauer-Lieb, K., Gasharova, B. & Potgieter, J. 2009. *OH partitioning coefficient between garnets and melt inclusions in Iherzolite xenoliths from the Kimberly diamond mine, South Africa (UNESCO IGCP 557).* Proceedings of the 19th Annual V.M. Goldschmidt Conference: Our volatile earth, Davos, Switzerland. 21-26 June. *Geochimica et Cosmochimica Acta* 73(13): A1059-A1059.

Sommer, H., Regenauer-Lieb, K. & Gaede, O. 2009. *Weertman cracks and the near sonic extraction of diamonds from the Earth's mantle (UNESCO IGCP 557).* Proceedings of the 19th Annual V.M. Goldschmidt Conference: Our volatile earth, Davos, Switzerland. 21-26 June. *Geochimica et Cosmochimica Acta* 73(13): A1249-A1249.

Tredoux, M., Lithauer, A. & Vermeulen, P.D. 2009. *The mobility of U in groundwater: A study done in a semi-arid region of South Africa.* Proceedings of the 19th Annual V.M. Goldschmidt Conference: Our volatile earth, Davos, Switzerland. 21-26 June. *Geochimica et Cosmochimica Acta* 73(13): A1345-A1345.

Tredoux, M., Oberthuer, T., Reid, D. & Trumbull, R. 2009. *Platinum value chain.* Proceedings of the 11th SAGA Biennial Technical Meeting and Exhibition: Ancient rocks to modern techniques, Royal Swazi Spa, Swaziland. 14-18 September. pp. 608-610.

Contact details

Prof. Willem van der Westhuizen

Faculty of Natural and Agricultural Sciences
Department of Geology
University of the Free State
PO Box 339
Bloemfontein
South Africa
9300

Telephone: +27 51 401 2515
Fax: +27 51 401 3815
E-mail: vdwestwa@ufs.ac.za
Website: www.ufs.ac.za

Staff

Professor: Prof. Willem van der Westhuizen

Associate Professors: Profs. Wayne Colliston, Christoph Gauert, Michael Haschke, Marian Tredoux

Senior Lecturers: Drs Hermann Praekelt, Holger Sommer

Junior Lecturers: Ms Huibrie Pretorius

Part-Time Lecturers: Messrs Johan Looek, Leon Nel

EarthWise-officer: Ms Mariette Erwee

Affiliated Lecturers: Prof. Gerhard Beukes, Messrs PG Laurens, Johann Grobler, Ron Vrijens, André Dunne, Derek Hall, Mss Daleen Diedericks, Vanessa Lickfold

Senior Officer: Ms Rina Immelman

Secretary: Ms Petro Swart

Technician: Mr Andries Felix

Officer: Professional Services: Mr Peet Roodt

Assistant Officer: Mr Jonas Choane

Technical Officer: Mr Daniël Radikgomo





13

Mathematical Statistics and Actuarial Science

Overview

The Department of Mathematical Statistics and Actuarial Science has more than 4 000 undergraduate and 40 postgraduate students. The Actuarial programme is offered up to accreditation Level 1. The department is in the process of obtaining accreditation Level 2 from the Actuarial Society of South Africa under a mutual recognition agreement with the Institute of Actuaries in the United Kingdom (UK). Mr Frans Koning, lecturer in the department and Head of the Actuarial division, qualified as an actuary in 2009.

At the end of September 2009, Prof. Daan de Waal retired as Head of Department after a most distinguished

and record-breaking tenure of 34 years in the position. His successor, in the role of departmental chairman, is Prof. Robert Schall.

Activities and achievements

Staff members were involved in several national and international collaborative research projects. Prof. Max Finkelstein was a visiting researcher at the Max Planck Institute for Demographic Research in Rostock, Germany from July to August 2009. He also paid research visits to the Ewha Womans University in Seoul, Korea, in July 2009 and to the St Petersburg Elektropribor Institute, Russia, in December 2009. Towards



“The department ended the year with a record number of publication outputs and it is hoped that this positive trend will continue.”

- Prof. Robert Schall





the end of 2009 Prof. Finkelstein received a National Research Foundation (NRF) rating of B1, as well as the research prize of the Faculty of Natural and Agricultural Sciences of the University of the Free State (UFS) for 2009. Prof. Finkelstein gave an invited lecture at the *Conference on Mathematical Methods in Reliability* in Moscow, Russia, in June 2009 and an invited discussion paper at the *Stellenbosch Statistical Symposium* of the International Society of Engineering Statistics in August 2009. The latter presentation was published as an invited discussion paper in the *Journal of Engineering Statistics*. Prof. Finkelstein is the Editor of the *South African Statistical Journal*.

Prof. Daan de Waal and his research group continued their work on risk in the energy market, a project funded by Eskom. Research concentrated on the modelling and prediction of the Southern Oscillation Index (SOI), which in turn was found to be a good predictor of annual inflow into the Gariep Dam. The research is relevant to the optimisation of hydroelectric power generation by Eskom. Prof. De Waal presented invited lectures at the *Workshop on Renewable Energy and Finance* (Port Elizabeth, October 2009), at the *Symposium in Honour of the late J van Noortwijk* (Delft, The Netherlands, November 2009), and was a keynote speaker at the *7th International Workshop on Probabilistic Methods* (Delft, The Netherlands, November 2009).

Prof. Abrie van der Merwe, who holds an NRF C1 rating, did research on Bayesian methods in quality control, random effects models and linear and



non-linear functions of parameters of the binomial and Poisson distributions. Prof. Van der Merwe supervised a number of graduate students based at other South African universities.

Prof. Robert Schall is a statistical consultant to Quintiles, an international clinical contract research organisation, and to Boehringer Ingelheim, an international pharmaceutical company. Prof. Schall's research is in the area of clinical trials and biostatistics, in particular on the statistical modelling and analysis of electrocardiographic data. Prof. Schall

gave invited lectures at the *Conference of the National Association of Pharmaceutical Manufacturers of South Africa* (Johannesburg, August 2009) and at the *3rd Annual Clinical Forum* of the Drug Information Association (Nice, France, October 2009). Prof. Schall serves as an Associate Editor of the *South African Statistical Journal*.

Dr Martin van Zyl continued his research in financial statistics.

The department ended the year with a record number of publication outputs

and it is hoped that this positive trend will continue.

The department received several national and international visitors, among them Prof. Pieter van Gelder of the University of Technology in Delft, The Netherlands and Prof. Jan Dhaene of the Catholic University of Louvain, Belgium. Both visitors presented lectures at the annual *Workshop on Applications of Statistics and Probability in Energy, Finance and Actuarial Science*, hosted by the department in March 2009.

Research outputs

Research articles

Cha, J. & Finkelstein, M. 2009. On a terminating shock process with independent wear increments. *Journal of Applied Probability* 46: 353-362.

Finkelstein, M. 2009. On damage accumulation and biological aging. *Journal of Statistical Planning and Inference* 139: 1643-1649.

Finkelstein, M. 2009. On some models of acceptable risk. *International Journal of Performability Engineering* 5: 5-14.

Finkelstein, M. 2009. On systems with shared resources and optimal switching strategies. *Reliability Engineering and System Safety* 94: 1258-1263.

Finkelstein, M. 2009. Rejoinder to 'Comments on understanding the shape of the mixture failure rate (with engineering and demographic applications)'. *Applied Stochastic Models in Business and Industry* 25: 673-677.

Finkelstein, M. 2009. Understanding the shape of the mixture failure rate (with engineering and demographic applications). Discussion paper. *Applied Stochastic Models in Business and Industry* 25: 643-663.

Finkelstein, M. 2009. Virtual age of non-repairable objects. *Reliability Engineering and System Safety* 94: 669-675.

Finkelstein, M. & Vaupel, V. 2009. Survival as a function of life expectancy (with J. Vaupel). *Demographic Research* 21: 879-884.

Hugo, J. & Van der Merwe, A.J. 2009. Bayesian tolerance intervals for the balanced one-way random effects model with non-normal measurement errors. *South African Statistical Journal* 43: 219-268.

Van der Merwe, S. 2009. Student success: Data mining measures what

matters. *Journal for New Generation Sciences* 7(2): 268-286.

Van Zyl, J.M. 2009. Modelling inflows into the Gariep Dam using Bayesian dynamic models. *South African Statistical Journal* 43: 85-96.

Reports

Chikobvu, D. & Van der Merwe, A.J. 2009. *A process capability index for averages of observations from new batches in the case of the balanced random effects model with three variance components.* Technical report number 395 to the University of the Free State, Bloemfontein, South Africa.

Chikobvu, D., Van der Merwe, A.J. & De Beer, J.A. 2009. *A Bayesian approach for comparing the relative returns of securities using the reciprocal of the coefficient of variation.* Technical report number 400 to the University of the Free State, Bloemfontein, South Africa.

Harvey, J. & Van der Merwe, A.J. 2009. *Bayesian confidence intervals for the ratio of means of lognormal data with zeros.* Technical report number 398 to the University of the Free State, Bloemfontein, South Africa.

Mokete, T.D. 2009. *Determinants of private investment in South Africa investor confidence index approach.* Technical report number 392 to the University of the Free State, Bloemfontein, South Africa.

Schall, R., Ring, A. & Endrenyi, L. 2009. *Residuals and outliers in replicate design crossover studies.* Technical report number 391 to the University of the Free State, Bloemfontein, South Africa.

Senatsi, B. & Verster, A. 2009. *Investigating nonparametric methods and tests.* Technical report number 393 to the University of the Free State, Bloemfontein, South Africa.

Van der Merwe, A.J. & Raubenheimer, L. 2009. *Bayesian estimation of functions of binomial rates.* Technical report number 401 to the University of the Free State, Bloemfontein, South Africa.

Van Zyl, J.M. 2009. *A note on box-cox quantile regression estimation of the parameters of the generalized Pareto distribution.* Technical report number 399 to the University of the Free State, Bloemfontein, South Africa.

Verster, A. & De Waal, D.J. 2009. *Approximating the generalized Burr-Gamma with a generalized Pareto-type of distribution.* Technical report number 397 to the University of the Free State, Bloemfontein, South Africa.

Verster, A. & De Waal, D.J. 2009. *Modelling risk on losses due to water spillage for hydro power generation.* Technical report number 394 to the University of the Free State, Bloemfontein, South Africa.

Von Maltitz, M.J. 2009. *An Application of Sequential Regression Multiple Imputation on Panel Data.* Technical report number 396 to the University of the Free State, Bloemfontein, South Africa.

Chapters in books

De Waal, D.J. 2009. Posterior predictions on river discharges. In *Risk and Decision Analysis in Maintenance Optimization and Flood Management*, edited by M.J. Kallen and S.P. Kuniewski. Amsterdam: IOS Press. pp. 43-56.

De Waal, D.J. & Verster, A. 2009. Losses due to spillage at Gariep Dam. In: *Proceedings of the 7th International Workshop on Probabilistic Methods*, edited by P.H.A.J.M. Van Gelder, D. Proske & J.K. Vrijling. Delft: Delft University of Technology. pp. 23-36.

Conference contributions

Chikobvu, D. & Van der Merwe, A.J.

2009. *Bayesian capability indices in pharmaceutical research*. Poster presented at the 7th International Workshop on Objective Bayes Methodology, Wharton School of the University of Pennsylvania, Philadelphia, USA. 5-9 June.

Chikobvu, D. & Van der Merwe, A.J.

2009. *Process capability indices for the balanced random eEffects model*. Invited lecture presented at the 57th Session of the International Statistical Institute (ISI): Our past, present and future, International Convention Centre, Durban, South Africa. 16-22 August.

De Waal, D.J. 2009. *Losses due to spillage at Gariep Dam*. Invited keynote

presented at the 7th International Workshop on Probabilistic Methods, Delft University of Technology, The Netherlands. 25-26 November.

De Waal, D.J. 2009. *Posterior predictions on river discharges*. Invited

paper presented at the Symposium in remembrance of Prof Jan M van Noorwijk, Delft, The Netherlands. 24 November.

De Waal, D.J. & Verster, A. 2009.

Losses due to spillage at Gariep Dam. Proceedings of the 7th International Workshop on Probabilistic Methods, Delft University of Technology, The Netherlands. 25-26 November. pp. 23-36.

Finkelstein, M. 2009. *Lifesaving and quality of life*. Invited lecture

presented at the Stellenbosch Statistical Symposium: ISBIS Satellite Meeting, University of Stellenbosch,

Stellenbosch, South Africa. 24-26 August.

Finkelstein, M. 2009. *On shock processes*. Invited lecture presented

at the Conference on Mathematical Methods in Reliability (MMR2009): Theory, methods, applications, Gubkin Russian State Oil and Gas University, Moscow, Russia. 22-27 June.

Finkelstein, M. 2009. *Understanding the shape of the mixture failure rate (with engineering and demographic applications)*. Invited discussion lecture

presented at the Stellenbosch Statistical Symposium: ISBIS Satellite Meeting, University of Stellenbosch, Stellenbosch, South Africa. 24-26 August.

Oosthuizen, W. 2009. *Methods for the assessment of the assumption of normality of data*. Presentation. Paper

presented at the 57th Session of the International Statistical Institute (ISI): Our past, present and future, International Convention Centre, Durban, South Africa. 16-22 August.

Ring, A. & Schall, R. 2009. *Proper and improper analysis of QT prolongation*. Invited lecture presented at the

Stellenbosch Statistical Symposium: ISBIS Satellite Meeting, University of Stellenbosch, Stellenbosch, South Africa. 24-26 August.

Schall, R. 2009. *Bioequivalence: The case of scaling*. Invited lecture

presented at the 3rd Annual Clinical Forum of the Drug Information Association (DIA), Nice Acropolis Congress Centre, Nice, France. 19-21 October.

Schall, R. 2009. *Bioequivalence*. Invited lecture presented at the Congress

of the National Association of Phar-

maceutical Manufacturers (NAPM): Generic Medicines Congress, Southern Sun Grayston Hotel, Sandton, Johannesburg, South Africa. 6-7 August.

Schall, R. & De Waal, D.J. 2009. *Rain fall and stock pile levels as predictors of loss of output of South African Coal power stations*. Paper presented at the Eskom Risk Workshop, University of the Free State, Bloemfontein, South Africa. 26 February.

Van der Merwe, S. 2009. *Bayesian additive regression trees sequential regression multiple imputation*. Paper presented at the 57th Session of the International Statistical Institute (ISI): Our past, present and future, International Convention Centre, Durban, South Africa. 16-22 August.

Verster, A. & De Waal, D.J. 2009. *Approximating the generalized Burr-Gamma with a GP-type of distribution*. Paper presented at the Energy Workshop, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa. 28-30 October.

Verster, A. & De Waal, D.J. 2009.

Modelling risk on losses due to water spillage for hydro power generation. Paper presented at the 57th Session of the International Statistical Institute (ISI): Our past, present and future, International Convention Centre, Durban, South Africa. 16-22 August.

Von Maltitz, M.J. 2009. *An application of sequential regression multiple imputation on panel data*. Paper

presented at the 57th Session of the International Statistical Institute (ISI): Our past, present and future, International Convention Centre, Durban, South Africa. 16-22 August.

Von Maltitz, M.J. 2009. *An application of sequential regression multiple imputation on panel data*. Paper

presented at the 57th Session of the International Statistical Institute (ISI): Our past, present and future, International Convention Centre, Durban, South Africa. 16-22 August.

Staff

Professors: Profs. Daan de Waal, Max Finkelstein, Robert Schall, Abrie van der Merwe

Senior Lecturers: Ms Linda van der Merwe, Dr Martin van Zyl

Lecturers: Drs Inet Kemp, Andréhette Verster, Delson Chikobvu; Mss Elizabeth Girmay and Wallina Oosthuizen; Messrs Frans Koning, Dries Naudé, Michael von Maltitz, Sean van der Merwe

Part-time Lecturers: Ms Zani Ludick, Mr GJ Mellet

Secretary: Ms Elize Mathee

Assistant Officer: Ms Ella Hayes

Messenger: Mr William Baranye

Contact details

Prof. Robert Schall

Faculty of Natural and Agricultural Sciences
Department of Mathematical Statistics and
Actuarial Science
University of the Free State
PO Box 339
Bloemfontein
South Africa
9300

Telephone: +27 51 401 2945

Fax: +27 51 444 2024

E-mail: schallr@ufs.ac.za

Website: www.ufs.ac.za



14 Mathematics and Applied Mathematics

Overview

The Department of Mathematics and Applied Mathematics offers a wide range of courses at both undergraduate and postgraduate level. Many of the staff members are active in research and community service.

Activities and achievements

Prof. Schoombie is still working on the modelling of evolution processes, using the principles of multiple games technique. Part of this project is done in cooperation with Prof. Eben Maré from the University of Pretoria.

Furthermore, Prof. Schoombie, together with a M.Sc. student, launched a re-

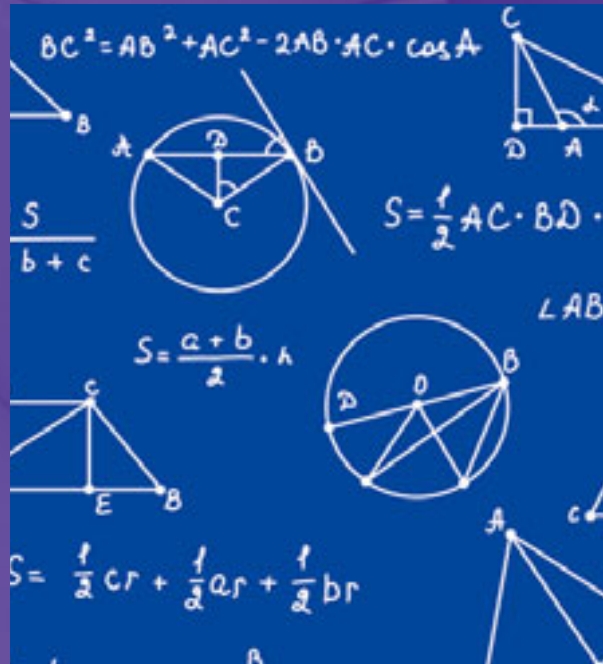
search project on the modelling of cancer tumours. The student, Ms Larisse Bolton, is planning to continue with this research within the framework of her Ph.D. studies.

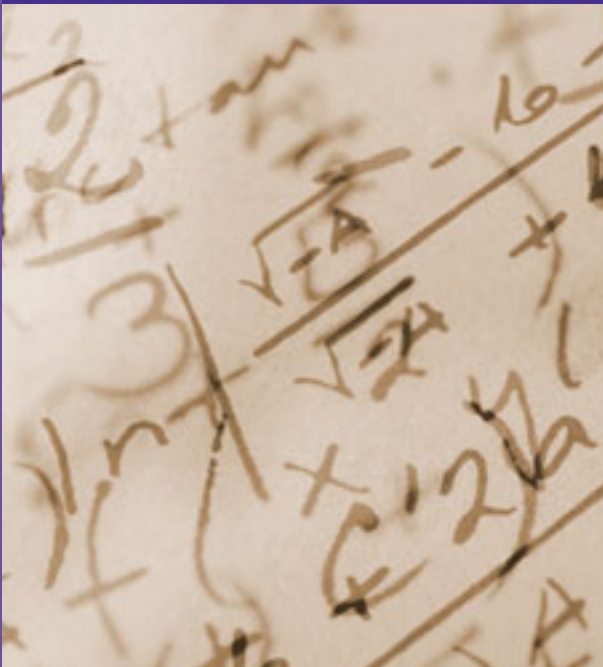
Prof. Johan Meyer paid a visit to Prof. Szigeti at the University of Miskolc in Hungary in April 2009 and started work on homomorphic images of triangular matrix rings. He also attended the biennial International Conference on Near-rings and Related Topics in Vorau, Austria in July 2009, where he presented a talk on his work with W-F Ke: *Matrix near-rings and 0-primitivity*.



“Many of the staff members are active in research and community service”

- Prof. Alain Clout





Prof. Meyer and Ms Howell, a former Ph.D. student of his, published a joint paper on work that resulted from Ms Howell's Ph.D. thesis. A further paper is envisaged during 2010/11.

Prof. Meyer also continued his involvement in Mathematics Olympiads (nationally and internationally) that placed an extra burden on his research time. This involvement is nevertheless important for general mathematical skills development in the South African and broader African community.

Prof. Alain Clout continued with his fundamental research on the topic of partial derivatives of non-integer orders and their applications in groundwater modelling.

Prof. Thomas Acho attended the Society of Industrial and Applied Mathematics (SIAM) Conference in Miami, Florida, United States of America (USA) that focused on the analysis of partial differential equations where he presented a contribution on the eigen functions and eigen values for high-energy resonance for non-standard Sturm-Liouville operator with a perturbation of the Coulomb potential.



Prof. Aho was also invited by the editor of the American Mathematical Society Journal to act as a reviewer for two of their articles.

In 2009 Dr Samantha Dorfling, in collaboration with Dr MJ Dorfling, did research on recognisable colourings of graphs and succeeded in proving all three conjectures suggested by G Chartrand *et al.*

in an article that appeared in the *Journal of Discussiones Mathematicae Graph Theory* in 2008.

Dr Dorfling also paid two research visits to Prof. E Jonck from the Department of Mathematics at the University of Johannesburg. During these visits they started a joint research project on broadcast chromatic numbers.

Research outputs

Research articles

Meldrum, J.D.P. & Meyer, J.H. 2009. The augmentation ideal in group near-rings. *Monatshefte für Mathematik* 156: 313-323.

Meyer, J.H., Szigeti, J. & Van Wyk, L. 2009. On ideals in triangular matrix rings. *Periodica Mathematica Hungarica* 59(1): 135-141.

Howell, K-T. & Meyer, J.H. 2009. Finite-dimensional near-vector spaces over fields of prime order. *Communications in Algebra* 38: 86-93.

Conference contributions

Acho, T.M. 2009. *Eigenfunctions and eigenvalues for high-energy resonance for non-standard Sturm-Liouville operator with a perturbation of the coulomb potential.* Paper presented at the Society of Industrial and Applied Mathematics (SIAM) Conference on Analysis of Partial Differential Equations (PD09), Florida Hilton Miami Downtown, Miami, USA. 7-9 December.

Contact details

Prof. Alain Clout

Faculty of Natural and Agricultural Sciences
Department of Mathematics and
Applied Mathematics
University of the Free State
PO Box 339
Bloemfontein
South Africa
9300

Telephone: +27 51 401 2190
Fax: +27 51 401 3805
E-mail: cloutah@ufs.ac.za
Website: www.ufs.co.za

Staff

Main Campus:

Professors: Profs. Johan Meyer, Schalk Schoombie, Dana Murray, Alain Clout

Associate Professor: Prof. Thomas Acho

Senior Lecturers: Dr Hubertus Bargenda, Ms Julia van Niekerk

Lecturers: Dr Samantha Dorfling, Mr Christiaan Venter, Ms Ansa Kleynhans

Part-time Lecturers: Mss Magrietha Theron, Martie Calitz, Anita Swart, Marina Botha

Administrative Officer: Ms Marinda Venter

Qwaqwa Campus:

Associate Professor: Prof. Jo Schröder

Lecturer: Mr Patrick Mbambo

Temporary Lecturers: Mr Nallapan Sebastian, Ms Mary de Jager, Ms Christa Faber



15 Microbial, Biochemical and Food Biotechnology

Overview

Despite 2009 generally being a dismal year due to the downturn in the global economy, for the Department of Microbial, Biochemical and Food Biotechnology it actually turned out to be a good year. The year started on a high note when the department celebrated its 50th anniversary. The festivities commenced with a public lecture titled *The origin of life: Exactly how did life begin?* on Friday, 13 March 2009, as part of the Darwin commemorative lecture series at the University of the Free State (UFS). The guest speaker was Prof. Doug Rawlings from Stellenbosch University. This event was a great success, judging by the attendance. It was followed by a reunion of current and previous staff and

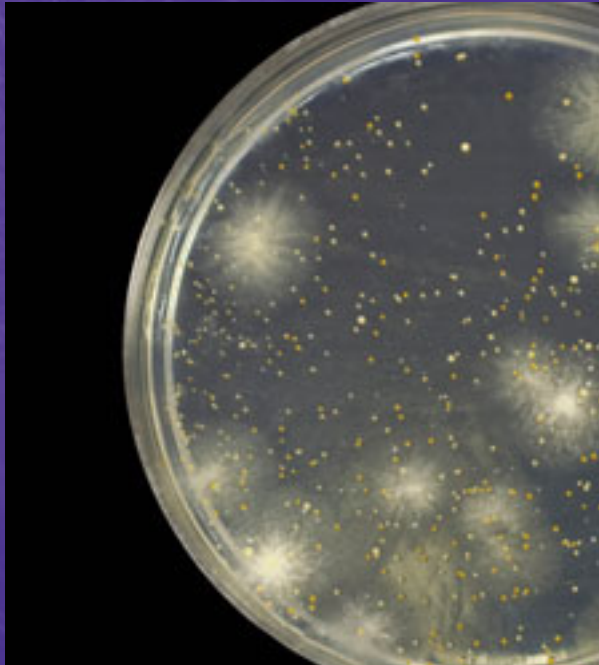
postgraduate students of the department at a barbecue the following day. The proceedings were concluded with a dinner in the UFS Centennial Hall that was attended by 153 guests. During the dinner the guests were entertained to a presentation on the origins and growth of the department which, from humble beginnings, developed to currently being one of the largest departments in the Faculty of Natural and Agricultural Sciences in respect of the number of staff and students as well as research outputs.

In terms of the acquisition of research equipment this has been an exceptional year for the department. The faculty's

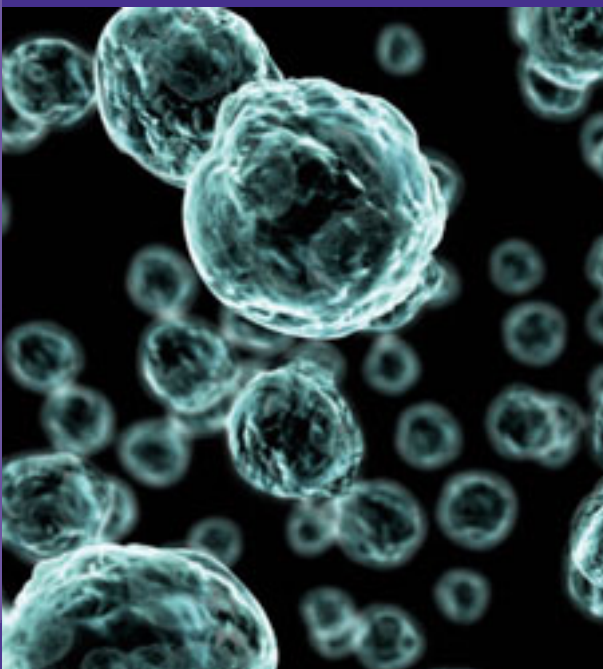


“In terms of the acquisition of research equipment this has been an exceptional year for the department.”

- Prof. James du Preez



The first departmental head and subsequent departmental chairpersons at the 50th anniversary dinner on 14 March 2009. From the left are: : Profs Bernard Prior (1991–1998), Piet Lategan (1962–1990) Derek Litthauer (1998–2002), James du Preez (2002–). Prof. Hans Potgieter (not in the photo) was acting head during 1959–1962.



strategic research fund financed equipment to the value of more than R2 million, while still more equipment was purchased with funds from other sources. Here the BioPAD UFS Metagenomic Platform research group played a major role in improving the department's research infrastructure through the acquisition of a Tecan Robotics Liquid Handling System (Evo 200), which allows automated high-throughput screening of metagenome libraries in a 96-well format. This versatile system can be used for diverse applications from automated PCR setup to protein crystallography. The facilities of the Platform were further improved by the purchase of an Agilent 2100 BioAnalyser with funding obtained from the Faculty of Natural and Agricultural Sciences.

Further good news was that the Department of Education allocated R15,9 million for the 2010 fiscal year towards the construction of new undergraduate laboratories. These will constitute the ground floor of the new building just North of and linking to our Biotechnology building. Construction is due to start in April 2010. This amount is, unfortunately, not sufficient for the entire two-storey building that has been planned, but will at least facilitate the first phase of construction that will alleviate our urgent need for additional laboratory space. Other great news was that the Department of Education also approved a grant of R7 million for the 2010/2011 fiscal year for the purchase of equipment for the training of postgraduate students and research. Together with the equipment bought this year, this grant will put the department in a very favourable position



At the Darwin commemorative lecture in the Wynand Mouton Theatre on 13 March 2009 are, from the left: Profs Jo van As (departmental chairperson of the Department of Zoology and Entomology, initiator of the Darwin year celebrations at the UFS), Doug Rawlings (guest speaker and head of the Department of Microbiology, Stellenbosch University), Dr Carlien Pohl-Albertyn and Prof. Koos Albertyn (academics of the Department of Microbial, Biochemical and Food Biotechnology and organisers of this event).

to conduct high-quality research and enhance student training.

The output of graduates in 2009 was slightly less than in previous years: two Ph.D., ten M.Sc. and thirteen B.Sc. honours degrees were conferred. In September 2009 the third-year microbiology students undertook an excursion to SA Breweries (SAB) in Gauteng. This included lectures by Prof. Bettie Lodolo, Brewing Consultant: Brewing Science and Hygiene of SAB and also an affiliate associate professor of the department, at the SAB Training Institute in Kyalami, a visit to SAB Alrode, followed by a visit to the SAB World of Beer in central Johannesburg. This was the second year in succession that this excursion has been undertaken and it is becoming an annual event due to its success.

Activities and achievements

This was a memorable year also for staff and students who excelled. For his research on novel antifungal compounds, Prof. Lodewyk Kock was placed in the B1 researcher category by the National Research Foundation (NRF). At present this is the highest NRF rating held by an academic at UFS and he is one of only two B1-rated UFS researchers. Prof. Kock's research was also included in the NRF Blue Skies Research Programme, the only successful application from the UFS. Prof. Esta van Heerden was selected winner of the 2009 TWAS (the academy of sciences for the developing world) Young Scientist Award, which is administered by the Academy of Science of South Africa (ASSAf). The committee that evaluated the nominations was

particularly impressed by Prof. Van Heerden's outstanding self-initiated research, her record of training postgraduate students, the potential contribution of her research to South African society and her involvement in furthering the public awareness of science. The TWAS Young Scientist Award was awarded at the ASSAf Awards Ceremony that was held on 5 October 2009 at the CSIR Convention Centre in Pretoria. Prof. Van Heerden also received the UFS faculty award for mentorship in recognition of her success in training postgraduate students.

A successful conviction for selling diluted olive oil under the guise of virgin olive oil was handed down in the Special Commercial Crimes Court in Durban on 23 March 2009. Prof. Kock and his SA Fryer Oil Initiative (SAFOI) team at UFS, in collaboration with the Olive Growers' Association, Agrilnspec and the South African Police Services, were responsible for exposing this unlawful practice. It is the first successful conviction of this kind in the South African food industry.

An enthusiastic group of postgraduate students, marketers and lecturers from the Faculty of Natural and Agricultural Sciences shared their passion for science with children and other SciFest Africa visitors in Grahamstown from 25 – 31 March 2009. A total of 71 000 people from across the country attended the festival. The theme of the exhibit was *From the micro-world to the macro-cosmos* and covered everything from microbiology to astrophysics, with students from the department participating in the UFS exhibit. UFS won the prize for the best exhibition.

Several international conferences were attended by staff and students. Prof. Kock, Dr Carlien Pohl-Albertyn, four Ph.D. students and Ms Andri van Wyk (professional officer) of the Lipid Biotechnology group attended the 17th Congress of the International Society for Human and Animal Mycology in Tokyo, Japan in May 2009. Five posters and one lecture were presented. Prof. James du Preez attended the 27th International Specialized Symposium on Yeasts (ISSY27) in Paris and the 14th European Congress on Biotechnology in Barcelona. During ISSY27 he represented South Africa at the meeting of the International Yeast Commission (ICY) and was appointed to a committee tasked with the revision of the constitution of the ICY.

Prof. Rob Bragg attended the American Society for Virology conference in Vancouver Canada in July 2009. Profs. Van Heerden and Derek Litthauer attended the Thermophiles 2009 conference in Beijing, China where both of them presented lectures on research results relating to the characterisation of novel catalytic activities for known enzymes and the genome sequence of *Thermus scotoductus* SA01. In November, Prof. Litthauer visited the Göttingen Genomics Laboratory at the Georg-August University of Göttingen as part of the SA/Germany International Research Exchange Programme where he attended workshops on the analysis of genome data at the Gesellschaft für wissenschaftliche Datenverarbeitung Göttingen, which is a joint institute between the Max Planck Institute and the University of Göttingen. Jacqueline van Marwijk, a Ph.D. student working in the

BioPAD UFS Metagenomics Platform presented results on the isolation of proteins involved in gold nanoparticle formation at the 5th International Conference on Gold Science, Technology and its Applications, Heidelberg, Germany. Prof. Litthauer was invited by Roche Products to present some of the research of his students at an International Roche user's conference in Lisbon, Portugal in June 2009. He also presented talks on invitation by Roche at the University of the Witwatersrand and University of Cape Town. In August 2009, Prof. Albertyn and two postgraduate students spent two weeks in the laboratory of Prof. José Berenguer at the Centro de Biología Molecular Severo Ochoa, Spain regarding the development of expression vectors for the thermophilic host *Thermus thermophilus*.

The department was also well represented at national meetings. Prof. Bragg was invited as a keynote speaker to the South African Society for Immunology conference in Cape Town. Prof. Van Heerden was invited to present work related to chrome bioremediation at the Bio- and Hydrometallurgy 2009 conference, also held in Cape Town. Prof. Albertyn and Dr Pohl-Albertyn were invited to present keynote lectures at the biennial conference of the South African Society for Microbiology and also acted as session chairs in their respective sessions. During this conference Mr Ruan Ells (study leader Dr Pohl-Albertyn) received the Beckman Coulter Award for the best national master's student and Miss Serena Morretti for the best national undergraduate student. Chantel Swart, a Ph.D. student of Prof. Kock, was invited to present a lecture at the CSIR, Pretoria in August 2009 at the *Recent Advances*



Prof. Bettie Lodolo, Brewing Consultant: Brewing Science and Hygiene of SAB and also an affiliate associate professor of the department, presenting a lecture to third-year microbiology students at the SAB Training Institute in Kyalami.

and Applications in Multidimensional Confocal Microscopy workshop. She was the only postgraduate student among world leaders in this field to present a lecture.

Research

The department comprises two divisions, namely Microbiology and Biochemistry and Food Science. Within these divisions there are various research groups. Activities of some of these research groups not reported above are indicated below.

With their knowledge of meat and lipids, Profs. Garry Osthoff and Arno Hugo of the **Food Science Division** assisted scientists from the North-West University, Potchefstroom, Onderstepoort Veterinary Institute and Kruger National Park with their investigation of the mass crocodile deaths in the Olifants River of the Kruger National Park. The disease pansteatitis was identified, which involves the hardening of the adipose fat, and was ascribed to fat oxidation due to the intake of oxidants. It was shown that the fat composition was not affected to

such an extent that hardening would occur. Although fat oxidation could not be excluded, the problem was more systemic, with the fat tissue becoming hard due to inflammatory conditions.

Prof. Hugo started an extensive project on the effect of dietary conjugated linoleic acid (CLA) supplementation on pig production efficiency and meat quality. This work is done in collaboration with the Animal Nutrition and Meat Science sections of the Agricultural Research Council (ARC). Preliminary findings indicated that CLA supplementation improved pig production efficiency, leading to elevated CLA levels in meat and improved chemical stability of meat. Prof. Hugo was appointed as member of two subject working groups for the Red Meat Research and Development Trust of South Africa. The two working groups are (a) Animal Products, Quality and Value Adding, and (b) Red Meat Safety, Nutritional Quality and Value. The responsibilities will include the evaluation of project protocols, progress reports and final reports.

The research on cactus pear food quality was considerably expanded. Dr Maryna de Wit had five postgraduate students investigating environmental effects, chemical composition and sensory aspects. Environmental effects were studied by comparing production sites from Bloemfontein, Cradock and Oudtshoorn. Preliminary results showed that a few cultivars maintained their quality, irrespective of season, but were highly affected by the locality in terms of fruit size, juice content and sugar composition. It was also shown that juice from some cultivars was less prone to sensory deterioration by high



Third-year microbiology students during their visit to the SAB Alrode brewery.

temperature processing. A comparison of content and structural composition of pectins and mucilages of selected cultivars is currently being investigated.

Although the processing method of yoghurt has been standardised internationally, Dr Koos Myburgh re-investigated several of the processing steps. It was found that “fine tuning” and careful interaction of some steps and parameters resulted in a reduced time span for yoghurt production. New product diversification would also be possible and the design of a “yoghurt kit”

for industrial use is envisaged. A patent application has been filed in this regard. His team also investigated the fat content and composition of commercially available dairy products with regard to nutritional quality. Prof. Osthoff’s research on milk of non-dairy animals has provided some lessons for nutrition and dairy processing. Although high levels of the prebiotic oligosaccharides are a property of human milk, it is not a rule for all primates. Fatty acid composition is largely determined genetically, but may be altered to some

extent by nutrition. It was believed that the fatty acid composition in ruminants is generally fairly constant and only modestly altered by nutrition. However, the family Alcelaphinae (blesbok and hartebeest) have been found to contain an exceptionally high content of myristic acid. This might indicate that it may be possible to alter milk fatty acid composition genetically. The melting properties of the milk fat have been studied in detail. However, to date some crystal types could only be typed as “mixed molecules”. With an array of milk fats



Prof. Osthoff (right) with personnel of the Dainybelle Corporation preparing yeast-inoculated Cheddar cheese.

from non-dairy animals that differ substantially in fatty acid composition, more light could be shed on the melting behaviour of milk fat, which would be of relevance to the food fat industry. The research on cheese biotechnology involving the enzymes from yeast adjuncts has been ongoing, and has progressed to the stage where amino acid catabolism with the concurrent production of volatile compounds is investigated.

The research of Dr Celia Hugo is focused on the microbial quality of food. In 2009 a study was completed on the occurrence of *Chryseobacterium* species on vegetables and soil surrounding the vegetables. *Chryseobacterium* species, which were previously known as *Flavobacterium* and also falls in the *Flavobacteriaceae* family, have been linked to food spoilage for many years. A group of unidentified flavobacteria isolated from milk and butter were subjected to 16S rRNA and BIOLOG analysis, which revealed the identity of these bacteria as strains of *Chryseobacterium* and *Empedobacter brevis*. The possible spoilage characteristics of these were also evaluated. It was shown that they could utilise certain carbohydrates, carboxylic acids, amino acids and polymers that could contribute to spoilage defects of food by creating off-odours, off-tastes, sliminess and bitterness of specific foods. In another study on the microbial quality of boerewors from butcheries and supermarkets in Bloemfontein, it was found that about 70% of the boerewors analysed conformed to standards for aerobic plate counts, *Enterobacteriaceae* and coliform counts. Except for coliform count differences between supermarkets and

butcher shops, no significant differences in other microbial parameters were found between region or retail type. This work emphasised the need for regular inspection of hygienic practices in these food retail outlets.

The BioPAD UFS Metagenomics Platform, under the management of Prof. Van Heerden, saw several changes in 2009. Following the departure of Dr Lizelle Piater, Prof. Koos Albertyn joined the management of this dynamic research team. Dr Dirk Opperman also joined the Metagenomic Platform following his return from a postdoctoral research stay at the Max Planck Institute in Germany. Several staff members and students of the Metagenomics Platform represented the UFS in visits to various research institutions and conferences abroad (see above). On the local scene, Prof. Van Heerden was invited to take part in a media round table discussion that was held at the Monte Casino in Gauteng on 24 February. This discussion furthered the public understanding of Biotechnology as related to the involvement of the Metagenomics Platform in bioprospecting.

The Metagenomics Platform hosted a number of international visitors. A team of three scientists from the Gottingen Genomics Laboratory visited the Metagenomics Platform in September 2009 to exchange expertise with respect to the isolation of DNA from environmental samples and the preparation of material for the analysis of transcriptomes. In October 2009 three scientists from the Lab de Ecología Molecular, Centro de Astrobiología, Spain, visited to collect samples from the deep mine environment in order to evaluate newly devel-

oped micro-array chips. In December 2009, Prof. José Berenguer visited the Metagenomics Platform to strengthen our ongoing collaboration. In addition, the Metagenomics Platform hosted the BBC for the production of a documentary, *Seven Wonders of the Solar System*, which will be distributed worldwide and features the research done by this group. This is the fifth international television production team to be hosted since the inception of the platform. The others were the Discovery Channel, National Geographic, Pioneer Productions and a Japanese production company.

The Metagenomics Platform sequenced and annotated the first South African subsurface bacterial genome. This bacterium, *Thermus scotoductus* SA-01, was isolated by Prof. Tom Kieft of the New Mexico Tech, USA in 1998 from fissure water at a depth of 3.2 km below surface. Kamini Gounder, a Ph.D. student under supervision of Profs. Derek Litthauer, Esta van Heerden and Dr Lizelle Piater sequenced the genome of this bacterium using a combination of 454 and Sanger sequencing. Most of the necessary bioinformatics systems were set up at the UFS. Automated annotation was done using the TIGR annotation engine. Manual finishing of the genome and curation of the annotation was done at the UFS. These data provide insight into the unique metabolic abilities of this organism. Although this is not the first genome to be sequenced and annotated in South Africa, this is probably the first use of 454 technology to sequence the complete circular chromosome of a bacterial species in South Africa.

Three provisional patents were filed in 2009. These patents are based on a

biological chrome (VI) removal process, uranium and platinum nanoparticle formation and a novel patatin enzyme from metagenome libraries.

Prof. Bennie Viljoen, who heads the **Food Biotechnology research group**, continued to investigate the importance of food attributes of indigenous fermented foods. The prospect of new microbial isolates from such foodstuffs revived numerous new collaborative research opportunities such as the South African/Norway research agreement, the South African/Hungarian bilateral Scientific and Technological Cooperation and the Norwegian Council of Universities Committee for Development, Research and Education (NUFU) Institutional partnership with Zambia. Furthermore, close collaboration was also established with scientists in Lesotho, Swaziland and the University of Venda. The programme focused on improving the livelihoods and incomes of rural communities and small-scale processors through improved technologies for processing and development of uniquely fermented milk products native to Southern Africa. Four magister students from Norway spent almost four months in our laboratory as part of their postgraduate studies on related topics. These important beverages and foods are utilised as weaning and/or complementary foods for children, as supplements for immune-compromised individuals and dietary staples for adults. The research contributed to local entrepreneurship and food security by applying fundamental knowledge of the growth kinetics, biochemical activities and technological properties of the microorganisms native to these fermented



Norwegian students and members of the local population with Prof. Judith Narvhus (centre) during the sampling of indigenous fermented milk products in Swaziland.

products. A strong collaborative group was established in recent years, and the group will continue to pursue the development of new starter cultures to apply and to commercialise.

The **Lipid Biotechnology research group** under the leadership of Prof. Lodewyk Kock and Dr Carlien Pohl-Albertyn concentrated on the development of novel antifungal compounds. One target identified for these compounds is mitochondria, which play important roles in eukaryotic cells. Compounds that affect mitochondria

may therefore be of use in the control of many cell functions. So far their research hypothesises a link between mitochondrial activity, mitochondrial inhibitor sensitivity and reproduction type (sexual or asexual) in respiring and fermentative yeasts (i.e. increased mitochondrial inhibitor concentration leads to decreased mitochondrial activity, decreased sexual reproduction followed by asexual reproduction). This hypothesis implicates mitochondria as an effective target to control fungal reproduction. This should now be explored to

assess its conserved status in the fungal domain. Such a model may be used to select specific mitochondrial inhibitors for further applied studies in combating fungal infections, controlling flocculation, or as a starting point for novel physiological and molecular studies to elucidate the mechanisms behind fungal flocculation, pathogenicity and resistance mechanisms developed against mitochondrial inhibitors. Methods utilising scanning electron microscopy (SEM) in conjunction with nano-scanning auger microscopy (NanoSAM)

and targeted ion etching have been developed in collaboration with Profs. Hendrik Swart and Pieter van Wyk of the Department of Physics and Centre for Microscopy, respectively, to further explore this phenomenon. A second research focus is the metabolism of lipids by pathogenic fungi. Some of these fungi are able to produce lipid hormones, a virulence factor important in host pathogen interaction. A better understanding of this virulence factor will answer basic scientific questions regarding the biology of pathogenic fungi and may provide novel targets for the development of antifungals. In addition, the antifungal properties of many fatty acids are being explored and some exciting possibilities regarding possible novel antifungal compounds have been identified and will be developed further for possible applications in clinical settings.

In the **Fermentation Biotechnology research group** led by Profs. Du Preez and Stephanus Kilian, research on the physiological role of alcohol dehydrogenases (Adh), in collaboration with Prof. Albertyn, continued, focusing on aerobic ethanol-limited chemostat cultures of a quadruple deletion mutant strain (Q1) of *S. cerevisiae* to determine to what extent Adh1 could substitute for the other alcohol dehydrogenase isozymes during growth on ethanol. Researcher Laurinda Steyn showed that Adh1p activity could substitute well for Adh2p with only slight differences between these two strains apparent. The research on *Blastobotrys mokoena* CBS8435, a relatively new yeast isolate, was concluded. The production of a significant xylanase activity among yeasts is relatively rare. *B.*

mokoena produced a xylanase activity comparable to that of *Aureobasidium pullulans* (a yeast species well known for its xylanase production) and had the advantages of a high growth rate, an optimum temperature of 38 °C and a xylanase with a temperature optimum of 60 °C. Prof. Kilian's recent research on prebiotics showed that oligosaccharides produced by yeasts promoted the growth of probiotic yeasts that are used in pharmacological preparations to improve the intestinal microbial population. Prebiotics beneficially modify the intestinal microbial population when ingested, resulting in an improvement of the individual's health. These results may be used to formulate synbiotics, which are combinations of prebiotics and probiotics. The ability to withstand digestion by enzymes and physical conditions in the intestinal tract is a required property of a functional prebiotic. Tests to determine the effect of these enzymes and conditions on the oligosaccharides are therefore currently under way.

Because of the renewed interest in biofuels, research was recently initiated on ethanol and single-cell protein production from a novel lignocellulosic biomass source, namely the prickly-pear cactus, *Opuntia ficus-indica*. This is in line with the worldwide research effort to target non-food plant biomass as feedstock for the production of "second-generation" biofuels. *O. ficus-indica* has tremendous potential for cultivation in semi-arid regions unsuitable for the production of conventional food crops; thus its cultivation will not compete for agricultural land or replace significant natural vegetation, nor will its use as feedstock for bioethanol production

lead to increased prices of conventional food crops. In collaboration with Prof. Albertyn, the department is also investigating the development of a non-*Saccharomyces* yeast isolate through metabolic engineering for use in the fermentation of the above biomass hydrolysate to ethanol. This yeast strain has been characterised and shown to have certain advantages compared to *S. cerevisiae*.

The **Biocatalysis research group** of Prof. Martie Smit focuses on the terminal hydroxylation of alkanes, alkylbenzenes, fatty acids and fatty acid derivatives by cytochrome P450 monooxygenases as well as benzylic hydroxylation of alkyl phenols by vanillyl alcohol oxidases. A specific goal is to develop excellent whole-cell biocatalysts for hydroxylation reactions. During 2009 Dr Michel Labuschagné, who worked in the Molecular Biology Laboratory of Prof. Albertyn, received an Innovation Post-doctoral Fellowship from the NRF to develop a yeast expression system that allows the evaluation of seven different yeasts for the heterologous expression of different enzymes. Some of these yeasts expressing different hydroxylating enzymes are giving very promising results as whole-cell biocatalysts.

The **Veterinary Biotechnology research group** of Prof. Rob Bragg was involved in the successful development and testing of a cell-culture based *Chlamydia* vaccine for use in sheep. This project highlights the growing level of cooperation between this research group and Onderstepoort Biological Products. This group was also involved in a large research project with a vaccine manufacturer from Israel, where

the efficacy of their vaccines was tested in poultry. Research is still ongoing on the development and testing of a vaccine for the control of the beak-and-feather-disease virus in parrots. Three very important additions to our parrot collection were made during the year in that highly endangered Cape parrots were sent to the university. These birds are currently infected with the virus and due to their highly endangered status every effort is being made to cure them of the virus.

Research on the other main projects in the group proceeded during the year. The culture collection of bacteriophages which could be used to treat *Escherichia coli* infection in poultry is constantly growing. The group is also gaining experience with the detection of virulence genes in *E. coli*. The genes involved in resistance to disinfectants have also been characterised and it has been established that these genes are involved in the resistance of the bacterial strains to various disinfectants.

The **Epigenomics research group** of Prof. Hugh Patterton has expanded the

use of mass spectrometry (MS) in proteomics in the department. Dr Gabré Kemp was appointed as researcher in the Advanced Biomolecular Research cluster to oversee the mass spectrometers and attended an EMBO workshop on advanced topics in MS in Odense, Denmark, as well as a workshop in San Diego, USA, on the use of the Mascot database in protein identification by MS. Prof. Patterton attended a workshop on the analysis of post-translational modifications of proteins by MS, also in Odense, Denmark. The mass spectrometers are now routinely used for the identification of proteins resolved by SDS-PAGE electrophoresis. Several projects aimed at mapping post-translational modifications of histones and relating such modification to the regulation of chromatin structure and gene expression is currently underway. In addition, a project to map the location of the epigenetically crucial histone tails in chromatin, making use of chemical cross-linking and MS is currently ongoing. This also involves the development of software to aid in the analysis of complex MS data, which is undertaken in the Bioinformatics group.

The group hosted Dr David Clark from the Section on Human Cell Genetics at the National Institutes of Health in November. Dr Clark also gave a plenary talk at the official launch of the Strategic Academic Research Clusters.

Staff matters

Some changes in staff took place. Prof. Garry Osthoff was promoted to professor and Prof. Hugh Patterton was appointed director of the UFS Advanced Biomolecular Research cluster. Prof. Patterton will still run his laboratory in the department, but has limited teaching duties. We welcomed our most recent academic appointment at the end of the year, namely Dr Dirk Opperman, who returned from his postdoctoral studies at the Max-Planck Institute in Mülheim an der Ruhr, Germany where he worked in the research group of Prof. Manfred T. Reetz. His research focused mainly on the directed evolution of enantioselective biocatalysts, such as Baeyer-Villiger mono-oxygenases. He will take up his post as lecturer in January 2010.

Research outputs

Research articles

De Witt, F.H., Els, S.P., Hugo, A., Van der Merwe, H.J. & Fair, M.D. 2009. Influence of dietary lipid sources on carcass traits of broilers. *South African Journal of Animal Science* 39(5): 49-52.

De Witt, F.H., Els, S.P., Van der Merwe, H.J. & Hugo, A. 2009. Effect of dietary lipid sources on production performance of broilers. *South African Journal of Animal Science* 39(5): 45-48.

Els, R., Kock, J.L.F., Van Wyk, P.W.J., Botes, P.J. & Pohl, C.H. 2009. Arachidonic acid increases antifungal susceptibility of *Candida albicans* and *Candida dubliniensis*. *Journal of Antimicrobial Chemotherapy* 63(1): 124-128.

Frouws, T.D., Patterton, H.G. & Sewell, B.T. 2009. Histone octamer helical tubes suggest that an inter-nucleosomal four-helix bundle stabilizes the chromatin fiber. *Biophysical Journal* 96: 3363-3371.

Hugo, A., Els, S.P., Bothma, C., De Witt, F.H., Van der Merwe, H.J. & Fair, M.D. 2009. Influence of dietary lipid sources on sensory characteristics of broiler meat. *South African Journal of Animal Science* 39(5): 11-14.

Hugo, A., Els, S.P., De Witt, F.H., Van der Merwe, H.J. & Fair, M.D. 2009. Effect of dietary lipid sources on lipid oxidation of broiler meat. *South African Journal of Animal Science* 39(5): 149-152.

Jordan, R., Van Heerden, E., Hugo, C.J. & Piater, L.A. 2009. Using current molecular techniques for rapid differentiation of *Salmonella typhi* and *Salmonella typhimurium*. *African Journal of Biotechnology* 8(9): 1815-1818.

Kock, J.L.F., Swart, C.W., Ncango, D.M., Kock (Jr), J.L.F., Munnik, I.A., Maartens, M.M.J., Pohl, C.H. & Van Wyk, P.W.J. 2009. Development of a yeast bio-assay to screen anti-mitochondrial drugs. *Current Drug Development Technologies* 6(3): 186-191.

Leeuw, N.J., Swart, C.W., Ncango, D.M., Kriel, W.M., Pohl, C.H., Van Wyk, P.W.J. & Kock, J.L.F. 2009. Anti-inflammatory drugs selectively target sporangium development in *Mucor*. *Canadian Journal of Microbiology* 55: 1392-1396.

Muchenje, V., Dzama, K., Chimonyo, M., Strydom, P.E., Hugo, A. & Raats, J.G. 2009. Some biochemical aspects pertaining to beef eating quality and consumer health: A review. *Food Chemistry* 112(2): 279-289.

Muchenje, V., Hugo, A., Dzama, K., Chimonyo, M., Strydom, P.E. & Raats, J.G. 2009. Cholesterol levels and fatty acid profiles of beef from three cattle breeds raised on natural pasture. *Journal of Food Composition and Analysis* 22(4): 354-358.

Osthoff, G., Hugo, A. & De Wit, M. 2009. Comparison of the milk composition of free-ranging blesbok, black wildebeest and blue wildebeest of the subfamily *Alcelaphinae* (family: *Bovidae*). *Comparative Biochemistry and Physiology Part B: Biochemistry and Molecular Biology* 154(1): 48-54.

Osthoff, G., Hugo, A., De Wit, M. & Nguyen, T.P.M. 2009. The chemical composition of milk of milk from free ranging African buffalo (*Syncerus cafra*). *South African Journal of Wildlife Research* 39(1): 97-102.

Osthoff, G., Hugo, A., De Wit, M., Nguyen, T.P.M. & Seier, J.B. 2009. Milk composition of captive vervet

monkey (*Chlorocebus pygerythrus*) and rhesus macaque (*Macaca mulatta*) with observations on gorilla (*Gorilla gorilla gorilla*) and white handed gibbon (*Hylobates lar*). *Comparative Biochemistry and Physiology Part B: Biochemistry and Molecular Biology* 152(4): 332-338.

Rashamuse, K., Ronnenburg, T., Hennessy, F., Visser, D., Van Heerden, E., Piater, L.A., Lithauer, D., Möller, C. & Brady, D. 2009. Discovery of a novel carboxylesterase through functional screening of a pre-enriched environmental library. *Journal of Applied Microbiology* 106(5): 1532-1539.

Siebrits, F.K., Makgekgenene, A. & Hugo, A. 2009. Effect of saponified high fat sunflower oilcake and lipoic acid on fat quality of lambs. *South African Journal of Animal Science* 39(5): 29-32.

Smith, E. & Myburgh, J. 2009. The optimization of yoghurt production. *Milk and Juice* 4(3): 14-17.

Van Marwijk, J., Opperman, D.J., Piater, L.A. & Van Heerden, E. 2009. Reduction of vanadium (V) by *Enterobacter cloacae* EV-SA01 isolated from a South African deep gold mine. *Biotechnology Letters* 31(6): 845-849.

Workneh, T.S., Osthoff, G. & Steyn, M.S. 2009. Integrated agrotechnology with preharvest ComCat® treatment, modified atmosphere packaging and forced ventilation evaporative cooling of tomatoes. *African Journal of Biotechnology* 8(5): 860-872.

Chapter in book

Albertyn, J., Labuschagne, M. & Nel, S. 2009. Yeasts as eukaryotic expression systems. In: *Diversity and Potential Biotechnological Applications of Yeasts* edited by T. Satyanarayana

and G. Kunze. The Netherlands: Spring Science and Business Media. pp. 369-403.

Report

Mielmann, A., Hugo, C.J. & Jooste, P.J. 2009. *Food spoilage characteristics of Chryseobacterium species - role and significance in food.* Report to VDM Verlag Dr. Müller, Saarbrücken, Germany.

Conferences contributions

Albertyn, J., De Smidt, O., Dukunde, A., Henn, M., Steyn, L. & Du Preez, J.C. 2009. *Molecular and physiological aspects of alcohol dehydrogenases in the yeast Saccharomyces cerevisiae.* Paper presented at the 16th Biennial Congress of the South African Society for Microbiology, Durban, South Africa. 21-23 September.

Bothma, C., Hugo, A. & De Kock, H.L. 2009. *Determination of the influence of dietary conjugated linoleic acid (CLA) on the sensory profile of pork chops.* Poster presented at the 4th International Federation of Home Economics (IFHE) - Africa Regional Conference, Ezulveni, Swaziland. 22-25 September.

Bragg, R.R. 2009. *Understanding Cholera - A review with special reference towards emergency drinking water treatment procedures.* Paper presented at the 2nd Annual Conference on Disaster Risk Reduction: Water Related Disasters, Disaster Training Centre for Africa, University of the Free State, Bloemfontein, South Africa. 25-27 May.

Bragg, R.R. 2009. *Vaccines against Avibacterium paragallinarum in poultry - the importance of serologically different strains of the bacterium.* Paper presented at the Annual Conference of the South African Immunological Society (SAIS), Vineyard Hotel, Newlands, Cape Town, South Africa. 9-11 December.

Bragg, R.R., Kondiah, K., Hattingh, A.R. & Albertyn, J. 2009. *Development of a DNA vaccine for Beak and*

Feather virus in parrot. Poster presented at the 28th Annual Meeting of the American Society for Virology, University of British Columbia, Vancouver, Canada. 11-15 July.

Bragg, R.R., Kondiah, K., Hattingh, A.R. & Albertyn, J. 2009. *DNA vaccine for Psittacine Beak and Feather disease virus.* Paper presented at the Annual Conference of the South African Immunological Society (SAIS), Vineyard Hotel, Newlands, Cape Town, South Africa. 9-11 December.

De Witt, F.H., Els, S.P., Van der Merwe, H.J., Hugo, A. & Fair, M. 2009. *Effect of dietary fatty acid saturation on broiler production performance.* Poster presented at the 43rd Congress of the South African Society of Animal Science (SASAS), Alpine Health Resort, Drakensberg, South Africa. 28-30 July.

Du Preez, J.C., De Goede, E. & Myburgh, J. 2009. *Blastobotrys mokoenaai: A thermotolerant yeast that produces extracellular endo beta-xylanase.* Poster presented at the 14th European Congress on Biotechnology (ECB14), Barcelona, Spain. 13-16 September.

Du Preez, J.C., Steyn, L., De Smidt, O., Dukunde, A. & Albertyn, J. 2009. *Phenotypic characteristics of multiple ADH deletion mutants of Saccharomyces cerevisiae.* Poster presented at the 27th International Specialized Symposium on Yeasts (ISSY), Institut Pasteur, Paris, France. 26-29 August.

Einkamerer, O.B., Price, M.M., De Witt, F.H., Hugo, A., Greyling, J.P.C. & Fair, M.D. 2009. *The effect of different dietary inclusion levels of Monensin on performance and carcass characteristics of lambs.* Poster presented at the 43rd Congress of the South African Society of Animal Science: Animal science in a changing world, Alpine Heath Resort and Conference Village, Drakensberg, Kwazulu-Natal, South Africa. 28-30 July.

Els, R., Kock, J.L.F. & Pohl, C.H. 2009. *Eicosanoids of Candida dubliniensis.* Paper presented at the 17th Congress of the International Society for Human and Animal Mycology (ISHAM2009), Keio Plaza Hotel, Tokyo, Japan. 25-29 May.

Gounder, K., Liesegang, H., Bruzuzkiewicz, E., Wolherr, A., Daniel, R., Gottschalk, G., Van Heerden, E. & Litthauer, D. 2009. *The genome sequence of Thermus scotoductus SA01 sheds more light on its metal reducing abilities.* Paper presented at the 10th International Thermophile Conference - Thermophiles 2009, Beijing, China. 16-21 August.

Jordan, R., Botes, E., Litthauer, D., Piater, L.A. & Van Heerden, E. 2009. *Microbial biome monitoring and its effective use in upscaled Cr (VI) bioremediation.* Paper presented at the Bio- and Hydrometallurgy 09 (BioHydromet 09) Conference, Cape Town, South Africa. 6-7 April.

Kock, J.L.F., Pohl, C.H. & Van Wyk, P.W.J. 2009. *Oxylipin studies expose antifungals with dual action in Candida albicans and Cryptococcus neoformans: A review.* Poster presented at the 17th Congress of the International Society for Human and Animal Mycology (ISHAM2009), Keio Plaza Hotel, Tokyo, Japan. 25-29 May.

Leeuw, N.J., Swart, C.W., Ncango, D.M., Joseph, M.J., Kriel, W.M., Pohl, C.H., Van Wyk, P.W.J. & Kock, J.L.F. 2009. *Anti-inflammatory drugs selectively target sporangium development in Mucor.* Poster presented at the 17th Congress of the International Society for Human and Animal Mycology (ISHAM2009), Keio Plaza Hotel, Tokyo, Japan. 25-29 May.

Mabizela, L., Van Heerden, E., Garcia-Moyano, A. & Litthauer, D. 2009. *Unculturable phage diversity in the deep South African subsurface.* Paper presented at the 3rd European Medicines Agency (EMA) Ge-nome Sequencer FLX User Conference, Lisbon, Portugal. 15-17 June.

Myburgh, J., Osthoff, G., Hugo, A. & De Wit, M. 2009. *Milk composition of South African beef breeds.* Poster presented at the 42nd Annual General Meeting and Symposium of the South African Society of Dairy Technology (SASDT), Witrivier, South Africa. 11-13 May.

Ncango, D.M., Pohl, C.H., Van Wyk, P.W.J., Swart, C.W. & Kock, J.L.F. 2009. *Asci: Indicators of novel antifungals.* Poster presented at the 17th Congress of the International Society for Human and Animal Mycology (ISHAM2009), Keio Plaza Hotel, Tokyo, Japan. 25-29 May.

Nguyen, M.T.P., Osthoff, G. & De Wit, M. 2009. *Enzymes from yeast adjuncts involved in aminolysis during Cheddar cheese ripening.* Paper presented at the 42nd Annual General Meeting and Symposium of the South African Society of Dairy Technology (SASDT), Witrivier, South Africa. 11-13 May.

Opperman, D.J., Sewell, B.T., Piater, L.A., Litthauer, D. & Van Heerden, E. 2009. *An Old Yellow Enzyme homologue from Thermus scotoductus SA-01.* Paper presented at the Annual Conference of the Catalysis Society of South Africa (CATSA 2009), Rawsonville, South Africa. 9-11 November.

Opperman, D.J., Sewell, B.T., Piater, L.A., Litthauer, D., Isupov, M.N., Littlechild, J.A. & Van Heerden, E. 2009. *Structure and mechanism of a thermostable Old Yellow Enzyme.* Poster presented at the BioTrans 2009 Biannual Conference, Berne, Switzerland. 5-9 July.

Osthoff, G. 2009. *Prebiotic oligosaccharides in milk.* Paper presented at the 42nd Annual General Meeting and Symposium of the South African Society of Dairy Technology (SASDT), Witrivier, South Africa. 11-13 May.

Osthoff, G., Nguyen, M.T.P., Hugo, A. & De Wit, M. 2009. *Milk of other species: Comparison of primate milk.* Poster presented at the 42nd Annual

General Meeting and Symposium of the South African Society of Dairy Technology (SASDT), Witrivier, South Africa. 11-13 May.

Osthoff, G., Nguyen, M.T.P., Hugo, A. & De Wit, M. 2009. *Milk of other species: Comparison of Alcenaphinae milk*. Poster presented at the 42nd Annual General Meeting and Symposium of the South African Society of Dairy Technology (SASDT), Witrivier, South Africa. 11-13 May.

Pohl, C.H., Kock, J.L.F., Eills, R. & Thibane, V.S. 2009. *Antifungal fatty acids*. Paper presented at the 16th Biennial Congress of the South African Society for Microbiology, Durban, South Africa. 21-23 September.

Seyoum, T., Osthoff, G. & Steyn, M.S. 2009. *The effect of preharvest treatment, disinfection and storage environment on quality of carrots*. Poster presented at the Tropentag 2009 Conference: Biophysical and Socio-economic Frame Conditions for the Sustainable Management of Natural Resources, University of Hamburg, Hamburg, Germany. 6-8 October.

Smith, A. & Myburgh, J. 2009. *Acceleration of yogurt fermentation*. Paper presented at the 42nd Annual General Meeting and Symposium of the South African Society of Dairy Technology (SASDT), Witrivier, South Africa. 11-13 May.

Swart, C.W., Van Wyk, P.W.J., Pohl, C.H. & Kock, J.L.F. 2009. *The life cycle of Nadsonia: A novel antifungal screen*. Poster presented at the 17th

Congress of the International Society for Human and Animal Mycology (ISHAM2009), Keio Plaza Hotel, Tokyo, Japan. 25-29 May.

Swart, P.Z., De Wit, M., Bothma, C. & Hugo, A. 2009. *The influence of different heat treatments on the sensory aspects of juices from eight cactus pear cultivars*. Poster presented at the 4th International Federation of Home Economics (IFHE) - Africa Regional Conference, Royal Swazi Convention Center, Ezulwini, Swaziland. 22-25 September.

Van Heerden, E., Bester, P.A., Gounder, K., Lithauer, D. & Opperman, D.J. 2009. *Mechanisms and multitasking of "reductases" from Thermus scotoductus SA01*. Paper presented at the 10th International Thermophile Conference – Thermophiles 2009, Beijing, China. 16-21 August.

Van Marwijk, J., Opperman, D.J., Gericke, M. & Van Heerden, E. 2009. *Purification of a gold (III) reducing and nanoparticle producing protein from Thermus scotoductus SA-01*. Poster presented at Gold 2009: 5th International Conference on Gold Science, Technology and its Applications, Heidelberg, Germany. 26-29 July.

Van Tonder, A., Blignaut, P.J., Harrison, I. & Atagana, I. 2009. *An investigation into biochemistry students' graphical literacy*. Paper presented at the New Zealand Association for Research in Education (NZARE) Conference and Annual Meeting, Rotorua, New Zealand. 30 November-04 December.

Contact details

Prof. James du Preez

Faculty of Natural and Agricultural Sciences
Department of Microbial, Biochemical and
Food Biotechnology
University of the Free State
PO Box 339
Bloemfontein
9300
South Africa

Telephone: +27 51 401 2679
Fax: +27 51 401 9376
E-mail: dpreezjc@ufs.ac.za
Website: www.ufs.ac.za/biotech



Staff

Division of Microbiology and Biochemistry

Professors: Profs James du Preez, Rob Bragg, Stephanus Kilian, Lodewyk Kock, Derek Litthauer, Hugh Patterton, Martie Smit, Bennie Viljoen

Associate Professors: Profs Koos Albertyn, Esta van Heerden

Senior Lecturers: Drs André van Tonder, Carlien Pohl-Albertyn

Lecturer: Dr Dirk Opperman

Researcher: Ms Laurinda Steyn

Professor Extraordinary: Prof. Bärbel Hahn-Hägerdal

Affiliate Associate Professor: Prof. Bettie Lodolo

Secretary: Ms Millie Cohen

Senior Professional Officer: Mr Sarel Marais

Professional Officers: Mss Nel-Marie Agenbag, Suzanne Brandt, Anita de Necker, Yvette Makaum, Mapula Maropola, Dalene van den Berg, Andri van Wyk

Senior Officer: Ms Leonie Myburgh

Officer: Ms Carin Badenhorst

Assistant Officer: Ms Ezelle van den Heever

Storeman: Ms Merriam Mogopodi

Technical Help: Mss Susan Leeuw, Lydia Mazwi, Mr Stanford Isaac, Petrus Mereko, Jack Mvula

Division of Food Science

Professor: Prof. Garry Osthoff

Associate Professor: Prof. Arno Hugo

Senior Lecturers: Drs Cecilia Hugo, Koos Myburgh, Mr Neels Bezuidenhout

Lecturers: Dr Maryna de Wit, Ms Carina Bothma

Secretary: Ms Anita van der Westhuizen

Senior Officer: Ms Rosalie Hunt

Professional Officer: Ms Eileen Roodt

Technical Help: Mss Tinah Mkololo, Sarah Senokoane

Cleaner: Mr Edward Mtshotana

16 Physics

Overview

For the Department of Physics 2009 was a special year in terms of academic excellence and capacity building. A few highlights stand out. The department received research equipment to the value of R23 million. Two researchers received prestigious awards from the National Science and Technology Forum (NSTF). In addition, a few postgraduate students won awards at national conferences. Profs. Pieter Meintjes and Koos Terblans presented their inaugural lectures after being promoted to full professors.

Dr Hoffman was promoted to associate professor and Dr Martin Ntwaeaborwa to senior lecturer. Under the supervision of Prof. Wiets Roos, a postgraduate

student from the department, Mr Charl Jafta, did well in the National Innovation Fund Competition. The department again made prominent contributions to science communication in the country. The Boyden Observatory, which is managed by the department, celebrated its 120th anniversary.

Activities and achievements

Two researchers from the department received prestigious awards from the NSTF during its eleventh gala award ceremony. Prof. Hendrik Swart, head of the department, was the recipient of the award for research capacity development over the past five to ten years. He

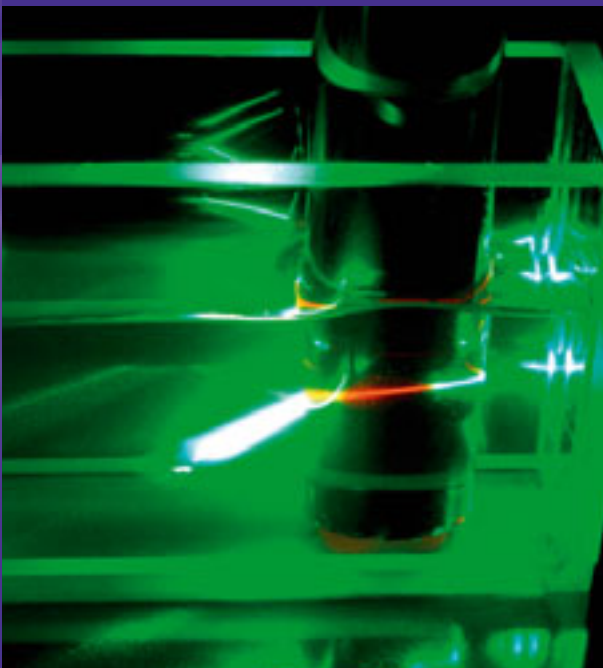


“Not many laboratories in the world have systems like this under one roof”

- Prof. Hendrik Swart



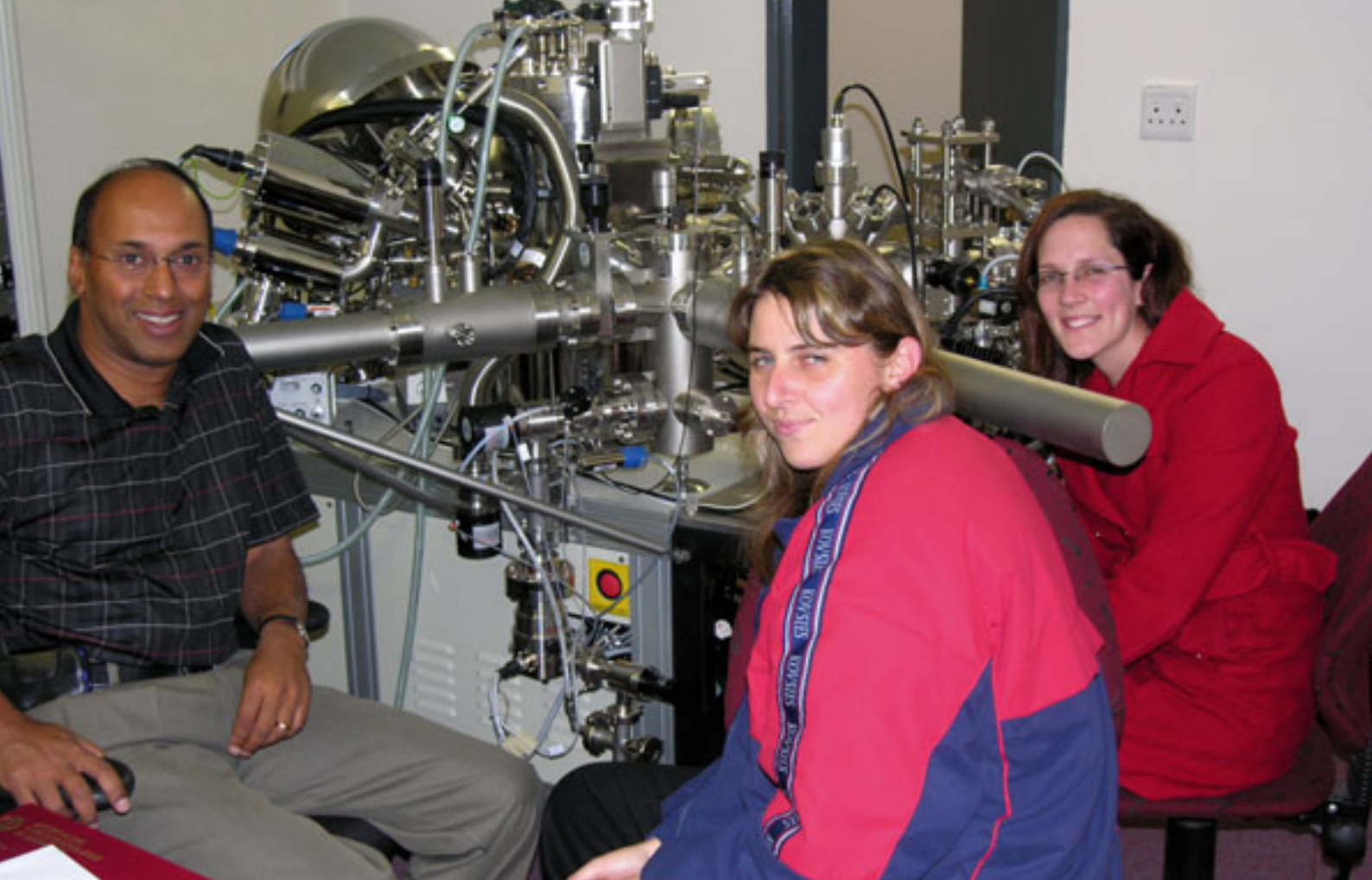
*Profs. Martin Ntwaeaborwa and
Hendrik Swart both received
NSTF awards.*



received the award for his significant contribution towards the development of students in niche areas of nanophysics. The award, sponsored by Eskom, includes a prize of R100 000 that will be used for research purposes. Prof. Swart is actively involved in the research of phosphor material, concentrating on the effectiveness of nanophosphor.

Dr Martin Ntwaeaborwa, senior lecturer in the department was the recipient of the TW Kambule National Research Foundation (NRF) award in Category J as distinguished young black male researcher over the last two to five years. He received the award for his contribution to the understanding and harnessing of light-emitting nanomaterials for application in light emitting devices. The award includes R100 000 in prize money towards Dr Ntwaeaborwa's research. Dr Ntwaeaborwa is an expert in luminescent nanomaterials. A first-year student of Dr Ntwaeaborwa, Thabo Ngobeni also received a Technology and Human Resources for Industry Programme (THRIP) bursary at the gala event.

The NSTF awards give recognition to the outstanding contributions of individuals and groups to science, engineering and technology. This includes all practising scientists, engineers and technologists across the spectrum of innovation, including, for example, teachers and students in mathematics, science and technology. The NSTF represents government, science councils, professional bodies, higher education, business and civil society. Altogether 13



Dr Sankar, Ms Lisa Coetsee and Dr Lizette Erasmus during training on the new Versaprobe XPS system.

individuals and corporate organisations or institutions were presented with the NSTF Awards trophy by the Minister of Science and Technology, Ms Naledi Pandor. As part of the acceptance of the prizes both Prof. Swart and Dr Ntwaeaborwa were involved in several talks and radio interviews during 2009 to promote science to the general public.

The South African Academy of Sciences (SAAWK) held a symposium in Bloemfontein in September 2009 as part of their centenary celebrations. This 9th Symposium was jointly hosted by the departments of Physics and Chemistry at the University of the Free State (UFS). A number of personnel was involved in the organisation of the symposium and

also acted as chairpersons at various sessions during the event.

Ms Biggs, a M.Sc. student, won the first prize in the Physics and Computer Science division for her oral presentation titled *'n Oorsig van verskillende tipes luminessensie en verskillende tipes fosfor: hul gebruike en karakterisering*. Prof. Swart and Dr Ntwaeaborwa were her supervisors. Mr Shaun Cronje won the second prize with his talk titled *Korrelgroottes en tweelingstrukture in vervormde koper*. The authors were Mr Shaun Cronje, Dr Ted Kroon, Prof. Wiets Roos, and Prof. Neethling.

Research

The departments of Physics and Chemistry at the UFS have worked together to obtain enough funds (R23 million) to add state-of-the-art nanosurface characterisation equipment in their new National Nano-Surface Characterisation Facility (NNSCF). Funds were mainly obtained through the NNEP and National Equipment Programme (NEP) of the Department of Science and Technology (DST) and the National Research Foundation (NRF). The two key role players in this effort were Dr Romilla Maharaj and Dr Rakeshnie Ramoutar from the NRF. Two new systems, namely a PHI700 Scanning Auger Nanoprobe with a resolution of 6–8 nm and the PHI5000 XPS Versaprobe with a resolution of less than 5 μm were added to the new national facility. Not many laboratories in the world have systems like this under one roof. Collaboration will be strengthened with other nanophysics groups in the country as well as abroad.

The systems were unveiled on 17 August 2009, followed by a seminar day on 18 August. The unveiling and seminar day were attended by researchers from across South Africa. This apparatus will not only be valuable for fundamental research on nanophosphors and segregation, but will in particular also assist in the industrial development of better catalysts to synthesise petrol and chemicals from gas or coal supplies. Sasol is one of the industries that will benefit from this. Prof. Jannie Swarts from the UFS Department of Chemistry was closely involved in this effort. Profs. Hendrik Swart and Jannie Swarts won the faculty prize for academic entrepreneurship.

A number of highlights have been achieved by the **Solid State Physics research group**. Profs. Koos Terblans and Wiets Roos obtained C2 ratings, Dr Martin Ntwaeaborwa a Y2 rating and Prof. Swart a B2 rating from the NRF. Three members of the department, Profs. Swart and Terblans and a postgraduate student, Mr RA Harris, presented four papers at the ECASIA09 conference in Turkey. One paper was on the ESSCR mechanism for phosphor degradation, two papers concerned the diffusion in Ni/Cu thin films and one paper was on Monte Carlo simulation and AES characterisation of phase formation in Pt-Al thin films. Prof. Francis Dejene, Prof. Swart and Ms Coetsee presented three papers at the 10th annual Conference on Laser Ablation (COLA) in Singapore during November 2009. Prof. Dejene and Mr Dolo presented papers at the International Conference on Nanotechnology and Advanced Materials at the University of Bahrain.

Three postdoctoral researchers joined the nano solid-state lighting group during 2009. They are Dr Vinay Kumar from Lovely Professional University, India, Dr Indrajit Nagpure from Nagpure University, India and Dr Shreyas Pitale from Maulana Azad National Institute of Technology (MANIT), India. They have made very good contributions towards development of luminescent nanomaterials in the department.

Mr Charl Jafta (M.Sc.) and his supervisor, Prof. Roos, entered the Innovation Fund competition coordinated by the Division of Research and Development at the UFS. The fund is managed by the NRF. The Innovation Fund aims to help anyone with ideas for technological innovation to enter the business world. Mr Jafta and Prof. Roos entered the competition with no less than four ideas, all of which reached the final stage. One of the ideas of the physics team won the second prize in the local competition. Mr Jafta is currently preparing a prototype of his idea and is also supported by the Rapid Prototyping Department at the Central University of Technology. He is going to present his idea during April 2010 at an exhibition in Durban.

A Ph.D. project by Ms Susan Titus, lecturer at the Tshwane University of Technology (TUT) with Prof. Roos as her promoter and Dr Asante (TUT) as co-promoter, resulted in the Tshwane University of Technology contributing R60 000 towards a thickness monitor. The monitor will be used to measure evaporation rates during surface segregation in an effort to improve the current segregation model. The thickness monitor was installed in the LEED/AES analysis spectrometer working chamber. The



Prof. Matie Hoffman (left) at the workshop for school Learning Facilitators (Subject Advisors) presented under the leadership of Dr Ted Kroon.

first evaporation measurements are to commence in March 2010.

The PHI5400 XPS system, previously obtained from the Max Planck Institute in Stuttgart, was further improved by Prof. Roos and Mr Jafta. It was used for various measurements during 2009. After replacing the channel-plate multipliers in October 2009, the spectrometer is still in a very good working condition and relative resolutions of 0,3% and counting rates $> 10^6$ can easily be maintained. The system uses a 300W dual anode (Mg and Al) X-ray gun and makes Angle-Resolved XPS possible with a computer-controlled stage control. Prof. Terblans also developed a new version of the control software (VisiScan 4.0) for the SAM 590 and SAM 600. It was implemented on the SAM 600. The new version includes the latest measuring techniques and also supports the USB controller card. Although the SAM 590 and SAM 600 are old systems, the new software enables the system to compete with new systems. Prof. Roos, Dr Ntwaeaborwa, Prof. Hillie, Dr Dhlamini and three Ph.D. students were invited to join a South African group from the Nanolab of the CSIR to attend a joint workshop on Nanotechnology. The workshop took place in October 2009 at the Korea Institute of Science and Technology in Seoul, Korea.

Dr Ntwaeaborwa was selected by the NRF to be involved in the evaluation of the aberration-corrected high resolution transmission electron microscopy (HRTEM) for the National Centre of Microscopy to be built at the Nelson Mandela Metropolitan University. The evaluation took place from 1 – 28 February 2009 and was conducted at MacMaster

University in Toronto, Canada, the Caeser Centre for Microscopy in Bonn, Germany and Shinshu University in Nagano, Japan. He went on a research visit with Dr Moses Mothudi to the Korea Institute of Science and Technology (KIST) in Seoul, South Korea from 25–30 March 2009. The purpose of the visit was to discuss the future of the research collaboration between KIST and UFS (which falls under bilateral agreement between South Korea and South Africa) and to prepare for a joint workshop that took place at KIST in October 2009. As part of his NSTF award, he was chosen by the National Department of Science and Technology to represent South Africa in the African Union Scientific Award. He attended the 56th symposium of the American Vacuum Society in San Jose, USA from 8–13 November 2009. Dr Ntwaeaborwa was also able to establish a photo-luminescent system in the department with the help of the National laser centre.

A large group of staff members and post-graduate students from the department attended the annual physics conference (SAIP2009) of the University of KwaZulu-Natal in Durban where they made a number of contributions. One of the contributions was an invited talk to the condensed matter physics materials science specialist group. This is for non-specialists by a specialist in the field of solid-state physics to promote solid-state physics. The talk was presented by Prof. Terblans and the title was *Moving Atoms: How we see them and what they can do for us*. Two students of the department were also awarded with best publication awards. Mr Dhlamini won the GOODFELLOW Ph.D.-publication award

for the most outstanding work in the field of condensed matter physics and/or materials science by a Ph.D. student based on a publication in a scientific journal originating from a doctoral thesis submitted at a South African institution for tertiary education. Mr Werner Jordaan won the VACUTECH M.Sc.-publication award (Solid State) for the most outstanding work in the field of condensed matter physics and/or materials science by a student, based on a publication in a scientific journal originating from a master's dissertation submitted at a South African institution for tertiary education. Both these students were supervised by Profs. Swart and Terblans.

Mr Jacques Maritz was awarded the prize for the best poster noticed by the SAIP council at the 2009 South African Institute of Physics (SAIP) Conference for his poster on *String theory – getting the most from your sonometer*. He was supervised by Dr Kroon.

Prof. Terblans presented his inaugural lecture on *'n Wandeltog met Atome in die Werklike Lewe/Walking with Atoms in Real Life*. The lecture focused on the movement (diffusion and segregation) of atoms within a solid material.

A new Ph.D. student, Mr Hassan Seed Ahmed arrived from the Sudan in July 2009. He will be working on energy transfer processes in phosphors under the supervision of Dr Kroon. Dr Moses Mothudi, lecturer from the Qwaqwa Campus obtained his PhD during the September 2009 graduation ceremony.

As far as the **Astrophysics research group** is concerned, the following highlights were achieved. Prof. Pieter Meintjes obtained a C2 NRF rating

during 2009. On 18 March 2009 Prof. Meintjes presented his inaugural lecture after being promoted to full professor on *Die Hoë-energie Heelal: Eksotiese Voorwerpe en Kataklimiese Uitbarstings/The High-Energy Universe: Exotic Objects and Cataclysmic Outbursts*.

The astrophysics research group presented two papers at international conferences. One paper was by Mr Nkundabakura on *Beyond the visible light: Multi-wavelength Astronomy in Southern Africa* at the Teaching Astronomy for Development (TAD) IAU regional workshop on Developing Astronomy in Africa. The conference was held at the University of Nairobi, Nairobi, Kenya from 9–13 November 2009. The other paper was presented by Mr Bosco Oruro at the 1st Summer School on *Multi-wavelength Astronomy in Paris*, France from 29 June to 10 July 2009.

The astrophysics research group also presented six papers at national conferences during 2009. This included four papers from Square Kilometre Array (SKA) bursary holders at the SKA Bursary Holders Conference that took place in Stellenbosch from 2–7 December 2009. Mr Oruro received the first prize for the best Ph.D. presentation in astrophysics during this conference.

During September 2009 a new 14" Celestron telescope was installed in a newly refurbished and upgraded building at Boyden Observatory. The camera to be used on the telescope is the Apogee camera that the Watcher Group from the University College Dublin in Ireland kindly agreed to lend to the project. The new telescope will be thoroughly tested and calibrated during 2010.



Physics students visited the observatory at Sutherland.

Important maintenance work was done on the 60" telescope dome during 2009. All the moving parts of the dome system were checked and upgraded or fixed, where necessary. The research capacity of the telescope was improved through the upgrade and improvement of Spica (custom-control data acquisition and interfacing software).

Early in 2009 the Watcher robotic telescope was upgraded with a new camera and control system, as well as a new

roof-control system. The project was supervised by the Watcher group from the University College Dublin in Ireland.

As part of the astrophysics programme two new 8-credit third-year courses on radiative processes in astrophysics, FSK372 and FSK382 were introduced in the department. Another important achievement during 2009 was the completion of an M.A. dissertation by Mr Dawie van Jaarsveldt, the Boyden community service officer. It is being

applied for the pilot project of the Boyden Science Centre NEC 302 community service module. 17 students enrolled for the first year of the module, which is an elective in many B.Sc. programmes. The findings will also be published as an academic article in an accredited journal. It is the first cycle of action research at the department. The reflection reports written by the students are evident of deep personal growth and character development.

This module is enjoyed and appreciated by the learners and teachers alike.

Community service

The department recently hosted a workshop for school learning facilitators (Subject Advisors) in the Free State under the leadership of Dr Kroon. This event was funded by the Department of Education through the South African Institute of Physics. The aim was to build bridges between the university and the school learning facilitators in order to contribute to the quality of Physics teaching in the province. The learning facilitators had an opportunity to visit the New National Nano Surface Characterisation Facility. They were then introduced to a variety of university programmes that aid in teacher development (e.g. the Itjhoriseng Project, Community Service Learning in the Faculty of Natural and Agricultural Science and opportunities offered by the Centre for Education Development, as well as spending an evening at the Boyden Observatory and Science Centre). The following day was spent with staff of the Department of Physics discussing more challenging topics from the school syllabus, building simple apparatus that can be used in schools and exchanging ideas for increasing the quality of teaching and learning of Physics in the province. The feedback obtained from the learning facilitators was very positive and it is hoped that such meetings could become a regular event.

Prof. Roos was invited to be a member of a three-man committee, judging the best Expo projects for young scientists in the Free State in five different categories during 2009.

On Friday, 8 May 2009, the 120th anniversary of the Boyden Observatory was celebrated with a special function at the observatory. A master plan for expanding the facilities at Boyden with a new building for interactive exhibits as well as a modern digital dome theatre/planetarium was unveiled at the event. A total amount of R720 000 of external funding was raised for the Boyden Science Centre with the assistance of Prof. Matie Hoffman and the UFS Marketing Office.

The Boyden Science Centre contributed an interactive IYA exhibit to the UFS's exhibit at the SciFest Africa in Grahamstown and TechnoX in Sasolburg. More than 20 000 Grade 10–12 learners visited these exhibits, as well as a few thousand younger learners and members of the public. The UFS Exhibit was jointly one of the top three exhibits at SciFest Africa.

From 1 September 2008 to 31 August 2009 intensive educational programmes were presented to approximately 8 400 people, amounting to more than 20 000 learning hours. These programmes included the following high-impact programmes:

- 1 100 teachers were reached with programmes and workshops;
- 1 900 Grade 10–12 learners were reached with programmes and workshops;
- 14 astronomy and physics workshops presented to 350 Grade 10 – 12 learners from 30 different schools at SciFest Africa 2009 in Grahamstown;
- Programmes at the Boyden Observatory for 310 Grade 7 – 9 teachers from Kgalagadi, the Northern Cape, North-West and the Free State, in

collaboration with the UFS Centre for Education Development;

- A programme at Boyden for 160 Grade 7 – 9 top achievers from 10 disadvantaged schools, in collaboration with the Grey Academy;
- Programmes at Boyden for 120 top Grade 10 – 12 physical science learners from more than 10 different schools, in collaboration with the UFS Centre for Education Development;
- National Science Week programmes presented to approximately 650 Grade 4 – 12 learners from 80 different schools, in collaboration with the UFS Centre for Education Development and the UFS Department of Geology. More information is provided in Appendix B; and
- Involvement of approximately 400 Grade 5 learners from approximately 100 schools all over the Free State in SAASTA's Astronomy Quiz competition. The Free State leg of the competition is co-coordinated by the Boyden Science Centre, in collaboration with the Free State Department of Education. Eunice Primary won the national finals.

The Boyden Science Centre also facilitated considerable media coverage for scientific topics during 2009. These included a short TV programme about Boyden on Morning Life TV. Prof. Hoffman participated on a regular basis on the popular SABC programme on RSG, *Sterre en Planete*. Prof. Hoffman also has a monthly one-hour science programme *Op Verre Vlugte* on Radio Rosestad and he is frequently interviewed by various radio programmes on space-related events. Prof. Hoffman was elected one of the two Vice-Presidents of the Astronomical Society of Southern Africa (ASSA).

Research outputs

Research articles

- Bem, D.B., Swart, H.C., Luyt, A.S. & Dejene, F.B.** 2009. Structural, Luminescent and Thermal Properties of Blue $\text{SrAl}_2\text{O}_4:\text{Eu}^{2+}, \text{Dy}^{3+}$ Phosphor filled low-density polyethylene composites. *Physica B: Condensed Matter* 404(22): 4504-4508.
- Biggs, M.M., Ntwaeaborwa, O.M., Terblans, J.J. & Swart, H.C.** 2009. Characterization and luminescent properties of $\text{SiO}_2:\text{ZnS}:\text{Mn}^{2+}$ and $\text{ZnS}:\text{Mn}^{2+}$ nanophosphors synthesized by a sol-gel method. *Physica B* 404: 4470-4475.
- Coetsee, E., Terblans, J.J. & Swart, H.C.** 2009. Characteristic properties of $\text{Y}_2\text{SiO}_5:\text{Ce}$ thin films grown with PLD. *Physica B* 404: 4431-4435.
- Coetsee, E., Terblans, J.J., Ntwaeaborwa, O.M. & Swart, H.C.** 2009. Luminescent mechanism of $\text{Y}_2\text{SiO}_5:\text{Ce}$ phosphor powder. *Physica B: Physics of Condensed Matter* 404(22): 4426-4430.
- Coetsee, E., Terblans, J.J., Swart, H.C., Fitz-Gerald, J.M. & Botha, J.R.** 2009. Luminescence of $\text{Y}_2\text{SiO}_5:\text{Ce}$ nanocrystalline thin films. *Electronic Journal of Surface Science and Nanotechnology* 7: 369-374.
- Dejene, F.B.** 2009. The structural and material properties of CuInSe_2 and $\text{Cu}(\text{InGa})\text{Se}_2$ prepared by selenization of stacks of metal and compound precursors by Se vapour for solar cell applications. *Solar Energy Materials & Solar cells* 93: 577-582.
- Dhlamini, M.S., Ntwaeaborwa, O.M., Swart, H.C., Ngaruiya, J.M., Hillie, K.T. & Swart, H.C.** 2009. Sensitized luminescence through nanoscopic effects of ZnO encapsulated in $\text{SiO}_2:\text{Tb}^{3+}$ sol gel derived phosphors. *Physica B: Condensed Matter* 404(22): 4406-4410.
- Dong, S.B., Gould, A., Udalski, A., Anderson, J., Christie, G.W., Gaudi, B.S., Jaroszynski, M., Kubiak, M., Szymanski, M.K., Pietrzynski, G., Soszynski, I., Szweczyk, O., Ulaczyk, K., Wyrzykowski, L., DePoy, D.L., Fox, D.B., Gal-Yam, A., Han, C., Lepine, S., McCormick, J., Ofek, E., Park, B.G., Pogge, R.W., Abe, F., Bennett, D.P., Bond, I.A., Britton, T.R., Gilmore, A.C., Hearnshaw, J.B., Itow, Y., Kamiya, K., Kilmartin, P.M., Korpela, A., Masuda, K., Matsubara, Y., Motomura, M., Muraki, Y., Nakamura, S., Ohnishi, K., Okada, C., Rattenbury, N., Saito, T., Sako, T., Sasaki, M., Sullivan, D., Sumi, T., Tristram, P.J., Yanagisawa, T., Yock, P.C.M., Yoshoka, T., Albrow, M.D., Beaulieu, J.P., Brilliant, S., Calitz, H., Cassan, A., Cook, K.H., Coutures, C., Dieters, S., Prester, D.D., Donatowicz, J., Fouque, P., Greenhill, J., Hill, K., Hoffman, M.J.H., Horne, K., Jorgensen, U.G., Kane, S., Kubas, D., Marquette, J.B., Martin, R., Meintjes, P.J., Menzies, J., Pollard, K.R., Sahu, K.C., Vinter, C., Wambsganss, J., Williams, A., Bode, M., Bramich, D.M., Burgdorf, M., Snodgrass, C., Steele, I., Doublier, V. & Foellmi, C.** 2009. Ogle-2005-blg-071lb, the most massive dwarf planetary companion? *Astrophysical Journal* 695(2): 970-987.
- Joubert, H.D., Terblans, J.J. & Swart, H.C.** 2009. Comparison of inter-diffusion coefficients for Ni/Cu thin films determined from classical heating analysis and linear temperature ramping analysis by means of profile reconstruction and a numerical solution of Fick's law. *Nuclear Instruments and Methods in Physics Research Section B* 267: 2575-2578.
- Koao, L.F., Swart, H.C., Coetsee, E., Biggs, M.M. & Dejene, F.B.** 2009. The effect of Mg^{2+} ions on the Photoluminescence of Ce^{3+} doped silica. *Physica B* 404: 4499-4503.
- Kubas, D., Cassan, A., Dominik, M., Bennett, D.P., Wambsganss, J., Brilliant, S., Beaulieu, J.P., Albrow, M.D., Batista, V., Bode, M., Bramich, D.M., Burgdorf, M., Caldwell, J.A.R., Calitz, H., Cook, K.H., Coutures, C., Dieters, S., Prester, D.D., Donatowicz, J., Fouque, P., Greenhill, J., Hill, K., Hoffman, M.J.H., Horne, K., Jorgensen, U.G., Kains, N., Kane, S., Marquette, J.B., Martin, R., Meintjes, P., Menzies, J., Pollard, K.R., Sahu, K.C., Snodgrass, C., Steele, I., Tsapras, Y., Vinter, C., Williams, A., Woller, K. & Zub, M.** 2008. Limits on additional planetary companions to OGLE 2005-BLG-390L. *Astronomy & Astrophysics* 483(1): 317-324.
- Kumar, V., Swart, H.C., Ntwaeaborwa, O.M., Kumar, R., Lochab, S.P., Mishra, V. & Singh, N.** 2009. Thermoluminescence response of $\text{CaS}:\text{Bi}^{3+}$ nanophosphor exposed to 200MeV Ag^{+15} ion beam. *Optical materials* 32: 164-168.
- Meintjes, P.J. et al.** 2009. Mass measurement of a single unseen star and planetary detection efficiency for OGLE 2007-BLG-050. *Astronomy and Astrophysics* 508(1): 467-478.
- Mishra, S.B., Mishra, A.K., Revaprasadu, N., Hillie, K.T., Steyn, W.J.vdM., Coetsee, E. & Swart, H.C.** 2009. Polymer-Strontium aluminate composites: Morphology, Luminescent properties and Hamburg wheel test. *Journal of Applied Polymer Science* 112(6): 3347-3354.
- Mothudi, B.M., Ntwaeaborwa, O.M., Botha, J.R. & Swart, H.C.** 2009. Photoluminescence and phosphorescence properties of $\text{MAl}_2\text{O}_4:\text{Eu}^{2+}, \text{Dy}^{3+}$ (M = Ca, Ba, Sr) phosphors prepared at an initiating

combustion temperature of 500 °C. *Physica B. Condensed Matter* 404(22): 4440-4444.

Msomi, J.Z. & Moyo, T. 2009. Synthesis and magnetic properties of $\text{Cu}_{0.5}\text{Ni}_{0.5}\text{Fe}_2\text{O}_4$ nanoparticles produced by glycothermal and hydrothermal processes. *Hyperfine Interact* 189: 151-158.

Msomi, J.Z. & Moyo, T. 2009. Effect of domain transformation on the magnetic properties of $\text{Cu}_x\text{Ni}_{1-x}\text{Fe}_2\text{O}_4$ ferrites. *Journal of Magnetism and Magnetic Materials* 321: 1246-1250.

Nsimama, P.D., Ntwaeaborwa, O.M., Coetsee, E. & Swart, H.C. 2009. The influence of the number of pulses on the morphological and photoluminescence properties of $\text{SrAl}_2\text{O}_4:\text{Eu}^{2+}, \text{Dy}^{3+}$ thin films prepared by pulsed laser deposition. *Physica B* 404: 4489-4492.

Ntwaeaborwa, O.M., Kroon, R.E., Kumar, V., Dubroca, T., Ahn, J-P., Park, J.K., Swart, H.C. 2009. Ex situ synthesis and optical properties of ZnO-PbS nanocomposites. *Journal of Physics and Chemistry of Solids* 70(11): 1438-1442.

Ntwaeaborwa, O.M., Nsimama, P.D., Abiade, J.T., Coetsee, E. & Swart, H.C. 2009. The effects of substrate temperature on the structure, morphology and photoluminescence properties of pulsed laser deposited $\text{SrAl}_2\text{O}_4:\text{Eu}^{2+}, \text{Dy}^{3+}$ thin films. *Physica B* 404: 4436-4439.

Ntwaeaborwa, O.M., Swart, H.C., Kroon, R.E., Terblans, J.J. & Holloway, P.H. 2009. Synthesis, characterization and luminescent properties of ZnO-SiO₂:PbS. *Journal of Vacuum Science and Technology A* 27(4): 767-769.

Saxena, A., Srivastwa, D.N.S., Sharma, S., Thakur, S., Kumar, V., Ntwaeaborwa, O.M. & Swart, H.C. 2009. Peculiar features of KCL+SbCl₃ Phosphors: PL and XRD studies. *Journal of Modern Optics* 56(17): 1880-1884.

Jafta, C.J., Roos, W.D. & Terblans, J.J. 2009. 'n Gebruikersvriendelike uitgloeisisteam. *South African Journal for Natural Science and Technology* 28(3): 248.

Swart, H.C., Terblans, J.J., Ntwaeaborwa, O.M., Coetsee, E., Motludi, B.M. & Dhlamini, M.S. 2009. Photon emission mechanisms of different phosphors. *Nuclear Instruments and Methods in Physics Research Section B* 267: 2630-2633.

Terblans, J.J. & Swart, H.C. 2009. The segregation of Bi and S from a Cu(Bi,S) ternary crystal. *Electronic Journal of Surface Science and Nanotechnology* 7: 480-485.

Venter, A., Botha, J.R., Swart, H.C., Naidoo, S. & Olivier, E.J. 2009. An investigation of the oxidized Ni/InAs interface. *Physica B* 404: 4452-4456.

Conference contributions

Ali, A.G., Swart, H.C., Botha, J.R., Coetsee, E., Biggs, M.M. & Dejene, F.B. 2009. *Structural and optical properties of ZnO, SiO₂:Ce³⁺ and ZnO: SiO₂:Ce³⁺ nanoparticles prepared by a Sol-Gel process.* Poster presented at the International Conference on Nanotechnology and Advanced Materials (ICNAM 2009), University of Bahrain, Bahrain. 4-7 May.

Bem, D.B., Swart, H.C., Luyt, A.S. & Dejene, F.B. 2009. *Structural, Luminescent and Thermal Properties of Blue SrAl₂O₄:Eu²⁺, Dy³⁺ Phosphor in LDPE and PMMA Polymers.* Poster presented at the 3rd Conference on Photonic Materials, Mabula Game Lodge, Bela Bela, South Africa. 23-27 March.

Bem, D.B., Swart, H.C., Luyt, A.S., Biggs, M.M. & Dejene, F.B. 2009. *Synthesis and Characterization of Long Persistence Strontium and Barium Aluminates Phosphors.* Paper presented at the 54th Annual Conference of the South African Institute of Physics (SAIP), University of KwaZulu-Natal, Durban, South Africa. 7-10 July.

Biggs, M.M., Ntwaeaborwa, O.M. & Swart, H.C. 2009. *Characterization and luminescent properties of ZnS: Mn²⁺ nanophosphor synthesized by a sol-gel method.* Paper presented at the 54th Annual Conference of the South African Institute of Physics (SAIP), University of KwaZulu-Natal, Durban, South Africa. 7-10 July.

Biggs, M.M., Ntwaeaborwa, O.M., Terblans, J.J. & Swart, H.C. 2009. *Characterization and luminescent properties of SiO₂:ZnS:Mn²⁺ and ZnS: Mn²⁺ nanophosphors synthesized by a sol-gel method.* Paper presented at the 3rd Conference on Photonic Materials, Mabula Game Lodge, Bela Bela, South Africa. 23-27 March.

Coetsee, E., Terblans, J.J. & Swart, H.C. 2009. *Characteristic properties of Y₂SiO₅:Ce thin films grown with PLD.* Paper presented at the 3rd Conference on Photonic Materials, Mabula Game Lodge, Bela Bela, South Africa. 23-27 March.

Coetsee, E., Terblans, J.J. & Swart, H.C. 2009. *The growth of Y₂SiO₅:Ce thin films with pulsed laser deposition.* Poster presented at the 10th Annual Conference on Laser Ablation (COLA), Singapore, Thailand. 22-27 November.

Cronje, S., Kroon, R.E. & Roos, W.D. 2009. *The effect of surface evaporation on contemporary segregation models.* Poster presented at the 54th Annual Conference of the South African Institute of Physics (SAIP), University of KwaZulu-Natal, Durban, South Africa. 7-10 July.

Cronje, S., Kroon, R.E., Roos, W.D. & Neethling, J.H. 2009. *Korrelgroottes en tweelingstrukture in vervormde koper.* Paper presented at the "9^{de} Simposium van die Suid-Afrikaanse Akademie vir Wetenskap en Kuns", University of the Free State, Bloemfontein, Suid-Afrika. 29-30 Oktober.

Dhlamini, M.S., Terblans, J.J., Kroon, R.E., Ntwaeaborwa, O.M., Ngaruiya, J.M., Botha, J.R. & Swart, H.C. 2009. *Photoluminescence pro-*

- erties of SiO₂ surface-passivated PbS nanoparticles.* Paper presented at the 3rd Conference on Photonic Materials, Mabula Game Lodge, Bela Bela, South Africa. 23-27 March.
- Dolo, J.J., Ntwaeaborwa, O.M., Terblans, J.J., Coetsee, E., Dejene, B.F., Biggs, M.M. & Swart, H.C.** 2009. *The effect of oxygen pressure on the structure, morphology and photoluminescence intensity of pulsed laser deposited Gd₂O₂S:Tb³⁺ thin film phosphor.* Poster presented at the 54th Annual Conference of the South African Institute of Physics (SAIP), University of KwaZulu-Natal, Durban, South Africa. 7-10 July.
- Dolo, J.J., Swart, H.C., Terblans, J.J., Coetsee, E., Ntwaeaborwa, O.M. & Dejene, B.F.** 2009. *Effect of oxygen pressure on the structural properties of pulsed laser deposition Gd₂O₂S:Tb thin films.* Paper presented at the International Conference on Nanotechnology and Advanced Materials (ICNAM 2009), University of Bahrain, Bahrain. 4-7 May.
- Dolo, J.J., Swart, H.C., Terblans, J.J., Coetsee, E., Ntwaeaborwa, O.M. & Dejene, F.B.** 2009. *Effect of oxygen pressure on the structural properties of pulsed laser deposition Gd₂O₂S:Tb thin films.* Poster presented at the 10th Annual Conference on Laser Ablation (COLA), Singapore, Thailand. 22-27 November.
- Eassa, N., Venter, A., Botha, J.R. & Swart, H.C.** 2009. *Formation of an oxide on InAs for MOS applications.* Poster presented at the 54th Annual Conference of the South African Institute of Physics (SAIP), University of KwaZulu-Natal, Durban, South Africa. 7-10 July.
- Harris, R.A., Swart, H.C., Van der Lingen, E. & Terblans, J.J.** 2009. *Monte Carlo Simulation and AES characterization of phase formation in Pt-Al thin films.* Poster presented at the 13th European Conference on Applications of Surface and Interface Analysis (ECASIA'09), Dedeman Resort Hotel & Convention Center, Antalya, Turkey. 18-23 October.
- Joubert, H.D., Terblans, J.J. & Swart, H.C.** 2009. *Determining the diffusion coefficient of Ni in Cu from a Ni/Cu thin film using linear heating, Scanning Auger Microscopy and a numerical solution of Fick's second law.* Poster presented at the 13th European Conference on Applications of Surface and Interface Analysis (ECASIA'09), Dedeman Resort Hotel & Convention Center, Antalya, Turkey. 18-23 October.
- Joubert, H.D., Terblans, J.J. & Swart, H.C.** 2009. *Diffusion coefficient of Ni in Cu: Auger electron spectroscopy and profile reconstruction with the Mixing-Roughness-Information model.* Poster presented at the 13th European Conference on Applications of Surface and Interface Analysis (ECASIA'09), Dedeman Resort Hotel & Convention Center, Antalya, Turkey. 18-23 October.
- Koao, L.F., Swart, H.C. & Dejene, F.B.** 2009. *Synthesis and characterization of Ce³⁺ doped silica (SiO₂) nanoparticles.* Poster presented at the International Conference on Nanotechnology and Advanced Materials (ICNAM 2009), University of Bahrain, Bahrain. 4-7 May.
- Koao, L.F., Swart, H.C., Coetsee, E., Biggs, M.M. & Dejene, F.B.** 2009. *The effect of temperature on the photoluminescence characteristics of Ce;Al or Ce;Mg doped SiO₂.* Paper presented at the 54th Annual Conference of the South African Institute of Physics (SAIP), University of KwaZulu-Natal, Durban, South Africa. 7-10 July.
- Koao, L.F., Swart, H.C., Coetsee, E., Biggs, M.M. & Dejene, F.B.** 2009. *The effect of Mg²⁺ ions on the Photoluminescence of Ce³⁺ doped silica.* Poster presented at the 3rd Conference on Photonic Materials, Mabula Game Lodge, Bela Bela, South Africa. 23-27 March.
- Kumar, V., Mishra, V., Ntwaeaborwa, O.M. & Swart, H.C.** 2009. *Preparation and Luminescence studies in CaS:Ce³⁺ nanophosphors.* Paper presented at the 54th Annual Conference of the South African Institute of Physics (SAIP), University of KwaZulu-Natal, Durban, South Africa. 7-10 July.
- Mbule, P.S., Swart, H.C., Terblans, J.J. & Ntwaeaborwa, O.M.** 2009. *Sol-gel synthesis and luminescence properties of different host matrices doped with Pr³⁺.* Poster presented at the 54th Annual Conference of the South African Institute of Physics (SAIP), University of KwaZulu-Natal, Durban, South Africa. 7-10 July.
- Mothudi, B.M., Ntwaeaborwa, O.M., Botha, J.R. & Swart, H.C.** 2009. *Photoluminescence and phosphorescence properties of MAI₂O₄:Eu²⁺, Dy³⁺ (M = Ca, Ba, Sr) phosphors prepared at an initiating combustion temperature of 500 °C.* Paper presented at the 3rd Conference on Photonic Materials, Mabula Game Lodge, Bela Bela, South Africa. 23-27 March.
- Mothudi, B.M., Ntwaeaborwa, O.M., Kumar, A., Botha, J.R., Sohn, K. & Swart, H.C.** 2009. *Phosphorescence properties of long persistent MA₁₂₀₄:Eu²⁺, R³⁺ (M = Ca, Ba, Sr) phosphors prepared by solid state reaction and combustion methods.* Paper presented at the 54th Annual Conference of the South African Institute of Physics (SAIP), University of KwaZulu-Natal, Durban, South Africa. 7-10 July.
- Ndllovu, G.F., Roos, W.D. & Hillie, K.T.** 2009. *Calibration of the variable temperature scanning tunnelling microscopy for high atomic resolution imaging.* Poster presented at the 54th Annual Conference of the South African Institute of Physics, University of KwaZulu-Natal, Durban, South Africa. 7-10 July.
- Ndllovu, G.F., Roos, W.D. & Hillie, K.T.** 2009. *Spin Splitting with surface alloys.* Poster presented at the 4th Korea-South Africa Joint Workshop on Nanotechnology, Korea Institute of Science and Technology, Seoul, Korea. 18-22 October.

Nsimama, P.D., Ntwaeaborwa, O.M., Coetsee, E. & Swart, H.C. 2009. *The influence of deposition parameters on the properties of SrO₂Al₄:Eu²⁺, Dy³⁺ thin film phosphors prepared by the pulsed laser technique: Working atmosphere.* Paper presented at the 54th Annual Conference of the South African Institute of Physics (SAIP), University of KwaZulu-Natal, Durban, South Africa. 7-10 July.

Nsimama, P.D., Ntwaeaborwa, O.M., Coetsee, E. & Swart, H.C. 2009. *The influence of the number of pulses on the morphological and photoluminescence properties of SrAl₂O₄:Eu²⁺, Dy³⁺ thin films prepared by pulsed laser deposition.* Poster presented at the 3rd Conference on Photonic Materials, Mabula Game Lodge, Bela Bela, South Africa. 23-27 March.

Ntwaeaborwa, O.M., Nsimama, P.D. & Swart, H.C. 2009. *Photoluminescence Properties of pulsed laser deposited SrAl₂O₄:Eu,Dy thin films.*

Paper presented at the 56th International Symposium and exhibition of the American Vacuum Society (AVS), San Jose, USA. 8-13 November.

Ntwaeaborwa, O.M., Nsimama, P.D., Abiade, J.T., Coetsee, E. & Swart, H.C. 2009. *The effects of substrate temperature on the structure, morphology and photoluminescence properties of pulsed laser deposited SrAl₂O₄:Eu²⁺,Dy³⁺ thin films.* Paper presented at the 3rd Conference on Photonic Materials, Mabula Game Lodge, Bela Bela, South Africa. 23-27 March.

Swart, H.C., Coetsee, E., Terblans, J.J. & Ntwaeaborwa, O.M. 2009. *Luminescent mechanism of Y₂SiO₅:Ce phosphor powder.* Paper presented at the 3rd Conference on Photonic Materials, Mabula Game Lodge, Bela Bela, South Africa. 23-27 March.

Swart, H.C., Coetsee, E., Terblans, J.J., Ntwaeaborwa, O.M., Nsimama, P.D. & Dolo, J.J. 2009. *Cathodolumi-*

nescence degradation of PLD thin films. Poster presented at the 10th Annual Conference on Laser Ablation (COLA), Singapore, Thailand. 22-27 November.

Swart, H.C., Terblans, J.J., Coetsee, E., Kumar, V., Ntwaeaborwa, O.M. & Biggs, M.M. 2009. *Auger Electron Spectroscopy and X-ray Photoelectron Spectroscopy study of the electron stimulated surface chemical reaction mechanism for phosphor degradation.* Poster presented at the 13th European Conference on Applications of Surface and Interface Analysis (ECASIA'09), Dedeman Resort Hotel & Convention Center, Antalya, Turkey. 18-23 October.

Venter, A., Botha, J.R., Swart, H.C., Naidoo, S. & Olivier, E.J. 2009. *An investigation of the oxidized Ni/InAs interface.* Paper presented at the 3rd Conference on Photonic Materials, Mabula Game Lodge, Bela Bela, South Africa. 23-27 March.

Contact details

Prof. Hendrik Swart

Faculty of Natural and Agricultural Sciences
Department of Physics
University of the Free State
PO Box 339
Bloemfontein
South Africa
9300

Telephone: +27 51 401 2926

Fax: +27 51 401 3507

E-mail: swarthc@ufs.ac.za

Website: www.ufs.ac.za

Staff

Main Campus:

Professor: Hendrik Swart; Koos Terblans, Pieter Meintjes

Associate Professor: Wiets Roos; Matie Hoffman; Martin Ntwaeaborwa

Senior Lecturer: Dr Ted Kroon

Researcher: Ms Lisa Coetsee

Qwaqwa Campus:

Associate Professor: Francis Dejene

Senior Lecturer: Dr Justice Msomi; Mr Richard Ocaya

Lecturer: Dr Moses Mothudi; Mr Jappie Dolo



Mr Bosco Oruro (left) received the first prize for the best PhD presentation in astrophysics during the SKA Bursary Holders' Conference

Overview

On 12 February 2009 the world celebrated the 200th anniversary of the birth of Charles Darwin and the 150th anniversary of the publication of the first edition of his famous book *On the origin of species*. For us this was a great opportunity and vehicle to promote science in its broadest sense under the title *The story of life and survival*. This was presented as a joint venture between the University of the Free State (UFS), The National Museum in Bloemfontein and the Central University of Technology (CUT).

The commemoration included 16 events, mostly popular scientific lectures, presented by different academic departments throughout the year. The lectures

were well attended by members of the public as well as by staff and students of the UFS.

Each lecture, including the slides of the presenter, is available as a podcast that can be downloaded from the UFS's website. This site also contains other event information, photographs and articles. The department played a pivotal role in the entire programme throughout the year. Ms Isabel Human was responsible for much of the arrangements for the different events. Prof. Liesl van As was also responsible for the production of a set of 10 DVDs of all the lectures. Each presenting author received a set in recognition of their participation.



“The department is organised into six research groups, each with its own specific study area and objectives.”

– Prof. Jo van As



Charles Darwin (aka Prof. Schalk Louw) interviewed by a reporter. From the left are: Prof. Schalk Louw from the Department of Zoology and Entomology at the UFS and Prof. Maitland Seaman, Departmental Chairperson of the Centre for Environmental Management also at the UFS.



The department is organised into six research groups, each with its own specific study area and objectives. There is also a satellite department at the Qwaqwa Campus. The groups do, however, share common goals within the strategic priorities of the Faculty of Natural and Agricultural Sciences and the UFS. Prof. Jo van As, Departmental Chairperson, is also involved in activities of the Cluster for Water Management in Water Scarce Areas at the UFS, whilst Prof. Schalk Louw participates in the Cluster concerning Technologies for Sustainable Crop Industries in Semi-arid Regions.

Aquatic Ecology

Due to an expansion in the group's research activities to also include conservation and wetland ecology, the research group's name was changed from ***Aquatic Parasitology*** to ***Aquatic Ecology***.

As part of the Darwin 200 Series, Prof. Jo van As presented the opening address as well as a lecture on animal biodiversity entitled *The tree of life*. Prof. Linda Basson presented a lecture entitled *Introducing Biodiversity and Animal Taxonomy*.

Staff spent the April 2009 recess at the De Hoop Nature Reserve in the Western Cape with the third-year Zoology students as part of the practical section of the Ecology course. During this trip the team from Homebrewfilms

joined us and produced three environmental programmes for *GROEN*, a programme on kykNET. Ms Esther van der Westhuizen, one of the presenters, gave a talk to the students as part

of their academic programme. Two of the third-year students also spent an afternoon with the crew, assisting them with the filming activities in the reserve.

During July 2009, Profs. Jo and Liesl Van As visited the Leseding Research Camp in the Okavango Delta, Botswana. This visit was, however, not for research purposes, but for the building of the information and environmental centre as an expansion to the Leseding facilities. These facilities are hosted at the Krokovango Crocodile farm, Samcochima, Botswana. The centre was completed in November 2009 with the assistance of the local workforce.

During August 2009, Profs. Jo and Liesl Van As accompanied postgraduate students on a research field trip to the Leseding Research Camp. Surveys were conducted mostly in the panhandle area to collect additional information for the Master's students' project. Due to the water level of the river, areas that had not had water for more than 20 years were flooded in 2009. It was thus an ideal opportunity to explore some of these areas. Profs. Jo and Liesl van As conducted a trip to the Boteti River together with Tim and June Liversedge. They collected plankton in the newly arrived water, as well as fish and some parasites.

Arachnology

This group consists of Mr Charles Haddad (lecturer and researcher) and Ms René Fourie (M.Sc. student).

The Ndumo Game Reserve in KwaZulu-Natal is currently the reserve with the highest known spider diversity in South Africa, with 421 species recorded thus far. Despite the very high spider biodiversity, little is known of the fauna occupying tree canopies. Canopy fogging is a sampling method that is used to collect spiders, pseudoscorpions and



Prof. Jo van As, Departmental Chairperson, busy with fieldwork in the Kalahari

insects from the crowns of trees that cannot be accessed by using conventional sampling methods. This is accomplished by spraying the tree canopy with a rapid knockdown pesticide, killing the arthropods that then drop down onto white sheets. The arthropods can then easily be collected and preserved. Although quite extensively used in tropical Africa, this technique has rarely been used in South Africa. The first samples were collected in the Limpopo Province in this way during and following the 2008 African Arachnid Colloquium at Lajuma.

During 2009 two projects were initiated to study the canopy fauna at Ndumo, the first focusing on trees associated with riparian and wetland forests (*Trichilia emetica*, *Kigelia africana*, *Ficus sycomorus* and *Breonadia salicina*), and the second sampling trees associated with deciduous woodlands (*Garcinia livingstonei*, *Strychnos spinosa* and *Combretum molle*). Over the course of the study a total of 10 samples will be taken from each tree species, with five in winter (June–July 2009) and five in summer (November–December 2009).

During June to July 2009, Mr Haddad, Ms Butler (third-year B.Sc. student) and former student Robin Lyle took the first 20 canopy fogging samples at Ndumo from the four wetland tree species. A second trip was undertaken by Messrs Haddad and Swart (UFS) and Ashley Kirk-Spriggs (National Museum, Bloemfontein and associate researcher in the department) during November to December 2009. Due to heavy rains in the preceding weeks, the site with *Breonadia salicina* trees could not be accessed due to extensive flooding of

the Pongola River. However, five trees each of the other wetland species were successfully sampled at Shokwe Pan and the first set of woodland samples was also gathered during the same trip.

This method has proven to be extremely successful and produced large quantities of valuable material that will be used in various ecological and taxonomic studies, making a valuable contribution to our knowledge of the Maputaland fauna. Mr Kirk-Spriggs was also able to gather large numbers of insects, particularly flies that form the focus of his research. The material collected has contributed to enlarging the Diptera collection in the National Museum, and also provided specimens for morphological and molecular studies as part of his Ph.D. research on the Afrotropical flies of the family Curtonotidae.

At the end of 2009 Ms Fourie completed her M.Sc. study that investigated the ground-, grass- and tree-living spider communities of the Erfenis Dam Nature Reserve in the Free State. In addition to the various ecological projects that formed part of her thesis, she also revised the purse-web spider genus *Calommata* in the Afrotropical region, including the description of four new species. These spiders are widely regarded as one of the most threatened arachnid taxa in South Africa. Mr Haddad is assistant project manager for the South African National Survey of Arachnida and part of the current phase of the project involving the preparation of a checklist of South African spiders (approximately 2 000 species), with details on their distribution, relative abundance and biology, as a prelude to the Red Data listing process. As such, Ms

Fourie's work on *Calommata* will make a valuable contribution towards the Red Data listing of this genus.

Nematology

This research group concentrates on plant parasitic nematodes occurring in the Free State Province that will, in the long run, aid farmers in this area. Dr Candice Jansen van Rensburg, head of this research group, is currently at the University of Gent in Belgium where she is doing a specialised M.Sc. in Nematology. Ms Landman an M.Sc student in Nematology attended the Nematological Society of southern Africa conference in May 2009, where she won the prize for the best student presentation (oral). The title of her presentation was: The genus *Histotylenchus* Siddiqi, 1971 in South Africa.

Eco-ethology

Two members of the academic staff, Mr Hennie Butler and Ms Lindi Heyns, work within the Eco-ethology research group, actively combining teaching and research. Together with eight post-graduate students, they form a study group that encourages inter-disciplinary research through a combination of laboratory and field science.

The Eco-ethology group pursues basic research in the field of behavioural biology and ecology, but also includes diverse areas such as the anatomy, physiology, natural and evolutionary history, taxonomy, conservation, management and economics of animals. Projects under way by group members mainly focused on applied questions in wildlife management of various antelope

species during 2009, but studies were also carried out on fish, felines, extinct mammals and birds as study animals.

Mr Hennie Butler (Ph.D.) and Ms Esmarie Jooste (Hons.) focused on the soil-eating behaviour (geophagy) of antelopes in semi-arid regions. Ms Elilyia Shardelow (M.Sc.) and Ms Nadine Jacobs (Hons.) investigated behavioural aspects of blue wildebeest and sable antelope, respectively.

Research carried out by Mr Savvas Vrahimis (Ph.D.) and Ms Lindi Heyns (M.Sc.) entailed a combination of behavioural biology and conservation genetics. Mr Vrahimis, associated with the Free State Department of Tourism, Environmental and Economic Affairs, researched aspects of the ecology, behaviour and genetic status of black wildebeest, whereas Ms Heyns continued to investigate behavioural and genetic aspects of blesbok and bontebok in the Free State.

Ms Andri Erasmus (M.Sc.) conducted fieldwork in Botswana where fish was collected from the Okavango River and examined for parasitic flukes that occur in the eyes and brain. Through behavioural experiments she aims to determine how the parasites influence the behaviour of the host. Concerning carnivores, Mrs Michelle van As (M.Sc.) continued to investigate the activity patterns of leopard in Lydenburg.

Mr Dewald du Plessis (M.Sc.) continued to examine the cranial endocasts of non-mammalian cynodonts to explore brain evolution with the aim to correlate brain size with the physiology and behaviour of these animals. Mr Johan van Niekerk completed his Doctoral thesis on a long-

term behavioural study of avifauna in the grassland biome.

The group was invited to attend a meeting of the local Hunters Association of Senekal where Mr Hennie Butler presented a talk on the different social structures of antelopes. Valuable discussions with hunters and game farmers resulted in invitations for future research. Mr Butler was also invited by the Bloemfontein Hunters Association to present a talk with the topic *The honesty of horns*. Members further attended the establishment of a Biodiversity Forum upon invitation from Free State Nature Conservation authorities at Soetdoring Nature Reserve.

The annual honours-class excursion to Willem Pretorius Game Reserve took place during mid-winter. Nearly every topic on animal behaviour was discussed around a warm campfire. The students, under supervision of Mr Butler and Ms Heyns, gained hands-on experience in terms of the varied means of performing animal behaviour research in the field, e.g. instantaneous scan sampling methodology and setting camera traps.

Mr Butler, Mss Heyns, Andri Erasmus, Nadine Jacobs and Esmarie Jooste attended the Annual Southern Africa Wildlife Management (SAWMA) Symposium, held at the Protea Hotel Black Mountain, Thaba 'Nchu from 13 to 16 September 2009, where four oral presentations were delivered on topics surrounding monitoring and criteria for wildlife sustainability as well as management implications of small reserves and fragmented populations. Ms Erasmus was recognised as the

best presenter in the student category. A sure highlight of the symposium was meeting the famous zoologist and author, Prof. John Skinner.

Ms Nadine Jacobs was contacted by *Farmers Weekly* magazine shortly thereafter and a popular article based on her sable antelope presentation was published in a later issue of the magazine. Apart from the tremendous response from the public, Ms Jacobs was contacted by the renowned biologist and author, Richard Estes, who acknowledged her preliminary findings and encouraged her to continue research on aggression amongst conspecifics. Group members were approached at the symposium by representatives of the Northern Cape Department of Tourism, Environmental and Economic Affairs to assist with an assessment of the prospect of reintroducing grey rhebok at Goegap Nature Reserve, Namaqualand. Ms Lindi Heyns accompanied them to the Richtersveld National Park tucked into the far north-western corner of the Northern Cape Province. The team managed to locate free-ranging grey rhebok in this mountain desert wilderness and attained the needed observational data to confirm that the habitat at Goegap Nature Reserve will be suitable for the reintroduction of this antelope species.

Insects on New Crops Programme (INCroP)

Throughout the year the group participated in the activities of the UFS Research Cluster 4: Technologies for Sustainable Crop Industries in Semi-arid Regions. Specific expertise was provided for the Cluster regarding pest



Fishing in the Boteti's new water.

management on new crops and soil health management. Several lectures were presented and workshops attended in this regard. New research planning was initiated within the Cluster, which included the role of arthropod mesofauna in soil health analysis. This forms part of the larger holistic plant health management research thrust of the INCroP Programme.

Cooperative research was conducted on the following topics:

Agromyza leafminer bionomics on wheat and barley with the Agricultural Research Council's (ARC) Small Grain Institute, Bethlehem and Griqualand

West Corporation, Douglas; *Hemipteran* insects as vectors of sorghum diseases with Plant Pathology, UFS; Navel orangeworm survival on pistachio with Green Valley Nuts, Prieska; and Arboreal insect stratification along the Omaruru River, Namibia with Polytech University of Namibia, Windhoek. Most of these projects are nearing completion or have been completed.

Upon invitation the group attended the 19th Symposium on Soil Health and Soil-borne Plant Diseases, hosted at the ARC Vredenburg Research Centre, Stellenbosch in September 2009. Prof. Schalk Louw and three postgraduate

students participated in the 16th Congress of the Entomological Society of Southern Africa hosted at the University of Stellenbosch from 5 to 7 July 2009. Three presentations were made.

In September 2009 two lectures on plant health management and insects associated with pecan nuts were presented at the Pecan Nut Open Day at Griqualand West Corporation in Douglas, Northern Cape.

Prof. Louw participated in the Darwin 200 Celebration Lecture Series hosted by the Department. This participation consisted of writing the script for a stage play on



Botany and Zoology students and staff on excursion at the De Hoop Nature Reserve.

The life of Charles Darwin, which was performed by Profs. Louw and Maitland Seaman, as well as a lecture on *Darwin was an insect man ...*, which formed part of a larger Biodiversity slot.

Together with Mr Ashley Kirk-Spriggs, entomologist at the National Museum and research associate in the department, a project on *Insect diversity and biogeography of Inselbergs in the Eastern Free State*, was launched and presented as a paper at a UFS/National Museum Cooperative Research Forum mini-symposium at Oliewenhuis Art Museum in August 2009.

Prof. Schalk Louw was appointed as Chairperson of the Centre for Plant Health

Management (CePHMa) that is affiliated under the UFS Research Cluster 4.

Two of the group's postgraduate students successfully completed their studies. A project entitled *Biology and control of the mango seed weevil in South Africa* was completed by M.Sc. student Ms Estelle Louw of Bavaria Fruit Estates, Hoedspruit. For this she was awarded her M.Sc. degree in Entomology.

Mr Johan Pretorius successfully completed his M.Tech. dissertation in Agricultural Management at the Central University of Technology (CUT), Bloemfontein entitled *A plant health management system for Aphididae on lettuce under variable shade house conditions*

in the central Free State, South Africa, with Prof. Schalk Louw as supervisor. He was awarded his degree *cum laude* and for this achievement he received the Dux Student Award for the best post-graduate study at the CUT in 2009. He has also been awarded a Fulbright Fellowship to continue his Ph.D. studies at the University of Nebraska in the USA.

Integrated Pest Management and Environmental Agriculture

The group consists of Mr Vaughn Swart (lecturer and researcher). During 2009 field work involved a range of pesticide trials on a potential pest on pecan nuts conducted in Prieska in the Northern

Cape. A range of three pesticides were compared in terms of efficacy to control a species of leafhopper (*Heteroptera: Cicadellidae*). A significant difference was observed in terms of the efficacy. Unfortunately there were no publications as a result of privacy rights. The research was conducted for André Van Niekerk from Oranje Landgoed Farms, Prieska. Further fieldwork was conducted at Aliwal North, Prieska and Upington. Here the main aim was to collect a single species of insect from each site and from different nut crops (viz. pecan nuts, pistachio nuts and walnuts) with the intention to isolate fungi from them. The fungi isolated were then quantitatively and qualitatively analysed and assessed to determine whether the fungi were a disease-causal organism, in other words, whether the insect has the potential to be a disseminator of disease causal organisms. Further research will be conducted to determine whether it is possible to use insects as indicators of which species of fungi are present in an orchard. This work forms part of an ongoing research project which is part of Mr Jaco Saaimans' (Hons.) 2010 research.

During July 2009 Mr Swart attended the 16th National Congress of the Entomological Society of Southern Africa hosted by the University of Stellenbosch. During the 72nd annual general meeting, which was held at the conference, the decision was taken that the University of the Free State would host the 17th National Congress of the Entomological Society of Southern Africa and Mr Swart would form part of the organising committee.

During November 2008 Mr Swart became associated with the South African Pecan Producers Association (SAPPA). SAPPA donated R10 000 for research for 2009 and invited Mr Swart as a representative of CePHMa to the annual general meeting in November 2009 to discuss further potential research and funding opportunities for CePHMa. During May 2009 several representatives of the SAPPA regions across the country were invited to an information session to discuss potential collaboration between SAPPA and CePHMa. Matters such as a Memorandum of Understanding and future funding were discussed. During September 2009 Mr Swart (accompanied by Prof. Schalk Louw) presented a talk on pests and diseases associated with pecan nuts at a farmers' day which was hosted by GWK Limited, Douglas in the Northern Cape. During November Mr Swart attended the AGM of SAPPA and presented a talk on the research conducted throughout the year. Further discussion was focused around the establishment of a potential statutory levy for research.

Medical, Veterinary, Forensic Entomology and Agricultural Entomology

This group consists of Prof. Theuns van der Linde (Professor, Researcher and Group Leader), Ms Sonja Brink (part-time Ph.D. student), Mr Kobus Kolver (Ph.D. student), Ms Ansie Scholtz (Ph.D. student, registered at the Centre for Sustainable Agriculture and Sustainable Development at the UFS, but the research is done in the Departments of Entomology and Animal Science), Messrs

Shaun Hoffman, Julien Liebenberg and Theo Viljoen (M.Sc. Students) and Mss Carmen Luwes and Elaine Allemann (B.Sc. Hons. students).

During 2009 the students did research in various aspects of Forensic Entomology.

Mr Kobus Kolver completed the final practical aspects of his research on the influence of burning of a body.

Ms Sonja Brink was doing a taxonomic study of the immature stages of blowflies of importance in forensic crime investigations. She completed her study at the end of November 2009 and submitted her thesis on 4 December 2009 for assessment. The thesis was unconditionally accepted by all three assessors (two external and one internal).

Mr Shaun Hoffman is doing a project in forensic entomology. The discipline is Entomotoxicology. This project is done in collaboration with Dr Piet van der Merwe from the Department of Pharmacology. Mr Hoffman is currently writing his thesis. He is planning to submit his thesis for evaluation during 2010.

Mr Theo Viljoen is busy with his research project in collaboration with Ms Karin Ehlers from the Department of Genetics. His project deals with the possible differences/similarities between closely related blowfly species viz. *Lucilia cuprina* and *Lucilia sericata*. These two species are morphologically almost identical and difficult to distinguish from each other. They are very important in criminal investigations. He is also planning to determine possible cross-breeding between *Chrysomya marginalis* and *Chrysomya albiceps*.



Etology students and their lecturer busy with animal behaviour observations.

Veterinary Entomology

Ms Ansie Scholtz is an employee of the Department of Agriculture at Elsenburg in the Western Cape Province. Her project deals with various aspects and causes of blowfly strike on sheep. Since she is a full-time employee of the Department of Agriculture, her research project is progressing slower than expected. She plans to complete her studies by May 2010 and submit her thesis for assessment. She is currently processing her results and writing some of the chapters. Early during 2010 two publications from her research were accepted for publication and they have already appeared in a subject-related journal. She is also busy preparing more manuscripts from her research for publication in subject-related scientific journals.

Scholtz AJ, Cloete SWP, Van Wyk JB, Misztal I, Du Toit E, Van der Linde TCdeK (2010a) Genetic (co)variances between wrinkle score and absence of breech strike in mulesed and unmulesed Merino sheep, using a threshold model. *Animal Production Science* 50, 203 – 209.

Scholtz AJ, Cloete SWP, Van Wyk JB, Kruger ACM, Van der Linde TCdeK (2010b) The influence of divergent selection for reproduction on the occurrence of breech strike in mature Merino ewes. Animal Production Science 50, 210–218.

Mr Julien Liebenberg is doing a M.Sc. project on the bio-ecology of the *Culicoides* in the Free State. Aspects of the bio-ecology and vector potential of these biting and blood-feeding midges

have not been researched extensively in the Free State. These biting midges are of major veterinary importance, because they can transmit the Bluetongue virus to sheep, Bovine ephemeral disease virus (Three-day stiffness disease) to cattle and the African Horse sickness virus to horses. The latter disease can cause huge financial losses to the equine breeding, equestrian sport industry and the international trade in horses. Mr Liebenberg was employed by a private company, Clinvet International, as a scientific assistant during 2009. This opportunity had a negative influence on the progress of his studies. He plans to complete his M.Sc. studies during 2010.

Agricultural Entomology

Mr Jan Richter is doing a M.Sc. study on bio-control of the Russian Wheat Aphid, using natural plant extracts. He is employed by the Department of Agriculture at Glen Agricultural College.

Pesticide Resistance Testing and Research Facility

This group consists of Mss Ellie van Dalen (lecturer and researcher) Christa du Rand (professional officer), Octavia Motlogeloa (full-time M.Sc. student), Sharon Terry and Mr Adri Jordaan (part-time M.Sc. student).

The year 2009 was once again a very busy year for the Pesticide Resistance Testing Facility, mainly due to the urgency for tick resistance testing and research. This effort gained momentum and tick collections from all over South Africa were received for testing. A television production team

also filmed the activities at the facility and two inserts were screened during the Agriculture Today programme on 26 February and 5 March 2009. These two inserts showed the laboratory testing and field component of tick collections respectively and shared important information about the urgency of correct management programmes to combat tick resistance on farms in South Africa.

Tick-resistance profile results obtained in 2008 in an ongoing study undertaken by this group in collaboration with Bayer, Division Animal Health and a private consultant Pierre van Niekerk, developer of the Scorpion dip apparatus, were used in planning and implementing short- and long-term management strategies during 2009. The goal is to restrict the further development of tick resistance in the three high tick-resistant areas in South Africa. These strategies showed promise with regards to a reduction in the use of acaracides to combat ticks. The evaluation of the efficacy of these strategies will be ongoing during 2010.

Follow-up field trips to nine farms in the Eastern Cape Province were undertaken by Ms Van Dalen and Ms Octavia Motlogeloa during April and November 2009 to collect ticks from cattle as part of Octavia's ongoing Master's study to determine the status of tick resistance against chemical control in the Grahamstown area of this province. These collections concluded the field work for this study and data evaluation and the completion of the dissertation is planned for 2010.

The group was also involved in the completion of a contract research project for in vitro efficacy studies in collaboration with ClinVet International for the Japan-situated company, Sumitomo Chemical Co., Ltd.

A trade visit during June 2009 was conducted by Ms Van Dalen to re-establish and extend collaboration with our clients in the pharmaceutical arena. For this purpose meetings were set up with Johan Collyer from Virbac, Centurion and Dr Barry Coats from Novartis. These meetings led to the inclusion of the facility, represented by Ms Ellie van Dalen, in a road show with Novartis during October 2009 in the form of farmers' days held in Kokstad, KwaZulu-Natal, McLearn, Southwell and Haga Haga in the Eastern Cape. During this road show much needed information on the problem of ticks developing resistance against chemical control and possible ways to manage this problem as well as information on the services provided by the facility were conveyed to the commercial farming communities.

Mr Whitey Jordaan and Ms Sharon Terry left the group to start their careers at ClinVet International while writing up their results on field collections to determine the geographic distribution of *Ixodes* (Acari:Ixodidae) ticks in the Free State Province as well as the seasonality of those associated with African Buffalo and the comparative taxonomy of four morphologically very similar ticks from the *Rhipicephalus* genus respectively as



Charles Haddad busy with the fogging of trees to collect samples of insects.

part of their M.Sc. projects. They both plan to hand in their dissertations at the end of 2010.

Ms Van Dalen attended the WHO/TDR Good Laboratory Practice Training Workshop held at the Faculty of Time Management Workshop presented by Mr Igno van Niekerk of Dreamagineers and hosted by the Staff Wellness Department of the UFS on 3 August 2009.

Research outputs

Research articles

Haddad, C.R. & Dippenaar-Schoeman, A.S. 2009. A checklist of the non-acarine arachnids (Chelicerata: Arachnida) of the De Hoop Nature Reserve, Western Cape Province, South Africa. *Koedoe* 51: 1-9.

Haddad, C.R. 2009. *Vendaphaea*, a new dark sac spider genus apparently endemic to the Soutpansberg Mountains, South Africa (Araneae: Corinnidae). *African Invertebrates* 50: 269-278.

Haddad, C.R., Lyle, R., Bosselaers, J. & Ramirez, M. 2009. A revision of the Afrotropical genus *Austrachelas* Lawrence, 1938 (Araneae: Corinnidae), and its transfer to the Gallieniellidae. *Zootaxa* 2296: 1-38.

Kaiser, W., Avenant, N. & Haddad, C.R. 2009. Assessing the ecological integrity of a grassland ecosystem: refining the SAGraSS method. *African Journal of Ecology* 47: 308-317.

Kelly, J.A., Van der Linde, T.C. & Anderson, G.S. 2009. The influence of clothing and wrapping on carcass decomposition and arthropod succession during the warmer seasons in central South Africa. *Journal of Forensic Sciences* 54(5): 1105-1112.

Le Roux, P.D.S., Kok, O.B. & Butler, H.J.B. 2009. Dietary composition of feral pigeons in the Bloemfontein urban area, central Free State. *Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie* 28(4): 414-422.

Louw, S.VdM., Parau, J.V. & Olevano, J.C. 2009. Bio-ecology of sap beetles (Nitidulidae), a new double impact pest on cactus pear in South Africa. *Acta Horticulturae* 811: 217-221.

Lyle, R. & Haddad, C.R. 2009. *Planochelas*, a new genus of tracheline sac spiders from West and

Central Africa. *Annals of the Transvaal Museum* 46: 91-100.

Pretorius, R.J., Louw, S.VdM. & Venter, P. 2009. Seasonal fluctuations in aphid and coccinellid populations on lettuce, cultivated under variable shadehouse conditions in central South Africa. *Journal of Applied Entomology* (In press).

Pretorius, R.J., Louw, S.VdM. & Venter, P. 2009. The occurrence and species composition of Aphididae and Coccinellidae associated with shadehouse cultivated lettuce in the central Free State (South Africa). *African Entomology* (In press).

Pretorius, R.J., Louw, S.VdM., Venter, P. & Van Der Westhuizen, C. 2009. The impact of varying aphid populations in two different shadehouse structures on some physical characteristics of head lettuce, cultivated in the central Free State, South Africa. *African Plant Protection*: (In press).

Reed, C.C., Basson, L. & Van As, L.L. 2009. First record of a myxozoan of the genus *Sphaeromyxa* Thélohan, 1892 (Myxozoa: Bivalvulida) from the tip of Africa. *The European Association of Fish Pathologists* 29: 73-76.

Venter, G.J., Wright, I.M., Van der Linde, T.C. & Paweska, J.T. 2009. The oral susceptibility of South African field populations of *Culicoides* to African horse sickness virus. *Medical & Veterinary Entomology* 23: 367-378.

Wesołowska, W. & Haddad, C.R. 2009. Jumping spiders (Araneae: Salticidae) of the Ndumo Game Reserve, Maputaland, South Africa. *African Invertebrates* 50: 13-103.

Reports

Louw, S.VdM. 2009. *Olive orchards at DeLuc, Ladybrand*. Report to

Mr Oscar de Freitas, DeLuc Farm, Ladybrand, South Africa.

Swart, V.R. 2009. *Pecan insect pests: Current problems in SA*. Report to the South African Pecan Producers Association (SAPPA), Craddock, South Africa.

Swart, V.R. 2009. *The efficacy of three pesticides to control Empoaceae sp. (Heteroptera: Cicadellidae) as a potential pest of pecan nuts, Prieska*. Report to the Industrial Development Corporation – Green Valley Nuts, Prieska, South Africa.

Swart, V.R. 2009. *What pecan growers must know, GWK, Douglas*. Report to Griekwaland Wes Korporatief Limited (GWK), Douglas, South Africa.

Van der Linde, T.C., Kolver, J.H. & Hoffman, S. 2009. *Ten forensic entomological reports for the South African Police Services*. (Unpublished and Confidential).

Conference contributions

Adendorff, J., Prinsloo, G.J. & Louw, S.VdM. 2009. *The bionomics of the grass leafminer, Agromyza ocularis (Diptera: Agromyzidae), in central South Africa*. Proceedings of the 16th Entomological Congress of the Entomological Society of Southern Africa (ESSA), Stellenbosch, South Africa. 5-8 July. p.11.

Basson, L. & Van As, J.G. 2009. *Hypotheses on mobile peritrich (Ciliophora: Peritrichia) transmission*. Paper presented at the 38th Annual Conference of the Parasitological Society of Southern Africa, Magaliesberg, South Africa. 20-23 September.

Dippenaar-Schoeman, A.S. & Haddad, C.R. 2009. *South African National Survey of Arachnida - A wealth of information on the arachnids*

in conserved areas. Paper presented at the 16th Entomological Congress of the Entomological Society of Southern Africa (ESSA), Stellenbosch, South Africa. 5-8 July.

Erasmus, A., Van As, J.G. & Butler, H.J.B. 2009. *Fish eye flukes: Not large but possibly in charge?* Paper presented at the 38th Annual Conference of the Parasitological Society of Southern Africa, Magaliesberg, South Africa. 20-23 September.

Erasmus, A. & Butler, H.J.B. 2009. *Behavioural aspects of Bontebok (Damaliscus pygargus pygargus) and Tsessebe (D. lunatus lunatus) in the central Free State*. Paper presented at the Southern African Wildlife Management Association (SAWMA) Symposium: Wildlife Management – Ensuring sustainability, Protea Black Mountain, Thaba 'Nchu, South Africa. 13-16 September.

Greenwald, H., Basson, L. & Van As, J.G. 2009. *Mobile peritrich transmission between fish and tadpoles*. Paper presented at the 38th Annual Conference of the Parasitological Society of Southern Africa, Magaliesberg, South Africa. 20-23 September.

Heyns, L., Kok, O.B., Ehlers, K. & Butler, H.J.B. 2009. *Using activity patterns and STR markers to distinguish between blesbok (Damaliscus pygargus phillipsi) and bontebok (D. p. pygargus) in the Free State, South Africa*. Paper presented at the Southern African Wildlife Management Association (SAWMA) Symposium: Wildlife Management – Ensuring sustainability, Protea Black Mountain, Thaba 'Nchu, South Africa. 13-16 September.

Jacobs, N., Heyns, L. & Butler, H.J.B. 2009. *Behavioural aspects of sable antelope, Hippotragus niger,*

- Harris 1838, in semi-arid regions of South Africa. Paper presented at the Southern African Wildlife Management Association (SAWMA) Symposium: Wildlife Management – Ensuring sustainability, Protea Black Mountain, Thaba 'Nchu, South Africa. 13-16 September.
- Jooste, E. & Butler, H.J.B.** 2009. *Geophagy and mineral preference by gemsbok (Oryx gazella) in the southern Kalahari*. Paper presented at the Southern African Wildlife Management Association (SAWMA) Symposium: Wildlife Management – Ensuring sustainability, Protea Black Mountain, Thaba 'Nchu, South Africa. 13-16 September.
- Landman, H., Jansen van Rensburg, C. & Marais, M.** 2009. *The genus Histotylenchus Siddiqi, 1971 in South Africa*. Paper presented at the 19th Nematological Society of Southern Africa conference. May 2009.
- Louw, S.VdM.** 2009. *Understanding the role of soil borne insects in soil ecosystems*. Proceedings of the 19th Annual Interdisciplinary Symposium of the Agricultural Research Council – Plant Protection Research Institute (ARC-PPRI): Biology and Soil-borne Plant Diseases, Vredenburg Research Centre, Stellenbosch, South Africa. 16-17 September. p. 77-93.
- Louw, S.VdM.** 2009. *Arthropods and soil health*. Invited lecture presented at the International Soil Health Workshop hosted by University of the Free State Strategic Research Cluster 4: Technologies for Sustainable Crop Industries in Semi-arid Regions, University of the Free State, Bloemfontein, South Africa. 30 September-2 October.
- Louw, S.VdM.** 2009. *Towards understanding microbes, nematodes and insects in soil ecosystems in South Africa*. Invited lecture presented at the Official Launch Symposium of the University of the Free State Strategic Research Cluster 4: Technologies for Sustainable Crop Industries in Semi-arid Regions, University of the Free State, Bloemfontein, South Africa. 25 November.
- Moller, J-H., Van As, J.G. & Van As, L.L.** 2009. *Siamese monogeneans of southern Africa*. Paper presented at the 38th Annual Conference of the Parasitological Society of Southern Africa, Magaliesberg, South Africa. 20-23 September.
- Muller, B., Louw, S.VdM. & Mostovski, M.** 2009. *A review of agroecological important Atherigona s. str. species (Diptera: Muscidae) of South Africa*. Proceedings of the 16th Entomological Congress of the Entomological Society of Southern Africa (ESSA), Stellenbosch, South Africa. 5-8 July. p.55.
- Pretorius, J., Louw, S.VdM. & Venter, P.** 2009. *Seasonal fluctuations in aphid and coccinellid populations on shade-house cultivated lettuce*. Paper presented at the 16th Entomological Congress of the Entomological Society of Southern Africa (ESSA), Stellenbosch, South Africa. 5-8 July. p.61.
- Richter, J., Prinsloo, G.J. & Van der Linde, T.C.** 2009. *Plant extracts: Potential use as a control strategy against Russian Wheat Aphid*. Poster presented at the 16th Entomological Congress of the Entomological Society of Southern Africa (ESSA), Stellenbosch, South Africa. 5-8 July.
- Swart, V.R.** 2009. *Insect - fungal ecology of nut crops in semi-arid regions of South Africa*. Invited lecture presented at the Official Launch Symposium of the University of the Free State Strategic Research Cluster 4: Technologies for Sustainable Crop Industries in Semi-arid Regions, University of the Free State, Bloemfontein, South Africa. 25 November.
- Van As, J.G.** 2009. *Charles Darwin 200 and Symbiosis*. Keynote address presented at the 38th Annual Conference of the Parasitological Society of Southern Africa, Magaliesberg, South Africa. 20-23 September.
- Van As, J.G.** 2009. *Charles Darwin en die boom van lewe*. Invited guest speaker at the Centenary Symposium of the South African Academy of Art and Science, University of the Free State, Bloemfontein, South Africa. 26 June.
- Van As, L.L. & Basson, L.** 2009. *Mobiline peritrichs found on African limpets*. Paper presented at the 38th Annual Conference of the Parasitological Society of Southern Africa, Magaliesberg, South Africa. 20-23 September.
- Venter, G., Labuschane, K., Liebenberg, J., Hermanides, K., Boikanyo, S., Majatladi, D. & Van der Linde, T.C.** 2009. *Paper: Light trap collection comparisons*. Paper presented at the 3rd Annual Meeting of the "Faculdade de Medicina Veterinária", University Técnica de Lisboa, Lisabon, Portugal. 2-4 December.

Contact details

Prof. Jo van As

Faculty of Natural and Agricultural Sciences
Department of Zoology and Entomology
University of the Free State
PO Box 339
Bloemfontein
South Africa
9300

Telephone +27 51 401 2427
Fax: +27 51 444 5943
E-mail: vanasJG@ufs.ac.za
Website: www.ufs.ac.za

Staff

Main Campus:

Professors: Profs. Jo van As, Linda Basson, Schalk Louw, Theuns van der Linde

Extraordinary Professors: Profs. Leon Fourie, Gerhard Prinsloo

Associate Professor: Prof. Liesl van As

Lecturers: Dr Candice Jansen van Rensburg, Messrs Hennie Butler, Charles Haddad, Ms Ellie van Dalen

Junior Lecturers: Ms Lindie Heyns, Mr Vaughn Swart

Affiliated Researchers: Profs. Dawie Kok, Ivan Horak, Jacob den Heyer, Dr Jennifer Botha Brink, Mr Johan van Niekerk, Mr Ashley Kirk-Spriggs

Qwaqwa Campus:

Subject Head and Senior Lecturer: Dr Oriel Thekiso

Lecturers: Dr Michael Cunningham, Messrs Johann van As, Emille Bredenhand, Ms Hafeleni Matete



The background features a light blue-toned image of a document with a bar chart. A silver pen is positioned diagonally across the chart. The chart has several vertical bars of varying heights. A dark blue horizontal band with a white dot pattern is at the top. A dark blue horizontal band with the text '25 Statistical Data' is in the middle. The overall aesthetic is professional and data-oriented.

25

Statistical Data

Faculty of Natural and Agricultural Sciences

Student figures: 2008-2009

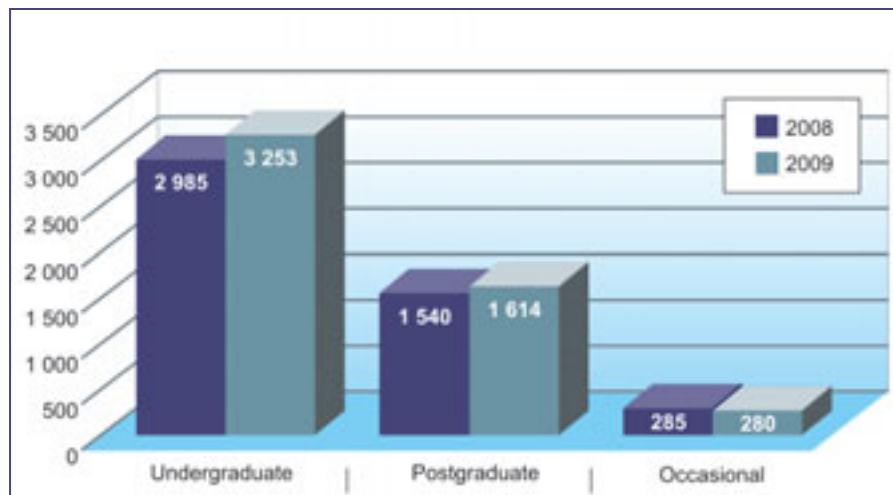
Year	Description	Female					Male					Total				
		Black	Coloured	Asian	White	Total	Black	Coloured	Asian	White	Total	Black	Coloured	Asian	White	Total
2008	Undergraduate	806	30	16	448	1300	860	21	22	782	1685	1666	51	38	1230	2985
	Postgraduate	298	19	24	257	598	458	21	19	444	942	756	40	43	701	1540
	Occasional	128	4	0	9	141	132	1	1	10	144	260	5	1	19	285
TOTAL		1232	53	40	714	2039	1450	43	42	1236	2771	2682	96	82	1950	4810
2009	Undergraduate	980	34	14	465	1493	901	27	19	813	1760	1881	61	33	1278	3253
	Postgraduate	304	13	21	268	606	494	20	25	469	1008	798	33	46	737	1614
	Occasional	116	2	0	16	134	125	1	0	20	146	241	3	0	36	280
TOTAL*		1400	49	35	749	2233	1520	48	44	1302	2914	2920	97	79	2051	5147

*2009 Final HEMIS figures not yet available

International students

Nationality	Year	
	2008	2009
Asian countries	24	21
Botswana	23	26
Democratic Republic of the Congo	1	-
European countries	12	11
Lesotho	146	151
Malawi	5	5
Mauritius	3	3
Mozambique	7	5
Namibia	65	83
North America	5	7
Other African countries	71	72
Swaziland	6	8
Zambia	8	8
Zimbabwe	62	64
Total	438	464

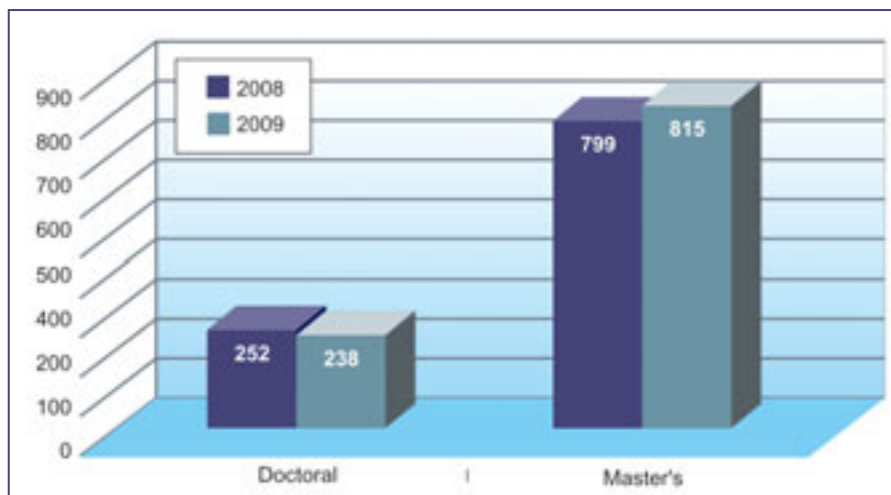
Comparison for the Faculty of Natural and Agricultural Sciences: 2008-2009



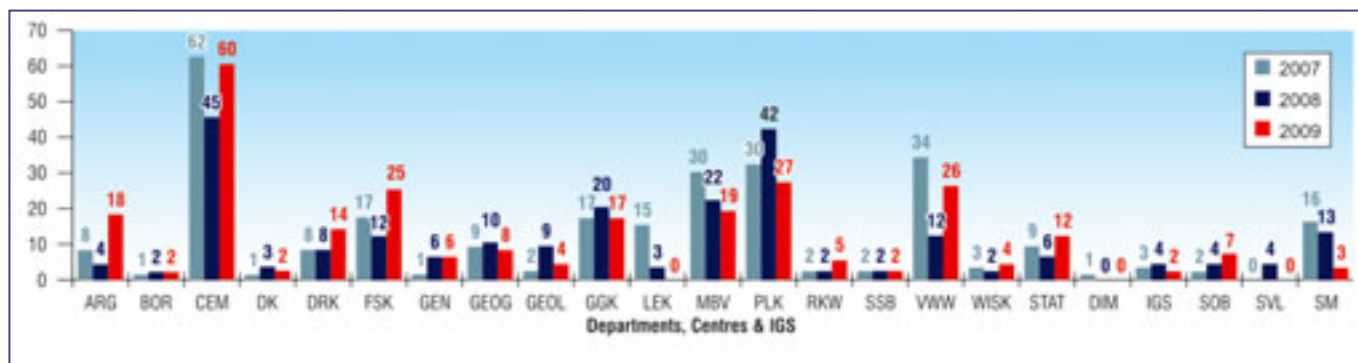
Student figures Post-/Undergraduates

	2008	2009
Undergraduate	2985	3253
Postgraduate	1540	1614
Occasional	285	280
Total	4810	5147
	2008	2009
Doctoral	252	238
Master's	779	815
Total	1031	1053

Comparison for the Faculty of Natural and Agricultural Sciences: 2008-2009



Accredited articles



List of abbreviations

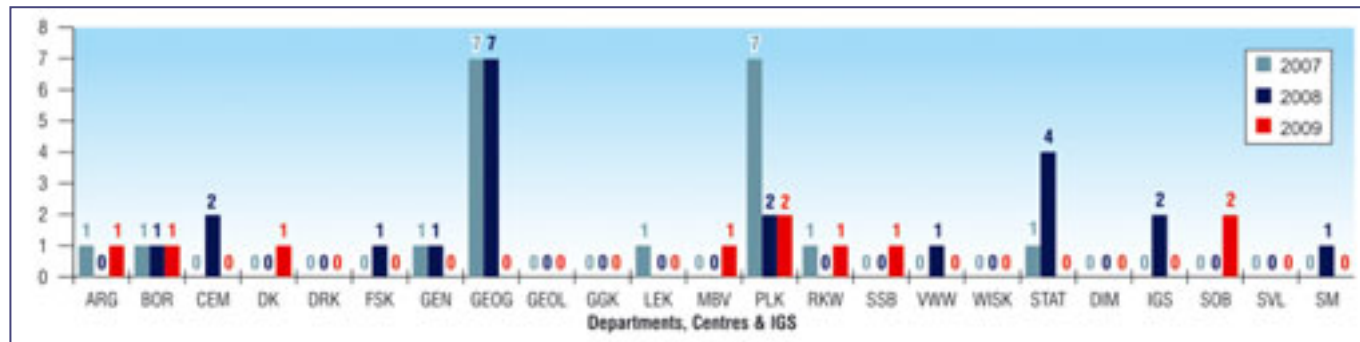
ARG Department of Architecture
 BOR Department of Quantity Surveying and Construction Management
 SOB Centre for Environmental Management
 CEM Department of Chemistry
 SM Centre for Microscopy
 SVL Centre for Sustainable Agriculture and Rural Development

DK Dean's Office
 DRK Department of Zoology and Entomology
 FSK Department of Physics
 GEN Department of Genetics
 GEOG Department of Geography
 GEOL Department of Geology
 GGK Department of Soil, Crop and Climate Sciences
 IGS Institute for Groundwater Studies

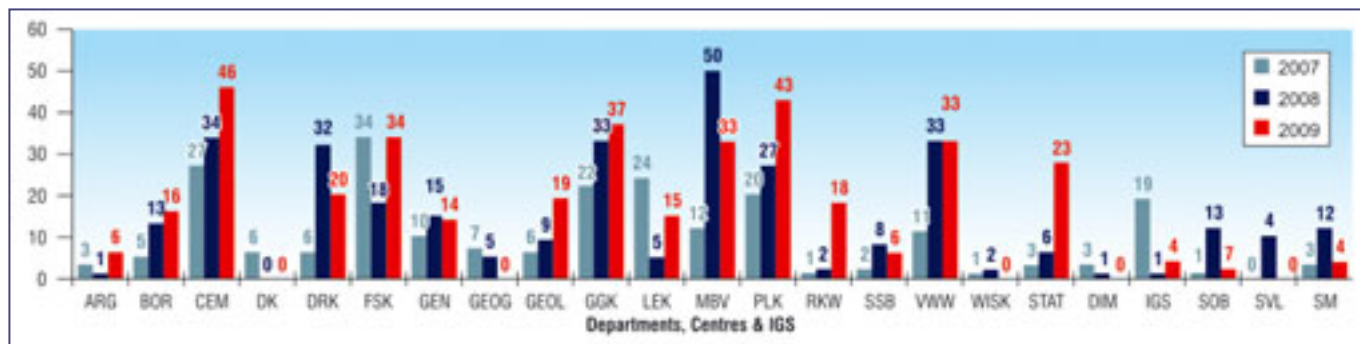
LEK Department of Agricultural Economics
 MBV Department of Microbial, Biochemical and Food Biotechnology
 PLK Department of Plant Sciences
 RKW Department of Computer Science and Informatics
 SSB Department of Urban and Regional Planning

SRB Disaster Management Training and Education Centre for Africa (DiMTEC)
 VWW Department of Animal, Wildlife and Grassland Sciences
 STAT Department of Mathematical Statistics and Actuarial Science
 WISK Department of Mathematics and Applied Mathematics

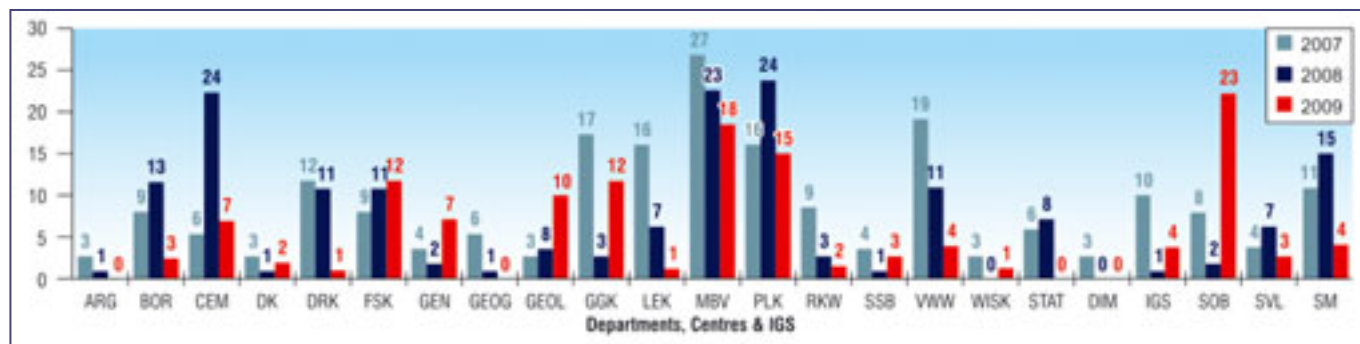
Books



Local conferences



Overseas conferences contributions





26 Glossary

Glossary

A

ADF -	Amsterdam Density Functional Programme
ADSARD -	Advanced Diploma in Sustainable Agriculture and Rural Development
AGM -	Annual General Meeting
AI -	Artificial Insemination
ARC -	Agricultural Research Council
ASQAQs -	Association of South African Quantity Surveyors
ASOCSA -	Association of Schools of Construction of Southern Africa
ASSA -	Actuarial Society of South Africa
ASSA -	Astronomical Society of Southern Africa
ASSAf -	Academy of Science of South Africa

B

BGR -	German Federal Survey of Geology
-------	----------------------------------

C

CANSA -	Cancer Association of South Africa
CCEM -	Centre for Confocal and Electron Microscopy
CCTC -	Center for Theoretical and Computational Chemistry
CEE -	Council for Economic Education
CENSARD -	Centre for Sustainable Agriculture and Rural Development
CePHMa -	Centre for Plant Health Management
CHESD -	Centre for Higher Education and Studies and Development
CHPC -	National Centre for High Performance Computing
CIDB -	Construction Industry Development Board
CIIFAD -	Cornell International Institute for Food, Agriculture and Development
CIOB -	Chartered Institute of Building
CLSM -	Confocal laser scanning microscope
CMW -	Cape Mohair and Wool
CNRS -	French National Centre for Scientific Research
COE -	Centre of Excellence
COLA -	Conference on Laser Ablation
CPU -	Central Processing Unit

CSIR -	Council for Scientific and Industrial Research Organisation
CUT -	Central University of Technology

D

DFG -	Deutsche Forschungsgemeinschaft
DiMTEC -	Disaster Management Training and Education Centre for Africa
DMISA -	Disaster Management Institute of Southern Africa
DRR -	Disaster Risk Reduction
DSC -	Differential Scanning Calorimetry
DST -	Department of Science and Technology
DWAF -	Department of Water Affairs and Forestry

E

EAAP -	European Association for Animal Production
ECA -	European Crystallographic Association
EPWP -	Expanded Public Works Programme

F

FAO -	Food and Agricultural Organisation
FFSC -	Farm Financial Standard Council
FLIP -	Facilitation Learning in Practice
FMP -	Facilities Management Programme
FP7 -	European Funding Program Seven

G

GIS -	Geographical Information Systems
GMI -	Groundwater Management Institute
GOOT -	Grow our Own Timber
GOL -	Government of Lesotho

H

HPC -	High Performance Computing
HRTEM -	High Resolution Transmission Electron Microscopy

I

IBREAM SA -	Institute for the Breeding of Rare and Endangered African Mammals
ICARD -	International Conference on Acid Rock Drainage
ICEC -	International Cost Engineering Council
ICPOES -	Inductively Coupled Plasma Optical Emission Spectroscopy
ICSU -	International Council for Science
ICY -	International Yeast Commission
IDC -	Industrial Development Corporation
IDP -	Internationally Displaced Persons
IFMA -	International Farm Management Association
IGS -	Institute for Groundwater Studies
INTSORMIL -	International Sorghum and Millet Research Support Programme
IPMP -	Intensive Project Management Programme
IRDP -	Institutional Research and Development Programme

K

KIST -	Korea Institute of Science and Technology
--------	---

L

LRAD -	Land Redistribution for Agricultural Development
--------	--

M

MANIT -	Maulana Azad National Institute of Technology
MCA-L -	Millennium Challenge Account-Lesotho
MCC -	Millennium Challenge Corporation
MNS -	Material and Nanosciences Cluster
MOU -	Memorandum of Understanding
MS -	Mass Spectrometry
MSA -	Masters degree in Sustainable Agriculture
MSDN -	Microsoft Developer Network
MUCPP -	Mangaung University Community Partnership Programme

N

NAMC -	National Agricultural Marketing Council
NECSA -	South African Nuclear Energy Corporation
NEP -	National Equipment Programme
NGO -	Non-Governmental Organisation
NIRS -	Infrared Spectrophotometer
NMMU -	Nelson Mandela Metropolitan University
NNSCF -	National Nano-Surface Characterisation Facility
NRF -	National Research Foundation
NSTF -	National Science and Technology Forum
NUFU -	Norwegian Council of Universities Committee for Development, Research and Education
NWS -	New World Sanitation

P

PEGG -	Primate Ecology and Genetics Group
PHP -	Peoples' Housing Process
PRT -	Protein Research Trust

R

RICS -	Royal Institute of Chartered Surveyors
RPO -	Red Meat Producers' Organisation

S

SA -	South Africa
SAAWK -	South African Academy of Sciences
SAB -	The South African Breweries Limited
SACAP -	South African Council for the Architectural Professions
SACLA -	Southern African Computer Lecturers Association
SACPCMP -	South African Council for the Project and Construction Management Professions
SACPVP -	South African Council for the Property Valuation Profession
SACQSP -	South African Council for the Quantity Surveying Profession

SADC -	Southern African Development Community
SAFEFE -	South African Foundation for Economic and Financial Education
SAFOI -	South African Fryer Oil Initiative
SAGA -	South African Geophysical Association
SAIA -	South African Institute of Architects
SAIP -	South African Institute of Physics
SAJAH -	South African Journal of Art History's
SANBI -	South African National Biodiversity Institute
SANPAD -	South Africa-Netherlands Research Programme on Alternatives in Development
SAPOA -	South African Property Owners' Association
SAQA -	South African Qualifications Authority
SASAS -	South African Society for Animal Science
SASAS -	South African Society of Atmospheric Sciences
SASCP -	South African Society of Crop Production
SASHS -	Southern African Society for Horticultural Sciences
SASPP -	Southern African Society for Plant Pathology
SASQUA -	Southern African Society for Quaternary Research
SASS -	South African Scoring System
SAWMA -	South African Wildlife Management Association
SEM -	Scanning Electron Microscope
SIDA -	Swedish International Development Cooperation Agency
SIFE -	Students in Free Enterprise
SKA -	Square Kilometre Array
SOI -	Southern Oscillation Index
SSSSA -	Soil Science Society of South Africa

T

TAD -	Teaching Astronomy for Development
TEM -	Transmission Electron Microscope

TGA -	Thermal Gravimetric Analysis
THRIP -	South African National Research Foundation Thrust for Industry-Related Projects
TRAC -	Trans African Concessions (Pty) Ltd
TUT -	Tshwane University of Technology

U

UACH -	Autonomous University of Chapingo
UCT -	University of Cape Town
UEC -	Unit for Earth Construction
UFS -	University of the Free State
UJ -	University of Johannesburg
UK -	United Kingdom
UKZN -	University of KwaZulu-Natal
UMN -	University of Minnesota
UN -	United Nations
UNU -	United Nations University
UNU-EHS -	United Nations University's Institute for Environment and Human Security
UP -	University of Pretoria
UPS -	Uninterrupted Power Supply
US -	United States
USA -	United States of America
USGS -	United States Geological Survey
UWC -	University of the Western Cape
UWM -	University of Milwaukee-Wisconsin

V

ViE -	Vice-Rectorate in Europe
-------	--------------------------

W

WCAP -	World Conference on Animal Production
WITS -	University of the Witwatersrand
WRC -	Water Research Commission
WSSSA -	Weed Science Society of South Africa
WVI -	World Vision International
WWU -	Muenster University

X

XPS -	X-ray photon spectroscope
-------	---------------------------

