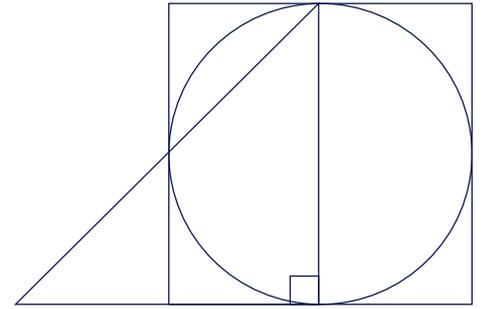


# Report

05/06



## Faculty of Natural and Agricultural Sciences





# Faculty of Natural and Agricultural Sciences

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# From the Dean's office



*Prof. Herman van Schalkwyk.*

The Faculty of Natural and Agricultural Sciences at the University of the Free State (UFS) leads the way in the practising of natural and agricultural sciences in South Africa and the highest levels of quality and credibility are reflected.

Our commitment, however, reaches far beyond just this. It reaches beyond the borders of the country and across continents; its multi-disciplinary and practical approach is vested in all the disciplines presented by the faculty.

In 2005/06 the Faculty experienced significant growth in measurable outputs. A contributing factor was the comprehensive apparatus strategy and plan which was implemented in 2005. With this strategy, university funds were used to leverage other funds in order to obtain huge discounts from suppliers of apparatus. In this way the faculty managed to obtain almost R50 million worth of apparatus in 2005.

The strategy was continued in 2006 when an agreement to the value of R7 542 531 was reached with Shimadzu, according to which apparatus was supplied to the faculty at discount prices. The agreement, which is valid for three years, entails the free replacement of apparatus which is purchased during this period with upgraded versions.

The new apparatus forms part of the UFS vision to compete internationally with quality research outputs in certain niche areas, to provide leadership in advanced training to students from the African continent and to establish the university as a leader among South African universities.

Two researchers with a B rating from the National Research Foundation (NRF) were also appointed. Both of these initiatives bore fruit and in 2006 the faculty increased its total research outputs by

about 13%. As an example, the Department of Chemistry's outputs increased by 100%.

The faculty has been bursting at the seams over the past couple of years. Student figures rose from 3 935 undergraduate, postgraduate and occasional students in 2005, to 4 224 in 2006. There is also strong representivity of students from other African countries and in 2005/06 almost 600 students studied at the faculty.

An extended B.Sc. programme has been presented to students since 2005. The programme aims at providing students who do not comply with all the requirements for the B.Sc. programme with the necessary sub-structure to complete the B.Sc. degree successfully. A preliminary evaluation of the results indicates that the programme is delivering the desired results.

The alignment of the Qwaqwa Campus, which was incorporated into the UFS in January 2003, remains a challenge. Regular discussions are held with staff on the campus in order to make the faculty's programmes more sustainable and to align it with the broader strategic plan of the UFS.

On a national level, the faculty is in the process of making its mark in terms of teaching and community service. In 2005 the faculty again actively began utilising its

experimental farms. A three-way agreement between the UFS, the National Farmers Union (NAFU) and the Mangaung Local Municipality led to the establishment of the Lengau Agricultural Development Centre on the Sydenham Experimental Farm. The centre provides training and mentorship to small-scale upcoming farmers.

To be dynamic and progressive requires innovative thinking. It requires commitment and a desire to deliver excellent teaching and learning opportunities to students. It requires a willingness to form partnerships, and a multi-disciplinary and practical approach to the tertiary education environment in South Africa.

This report covers the faculty's activities in 2005/06. It is a reflection of two years' commitment on the part of a team of skilled and motivated academics and support staff.



**Prof. Herman van Schalkwyk**

Dean: Faculty of Natural and Agricultural Sciences  
University of the Free State

# Departments in the Agricultural Sciences





# Agricultural Economics



“We have the ability to understand the social, environmental and economic challenges facing the agricultural sector in Africa and its people.”

Prof. André Jooste.

## Overview

The Department of Agricultural Economics had its origin in 1958 and has since developed into one of the leading departments of agricultural economics in South Africa, and possibly even in Africa.

This growth is a result of the department's capacity to capitalise on incentives, to build on partnerships with leading international counterpart departments, and to combine an entrepreneurial approach with the multi-disciplinary nature of tuition, research and community service in its efforts to address the challenges of a dynamic agricultural environment.

Teaching and mentorship are regarded as pivotal in reaching our objectives. Over and above the fact that course materials are regularly updated to reflect international best practice, engagement with students is taken very seriously. The seminar series in the department provides students and staff with the opportunity to engage actively in research and teaching matters. As a result, 13 of a total of 30 papers were presented by students and staff of the department at the annual Agricultural Economics Association of South Africa (AEASA) conference in 2005, while at the 2006 AEASA conference, 15 of the 35 papers presented were from the department, and one was an invited paper.

In 2005 Mr Pieter Taljaard, Dr Zerihun Alemu and Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences, won the prize for the best published article in Agrekon at the AEASA conference. Messrs Andries Jordaan and Diekus van Wyk respectively won the second prize for the best M.Sc. thesis and for the best student essay. Mr Henry Jordaan received the award for the best final year student in Agricultural Economics at the UFS.

The 2006 AEASA conference was held in Grahamstown. Mr Olu Oyewumi won the prize for the best master's thesis. Mr David Spies, Ms Heidi Mabandda and Mr Van Wyk respectively won the second prize for the best paper, best poster and the best student essay. Mr Ferdie Botha received the award for the best Agricultural Economics student at the UFS.

“The department was also privileged to be able to host two AW Mellon Foundation fellows.”

During a conference of the International Food and Agribusiness Management Association (IAMA) that was held in Buenos Aires, Argentina, the South African team, consisting of students from the Universities of the Free State, Stellenbosch, and Pretoria, won a competition in which they had to develop a business strategy for an Italian company threatened by the dreaded bird flu epidemic. Six student teams from various countries took part in the competition. Two heats were held and the South African team walked away with the laurels.

In 2005 three National Research Foundation (NRF) projects were registered in the department, and two researchers received Thuthuka grants from the National Research Foundation (NRF). In 2006 the department was successful in establishing a Research Niche Area (RNA) entitled: Risk Management in Africa, under the auspices of the NRF.

The department was also privileged to be able to host two AW Mellon Foundation fellows, Ms Ntsikane Maine (Ph.D.) and Mr Derrick Montshwe (M.Sc.), under the university's Grow Our Own Timber programme. Both fellows have completed their studies and in 2005 Ms Maine was appointed as lecturer in the department. Mr Montshwe is now employed as Assistant Project Manager: Farmer Support and Development Programmes at the National Emergent Red Meat Producers' Organisation (NERPO). New candidates for the Grow Our Own Timber programme will be nominated for 2007.

In 2005/06, 49 M.Sc. and 41 Ph.D. students enrolled for their studies in the department. This includes students from Eritrea, Mozambique, Nigeria, Namibia, Botswana, Lesotho, Ethiopia, Swaziland, Ghana and South Africa, among others. The department also has a very active student body known as LekForum.

The department continues to excel in community service. Apart from the fact that many of the research projects have a strong community service component, several



The department and donors donated a manual and DVD entitled: *Growing vegetables, a comprehensive guide on how to establish, maintain and manage a vegetable garden* to two projects in Bloemfontein. Mss Marieta Jonker of Free State Care in Action and Mathilda Koch of Child Care Bloemfontein and Childline Free State received the manuals on behalf of their organisations. Handing over the manuals are, from the left: Mss Dora du Plessis, co-ordinator of the vegetable garden project, Koch, Dr Wimpie Nell, Director of the Centre for Agricultural Economics at the UFS, and Ms Jonker.



At an international workshop for trainers in the United States of America's National Council on Economic Education's (NCEE) outreach programme to improve the quality of training of Economics teachers and lecturers across the world, are, from the left, front: Dr Patty Elder, Vice-President of the NCEE's international programme, and Mr Wimpie Plaatzies, Provincial Subject Co-ordinator for Economics of the Northern Cape Province; back: Prof. Geoff Antrobus, Department of Economics at Rhodes University, Prof. Klopper Oosthuizen, Lecturer at the department and initiator of the cooperative agreement with the NCEE, and Prof. André Jooste, Departmental Chairperson.

actions focus specifically on community service. These include a short course series on topics such as financial management, strategic management and farm management. Fiftytwo commercial farmers and 95 emerging commercial farmers attended these courses in 2005 and in 2006, 65 commercial farmers attended the courses. No new courses for emerging farmers were presented in 2006, but follow-up visits were made to

the emerging farmers at Koffiefontein and Oppermansgronde. The Centre for Agricultural Management also involved a group of farmers at Tierpoort outside Bloemfontein.

The Food Garden Training Course was presented at schools, the Mangaung University of the Free State Community Partnership Programme (MUCPP) and at Springfontein and Trompsburg, where com-

community members attended the courses. Members of the reach project attended the Food Garden Training Course in Heidedal, Bloemfontein.

In March 2006 a Meat Imbizo was held at the UFS, hosted by Prof. André Jooste, Departmental Chairperson. Representatives from the National Agricultural Marketing Council (NAMC), the National Department of Agriculture (NDA), Griekwaland-Wes Koöperasie (GWK), SenWes, Afgri, Free State Agriculture and Vleissentraal spoke at this event. The objective of the imbizo was to create an opportunity to exchange information and to identify possible points for collaboration between the different industries. In addition, Prof. Johan Willemse and his researchers conducted successful Market Outlook Workshops with groups of farmers, which were well attended.

A short course in grain options, attended by 83 persons, was presented in collaboration with Ms Sue Goll, a recognised international specialist in grain options.

An initiative of the department in partnership with the Provincial Department of Education and the National Council for Economic Education (NCEE) in the United States of America (USA) is growing rapidly and is considered to be one of the flagship community service projects in the faculty. The main thrust of this initiative is to build capacity in teaching economics at school level. Other collaborators include the School for Education and the Department of Economics at the UFS. The Economic Education initiative is managed by Prof. Klopper Oosthuizen. This project has already had tremendous successes, which include Train-the-teacher workshops attended by 73 teachers and a Train-the-trainer workshop attended by 50 delegates from countries with transitional economies such as Egypt, Mexico, Indonesia, Jordan and Palestine. Future plans include a roll-out to other provinces and the rest of Africa.

More than a thousand teachers in the intermediate and senior phases in Free State schools already benefit from the NCEE partnership. A very important role player is Mr Mafu Rakometsi, the Superintendent General of the Free State Department of Education who acts as ambassador in expanding the partnerships in South Africa beyond the borders of the Free State.

The establishment of the Central South African Council on Economic Education (CSACEE) has been another highlight in this department. Ms Winkie Direko, National Member of Parliament and former Premier of the Free State, is playing a leading role in positioning the CSACEE.

The department also has links with renowned international partners through co-operation agreements. The Departments of Applied Economics at the University of Minnesota, USA and Agricultural Economics at the Purdue University in Indiana, USA strengthen the capa-



The department continues to excel in community service, as many of the research projects have a strong community service component and several specific actions focus on community service.

city of the department and provide a vehicle for continuous international benchmarking.

The group that specialises in agricultural risk management and the development of decision support models with particular reference to irrigation is renowned for the development of management strategies and technologies with the potential of increasing economic returns and reducing risk in agricultural production. The group is also represented in two international working groups on irrigation economics and consists of Prof. Oosthuizen, Mr Bennie Grové and several student researchers.

Another research group, consisting of Prof. Giel Viljoen, Dr Godfrey Kundhlande and several student researchers, focuses on the generation of information to improve efficiency and sustainability in the use and management of natural resources (water and land). The group more specifically focuses on the determination and control of the social and economic impacts of floods and water restrictions. More recently, the research agenda of this group was broadened to include the economic impacts and management of saline irrigation water, capacity sharing in water use and rain water harvesting.

The Centre for Agricultural Management follows a multi-disciplinary and practical approach to equip students with skills to achieve sustainable success in the total agricultural system. Apart from strategic management research, the centre also specialises in precision agriculture research at master's and doctoral level. This research is funded by New Holland SA. With the financial assistance of its donors Afgri, Agri Risk Specialists (ARS), First National Bank and Vrystaat Koöperasie Beperk (VKB), the centre also developed a certificate training package consisting of various short courses in agriculture and has recently launched its Vegetable Garden training video – a first in South Africa. The group consists of Dr Wimpie Nell, Ms Maine and several student researchers.

In 2005 Proff. Jooste, Willemse, Kobus Laubscher, Dr Alemu and Mr Taljaard focused on topics such as trade, policy analysis, value chain analysis, marketing, development and strategic planning in a multi-disciplinary and holistic manner. Prof. Jan Groenewald and Dr Kit le Clus, both Extraordinary Professors in this department, work closely together with this group. In addition, the capacity of the department and this group was extended to the Western Cape by Affiliate Associate Professor, Prof. Daan Louw, who is based in Paarl and who is the Chief Executive Officer of Optimal Agricultural Business Solutions (OABS). Their work also goes beyond the borders of South Africa into neighbouring



A large group of the students and researchers in the department received their degrees in 2006.



The department presented a Meat Imbizo to discuss the challenges facing the industry and identify possible areas of collaboration. Attending the Imbizo are, from the left, Messrs Dave Ford, South African Feedlot Association, Aggrey Mahanjana, National Emergent Red Meat Producer Organisation, Mogala Mamabolo, Department of Agriculture in Pretoria, Prof. André Jooste, Departmental Chairperson and Mr Harry Prinsloo, National Wool Growers Association.

countries and they are renowned for their ability to link external challenges with the internal dynamics of industries and firms. The group actively addresses policy, value chain and management issues in a multi-disciplinary and holistic manner.

Agricultural Engineering, led by Mr Kobus van Staden, focuses on the whole spectrum of irrigation design ranging from flood irrigation to specialised drip irrigation. Central to this group's activities is an emphasis on irrigation that is suitable for Africa and its specific

climatic conditions. On the research front, the group is a leader in sub-surface drip irrigation and places much-needed emphasis on sustainable agricultural projects in rural areas.

Research areas covered in the department included value chain analysis, resource and environmental economics, risk management, trade, policy analysis, development and farm management. Research concentrated on finding solutions to challenges not only in South Africa, but also in Africa as a whole.

The research expertise in the department is further recognised by organisations such as the World Bank, United States Agency for International Development (USAID), Food and Agricultural Organisation (FAO) and the Organisation for Economic Co-operation and Development (OECD) and numerous others within South Africa, leading to demand-driven research initiatives.

Prof. Jooste resigned from the university at the end of 2006. Prof. Johan Willemse was appointed as chairperson in his place.



The South African team that won a competition during a conference of the International Food and Agribusiness Management Association in Buenos Aires, Argentina were, from the left: Prof. André Jooste, Departmental Chairperson, Kobus Laubscher, team advisor and Lecturer at the department, Mr Bonani Nyhodo, student at the University of Stellenbosch, Dr Dirk Esterhuizen, Manager: Agricultural Information of the Agricultural Chamber of Business and student at the University of Pretoria, Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences at the UFS, Mr Olubokola Oyewumi, student at the UFS, Mr Hilton Madevu, student at the University of Pretoria, and Ms Lindie Botha, also a student from the UFS.

### Academic staff

**Professors:** Prof. Kloppe Oosthuizen, Giel Viljoen

**Associate Professors:** Prof. André Jooste, Johan Willemse

**Professors Extraordinary:** Prof. Jan Groenewald, Kit le Clus

**Affiliate Associate Professor:** Prof. Daan Louw

**Senior Lecturers:** Drs Wimpie Nell, Zerihum Alemu, Mr Kobus van Staden

**Lecturers:** Messrs Bennie Grové, Pieter Taljaard, Ms Ntsikane Maine

**Contract Lecturers:** Prof. Kobus Laubscher, Dr Godfrey Kundhlande

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# Research outputs

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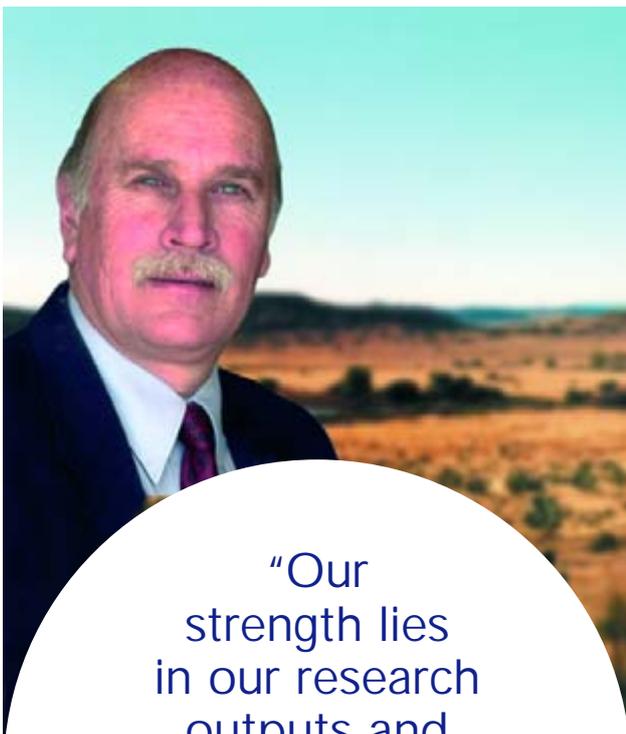
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- Willemse, B.J.** 2005. *Die winsgewindheid en toekoms van die rooivleisbedryf.* Paper presented at the North West Redmeat Producers Organisation (RPO) Annual Congress, Klerksdorp, South Africa.
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- Willemse, B.J.** 2005. *Overview and outlook of agricultural markets.* Paper presented at the 2005 Annual Conference of South African Feedlot Association, Johannesburg, South Africa.
- Willemse, B.J.** 2005. *South African soybean production - what can we expect?* Paper presented at the 7th International Soyfood Conference, Pretoria, South Africa.
- Willemse, B.J.** 2005. *Trends in the agricultural sector.* Paper presented at the Meadow Feeds National Conference, Pretoria, South Africa.
- Willemse, B.J.** 2006. *Produseer vir jou klient se behoefte.* Contribution to the "Beesboer-konferensie", University of the Free State, Bloemfontein, South Africa.
- Willemse, B.J. & Van Wyk, D.** 2005. *The growing middle class in South Africa and the market for high value food products.* Poster presented at the 43rd Conference of the Agricultural Economic Association of South Africa (AEASA), Polokwane, South Africa.

Department of

# Animal, Wildlife and Grassland Sciences



“Our  
strength lies  
in our research  
outputs and  
community  
involvement.”

Prof. Johan Greyling.

## Overview

The Department of Animal, Wildlife and Grassland Sciences researches animal production to supply animal products of high quality, taking into account public health and the protection of natural resources and wildlife, by applying the principles of the disciplines of Animal Physiology, Animal Nutrition, Animal Breeding and Pasture Science.

Animal Science as such focuses on a variety of livestock species, among others cattle, sheep, goats, pigs and poultry, in production systems ranging from intensive to extensive and from small scale to large commercial units.

The faculty signed an agreement regarding a Nguni cattle project with the Industrial Development Corporation (IDC) and the Northern Cape Department of Agriculture and Land Reform in Kimberley. With this flagship project commercial farmers will be technically assisted to change community farmers into accredited breeders of stud quality Nguni cattle. The UFS will be involved with the implementation and monitoring of the project, as well as research, training of livestock managers and the marketing of the project.

Grassland Science, on the other hand, involves the study of all aspects regarding the utilisation, conservation and improvement of grassland and cultivated pastures - in harmony with animal production. This discipline is also committed to the conservation of the environment, and here wildlife contributes to the efficient utilisation of the grazing ecosystem.

The ultimate aim of training and research in the department is to increase food and fibre production whilst maintaining quality and natural resources. The fact that the livestock industry in South Africa is responsible for 45% of total agricultural production, reflects the importance of these disciplines in the department and in the industry.

External funding from national and international institutions such as the National Research Foundation (NRF), the AW Mellon Foundation, Cape Mohair and Wool, the National Wool Growers

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Association (NWGA), the May and Stanley Smith Charitable Trust, Alexander Forbes, the Central Research Fund of the UFS and the National Lucerne Organisation, has been the life-line in making research possible and in spreading the reputation of the department both locally and abroad.

The research facilities were upgraded in 2005 with the acquisition of apparatus to the value of more than R600 000 for the year – a great injection via the dean’s office, which helped considerably in capacity building.

Community service projects in terms of small-scale egg production in 35 households in the rural areas, together with broiler production systems in four schools for the handicapped, were maintained. The team re-

sponsible for these projects was Prof. Johan Greyling Departmental Chairperson, Ms Khoboso Lehloenya, Dr Luis Schwalbach and Mr Foch de Witt. Training of upcoming small-scale livestock farmers in basic husbandry skills was also undertaken in Bothaville by Prof. H.O. de Waal and Dr Schwalbach - evidence of the wide scope of community service in the department.

Proff. Greyling, Frikkie Nesor, Hentie van der Merwe and De Waal were involved as the main judges in the National Breed Plan’s Voermol Cattle and Sheep Farmer of the year, SA Dairy Farmer of the year and SA Young Farmer of the year competitions, as well as in farmers’ days. All members of the department also made themselves available



Hens in a small-scale layer unit.



Involved in a small-scale egg production project supported by the UFS are, from left: Mss Aletta Bob, Khoboso Lehloeny, co-ordinator of the project from the department and Merriam Aplane.



The South African Society for Animal Science (SASAS) presented its 41st congress at the UFS. The theme was: *New challenges for the animal science industries*. At the congress are, from the left, back: Prof. H.O. de Waal, Chairperson of the Organising Committee: SASAS Congress 2006, Mr Paul Bevan, President of SASAS, front: Mr Aggrey Mahanjana, Group Managing Director of the National Emergent Red Meat Producers' Organisation and Dr Wameotsile Mahabile, Department of Agricultural Research at Sebele, Gaborone, Botswana.



Attending the signing ceremony between the UFS, the Industrial Development Corporation (IDC) and the Northern Cape Department of Agriculture and Land Reform are, from the left: Dr Michael Hendricks, Director-General: Northern Cape, Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences at the UFS, Mr Mvuleni Qhena, Chief Executive Officer of the IDC, Ms Tina Joemat-Pettersson, Minister of Agriculture and Land Reform in the Northern Cape, and Mr Kagisho Molusi, Minister of Sport, Arts and Culture in the Northern Cape.

for consultation with farmers and institutions. They served on various formal agricultural committees, among others the Redmeat Producers Organisation (RPO), the Free State Game Steering Committee, the National Lucerne Organisation, the SA Society for Animal Science, the Grassland Society of Southern Africa, and the World Poultry Organisation, as well as on the editorial boards of national and international journals such as *Small Ruminant Research*, *Livestock Production Science*, *SA Journal of Animal Science* and the *SA Journal of Grassland Science*.

Besides teaching, one of the major strengths of the department has been in research outputs. In 2005 Proff. Japie van Wyk and Nesper made research presentations at the European Association for Animal Production in Sweden and attended the Interbull meeting in Uppsala, Sweden.

Nationally, Grassland Science workshops and symposia were attended and presentations were made by Prof. Hennie Snyman, Prof. Nico Smit and Mr Gideon Janse van Rensburg. The 10th International Grassland Congress held in Dublin, Ireland was attended by Proff. Smith and Snyman. These two professors, besides making their own presentations, were authors/co-authors of 11 of the presentations.

During the 40th Annual Congress of the Grassland Society of Southern Africa, the poster presented by Mr Janse van Rensburg and Prof. Snyman was judged the best. Short courses on artificial insemination in sheep and cattle were presented by Dr Schwalbach, Prof. Greyling and Ms Lehloeny to students and farmers. The department also organised and chaired a Cattleman's Conference (120 participants) in conjunction with the Glen Agricultural Development Institute (Glen ADI) and locally renowned experts. Prof. Van der Merwe also presented a Meadows farmers' day on the Paradys experimental farm, with the focus on the rearing of calves.

Proff. Van Wyk, Nesper and Mike Fair from the discipline of animal breeding presented an accredited course on the basic principles of animal breeding to technical advisors, and two meetings of the Postgraduate School in Animal Breeding were also held at the department. Several members of the department were invited to make presentations at farmers' days and information days during 2005 and 2006.

Contract research was done under supervision of Prof. Van der Merwe with Meadow Feeds and the National Lucerne Organisation, while Dr Schwalbach was contracted by Virbac. Negotiations with Intervet are under way regarding joint ventures.

The African Large Predator Research Unit (ALPRU), situated in the department and under the supervision of Prof. De Waal, published and undertook research projects funded by outside institutions. Great success was achieved in co-ordinating and documenting all relevant research done on wild carnivores. A new course on Applied Nutrition in Wild Herbivores and Carnivores was established in 2005 – an aspect that is generating great interest amongst students and the industry.

In 2006 the department made significant contributions, both locally and abroad, in terms of its research. Proff. Van Wyk and Nesper, together with Mr Fair, attended and made



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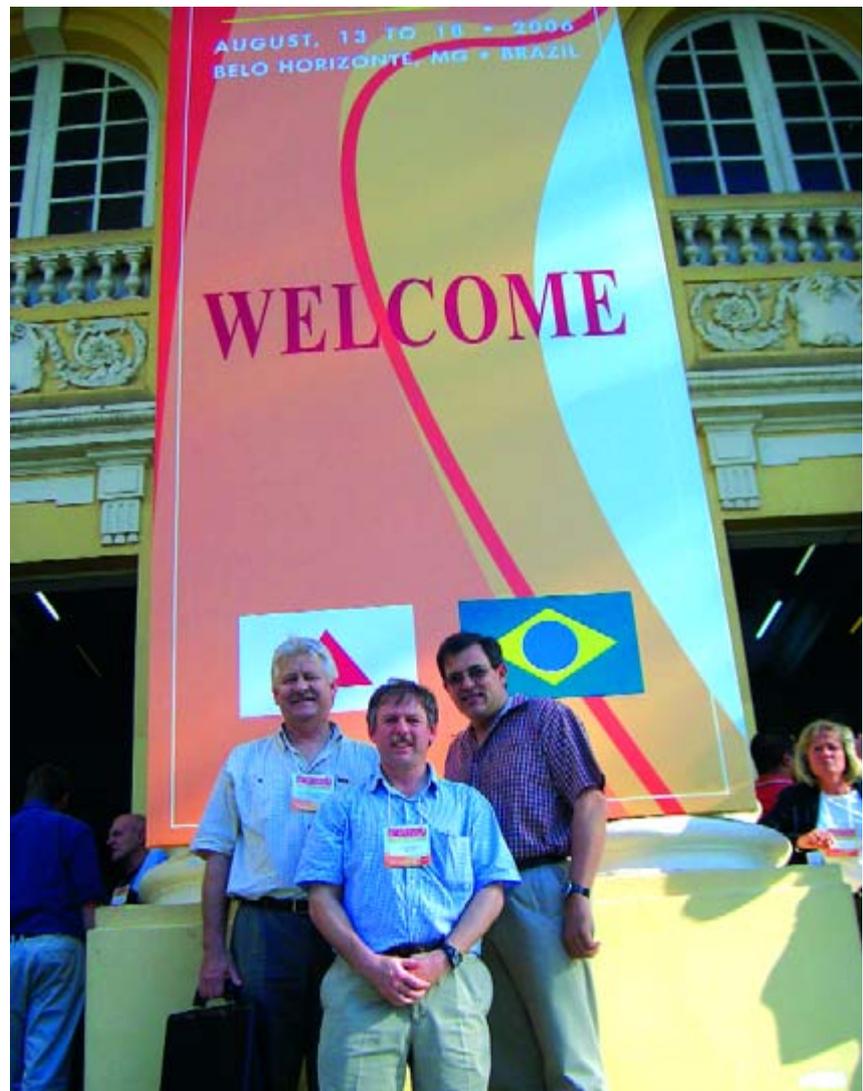
presentations at an Animal Breeding World Congress, applied to livestock production in Brazil. Prof. Snyman, too, collaborated on research related to Grassland Science at an institute in Leipzig, Germany.

The three physiologists in the department, Prof. Greyling, Dr Schwalbach and Ms Lehloeny, attended a Ruminant Reproduction Symposium in Wellington, New Zealand where all presented papers. Ms Lehloeny also presented a research paper at the European Animal Production congress in Slovenia. Regarding local congresses, 16 contributions in Grassland Science were made at the Grassland Society of South Africa, five at the Arid Zone Ecology forum and five at an international Cactus Pear Conference in Bloemfontein. The Cactus Pear Conference was presented by the Centre for Plant Health Management (CePHMa) at the UFS. In Animal Science, a total of 30 contributions

were made at the conference of the South African Society for Animal Science, with all members in Animal Science making contributions. Prof. De Waal also made a contribution in Animal Science at the International Cactus Pear Conference in Bloemfontein.

Prof. Snyman was awarded the Compton prize by the *South African Journal of Botany* for the best article investigating the influence of fire on the dynamics and functioning of a grassland ecosystem - another feather in the cap for the department.

Prof. Van der Merwe is currently conducting contract research with Meadow Feeds and the National Lucerne Organisation. A substantial donation of R191 000 was obtained by Prof. Greyling, Ms Lehloeny and Mr De Witt from Alexander Forbes for community service and specifically for the small-scale chicken project in rural areas. The data generated here could be used in future research projects.



Prof. Japie van Wyk, Mr Mike Fair and Prof. Frikkie Naser attended and made presentations regarding livestock production at an Animal Breeding World Congress in Brazil.



Great success was achieved in co-ordinating and documenting all relevant research done on wild carnivores. A course in Applied Nutrition in Wild Herbivores and Carnivores was established in the African Large Predator Research Unit in 2005 – an aspect that is generating great interest amongst students and the industry.

### Academic staff

**Professors:** Proff. Johan Greyling, Nico Smit, Hennie Snyman, Hentie van der Merwe, Japie van Wyk

**Professors Extraordinary:** Proff. Amie Aucamp, Schalk Cloete, James Hayes, Naida Loskutoff, Machiel Scholtz

**Associate Professors:** Proff. H.O. de Waal, Erhard du Toit, Frikkie Nesper

**Senior Lecturers:** Dr Luis Schwalbach, Mr Wikus Vorster (contract)

**Lecturer:** Messrs Mike Fair, Paul Malan, Ms Khoboso Lehloenyana

**Junior Lecturers:** Messrs Foch de Witt, Ockert Einkamerer

### Contact details

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## Research outputs

### Publications

**Almeida, A.M. & Schwalbach, L.M.J.** 2005. Raças ovinas da África do Sul - Breve introdução. *Revista Portuguesa do Sindicato Nacional dos Medicos Veterinarios* Jul/Aug: 22-36.

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**Cloete, S.W.P., Lambrechts, H., Bunter, K.L., Brand, Z., Swart, D. & Greyling, J.P.C.** 2006. Variance components for live weight, body measurements and reproductive traits of pair-mated ostrich females. *British Poultry Science* 47(2): 147-158.

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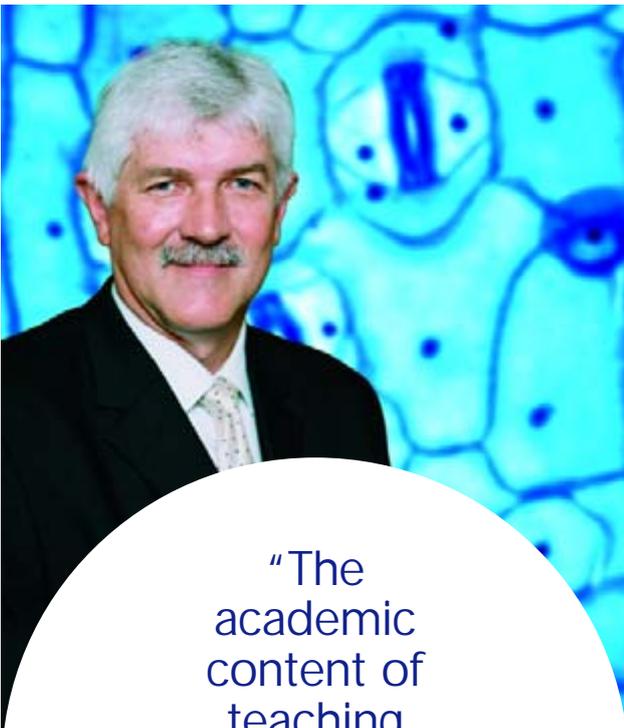


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# Plant Sciences



“The academic content of teaching programmes was improved and disciplines extended.”

Prof. Sakkie Pretorius.

## Overview

The mission of the Department of Plant Sciences is to create an advancement of knowledge within Botany, Genetics, Plant Breeding and Plant Pathology to the benefit of all.

This is realised in the departmental goal of academic excellence, as underwritten by relevant undergraduate and postgraduate education, research and service delivery. The multi-disciplinary nature of the department further lends itself to a valuable integration of basic biological and more applied agricultural sciences.

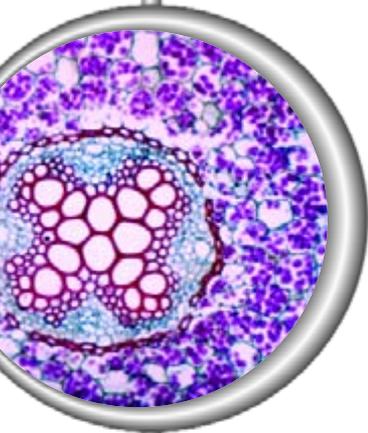
In 2005 the centenary year of Botany at the UFS was commemorated, with special acknowledgement of the previous departmental heads namely Proff. Geo Potts (1905-1937), Wilhelm Jan Lütjeharms (1938-1962), Eduard van Zinderen Bakker (1963-1972), Kobus Eloff (1973-1983), Chris Small (1984-1992) and Johan Grobbelaar (1993-2001). To coincide with the celebrations, the 31st Annual Congress of the South African Association of Botanists was presented successfully at the UFS.

As part of the Faculty of Natural and Agricultural Sciences' innovative equipment initiative, the department was strengthened in 2005 by the acquisition of certain key items. A phospho-imager, a microscope with digital image analysis, spectrophotometers, high performance liquid chromatography (HPLC) and other smaller laboratory items were some of the additions.

In 2006 the department, with Prof. Sakkie Pretorius as Departmental Chairperson, celebrated its fifth year of existence. Although the individual disciplines have been part of the UFS for many years, the combined department had to adapt in many ways. As a result of loyal staff support and a healthy work ethic, the department is now well established. The academic content of teaching programmes has continuously been improved and disciplines developed to embrace new opportunities and challenges.

The versatility, outward involvement and productivity of the department are core values for the ongoing improvement of academic excellence.

“The diversity of crops being researched includes wheat, maize, sorghum, coffee, cassava, sunflower, potatoes, cotton and kenaf.”



The department comprises of four divisions, namely Botany, Plant Breeding, Plant Pathology and Genetics.

### Botany

In 2005 an international congress of the Southern African Society for Quaternary Research (SASQUA), in collaboration with the African Pollen Database, was organised under the leadership of Prof. Louis Scott, an internationally acclaimed pollen expert, on the Main Campus in Bloemfontein. A highlight of the congress was the contribution of Prof. David Thomas of the University of Oxford in the United Kingdom (UK) about the history and future of the Kalahari Desert. Ms Graciela Gil Romero of Spain completed part of her postgraduate studies with Prof. Scott.

During her visit an adventurous excursion was launched to collect fossilised *Cape hyrax* (rock rabbit) dung in rough and inhospitable terrain in Namibia. The dung was examined for pollen appearance in order to explain variations in plant growth with regard to climate changes. In November 2006 the Autonomous University of Madrid in Spain appointed Prof. Scott to the tribunal for the defence of the doctoral thesis of Dr Gil Romera. Her project, *Palaeoenvironmental reconstruction of the Namib Desert eastern margin (Namibia): Palynology of fossil hyrax middens*, was mostly carried out at the UFS. Dr Gil Romera graduated *cum laude*. In addition, Prof. George Brook of Athens in the United States of America (USA) joined Prof. Scott for field work on fossil fountain sediments in South Africa.



Representatives from EnviroLogix Inc. in the United States of America visited the department to develop a new diagnostic test for soja beans together with Dr Botma Visser, Lecturer at the department. From the left, are: Drs Murali Bandla, EnviroLogix Inc., Visser and Ms Joan Lawton, from EnviroLogix Inc.

Prof. Johan Grobbelaar acted as keynote speaker at the 10th Congress of the International Society for Applied Phycology in Kunming, China, as well as the 8th International Phycology Congress in Durban.

In the plant physiology laboratory of Prof. Amie van der Westhuizen, research on plant reaction to stress factors was continued. In collaboration with Dr Lintle Mohase, they are responsible for unravelling the mechanisms plants use to withstand disease and insect attack. This research has led to a very successful international partnership.

During 2005 reciprocal visits were made between the UFS and the University of Münster in Germany. Prof. Van der Westhuizen visited Germany to investigate chitosans, specific activators of plant defence mechanisms, with Prof. Bruno Moerschbacher. Furthermore, Ms Jenni Moldenhauer, a German Ph.D. student from the same university, completed part of her research under the guidance of Prof. Van der Westhuizen on the Main Campus in Bloemfontein in February 2006. Her project on the molecular basis of resistance genes against yellow rust in wheat is of great value to South Africa as she unravelled the genetics of a well-known local variety.

Prof. Van der Westhuizen, co-promoter of Ms Moldenhauer's study, visited Münster during May 2006 to discuss progress and future planning. Ms Uschi Beike from the same institute spent two months in the department to establish a technique for the artificial growth of biotrophic fungi. Both of the above mentioned projects form part of the research co-operation between the department and University of Münster, involving Prof. Moerschbacher, Van der Westhuizen, Pretorius and Renée Prins.

Dr Gabré Kemp, a former student, returned as a postdoctoral fellow after two years at the University of Georgia in the USA, to continue his research in biochemical and molecular aspects of Botany. He specialises in mechanisms of plants to prevent infection by fungal pathogens.

Two ecologists from the department participated in a project in the Maluti mountains. Dr Johann du Preez and Ph.D. student Mr Robert Brand assisted members of Ezemvelo Wildlife in a biodiversity survey of the Drakensberg peaks namely Sentinel, Eastern Buttress, Inner and Outer Horn, Cathkin Peak and the Triplets. These mountain peaks are all higher than 3 000 m and the group had to be transported by helicopter. Because the study area has been inaccessible to humans for all practical purposes, interesting data were collected. New localities for plant species were reported and a number of uncatalogued invertebrates were observed during the first visits. This study confirmed the rich biodiversity of South Africa and the need for detailed surveys of isolated areas.

Botany is not being taught only on the Main Campus in Bloemfontein. Mr Robert Lentsoane and his team ensure that Botany is also presented as main subject at the Qwaqwa Campus.

Dr Frank Neumann started as a postdoctoral fellow with Prof. Scott. His research comprises the palynological examination of a borehole core from Lake Sibaya in KwaZulu-Natal, spanning approximately 2 000 years. The core has already been dated by the radiocarbon and lead dating methods by Prof. Curt Stager of Paul Smith's College in New York, USA. The research will reveal climate change, palaeoecological developments and human impact in and around the lake.

Prof. Scott re-established palynological research at the well-known Pliocene site, Langebaan Road in the West Coast Fossil Park. In July 2006 he attended a workshop where he made a presentation which will be used by the Fossil Park for educational purposes. In addition, Ms Alma Fuller assisted Prof. Scott in digitising the department's extensive pollen collection.

A project launched in collaboration with the USA company EnviroLogix Inc. produced two commercial products. With the assistance of Dr Botma Visser, an ELISA diagnostic test for soybean rust was developed in 2005, followed by a more user-friendly lateral flow device in 2006. This strip test allows a positive confirmation of the disease within a few minutes.

Prof. Jill Miller and Dr Rachel Levin, both of Amherst College in Massachusetts, USA accompanied by a Ph.D. student, visited the department in October 2006. Dr Andor Venter and Prof. Miller have been researching evolutionary history and relationships in the genus *Lycium* (Solanaceae) for the past ten years. The current project compares the pollination syndrome between African and American species with the aim of unravelling global distribution of *Lycium*.

During November 2006 Ms Gretchen Ionta of the University of Florida in the USA visited Prof. Johan Venter. Ms Ionta specialises in the molecular aspects of the sub-family *Periplocoideae*, supporting the morphological work of Prof. Venter. Her association with the UFS is also of value to the taxonomic research of *Cryptolepis* (Periplocoideae) by Ms Lize Joubert.

In 2005/06 Dr Mohase spent ten months at the Sordertons University College in Sweden for a sabbatical visit. She worked with Prof. Lisbeth Jonsson on the structure and function of insect resistance in cereals. The expression of ATP-binding cassette transporters is associated with markers for resistance to aphids in barley. Understanding the regulation of these transporters as well as their substrates will contribute towards unravelling some of the defence mechanisms against aphids and the establishment of effective control measures.

Prof. Grobbelaar's experience in algal biotechnology is applied in a *Spirulina* plant outside Musina where he acts as technical advisor for commercial production. The plant is in full production and the first tablets were marketed in 2006. Bio fuels are currently topical and Prof. Grobbelaar negotiated with Infinitibiodiesel of Mookgopong (Naboomspruit) and Greenfuel Technologies Corporation in the USA regarding the use of algae as a source of oil. Upon invitation he visited Algae Fuels Africa in Quelimane, Mozambique and met with staff of the Eduardo Mondlane University.

Student achievements included Ms Lize Joubert who received the award for the best B.Sc. Honours student for 2005 in the faculty. Ms Jenni Moldenhauer received an award for the best student presentation at the congress of the Southern African Society for Plant Pathology and Mr Corné Botha, an M.Sc. student, presented the best poster at a meeting of the *Suid-Afrikaanse Akademie vir Wetenskap en Kuns* in Bloemfontein. Ms Lienke Oelofse was voted the best honours student at the annual postgraduate symposium of the Department of Botany, University of Johannesburg.

### Plant Breeding

In 2005 the Plant Breeding division, which mainly trains postgraduate students, had an exceptionally productive year. This group, under the leadership of Prof. Maryke



“The first cactus pear conference since 1995 was organised under the auspices of CePHMa in March 2006.”

Labuschagne, trains local plant breeders and students from several different African countries.

The diversity of crops being researched includes wheat, maize, sorghum, coffee, cassava, sunflower, potatoes, cotton and kenaf. Many plant breeding students are employed in the agricultural sector and are studying part time. Ms Barbara Mashope, a former fellow of the AW Mellon Foundation, was appointed in May 2005 as lecturer-researcher to strengthen the numbers in plant breeding. One of the strong points of the section is its expertise in conventional, molecular and crop quality breeding. As reflected by the number of applications and enquiries, Plant Breeding is considered a growth point for Plant Sciences.

The breeders' new molecular laboratory, under the expert guidance of Dr Liezel Herselman, was established during 2005, and is used for training, research and genetic service rendering.

International contact was strengthened by papers presented at congresses in the USA, Austria and Argentina, and also by a visit to the International Centre for Tropical Agriculture (CIAT) in Colombia for collaboration on the genetic improvement of cassava. Scientists of the Budapest University of Technology and Economics and the University of Malawi also visited the division of Plant Breeding.

From a student training perspective considerable value was added by five M.Sc. and two

Ph.D. degrees being awarded in Plant Breeding in 2005.

In February 2006 Prof. Labuschagne and Dr Herselman visited the International Institute of Tropical Agriculture (IITA) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Nairobi, Kenya to discuss the training of three Ph.D. students sponsored by the Rockefeller Foundation. During this visit additional Ph.D. and M.Sc. students were recruited for postgraduate studies at the UFS. Furthermore, long term projects and training in starch quality of cassava and sweet potato were co-ordinated with co-workers in Malawi and Ghana.

Co-operation with the Agricultural Research Council (ARC) was strengthened through visits to postgraduate students at Potchefstroom, Rustenburg, Bethlehem and Nelspruit. Altogether 17 ARC employees were registered in Plant Breeding and six doctoral and five master's degrees were awarded during 2006. Prof. Prins and Dr Herselman presented two courses in marker-assisted breeding to Monsanto and Pannar. Dr Elizma Koen did training and diagnostic work on barley and wheat for SA Maltsters and the SA Grain Laboratory.

### Plant Pathology

The plant pathologists, managed by Prof. Wijnand Swart, were strengthened in 2005 by the strategic appointment of Prof. Neal McLaren, who has had a long and successful research career at the ARC. He has brought a new, applied dimension to the department.

One of the prerequisites for good agricultural scientists is balanced training in basic science and its application. As epidemiologist, Prof. McLaren's philosophy is that all research eventually must lead to practical disease prevention and/or control.

The management of the sporadic yet devastating epidemics of *Fusarium* head blight on irrigated wheat in the Northern Cape is one of the biggest challenges for plant pathologists in South Africa. To establish international contacts and gain new insights for local research, Ms Kriel attended a meeting of the USA National Wheat Scab Forum in Milwaukee, Wisconsin, USA in 2005. She also attended a *Fusarium* workshop at the International Maize and Wheat Improvement Centre (CIMMYT) in Mexico in 2006.

The vision of plant pathology at the UFS is a holistic approach towards sustainable crop protection, with the emphasis on healthy rather than diseased plants. This approach led to the introduction of the Centre for Plant Health Management (CePHMa) during a suc-



Some of the guests attending the signing of the Memorandum of Agreement between the Centre for Plant Health Management (CePHMa) and the University of Chapingo in Mexico were, from the left, front: His Excellency Mauricio de Maria y Campos, Ambassador of Mexico in Southern Africa, Prof. Magda Fourie, Vice-Rector: Academic Planning at the UFS and Dr José Sergio Barrales Domínguez, Rector of the University of Chapingo in Mexico; back: Prof. Wijnand Swart, Chairperson: CePHMa, Sakkie Pretorius, Departmental Chairperson, Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences and Frans Swanepoel, Director: Research Development at the UFS.

successful one-day seminar in 2005. Prof. Swart is currently at the head of CePHMa matters.

Prof. Pretorius, who specialises in rust diseases of agronomic crops, was responsible for the evaluation of rust resistance in all commercial wheat cultivars in 2005/06. In collaboration with colleagues, the industry and other universities, he identified four new rust strains from three fungal species in 2005. The yellow rust mutant in particular is a threat to local wheat production as it overcame resistance in several popular and productive cultivars. As a result of previous research, during which he described the new Ug99 wheat stem rust strain from Uganda, Prof. Pretorius was invited to attend a workshop in Rome. At this meeting, which included international breeders and pathologists, research plans to prevent the global threat posed by this stem rust race were discussed.

In September 2005 Prof. Pretorius attended a congress in Australia and delivered an invited paper about the challenges for wheat disease control in South Africa. In 2006 Prof. Pretorius visited Kenya, Egypt and the USA as part of the Global Rust Initiative, an international group working on potentially damaging cereal rust diseases. Local research, in collaboration with the ARC, Monsanto, Pannar and CenGen, financially supported by the Winter Cereal Trust and National Research Fund (NRF), endeavours to identify and characterise durable resistance to these diseases. With the assistance of Ms Cornel Bender, a short course in cereal rust pathology was also presented.

Prof. Pretorius and McLaren, in collaboration with Prof. Van der Westhuizen and Ms Liezl van Jaarsveld, a Ph.D. student, are analysing biochemical markers for onset of rust susceptibility in soybean.

Prof. McLaren developed new inoculation and evaluation procedures for stem rot of soybean, and continued his research on grain mould of sorghum. He acted as an external reviewer of the Department of Plant Pathology, University of Stellenbosch and visited Zambia in March 2006 to co-ordinate regional co-operation and

training in the International Sorghum and Millet Research Support Programme (INTSORMIL).

The first cactus pear conference in South Africa since 1995 was organised under the auspices of CePHMa by Prof. Swart in March 2006. The International Cactus Pear Conference, held on the Main Campus, was attended by 88 delegates from countries such as Chile, Mexico, Ethiopia, Namibia and the UK and received media coverage on *SABC News* and *Morning Live*. The conference coincided with the signing of a Memorandum of Understanding between CePHMa and the Autonomous University of Chapingo in Mexico. The Mexican ambassador, His Excellency Mauricio de Maria y Campos, attended the proceedings.

Prof. Swart was contracted by Phytopharm, a British company, to investigate diseases of *Hoodia gordonii* (ghaap) in the Northern Cape.

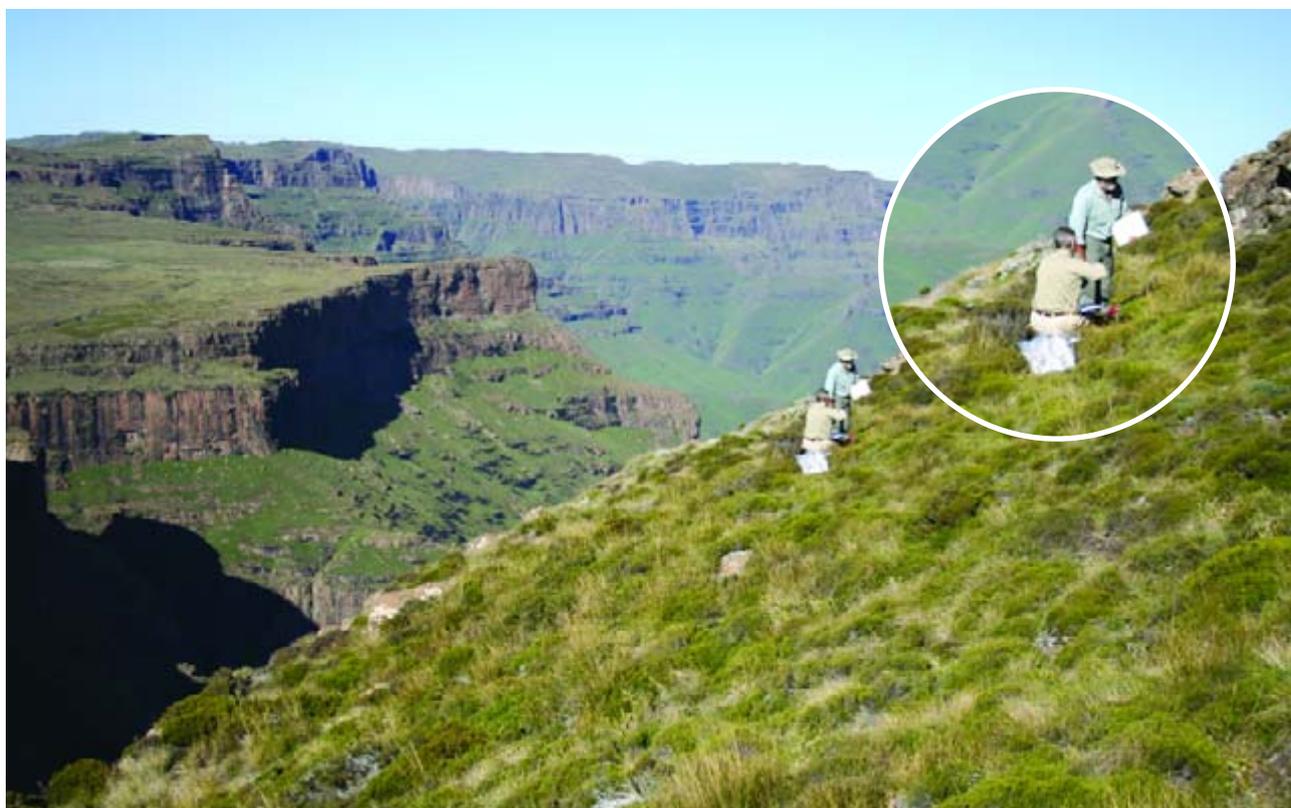
Foreign visitors to the division included Ms Mary Anne Hansen from Virginia Tech, USA for a student exchange programme, Dr Gary Peterson from Texas A&M, USA for the Southern African INTSORMIL programme and Dr John Leslie from Kansas State University, USA for Fusarium diseases.

## Genetics

Ongoing improvement of the Genetics curriculum, under the guidance of Prof. Johan Spies, has resulted in a steady increase in student numbers.

The division also expanded to include animal genetics. In its first year, this section acquired funding to establish a South African database for genetic diversity in cheetahs. The interest in animal genetics is not only important for the discipline, but also for the faculty and the university.

During 2005 the Genetically Modified Organisms (GMO) Testing Facility, under management of Dr Chris Viljoen, conducted a survey



Dr Robert Scott-Shaw from Ezemvelo Wildlife (seated) and Mr Robert Brand, Ph.D. student, busy with a biodiversity sampling of the Drakensberg peaks.



of genetically modified (GM) food products. Of the 58 maize and soy products randomly selected, 76% tested positively for GM. It was found that 71% of products with a "non GM", "GM free" or "organic" label were GM positive. This was the first survey of GM in food products in South Africa and highlights the need to determine regulations for GM labelling. In addition, the facility tested products for 25 companies during 2005 as well as all food aid to Africa on behalf of the World Food Programme (WFP).

During 2005 Ms L. Chetty, a Ph.D. student in the GMO Testing Facility, received a grant from the Centre of Excellence for Biodiversity based at the University of Stellenbosch. The grant includes running costs and a bursary and is guaranteed for three years.

The GMO Testing Facility generated a total of R600 000 in external funding from competitive research grants, contract research and diagnostic testing. Dr Viljoen was elected to an international committee which advises the secretariat of the Convention of Biological Diversity (CBD), a programme of the United Nations (UN). Furthermore, Dr Viljoen has been asked to participate in the local Advice Committee relating to GMO's, including risk assessments on behalf of the Council for the GMO Act of 1997.

As part of the initiative to extend Genetics, Prof. Paul Grobler, previously from the University of Limpopo, joined the division in 2006. His expertise on animal genetics, specifically the identification of geographic variants with evolutionary potential, is a valuable asset to the UFS. Ms Karen Ehlers made progress with the compilation of a National Genetic Database for cheetahs and Dr Adéle Strydom obtained a Ph.D. degree with a thesis on phylogenetic relationships in the plant family *Amaryllidaceae*.

### Academic staff

#### Main Campus

**Professors:** Proff. Sakkie Pretorius, Johan Grobbelaar, Maryke Labuschagne, Neal McLaren, Louis Scott, Johan Spies, Wijnand Swart, Amie van der Westhuizen, Charl van Deventer, Rudi Verhoeven, Johan Venter (emeritus)

**Associate Professor:** Prof. Paul Grobler

**Affiliated Associate Professors:** Prof. Koos van Rensburg, Antoinette Kotze, Renée Prins, Chris Viljoen

**Senior Lecturers:** Drs Johann du Preez, Liezel Herselman, Elizma Koen, Adéle Strydom

**Lecturers:** Drs Lintle Mohase, Gerhard Potgieter, Andor Venter, Botma Visser, Mss Karen Ehlers, Wilmarie Kriel, Barbara Mashope

**Professional Officers:** Mss Cornel Bender, Susan Reinecke, Mr Koos van der Heever

#### Qwaqwa Campus

**Associate professor:** Prof. Rodney Moffett

**Lecturers:** Mr Robert Lentsoane, Ms Joyce Moloi

**Junior Lecturer:** Mr Raymond Pitso

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# Research outputs

## Publications

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## Reports

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Swart, W.J. 2005. *Alternaria diseases in pistachio orchards*. Report to Green Valley Nuts, Prieska, South Africa.

Van der Westhuizen, A.J. 2006. *Biochemistry of resistance in wheat to biotic stresses*. Progress Report Presentation, Winter Cereal Trust, Pretoria, South Africa.

## Conference contributions

Appelgryn, J.J., Visser, B. & Pretorius, Z.A. 2005. *Identification of genes uniquely expressed in resistant wheat infected by leaf rust*. Paper presented at the 31st Annual Congress of the South African Association of Botanists, University of the Free State, Bloemfontein, South Africa.

Appelgryn, J.J., Visser, B. & Pretorius, Z.A. 2006. *Early signaling events that occur during the interaction between wheat and leaf rust*. Paper presented at the 19th Congress of the South African Genetic Society, University of the Free State, Bloemfontein, South Africa.

Bender, C.M. & Pretorius, Z.A. 2006. *Breeding for stripe rust resistance: Are we progressing?* Paper presented at the 44th Congress of the

Southern African Society for Plant Pathology, Magalies Park, South Africa.

**Benesi, I.R.M., Labuschagne, M.T., Herselman, L. & Mahungu, N.M.** 2006. *Comparison of morphological and AFLP genetic diversity analysis of Malawian cassava germplasm*. Paper presented at the 6th Plant Breeding Symposium, Club Mykonos, South Africa.

**Berner, J.M. & Van der Westhuizen, A.J.** 2005. *The involvement of the lipoxygenase and cyclooxygenase pathways during the resistance response of wheat to the Russian wheat aphid*. Paper presented at the 31st Annual Congress of the South African Association of Botanists, University of the Free State, Bloemfontein, South Africa.

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**Dessalegn, Y., Herselman, L. & Labuschagne, M.T.** 2006. *Comparison of AFLP and SSR markers for coffee (Coffea arabica L.) genetic diversity analysis*. Poster presented at the 6th Plant Breeding Symposium, Club Mykonos, South Africa.

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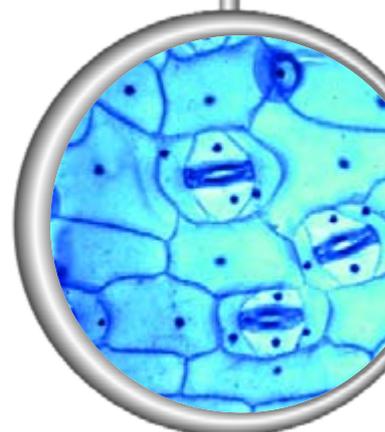
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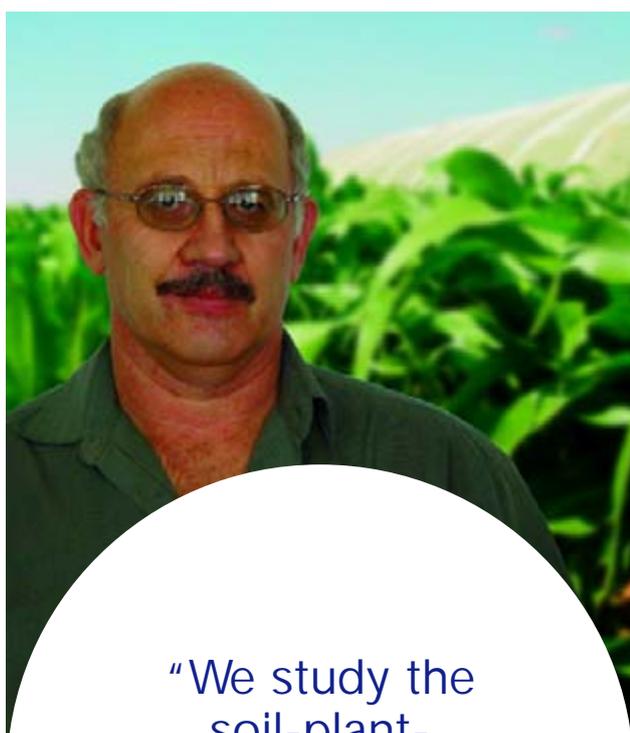
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Department of

# Soil, Crop and Climate Sciences



“We study the soil-plant-atmosphere system.”

Prof. Chris du Preez.

## Overview

The Department of Soil, Crop and Climate Sciences specialises in the disciplines of Agronomy, Soil Science, Horticulture and Agrometeorology. In addition to undergraduate and postgraduate teaching in the four disciplines, the department also delivers important teaching contributions at the Centres for Sustainable Agriculture, Environmental Management, Disaster Management, Developmental Studies and the Department of Quantity Surveying at the UFS.

Over the past few years the department has shown growth not only in the number of undergraduate students but also in the number of postgraduate students. In 2005/06 an average of 36 masters and 21 doctoral students were enrolled. Approximately 40% of these students came from countries like Eritrea, Ethiopia, Kenya, Lesotho, Mauritius, Mozambique, Namibia, Swaziland and Zimbabwe. Twelve master's and eight doctoral students graduated.

During 2005/06 the department has managed to improve some of its infrastructure for teaching and research. Approximately R1 million was spent on apparatus such as a carbon analyser and a spectrophotometer. The climacabinets and the building in which they are situated were upgraded at considerable cost. These cabinets are used for the controlling of factors such as temperature, light and humidity on an hourly basis to test their effects on the growth and development of crops. The cabinets are now computerised, which improves their efficiency. Various improvements were also made to the department's experimental sites on the west campus of the Main Campus in Bloemfontein and at the Kenilworth Experimental Site.

In 2005 Mr Stephan Steyn, in conjunction with Prof. Sue Walker, initiated two community service projects which are still running. The *Lesedi FM* project uses Sotho-speaking students to deliver agricultural predictions and relevant information to the community on a weekly basis in an attempt to better inform young emerging farmers. In the second project, students erect automatic weather stations at certain schools in the greater Mangaung area. They then conduct lectures for learners and teachers on interesting weather-related themes.



Lysimeter unit at Kenilworth Experimental Site for water and salt balance studies.

for Agricultural Meteorology, was the guest speaker. The topic of his speech was: *Problems with the establishment of agrometeorological services: Austral climates can't escape*. Dr John McGregor from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia delivered a keynote address on the topic: *Variable resolution in global modelling*. A total of 60 papers and 31 posters were presented at the conference. Prior to the conference, a workshop was held to strengthen the ties within the South African agrometeorological community by discussing current projects and identifying future projects.

A short course on Agrometeorology and on-farm decision making was presented in 2006 for the Early Warning Unit of the Directorate of Agricultural Disaster Management at the national Department of Agriculture. Representatives from all of the provincial departments of agriculture who are involved in the dissemination of seasonal forecasts and other climate-related agricultural extension matters attended the course.

In 2006 Dr James Allemann was invited to and chaired the opening session of the Crop Strategy Development Workshop of the Centre for Underutilised Crops held in Nairobi, Kenya. He also presented one paper and one poster at the 1st International Conference on Indigenous Vegetables and Legumes. Two scientific papers were published as a result. Dr Allemann played a pivotal role as invited peer-reviewer of research in the Plant Science Division of the Agricultural Research Council (ARC)-Roodeplaat Vegetable and Ornamental Plant Institute. He also presented a paper at the South African Agricultural Technologists Conference in Midrand.

Ms Kimberly Jennings, an honours student in Soil Science, was awarded the medal for the best paper presented by an author under 30 years old at the 2006 combined conference of the South African Soil and Crop Science Societies held at the Howard College Campus of the University of KwaZulu-Natal. The conference was attended by 290 delegates who contributed 150 papers on a wide range of subjects. Ms Jennings' paper addressed the redox behaviour of a Kroonstad soil type in the Weatherley catchment.

Research in the department is aimed at various aspects of the soil-crop-atmosphere system. More than R4 million was spent on research in 2005/06, of which only 10% came from the university. The rest was from institutions such as the National Research Foundation (NRF), the Water Research Commission (WRC), the Protein Research Trust (PRT), Agri Risk Specialist Limited, New York Botanical Gardens, Omnia Fertilizer Limited, Agraforum and Green Valley Nuts.

In his research aimed at crop physiology, Prof. Seef Pretorius' team tested more than 2 000 extracts of South African plants for antifungal, antibacterial, bio-stimulating and herbicidal activity. The extracts of two plants showed extraordinarily high *in vitro* and *in vivo* antifungal activity. Ten active molecules – of which five were new – were isolated, cleared and identified by nuclear magnetic resonance spectroscopy.

The value of this discovery is that natural antifungal products can be developed and commercialised with a higher than average economic potential. An added benefit is that the donor plants can be developed into new crops which might be of economic value, especially to new upcoming farmers. A patent (*Extracts and compounds from "Agapanthus africanus" and their use as biological plant protection agent*) was registered and the production of a natural fungicide is envisaged. Furthermore, ten years of research on natural plant-strengthening agents, under contract for a German company, was completed during 2005. This makes it possible for a second patent to be registered and a natural product to be produced and commercialised.

In 2006 Prof. Pretorius and Dr Elmarie van der Watt registered another patent: *Novel natural chemicals from Lupinus albus with growth and yield enhancing properties as well as application potential in the agricultural industry*.

Additionally, in 2006 a series of commercially available plant growth regulating agents were compared under field conditions in order to assist farmers in making calculated decisions on their use. This project was financed by the PRT.

A novel molecule, pheroid, with the ability to improve translocation of organic substances over plant membranes, was discovered by the North-West University. The application potential of this molecule in agriculture was investigated under contract by this team of researchers both in the greenhouse and under field conditions. Promising results were obtained which could lead to the commercialisation of the product.

Both Dr Gesine Engelbrecht and Ms Anneline Bothma-Schmidt presented posters at the Annual Conference of the South African Society for Horticultural Sciences. Dr Engelbrecht's research focused among others on the sustainable production of vegetable crops by upcoming farmers. As a result, she became involved in community service projects such as vegetable gardens. A video was made to be used as a training aid for communities in the cultivation of vegetable crops and the management of vegetable gardens. She also did research on the

At the initiative of Prof. Leon van Rensburg, an information day was held in 2005 at the Kenilworth Experimental Site to introduce certain research activities of the department. Various prominent agriculturalists and farmers attended. The feedback was extremely positive and a more focused information day on in-field rain water harvesting was held in 2006 at the Paradys Experimental Farm to demonstrate the commercialisation of this technique.

In 2006 the Agrometeorology section organised the annual national conference for the South African Society of Atmospheric Sciences. Prof. Kees Stigter, from Agromet Vision and founder of the International Society

fertilisation of *Lachenalia*, a decorative plant becoming more and more popular both locally and overseas. She is currently editing this research, which will form a chapter in a book in which the cultivation of *Lachenalia* is discussed.

Research by Ms Bothma-Schmidt is aimed at nut crops. Pistachio nut orchards close to Prieska were monitored to ascertain the role of climate on pollination problems. A course on dormancy in pistachios was held in an attempt to better understand the process. A number of propagating techniques for walnuts are currently being evaluated at Aliwal North.

Dr Gert Ceronio has been researching frost damage in wheat for the past four years. He identified the growth stage during which frost damage takes place, and also showed that by employing the correct management practices, the risk of frost damage can be lowered considerably or even avoided. The mechanism of cold damage is currently being investigated. He presented two posters at the 2006 conference of the South African Society for Horticultural Sciences.

Dr Allemann investigated the effect of alachlor on 22 different South African sunflower cultivars. This included an evaluation of alachlor formulations.

The pedology team (Drs Cornie van Huyssteen, Piet le Roux and Malcolm Hensley) completed a research project for the WRC on the role of soil in the hydrological cycle. Soil plays a dominant role in the cycle and the results of the project are already being used by hydrologists to model the water balances of catchment areas. In this regard, collaboration is taking place with hydrologists from the University of KwaZulu-Natal.

Until recently, hydrological models ignored the role of soil, or treated soil as a uniform system. To address this aspect further, the WRC will fund this team with another R1,85 million for the next three years to bridge the gap known internationally as hypopedology. This is the fastest growing career field in the United States of America (USA) and soil scientists from this department are now leading the field of hypopedological research in South Africa.

Dr Hensley initiated research on the collection of rain water in ploughed fields while he was still associated with the Institute for Soil, Climate and Water at the ARC. This research was continued by Prof. Van Rensburg. It was shown that the yield of maize and sunflowers could be increased by up to 50% on soil not considered good enough for dry land cropping. Now that both Prof. Van Rensburg and Dr Hensley have joined the department, research is conducted in collaboration with Dr Le Roux to extend the technique to other soils and also to adapt it for commercial farmers.

The first phase of a research project on the fate of organic matter in cultivated plinthic soils in the Free State has been completed. The research is being conducted by a team under the leadership of Prof. Wulf Amelung from the University of Bonn in Germany. Prof. Chris du Preez, Departmental Chairperson, is a member of this team. Eleven articles have already been published in accredited scientific journals and another three are in the pipeline. The soil samples of the second phase of the project were collected during the spring of 2005. This project is financed by the Research Foundation of Germany.

In conjunction with this research, Ms Elmarie Kotzé and Prof. Du Preez investigated the influence of cultivation practices on the organic matter content of plinthic soil in a long-term experiment of the ARC-Small Grain Institute at Bethlehem.

Research over the past six years on water quality in the catchment area of the lower Vaal River and its influence on soil and crops will continue. This research is financed to the amount of R1,8 million by



Photographed in a controlled environment cabinet are, from the left, back: Mr Adriaan Hugo, head of the UFS Electronics and Mechanisation Division, Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences at the UFS, and Prof. Koos Terblans, Lecturer at the Department of Physics; front: Mr Koos Uys, engineering consultant from Experto Designa who helped with the cooling systems of the cabinets.



Prof. Leon van Rensburg, measuring the leaf xylem potential of irrigated maize using a Scholander pressure chamber. The leaf was sampled at the lysimeter complex of the Department of Soil, Crop and Climate Sciences at Kenilworth.



Research at Kenilworth Experimental Site to quantify the effect of soil salinity on peas.

the WRC, and a further R2,4 million has been allocated for the next four years. Various staff members will be involved due to the interdisciplinary nature of the research, namely Proff. Du Preez, Van Rensburg and Alan Bennie, Drs Le Roux and Van Huyssteen, Messrs Johan Barnard, Jason Sparrow and Gideon Voigt and Ms Kotzé. They will focus on the management of salinity in irrigated areas like the Riet River and Vaalharts.

Prof. Du Preez is also a member of a team doing research on the modelling of non-point pollution of water by agriculture. Researchers from five universities (KwaZulu-Natal, Pretoria, Stellenbosch, Free State and the Western Cape) as well as two ARC Institutes (Soil, Climate and Water; and Plant Protection) have been incorporated due to the multi-disciplinary nature of the work. This R5,5 million project is managed by Sigma Beta Consulting Engineers.

In 2005 Dr Harun Ogindo and Prof. Walker completed a project for the Water Research Fund for Southern Africa regarding the rainfall usage efficiency of maize-bean intercropping. She was also involved in an investigation undertaken by Ms Muna Elhag on desertification in Sudan.

Ms Linda de Wet, in collaboration with Proff. Walker and Sakkie Pretorius from the UFS Department of Plant Sciences, is trying to develop an early warning system for stripe rust in wheat by using weather data. Such a system could be of great value to researchers and especially farmers.

The Agrometeorology section secured a five-year WRC project entitled: Applications of

rainfall forecasts for agriculturally related decision making in selected catchments in 2006. This is a partnership project with the universities of Cape Town, Pretoria and KwaZulu-Natal as well as the ARC and the South African Weather Service. Mr Steyn is the project leader for the UFS contribution, which includes downscaling of rainfall and temperature predictions for two catchments, namely the upper Olifants River in Mpumalanga and the Modder-Riet in the Free State.

Extraordinary stability in terms of staff has been experienced in the department over the past three years. Prof. Van Rensburg, previously associated with the ARC Institute for Soil, Climate and Water, joined the department in November 2005 with the task of expanding soil physics.

In December 2005, after 26 years, Ms Alida du Plessis retired as secretary. In January 2006 Ms Brenda Oosthuizen was appointed in her place.

Various staff members improved their qualifications. Ms Kotzé obtained an M.Sc. and Drs Ceronio, Engelbrecht and Elmarie van der Watt all obtained their Ph.D. degrees.

Dr Van Huyssteen was promoted to senior lecturer, Ms Kotzé to lecturer and Ms Van der Watt to professional officer.

As usual, departmental staff acted as external examiners for other universities, evaluated articles for scientific magazines, served on pilot committees of research projects, and so forth.

In 2005 Prof. Seef Pretorius was the president of the Crop Production Society of

South Africa. In 2006, he and Prof. Walker were respectively former president and council member of this society. In 2005/06 both Prof. Van Rensburg and Dr Van Huyssteen were council members of the Soil Science Society of South Africa. In 2005 Dr Le Roux was chairperson of the South African Soil Surveyors' Organisation and Dr Van Huyssteen succeeded him in 2006.

In 2005 the World Meteorological Organisation invited Prof. Walker to act as vice-chairperson for a team of experts who presented a workshop on verification and predictions of rainfall and temperatures of seasons in Tokyo, Japan. Prof. Walker was also privileged to represent South Africa in 2006 at the World Meteorological Organisation of the United Nations Meeting in New Delhi, India. At this meeting, she was appointed chairperson of the open programme for the next four years, dealing with agrometeorological services for agricultural production.

For the fourth consecutive time, Prof. Du Preez was a member of a panel evaluating researchers for an award by the International Fertiliser Association in Paris, France.

### Academic staff

**Professors:** Proff. Chris du Preez, Seef Pretorius, Sue Walker, Leon van Rensburg

**Senior Lecturers:** Drs Cornie van Huyssteen, Piet le Roux, James Allemann

**Lecturers:** Drs Gert Ceronio, Gesine Engelbrecht, Mss Anneline Bothma-Schmidt, Elmarie Kotzé, Linda de Wet

**Junior Lecturer:** Mr Stephan Steyn

**Assistant Researcher:** Dr Malcolm Hensley

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# Research outputs

## Publications

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- De Wet, L.** 2006. *Weather conditions affecting wheat stripe rust: Field experiment results*. Paper presented at the Combined Congress of South African Society of Crop Production and Soil Science Society of South Africa, Durban, South Africa.
- Dikgwathe, S.B., Ceronio, G.M. & Van Rensburg, L.D.** 2006. *The effect of water quality on growth and yield of irrigated peas (Pisum sativum L.)*. Paper presented at the Annual Conference of the South African Society for Horticultural Sciences, Stellenbosch, South Africa.
- Du Plessis, M.J., Le Roux, P.A.L. & Van Huyssteen, C.W.** 2005. *Recognition of a new soil form with the sequence of horizons: Orthic A / red apedal B / hard plinthic B horizon*. Paper presented at the Combined Congress of Soil Science Society of South Africa, South African Society of Crop Production, Southern African Society for Horticulture and Southern African Weed Science Society, Potchefstroom, South Africa.
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- Elhag, M. & Walker, S.** 2006. *Impact of climate variability on vegetation cover in the Butana area of Sudan*. Paper presented at the International Conference on Ecosystems Changes and Implications on Livelihoods of Rural Communities in Africa, Dar es Salaam, Tanzania.
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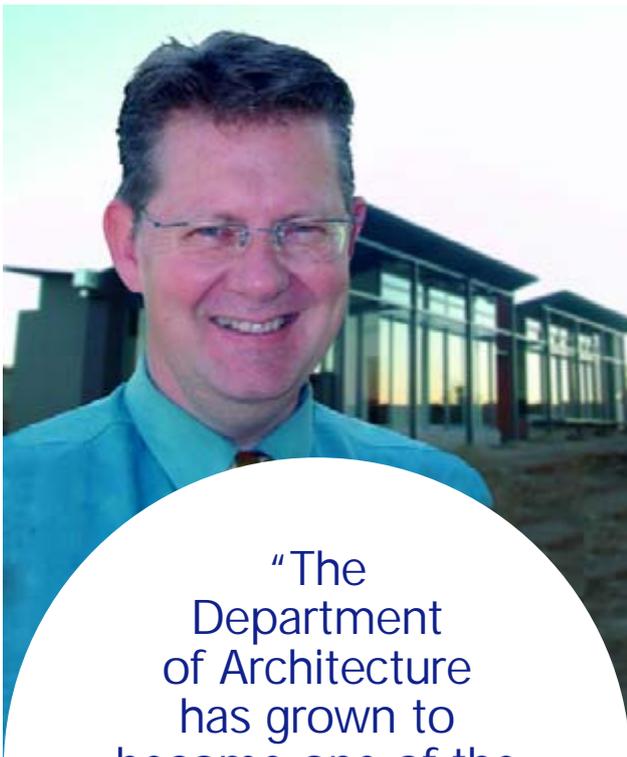
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- Walker, S., Ogindo, H.O. & Mokoena, L.H.** 2005. *Evaluation of yield from maize-bean intercropping*. Paper presented at the Maseno University, Maseno, Kenya. (Invited speaker).
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- Zere, T.B., Van Huyssteen, C.W., Hensley, M. & Le Roux, P.A.L.** 2005. *Soil hydrology during a drying cycle on a hillslope at Weatherley*. Paper presented at the Combined Congress of Soil Science Society of South Africa, South Africa Society of Crop Production, Southern African Society for Horticulture and Southern African Weed Science Society, Potchefstroom, South Africa.
- Zere, T.B., Van Huyssteen, C.W., Le Roux, P.A.L. & Hensley, M.** 2006. *Degrees of wetness of selected diagnostic horizons in the Weatherly catchment*. Paper presented at the Combined Conference of the South African Soil and Crop Science Societies, University of KwaZulu-Natal, Durban, South Africa.

# Departments in the Building Sciences





# Architecture



“The Department of Architecture has grown to become one of the leading architectural departments in South Africa.”

Prof. Jan Smit.

## Overview

Over the years the Department of Architecture has grown into one of the leading architectural departments in South Africa, proven by the unconditional international accreditation from the Royal Institute of British Architects, the Commonwealth Association of Architects and the South African Council for the Architectural Profession. This, together with the upswing currently being experienced in the building industry in the country, is causing a new enthusiasm and interest in the building trades.

The 50th anniversary celebrations of the department in 2005 were commemorated with a gala dinner in the Centenary Complex on the Main Campus in Bloemfontein during the Sophia Gray festivities. The guests of honour on this occasion were Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences at the UFS, Prof. Glenn Murcutt, world-renowned architect from Australia, and Dr Hennie de Clercq, Executive Director of the Southern African Institute of Steel Construction.

Demand in the architectural field has escalated sharply over the past years. The year 2006 can be considered highly successful for this department. More than 240 enquiries were received for this field of study. To ensure quality and to conform to the university's strategic aim of excellence, only 60 students were selected for 2006 and 50 for the 2007 intake. This positive reflection of the building industry as well as the motion of confidence in the department caused the staff to take stock early in 2006.

In 2005/06 various student tours took place to different centres in the country, among others Phillippolis, Clarens, Cape Town and Johannesburg and students took part in several student design competitions:

- In 2005 the department's entries for the National Des Baker Student Design competition received an honourable commendation (from 24 entries). Students participated in this competition in 2006 as well. The community projects where students designed and built the projects also had some interesting features, although most

## “The Department of Architecture commemorated its 50th anniversary in 2005.”

important were the housing developments done for the Paradys Experimental Farm of the university.

- In 2005 Ms Marieta Meyer, a third-year student of the department, won the National Steel competition (SAISC) for her project, *Steel in the fabric of the South African house*. In 2006 Mr Charles de Jager, also a student from the department, won this prestigious competition.
- In 2005 Ms Alet van der Merwe entered her first-year photography class in several categories of the Freshford Bloemfontein photographic competition. A number of prizes were won, with Ms Michelle Marais winning a first prize in one of the categories. In 2006 Ms Van der Merwe organised the ex:posed photography exhibition in the Johannes Stegmann Gallery on the Main Campus. This will probably become an annual event on the campus calendar.

- Ms Surette Pieterse was appointed regional winner of the Corobrik Student of the Year competition in 2005, for producing the best thesis. In 2006 Ms Mari-Louise Flanagan was appointed regional winner for the best thesis.
- In 2005, 29 third-year students of the Building Science course built full-scale copies of the well-known Rietveld chair (designed in 1917 by a Dutch architect) under leadership of Mr Jacques Laubscher.
- In 2006 one of the second-year students, Mr Justice Liebenberg, was one of the ten finalists in the National PG Bison competition.
- In 2006 three entries for the Cement and Concrete Institute competition for honours students were received from students in the department. This is a competition for a project in Batho, Bloemfontein, based on sustainable principles applied to design.

The department was also involved in various projects:

- Dr Pieter le Roux was a collaborative member of the Centre for People and Buildings (CfPB) in Delft in the Netherlands. His contribution focuses on the conveying of knowledge on the functioning of workplace evaluation from the Netherlands database to the South African context. This centre is currently busy with a variety of research projects



House Uys is situated in Rayton and was designed by Smt! Architects. It reflects farm architecture with its use of galvanised iron as building material.



Third-year students on their self manufactured copies of the well-known Rietveld chair in front of the Architecture Building.

that examine and evaluate the inter-dependent relationships of people with the built-up area. Under the leadership of Dr Le Roux, various projects were introduced and several completed during 2006. Research on the improvement and optimising of facilities on the Main Campus was published during 2006 in the September issue of the *Journal of Facilities Management (JFM)*.

- The Unit for Earth Construction is being run from the department under the leadership of Ms Petria Jooste-Smit and Mr Gerhard Bosman. Both of these lecturers were invited by the Technical University Eindhoven (TUE) in the Netherlands to do their doctorates in Earth Building at their facility. The centre also helped with the completion of the !Xhariep Dam Tourist Centre in the Free State. In 2006 this unit, with the participation of Prof. Das Steyn of the Department of Urban and Regional

Planning at the UFS, completed its field work for the South Africa-Netherlands Research Programme on Alternatives in Development (SANPAD) research project with the TUE. The title of the project was: *A South African building renaissance; acceptability of sustainable, high quality, earth-constructed, public and private buildings to support local economic development*. The centre also assisted in the Des Baker student competition project. Real clients in the low income sector were used, one of which, House Seekoei in Heidedal, was recently completed.

- At a housing project in Kimberley the building work was evaluated by the Unit for Earth Construction. A process of employment creation was also part of this project. The Department of Housing was advised regarding the quality of the housing as well as the future plan of action.

- In 2005 Ms Maxie Botha, a postgraduate student in architecture, worked for the Umbili Foundation in Tsumeb, Namibia for three months, on the relocation of a group of San people. The work included the design, production and physical building of earth bricks for their houses.
- Altogether 21 honours students took part in a building project known as Permaculture and Earth Building Workshop, under the leadership of Mr Bosman, on a smallholding in Linbro Park, Johannesburg. The students learned to employ sustainable architectural principles on a small scale, as well as how to erect a residential home by using three different earth building techniques.
- A strategy was developed and designs were created for the upgrading of the housing and communal facilities on the Paradys and Sydenham Experimental Farms.



House Enkalweni, which was designed by Smlt Architects is a contemporary work of the traditional Free State building styles.



House Gutter is situated in Rayton. This house, designed by Smlt Architects, reflects the historically sandstone heritage of Free State architecture.

- Third-year students presented designs for a new entrance gate for the State President Swart High School in Brandfort, for the school's centenary celebrations.
- Mr Hendrik Auret, an honours student, took part in an international architectural students' workshop, seeking solutions to counteract the deterioration of Zeyrek, a poverty-stricken residential area in Istanbul, Turkey.
- On request from the University of Fort Hare, the department was involved in the redesigning of the East London Campus. As part of the design course, students were introduced to real clients. Solutions were presented to the university authorities, and these were received very positively.
- On the initiative of Mr Laubscher, the first winter school for architectural students was held during the winter holiday in 2006. The school was attended by 30 students from all over the country.

Prof. Pattabi Raman continued to be the technical adviser to the Freedom Park development in Gauteng.

The department presented a number of opportunities for members of the profession and students in the architecture environment to gain the insight and knowledge from experts in the field:

- The 17th Sophia Gray Memorial Lecture was held in August 2005, with the title: *Stories... Architecture... Life*. Prof. Bannie Britz, former head of the department, was the guest speaker. The 2006 Sophia Gray Memorial Lecture was held by Design Workshop SA from Durban. This practice was responsible for the design of the Constitutional Hill Court building in Johannesburg.
- To coincide with the 50th anniversary of the department, Prof. Murcutt from Australia was invited as guest speaker to present a lecture that was arranged by the Southern African Institute of Steel Construction (SAISC). It was specifically the emphasis of his approach to regional architecture which made his visit to Bloemfontein valuable, since this department also ascribes to the concept of regionally bound architecture. Mr Richard Murphy from Edinburgh spoke at the 2006 lecture of the SAISC.
  - Other than Prof. Murcutt, Mr Dolf Wieërs from the University of Limburg in Hasselt, Belgium also visited the department in 2005, with the aim of investigating exchange possibilities between the university and the UFS. Mr Wieërs also gave a public lecture about their School of Architecture.

- Prof. Mikki Desai from India visited the department and gave a series of lectures on Indian architecture.
- Mr Laubscher arranged a lecture series, with Sanlam as the sponsor, in conjunction with the Volksblad Arts festival in July 2005. Guest speakers were Prof. 'Ora Joubert on *Contemporary South African Architecture*, Mr Kobus du Preez on *Tangible points between South African and International Architecture* and Mr Johann Slee on *Critical regionalism within the South African context*. In 2006, with Plascon as the sponsor, Ms Gardiol Bergentuin (Johannesburg), Mr Pieter Matthews (Pretoria) and Prof. Jan Smit and Ms Jooste-Smit from the department acted as guest speakers at this occasion. Prof. Smit is the Departmental Chairperson of the Department of Architecture.

- Ever since the tours to architecturally designed residential houses were initiated by Mr Laubscher in 2004, this has become one of the most popular activities during the Volksblad Arts Festival. Three of the Smit couple from Smit Architects' new designs in Rayton were also included in the tours. Of the contemporary houses featured on the popular house tours in 2006, House Smit (Smit Architects), House Uys (Smit Architects) and a house done by Mr Sergio Nunes (part time lecturer in architecture) were included.
- The department acted as host for the biannual Sustainable Built Environment (SBE) congress held in July 2006 on the Main Campus.

The department was approached to present a workshop together with the Department of Architecture of the Nelson Mandela Metropolitan University (NMMU) in Graaff-Reinet. From the UFS, Prof. Smit and Raman, Dr Le Roux as well as Messrs Du Preez, Pretorius and Ms Jooste-Smit attended. They did strategic planning and exchanged ideas on training.

Staff from the department also enhanced their knowledge on an international level during a number of study tours. Messrs Ras and Laubscher visited Verona, Italy in September 2005, attending the exhibition: *Designing with Natural Stone*. They also received three days' training in the use of natural stone. Prof. Smit and Ms Jooste-Smit visited England, Switzerland, Italy and Croatia in June 2005. They especially focused on historical Roman structures and Middle Age cities in Europe. Mr Gert Swart visited Eastern Europe, focusing on historical and contemporary architecture of Jewish communities, as well as on the concentration and extermination camps during the Second World War, which were used during the Holocaust. Ms Van der Merwe visited the Department of Architecture at the National University of Science and Technology in Bulawayo, Zimbabwe in July 2005.

Prof. Raman, previously departmental head of Architecture at the University of the Witwatersrand, was appointed as research professor for a term of three years, starting in 2005. Dr Le Roux was a former resident of Japan, where he received his doctorate at the Toyohashi University of Technology with a thesis entitled: *Application of a model of work style typology on aspects of autonomy and diversity in work performance in open plan offices: A study on predictive facility management*. He was appointed as senior lecturer in April 2005.

### Academic staff

**Professors:** Prof. Pattabi Raman

**Associate Professor:** Prof. Jan Smit

**Senior Lecturers:** Dr Pieter le Roux, Ms Petria Jooste-Smit

**Lecturers:** Messrs Jan Ras, Gerhard Bosman, Kobus du Preez, Jacques Laubscher, Gert Swart

**Junior Lecturers:** Mr Henry Pretorius, Ms Alet van der Merwe

**Contract Lecturers:** Messrs Char-Pierre Cilliers, Sergio Nunes, Pieter Venter, Dr Zoë Henderson, Ms Wilandi Esterhuysen

### Contact details

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# Research outputs

## Publications

**Le Roux, P.C.** 2005. A study on the application of current and anticipated work style diversity: Work style directional change model for predictive facility management. *Journal of Architectural Planning (Research Journal of the Architectural Institute of Japan)* 594: 33-38.

**Le Roux, P.C.** 2006. Optimal use of facilities: Free State's strategic approach. *Journal of Facilities Management: Africa* September: 32-39.

**Pretorius, H. & Raman, P.** 2006. Propriety and syntax: Some reflections on Gawie Fagan's work. *Architecture South Africa*, March/April: 50-53.

**Raman, P.** 2005. Giancarlo de Carlo. *Architecture South Africa* May/June: 70-72.

**Raman, P.** 2005. Humanitarian architectural practice. *Architecture South Africa* May/June: 12-17.

**Steyn, J.J. & Jooste-Smit, P.** 2006. Informal small brickyards in Free State townships are enhancing local economic development. *Acta Structilia* 13(1): 82-105.

**Swart, G.P.** 2006. Betekenis en verhaal van UV-kampus-argitektuur 1904-2004: 'n Kritiese teoretiese oorsig. *Town and Regional Planning* 48: 35-67. (Special edition, University of the Free State, Bloemfontein, South Africa).

## Chapters in books

**Bosman, G.** 2006. Promoting sustainability of earth constructed private and public buildings in South Africa. In *Eco-Architecture: Harmonisation between architecture and nature*, edited by G. Broadbent & C.A. Brebbia, Wessex Institute of Technology, UK: WIT Press. pp. 297-306.

**Raman, P.** 2006. Design and representation. In *Inquiry into Urban environment: Issues*, edited by D. Oktay. Farmagusta: EMU Press. pp. 126-141.

**Raman, P.** 2006. Beyond lateral thinking. In *The Design Studio: A Black Hole*, edited by G. Saglamer. Istanbul, Turkey: YEM Yayin. pp. 55-70.

**Raman, P.** 2006. Message and meaning. In *The Architecture of Edge Cities*, edited by P.

Hobbs. Johannesburg: David Kurt Publishers. pp. 256-275.

**Raman, P.** 2006. The architecture of edge cities. In *Messages and Meaning*, edited by P. Hobbs. Johannesburg: David Kurt Publishers. pp. 256-275.

## Conference contributions

**Bosman, G.** 2005. *The sustainability of earth construction*. Paper presented at the Sustainable Built Environments (SBE 2005) Congress, University of Pretoria, Pretoria, South Africa.

**Bosman, G.** 2005. *Teaching earth construction in the Free State: 1995-2005*. Paper presented at the Sustainable Built Environments (SBE 2005) Conference, University of Pretoria, Pretoria, South Africa.

**Bosman, G.** 2006. *Promoting sustainability of earth constructed private and public buildings in South Africa*. Paper presented at the Eco-Architecture Congress, Wessex Institute for Technology, England.

**Laubscher, J.** 2005. *Building science education*. Paper presented at the South-African Institute of Architects Congress: Educating the Architect, University of KwaZulu-Natal and the KwaZulu-Natal Institute for Architecture, Durban, South Africa.

**Le Roux, P.C.** 2005. *Towards the improvement and optimization of facilities on the campus of the University of the Free State*. Paper presented at the 2nd Annual South African Facilities Management Association (SAFMA) Conference, Midrand, South Africa.

**Le Roux, P.C. & Esterhuysen, W.** 2006. *Revitalization of the historic Main Building on the campus of the University of the Free State: Towards the improvement and optimization of facilities*. Poster presented at the 1st International Symposium on Environment, Behaviour, and Society, University of Sydney, Sydney, Australia.

**Le Roux, P.C. & Raman, P.** 2006. *Alternative approaches to housing delivery strategies in low-income communities in the South African context:*

*Identifying existing patterns of use and appropriation as analogy for the transformation of existing settlements*. Poster presented at the 1st International Symposium on Environment, Behaviour, and Society, University of Sydney, Sydney, Australia.

**Pretorius, H.** 2006. *The influence of regional vernacular architecture on the work of Jan and Petria Smit Architects*. Paper presented at the South African Association of Visual Arts Historians (SAVAH) Conference: Transformations in Visual Culture, Vaal University of Technology, Vanderbijlpark, South Africa.

**Pretorius, H.** 2006. *The use of steel in residential architecture: An analysis of the steel shed vernacular and its applicability as interpreted in three houses in the Free State, South Africa*. Paper presented at the Southern African Institute of Steel Construction Congress: Construct in steel - The next 50 years, Johannesburg, South Africa.

**Raman, P.** 2005. *Art, architecture and the hermeneutic concept of distance*. Paper presented at the Society of Art Historians Conference, Johannesburg, South Africa.

**Raman, P.** 2005. *Heterogeneity in Housing Form*. Paper presented at the Seminar on Housing, Department of Development Studies, University of the Free State, Bloemfontein, South Africa.

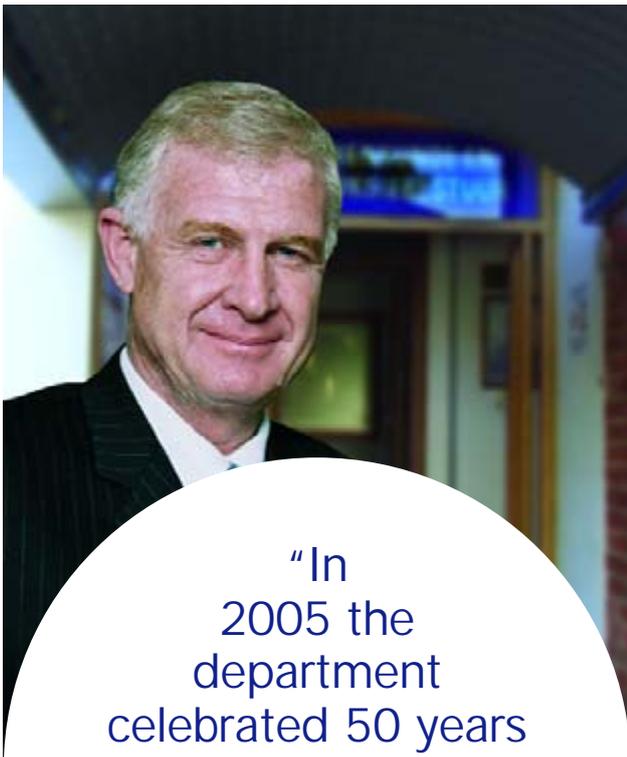
**Raman, P.** 2006. *Architectural transformations*. Paper presented at the South African Visual Arts Association 22nd Annual Conference, Johannesburg, South Africa.

**Raman, P.** 2006. *Content, container and context of museums*. Paper presented at the South African Museums Associations 70th Annual Conference, Johannesburg, South Africa.

**Raman, P.** 2006. *Fragmentation of cities*. Paper presented at the International Conference on Housing, University of La Sapienza, Rome.

**Raman, P.** 2006. *Heterogeneity in housing form*. Paper presented at the International Conference on Housing, University of La Sapienza, Rome.

# Quantity Surveying and Construction Management



“In 2005 the department celebrated 50 years of quantity surveying and construction management at the UFS.”

Prof. Basie Verster.

## Overview

During 2005 the Department of Quantity Surveying and Construction Management was involved in several actions, events and developments and experienced various highlights, one being its 50th birthday celebrations.

In 1955 the department offered four programmes. This increased to a staggering 14 programmes in 2005.

The open learning programme for Quantity Surveying, Construction Management and Project Management, which presents programmes for individuals in construction management and quantity surveying, was implemented in 1998. The UFS is the only university in Africa to offer open learning programmes in these disciplines.

In the area of education, more students than ever were served by open-learning (programmes presented in different areas/cities) or residentially (programmes are presented in Bloemfontein only). New programmes were added and different programme options were made possible at undergraduate and postgraduate level for both residential and distance learning students to keep up with the ever-changing environment in technological and traditional professional activities. In 2005 the department served a total of 469 students – the most in its history. During this year, a record of 38 students registered for the masters degree programme.

During the National Construction Week, the department distributed information on career opportunities in the construction industry to scholars. This marketing opportunity was used to make scholars and potential students aware of the programmes offered by the department.

Apart from existing programmes, the department developed different registered short programmes and courses as an additional training initiative.

In 2005 54 students completed the Facilities Management Programme (FMP) supported by the South African Property Owners Association (SAPOA) in Johannesburg, ten students completed the Intensive Project Management Programme (IPMP) also supported by the SAPOA and 31

“To celebrate its 50th birthday the department launched a special publication during a prestigious ceremony. ”



Ms Benita Kotzé, Prof. Basie Verster, Departmental Chairperson and Ms Alna Beukes, co-ordinator of the 50 year celebration publication, at the launching ceremony.

students completed the Health and Safety Programme for Construction Managers (HSPCM) supported by the Gauteng Masters Builders Association (GMBA).

In 2006 a total of 81 students completed the FMP, 17 students the IPMP and ten students the HSPCM programmes. These programmes were of great value to the industry.

During 2005 the department developed 11 computer-based learning modules for the Association of South African Quantity Surveyors (ASAQS) for the very important *Go-learning* programme for continuous training of practising quantity surveyors.

The department's involvement in community service is apparent in the continued presenta-

tion of mentorship programmes offered to emerging contractors. For the past 19 years, the Centre for Construction Entrepreneurs has offered training to several small emerging building contractors. In 2005/06, 12 students completed the two-year certificate in Building Science. This training is offered with the support of the ASAQS.

The department also offers a continuous development service to emerging construction contractors and other stakeholders through the Construction Mentor Accreditation Programme. The principle of mentor-based development programmes is now a standard component in the support of emerging contractors and other forms of development in the construction industry. The highly

esteemed Expanded Public Works Programme (EPWP) has accepted the idea of mentors for emerging contractors within their programme. Staff members of the UFS, in collaboration with the Council for Scientific and Industrial Research (CSIR) and other consultants, are at the forefront of the development and implementation of mentorships. Mentors who offer their services as part of this programme are accredited by the UFS.

The department has made a distinct contribution to the different professions and the industry during the past 50 years and has accreditation with the South African Council for the Quantity Surveying Profession (SACQSP), the South African Council for the Project and Construction Management Profession (SACPCMP) and the South African Council for the Property Valuers Profession (SACPVP). Internationally the department received accreditation by the Royal Institute of Chartered Surveyors (RICS) in the United Kingdom (UK) and the Chartered Institute of Building (CIOB), also in the UK.

Former students of the UFS practise mainly in South Africa, although many are employed in countries such as England, Ireland, Dubai and the Middle East. To serve the various arms of this industry, personnel with diverse backgrounds such as quantity surveying, construction management, project management, engineering and property economics are employed.

Prof. Basie Verster, Departmental Chairperson, was awarded the Distinguished International Fellow award by the International Cost Engineering Council (ICEC) during the council's world congress held in Ljubljana, Slovenia in 2006. Five members of the department presented nine papers at this congress and Prof. Verster was an invited speaker.

Members of the department are actively involved with industry by serving on various committees. Internationally they are involved with the Chartered Institute of Building-South Africa (CIOB-SA), the ICEC worldwide and the RICS in the UK.

Prof. Verster served as chairman of the international body of ICEC for 2005/06 as well as of the Education Standards and Research Committee for the SACQSP, and was admitted as a Fellow of the CIOB in the UK. Dr Hendrik Marx is a board member of the Central University of Technology in the Free State, and is chairman and board member of the South African Association of Consulting Engineers (SAACE). Mr Hendrik van Vuuren is a committee member of the CIOB-SA.

In 2005 Ms Helena Jordaan was awarded the prestigious gold medal for students from the ASAQS for excellence in Quantity Surveying in South Africa. Over the past 50 years, 14 students from the department were awarded this award. Ms Suzanne Chinner received the ASAQS award for the excellent first year student in B.Sc. Quantity Surveying in 2005.

In the research area, the accredited journal *Acta Structilia* celebrated its 12th year of existence in 2005. The *Acta Structilia* is a South African accredited journal for independently refereed research articles on any topic in the field of the physical and development sciences. Since 1993, 60 research articles, 12 international articles, 12 commentaries, seven book reviews and eight introductions have been published. A number of articles from the department were contributed for publication in this journal.

In 2006 the 23rd edition of the *Bouvaria*, a student journal, was published. This publication contains articles by final year students, photos of departmental activities and prizes awarded to students.

Ms Benita Kotzé and Mr Stephen Ramabodu respectively delivered papers on: *The built environment in Southern Africa – the influence of diversity and culture on conservation* and *A project management*



Dr Corné de Leeuw, President of the African Association of Quantity Surveying, who received the Directors Award of Appreciation for his contributions to Africa, and Prof. Basie Verster, Departmental Chairperson, who received the Distinguished International Fellow award as outstanding international member, by the International Cost Engineering Council.



The department offers a service to stakeholders through the Construction Mentor Accreditation Programme.



approach to housing and infrastructure development in South Africa during the 2005 Housing Research Day.

The prestigious RICS magazine, *Journal of Property Investment and Finance*, accepted an article entitled: *Diversity and value in Africa's Real Estate: Challenges facing property development in South Africa* by Mr Ramabodu, Ms Kotze and Prof. Verster.

The department is one of 14 international research partners involved in a combined research project on maturities in project-oriented communities in partnership with the Wirtschaftsuniversität Wien, in Austria. Prof. Roland Gareis from this university visited the department and presented a commemorative lecture entitled: *International trends in Project Management*, which also strengthened the international bond between the universities.

The department is also involved in joint research projects with the RICS, the Bureau for Economic Research at the University of Stellenbosch, the Construction Industry Development Board (CIDB) and the ASAQS.

### Academic staff

**Professors:** Proff. Basie Verster, Andries Hauptfleisch (in Midrand)  
**Senior Lecturer:** Dr Hendrik Marx  
**Lecturers:** Messrs Frank Berry, Ben Swart, Hendrik van Vuuren, Stephen Ramabodu, Ms Benita Kotzè  
**Contract Lecturers:** Messrs Carl Van Zyl, Pierre Oosthuizen

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During National Construction week, the department distributed information on career opportunities in the construction industry to scholars. Students, scholars and members of this profession are standing at a project of the Department of Public Works at the Appeal Court in Bloemfontein.

# Research outputs

## Publications

**Hauptfleisch, A.C.** 2005. Bemagtiging: 'n Geïntegreerde model vir die ontwikkeling van opkomende kontrakteurs in die konstruksiebedryf. *Acta Structilia Journal* 12(2): 129-137.

**Lazarus, S., Hauptfleisch, A.C. & Verster, J.J.P.** 2006. The development and assessment of an integrated skills development model for emerging construction contractors. *Acta Structilia Journal* 13(2): 145-158.

**Ramabodu, M.S., Kotzé, B.G. & Verster, J.J.P.** 2005. Diversity and value in Africa's real estate: Challenges facing property development in South Africa. Accepted for publication in *Journal of Property Investment and Finance* 25(1): 7-22.

**Verster, J.J.P.** 2006. Project management maturity models and analyses: How mature is the construction industry? *SA Builder* 973: 22-23.

**Verster, J.J.P. & Berry, F.H.** 2005. The property development challenge: Creating wealth through regional and rural projects. *Acta Structilia Journal* 12(1): 20-40.

## Conference contributions

**Grant, M. & Verster, J.J.P.** 2006. *Real time integrated cost planning and control: The living process*. Paper presented at the 1st International Cost Engineering Council (ICEC) & International Project Management Association (IPMA) Global Congress on Project Management, Ljubljana, Slovenia.

**Hauptfleisch, A.C.** 2006. *An accelerated integrated small construction contractor development model: A holistic approach for developing countries*. Paper presented at the 1st International Cost Engineering Council (ICEC) & International Project Management Association (IPMA) Global Congress on Project Management, Ljubljana, Slovenia.

**Hauptfleisch, A.C. & Kotzé, B.G.** 2006. *Real time integrated cost planning and control:*

*Bringing the process alive through procurement dynamics*. Paper presented at the 1st International Cost Engineering Council (ICEC) & International Project Management Association (IPMA) Global Congress on Project Management, Ljubljana, Slovenia.

**Kotzé, B.G.** 2006. *Real time integrated cost planning and control: Communication for results*. Paper presented at the 1st International Cost Engineering Council (ICEC) & International Project Management Association (IPMA) Global Congress on Project Management, Ljubljana, Slovenia.

**Kotzé, B.G.** 2006. *Relationships, risk management, recommendations and realised performance: The 4r's as strategic tools for customer satisfaction*. Paper presented at the 1st International Cost Engineering Council (ICEC) & International Project Management Association (IPMA) Global Congress on Project Management, Ljubljana, Slovenia.

**Lazarus, S.** 2006. *The development and assessment of an integrated skills development model for emerging construction contractors*. Paper presented at the Construction Industry Development Board (CIDB) 4th Post Graduate Conference on Construction Development, Stellenbosch, South Africa.

**Marx, H.J.** 2006. *Evaluation of the BER building cost index*. Paper presented at the Construction Industry Development Board (CIDB) 4th Post Graduate Conference on Construction Development, Stellenbosch, South Africa.

**Marx, H.J.** 2006. *The value of cost data for estimation: Evaluation of a construction tender price index*. Paper presented at the 1st International Cost Engineering Council (ICEC) & International Project Management Association (IPMA) Global Congress on Project Management, Ljubljana, Slovenia.

**Marx, H.J. & Hauptfleisch, A.C.** 2005. *Categorisation of postgraduate research in the built*

*environment in South Africa 2005*. Proceedings of the Construction Industry Development Board (CIDB) Post-Grad Conference, Johannesburg, South Africa. pp. 434-472.

**Marx, H.J. & Hauptfleisch, A.C.** 2006. *Categorisation of postgraduate research in the built environment in South Africa*. Paper presented at the Construction Industry Development Board (CIDB) 4th Post Graduate Conference on Construction Development, Stellenbosch, South Africa.

**Prinsloo, J.D.G.** 2005. *Wheat straw bales as building material: A study of the physical and economic properties of wheat straw bales as an alternative to certain construction materials*. Proceedings of the Construction Industry Development Board (CIDB) Post-Grad Conference, Johannesburg, South Africa. pp. 159-168.

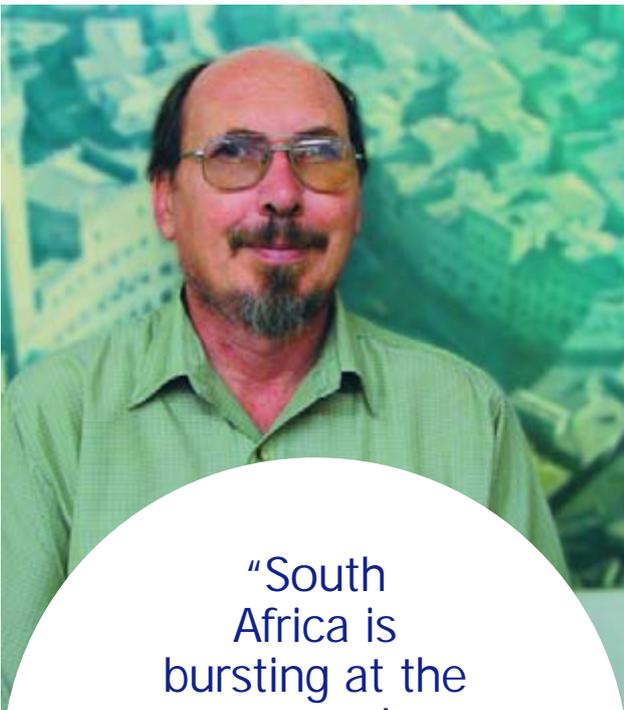
**Swart, B.J.** 2006. *Property investment: Reality or fiction? What is the real value in property*. Paper presented at the 1st International Cost Engineering Council (ICEC) & International Project Management Association (IPMA) Global Congress on Project Management, Ljubljana, Slovenia.

**Verster, J.J.P.** 2006. *Managing cost, contracts, communication and claims: A quantity surveying perspective on future opportunities*. Paper presented at the 1st International Cost Engineering Council (ICEC) & International Project Management Association (IPMA) Global Congress on Project Management, Ljubljana, Slovenia. (Invited paper).

**Verster, J.J.P.** 2006. *Real time integrated cost planning and control: Mitigation and resolution of claims*. Paper presented at the 1st International Cost Engineering Council (ICEC) & International Project Management Association (IPMA) Global Congress on Project Management, Ljubljana, Slovenia.



# Urban and Regional Planning



“South Africa is bursting at the seams and we would like to ensure that everyone gets his rightful place in the sun.”

Prof. Das Steyn.

## Overview

The year 2005 kicked off with two new programmes being presented for the first time: honours degrees in Spatial Planning and Land Property Development Management (Housing).

The honours in Spatial Planning is part of the new package consisting of a one-year honours and a one-year master's programme in Urban and Regional Planning (MURP), which replaces the old two-year MURP programme. Both of these qualifications are necessary to register as a professional urban and regional planner.

It is important that students complete most of the basic theoretical work during the honours course and then concentrate more on research while doing their master's degree. A student undertaking this new masters degree will be able to specialise in Sustainable Rural Development, Tourism and Development, Community Planning or Integrated Developmental Planning.

In 2005 two contract research projects were completed. The first project, with Dr Maléne Campbell as study leader, was a study into the possibility of a development corridor between Bloemfontein and Welkom. Prof. Steyn, Departmental Chairperson, and a team of students were closely involved in the research and found that such a corridor would not be viable. They pointed out that the national government would have to help by supplying economic aid to save the Free State Goldfields.

Prof. Steyn and Mr Piet Potgieter led a departmental team in the compiling of a redevelopment plan for the Bloemfontein urban centre. The team was part of a greater multi-disciplinary team under the leadership of Mr Kobus Botha from Vela VKE Consulting Engineers and included Mr Kobus du Preez from the UFS Department of Architecture and Dr Lochner Marais from the Centre for Development at the UFS.

In 2006 the field work for a project of the South Africa-Netherlands Research Programme on Alternatives in Development (SANPAD) on



Students doing a practical survey of Bloemfontein.

the acceptability of earth construction was completed. Prof. Steyn, study leader, worked with Ms Petria Jooste-Smit and Mr Gerhard Bosman from the UFS Department of Architecture on this project. Ms Tamara Derksen, a student from the Technical University of Eindhoven and an associate of the department, helped with the statistical

work. A draft report was tabled in November 2006 in Eindhoven during a workshop held to analyse the final results. The final report will be completed in 2007. The department also published a special festival centennial issue *UV 100 jaar* of the journal *Stads- en Streeksbeplanning* in which the department's accredited articles appeared.



Students busy with a housing survey in informal settlements for the South Africa-Netherlands Research Programme on Alternatives in Development for an earth construction research project.



A play, written by Mr David Brink from Stage Alive, was performed in Sesotho and Tswana by two students – Galie Malebo and Godfrey Manenye – from the UFS. Here the play is performed at the Dibeng-Sa Tsebo School. The play was performed to teach communities how to build houses using earth bricks.

### Academic staff

**Professor:** Prof. Das Steyn  
**Senior Lecturer:** Dr Marléne Campbell  
**Lecturers:** Mr Pieter Potgieter,  
 Ms Lize Barclay  
**Senior Professional Officer:** Ms  
 Drienie Steenkamp

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## Research outputs

### Publications

- Detering, A., Campbell, M.M. & De Kock, J.** 2005. City-regional councils: A myth, or method for better planning? The case of the Khomas region (Namibia). *Acta Structillia* 12(1&2): 84-105.
- Potgieter, P.J.** 2005. Studentehuse rondom die Universiteit van die Vrystaat: 'n Noodsaaklike euwel? *Urban and Regional Planning* 48: 17-26.
- Steenkamp, G.M. & Steyn, J.J.** 2006. To control or not to control: The role of sustainable planning in order to accommodate informal brickyards in the integrated development plan of the Mangaung Municipality. *International Journal of Sustainable Development and Planning* 1(4): 1-8.
- Steenkamp, G.M., Mogoe, M.E., Campbell, M.M. & Steyn, J.J.** 2005. Moontlike ruimtelike oplossings vir gesinne en gemeenskappe waar die gesinstuktuur verander het weens MIV/VIGS. *Urban and Regional Planning* 48: 27-34.
- Steyn, J.J.** 2005. *Inspraak sonder insig is uitspraak sonder uitsig*. Research publication 31: Department of Urban and Regional Planning, University of the Free State, Bloemfontein, South Africa.
- Steyn, J.J.** 2005. The European Union's is not a development model for Africa. *Urban and Regional Planning* 49: 34-44.
- Steyn, J.J. & Jooste-Smit, P.** 2006. Informal small brickyards in Free State townships are enhancing local economic development. *Acta Structillia* 13(1): 82-105.

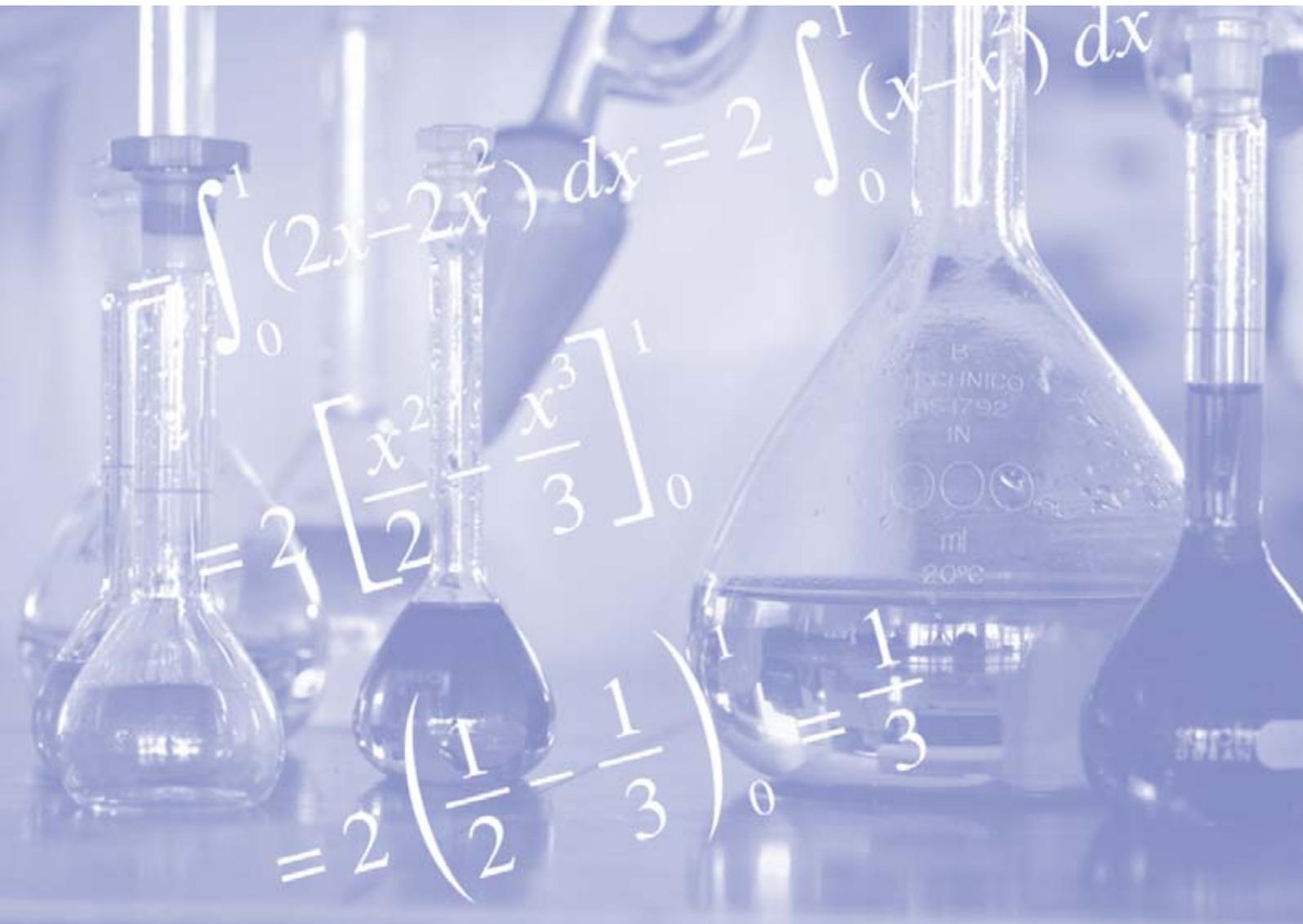
- Steyn, J.J. & Steyn, M.M.** 2005. Die rol en plek van ideologie in stadsbeplanningsteorie. *Tydskrif vir Christelike Wetenskap* 41(1&2): 193-213.

### Conference contributions

- Bolton, T. & Campbell, M.M.** 2005. *The R30 region as development corridor: A study to determine the feasibility of development*. Paper presented at the 18th Workshop on European Advanced Studies, Institute in Regional Science, Lodz and Krakow, Poland.
- Campbell, M.M.** 2006. *The changing profiles of homeless people: Conflict, rooflessness and the use of public space*. Paper presented at the 17th Europe Advanced Studies Conference, Institute in Regional Science, Ljubljana, Slovenia.
- Campbell, M.M.** 2006. *The viability of a corridor development of the R30 Route between Welkom and Bloemfontein*. Paper presented at the Planning Africa 2006 Conference: Making the connection, Cape Town, South Africa.
- Campbell, M.M., Ward, M. & Stewart, T.** 2005. *Towards the integration of housing with a mass transport system in the Greater Johannesburg*. Paper presented at the 33rd World Congress in Housing, Pretoria, South Africa.
- Steenkamp, G.M.** 2005. *Brickyard: A threat to the environment or job creation?* Paper presented at the 11th Annual Conference of the International Association for Impact Assessment, Thaba 'Nchu, South Africa.

- Steenkamp, G.M.** 2006. *Stormwater in South Africa: A problem or an asset? A planning perspective*. Paper presented at the Sustainable Built Environments Conference: Sustainable Building - Mitigating Social and Environmental Poverty, Bloemfontein, South Africa.
- Steenkamp, G.M. & Steyn, J.J.** 2005. *To control or not to control? The role of sustainable planning in order to accommodate informal brickyards in the integrated development plan of the Mangaung Municipality*. Paper presented at the Sustainable Development and Planning Conference, Bologna, Italy.
- Steyn, J.J.** 2005. *The European Union is not a role model for Africa's NEPAD*. Paper presented at the 18th Workshop on European Advanced Studies, Institute in Regional Science, Lodz and Krakow, Poland.
- Steyn, J.J.** 2006. *'n Plekkie in die son vir elkeen: Ruimtelike lesse uit België vir 'n Suid-Afrika in transformasie*. Paper presented at the "Suid-Afrikaanse Akademie vir Wetenskap en Kuns Multidissiplinêre Wetenskapsimposium", Bloemfontein, South Africa.
- Steyn, J.J.** 2006. *Orania: An eco town to accommodate Afrikaners*. Paper presented at the 6th Eco-city Conference, Bangalore, India.
- Steyn, J.J.** 2006. *Sustainability: An acceptable world wide religion which few practices*. Paper presented at the Sustainable Built Environments Conference: Sustainable Building - Mitigating Social and Environmental Poverty, Bloemfontein, South Africa.
- Steyn, J.J. & Drewes, E.** 2005. *NEPAD – Uitdaging vir ruimtelike beplanning om 'n droom te realiseer*. Paper presented at the "Suid-Afrikaanse Akademie vir Wetenskap en Kuns Simposium", Pretoria, South Africa.
- Steyn, J.J. & Schoeman, A.D.** 2005. *Is Ad Hoc planning the death in the pot for urban neighbourhoods? A case study of Langenhoven Park (Mangaung Municipality)*. Paper presented at the Housing Research Dissemination Day, Housing Educators' Forum, Free State Branch, Department of Housing, Bloemfontein, South Africa.
- Steyn, J.J. & Schoeman, A.D.** 2006. *Is Ad Hoc planning the death in the pot for urban neighbourhoods? A case study of Langenhoven Park (Mangaung Municipality) changing from a garden suburb to a possible urban liability*. Paper presented at the Planning Africa 2006 Conference: Making the Connection, Cape Town, South Africa.
- Steyn, J.J. & Schoeman, A.D.** 2006. *Public space determines the quality of housing: A case study in Langenhoven Park (Mangaung Local Municipality)*. Paper presented at the South African Housing Foundation Conference, Cape Town, South Africa.

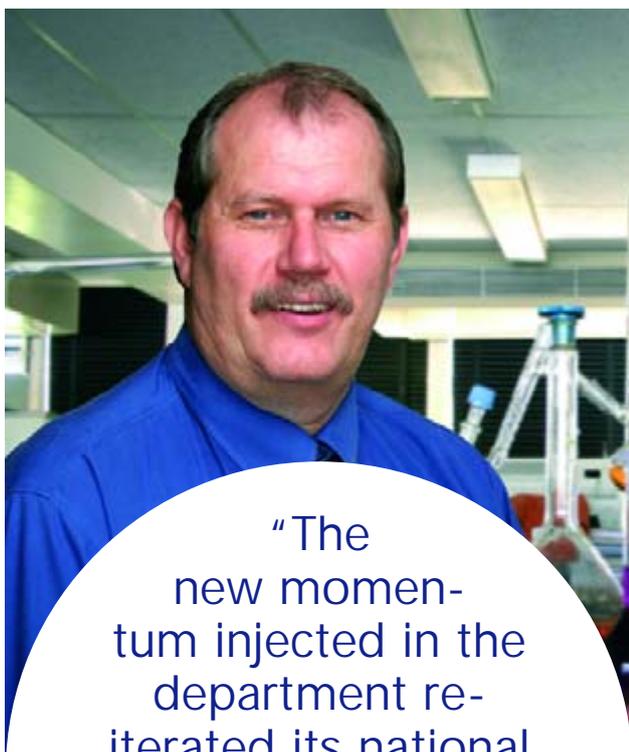
# Departments in the Natural Sciences





Department of

# Chemistry



“The new momentum injected in the department reiterated its national research status and continued increased international impact.”

Prof. André Roodt.

## Overview

In pursuit of the strategic priorities of the UFS and the Faculty of Natural and Agricultural Science, the Department of Chemistry experienced an exceptional revival and elaboration in quality and excellence during 2005/06.

Strategic planning regarding the forthcoming retirement of senior personnel led to the appointment of Prof. André Roodt, a B-rated National Research Foundation (NRF) researcher, as senior professor in Inorganic Chemistry in 2005. He has also been appointed as outstanding professor and Departmental Chairperson for 2007-2009, succeeding Prof. Steve Basson who held the position for the previous nine years.

In 2005 Prof. Hans Hundt, retired bioanalytical chemist, was appointed as professor extraordinary. With his clinical research experience an important contribution to bioprospecting was made in the Organic and Analytical Chemistry disciplines. The appointment of Dr Susan Bonnet in Organic Chemistry and Mr Karel von Eschwege in Analytical Chemistry led to capacity building in both of these disciplines.

The department was also privileged to host three grantholders from the AW Mellon Foundation, namely Messrs Thato Mtshali and Wade Davis, and Ms Rebotsamang Shago, under the university's Grow Our Own Timber programme. All of them are nearing completion of their Ph.D. studies under the mentorship of Proff. Jannie Swarts and Walter Purcell. Mr Mtshali was appointed as junior lecturer in Inorganic Chemistry, and recently received his Ph.D.

The contracting of seven postdoctoral associates together with 31 M.Sc. and 23 Ph.D. students in different sub-disciplines in 2005 led to phenomenal growth in research outputs among which are 51 publications in international accredited journals, a book contribution and several local and international congress activities. This momentum continued and in 2006 altogether eight postdoctoral associates, 35 M.Sc. and 25 Ph.D. students in different sub-disciplines led to further growth in research outputs. Some examples include more than 60 publications in internationally accredited journals, two book contributions and a large number of local and international congress activities.

“R40 million is being spent to modernise, refurbish and extend the Chemistry Building on the Main Campus. This is the largest amount the UFS has ever spent on the refurbishing of a building.”



In 2005 several internationally renowned scientists, namely Prof. Piet van Leeuwen (University of Amsterdam in the Netherlands), Rudi van Eldik (Friedrich-Alexander University of Erlangen-Nuremberg, Germany), Carl-Axel Andersson (Lund University in Sweden), Manie Vosloo (North-West University, South Africa), and Dr Judy Caddy (MINTEK in Johannesburg) were invited for lectures which broadened the research perspectives of our postgraduate students. In 2006 well-known scientists such as Prof. Lothar Helm (Lausanne in Switzerland), Ted Baker (New-Zealand), Michael Cook (United Kingdom (UK)), Graham Jackson (University of Cape Town (UCT)), Rui Carvalho (University of Coimbra in Portugal), Daneel Ferreira (University of Mississippi, United States of America (USA)), Ola Wendt (Lund University in Sweden) and Dr Hendrik Engelbrecht (Missouri, USA) presented lectures in the department and conducted research discussions with students and researchers.

The upgrading of the faculty's and specifically the department's research apparatus has already contributed to an increased research output. The new 600 MHz Bruker nuclear magnetic resonance (NMR) apparatus to the value of R11 million was purchased via the UFS strategic fund and is, according to Bruker's Dr Detlef Müller at the time of installation, the most powerful on the African continent. Another piece of equipment, the improved Bruker APEX 2 Kappa diffractometer to the value of R3 million will also improve the rate and quality of publication outputs on molecular structure analyses.

Prof. Roodt and Dr Alfred Muller, a crystallographer, supervise the diffractometer. In addition to this is the Mettler Toledo thermographic analysis workstation to the value of R3,1 million, which was financed in 2005 partly from the UFS strategic fund, and also from an NRF grant of R1,85 million, made to Prof. Swarts.

A new development, comprising a three-year agreement worth R9 million between the UFS and Sasol was closed in 2005, according to which process technology and research development on oxidation and homogeneous catalysis will reside in the department. Part of this agreement involved the seconding of a senior researcher from Sasol to the department which will enhance the interaction between the department and the chemical industry. In 2006 Prof. Ben Bezuidenhout, senior scientist from Sasol with significant international research and teaching experience, was seconded to the department for a period of five years.

The largest construction contract in the history of the UFS to the value of R40 million was started in 2006 on the Main Campus in Bloemfontein. The contract entails the extensive modernising, refurbishing and extension of the Chemistry Building. This is the largest amount the UFS has ever spent on the refurbishing of a building and it manifests the unprecedented investment in Chemistry by the UFS and the commitment to create a highly competitive teaching and research unit.

Teaching aspects across the department at the Main Campus in Bloemfontein, as well as the Qwaqwa Campus (with Prof. Riaan Luyt as programme head of Natural and Agricultural Sciences, subject head of Chemistry and acting subject head of Mathematics), have also been attended to.

The learning content of first year modules, based on previous experience, was upgraded and packaged differently under supervision of Prof. Swarts, Jan van der Westhuizen and Dr Deon Visser in order to improve the success rates of distance learning, extended learning and mainstream students.

In 2006 new topics were introduced in advanced NMR by Prof. Carvalho, natural product chemistry by Prof. Ferreira, industrial and organometallic chemistry by Prof. Bezuidenhout and computational chemistry by Dr Petrie Steynberg from Sasol, in the standard honours courses in Organic Chemistry. The special honours course saw the stereochemistry course completely rewritten by Dr Bonnet and the appointment of external lecturers led to the introduction of new topics in bioanalytical chemistry (Drs Ken Swart and Thinus van der Merwe from FARMOVS-PAREXEL), mass spectrometry (Mr Uwe

Voëlkopf from Applied Biosystems in Canada) and enzymatic chemistry (Dr Martie Smit from the Department of Microbial, Biochemical and Food Biotechnology at the UFS).

The department again presented the science quiz competition, Minquiz, during 2005/06. The competition is one of the faculty's community service flagships and is jointly sponsored by the UFS and Mintek. It has been running for more than a decade and annually gathers 400 pupils, comprising the three top physical science learners of each secondary school in the Free State. The learners visit the Main Campus where they are exposed to information on career opportunities in Chemistry, Physics and Geology. The winning schools also receive prizes to improve their science laboratory facilities.

Many colleagues in the department were involved in different committees, notably Prof. Swarts, who contributed significantly in planning and negotiations to expand the faculty's equipment infrastructure. Others served on faculty and UFS committees, acted as external reviewers for the South African NRF and for different international chemistry journals, as well as serving as external examiners for a number of universities on undergraduate and graduate level. Most of the lecturers were involved in continuous career guidance and laboratory demonstration sessions to individuals and groups of school learners. Colleagues at both the campuses contributed to UFS Open and Expo days in Bloemfontein, Bethlehem and Sasolburg.

Research in the department is organised as follows:

Research in **Inorganic Chemistry** focuses on coordinating chemistry with the primary aim on an integrated investigation of reaction mechanisms through the use of crystallography, spectroscopy, compu-

tational chemistry and reaction kinetics. Two sub-foci concentrate on applications to medicine (radiopharmaceutical and chemotherapeutic agents), industrial reactions and homogeneous catalysis.

The research, under the guidance of Prof. Roodt, in 2005 set up infrastructure such as extensive high-pressure equipment and synthetic reaction facilities. He was supported in this by his group of three postdoctoral associates, namely Drs Gideon Steyl in computational chemistry, Reinout Meijboom in synthesis, and Muller in crystallography, as well as nine postgraduate students. Apparatus amounting to R3 million, jointly acquired through financing by the UFS and agreements with Sasol, formed part of this infrastructure injection in the department. The group produced more than 20 research articles in the international chemical literature.

In 2006 research continued and the infrastructure was further expanded. Prof. Roodt was supported by Dr Deon Visser, three postdoctoral associates, Drs Muller, Meijboom, Steyl, and Mtshali, Mr Johan Venter and 11 postgraduate students. Dr Fanie Otto from Sasol was also appointed as affiliated associate professor.

For 2005/06, the group produced over 40 research articles in the international literature and more than 30 conference contributions, also at international venues in the UK, Belgium, Morocco and South Africa. Nine of these were invited oral presentations.

The medical research focus, in collaboration with MINTEK, the Universitas Hospital in Bloemfontein, the University of Missouri (USA), Lund University in Sweden and the Cancer Association of South Africa (CANSA), showed good progress in 2005/06 and several research



During the ceremonial kick-off to the biggest construction project in the history of the UFS are, from the left: Prof. Steve Basson, former Departmental Chairperson, Jannie Swarts, professor at the department, Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences, Frederick Fourie, Rector and Vice-Chancellor of the UFS, André Roodt, current Departmental Chairperson and Jan van der Westhuizen, professor at the department.

"A three-year agreement worth R9 million between the UFS and Sasol was closed. This included a chair in Organic Chemistry, seconded by Sasol."

reports and ten articles in internationally accredited journals were published. A spin-off of this research was the syntheses of chemotherapeutic agents which were evaluated very positively for future applications.

During 2005/06 the homogeneous catalysis research was driven in close collaboration with Sasol and the Department of Science and Technology's Centre of Excellence in Catalysis at UCT. The research focus is on the conversion of simple feedstock molecules into value-added products and includes studies of one or more of the 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). More than 25 research articles were produced. Collaboration with the North-West University, the Universities of Johannesburg, Cape Town, Western Cape, Lund in Sweden and Amsterdam as well as Sasol forms part of this focus. Dr Steyl visited the research group of Prof. Tom Cundari at the University of North Texas, Denton, USA on a collaborative computational chemistry project.

A second *in situ* infrared high pressure reactor was obtained from Dr Mike Green from Sasol on a loan basis in 2006, while funding under the South African National Research Foundation Thrust for Industry Related Projects (THRIP), MINTEK and CANSAs was sourced. Funding under the Swedish International Cooperation Development Programme, which was again secured for 2006, allows students and supervisors from the UFS and the University of Lund in Sweden, to visit each other's research facilities. Ms Alice Brink departed for Lund in December 2006 on such a visit.

The **Physical Chemistry division**, headed by Prof. Swarts and assisted by Dr Jeanet Conradie, is focused in two broad themes with three project thrusts each.

In 2005 an international NRF-funded quantum chemical research agreement with Prof. Abhik Ghosh from Norway led to research visits by Prof. Swarts and Dr Conradie to the University of Tromsø, in Norway. The electrochemical research of this group led to the first cobaltocene-modified graphite electrode. They also produced a world patent on chemotherapeutic agents, and research is continuing in this area. Two rhodium complexes were found to radiosensitize cancer cells under oxy and hypoxia conditions.

In 2006 Prof. Swarts' group focused firstly on the synthesis, electrochemistry, spectroscopy and thermodynamics of porphyrins and phthalocyanins. Highlights were the isolation and electrochemistry of a new triple-decker dicadmium phthalocyanine complex, in which ten of a theoretical 12 redox steps could be identified, the quantification of electronic communication of mixed valence redox states in intermediates as well as the first detection ever of delayed phosphorescence and fluorescence in phthalocyanins.

The second thrust focused on the synthesis, kinetics, electrochemistry and thermodynamics of metallocenes and their co-ordination complexes with rhodium or titanium, and specifically, the influence of titanocene, ferrocene, ruthenocene, osmocene and cobaltocene in multinuclear co-ordination complexes. This allowed the identification of unique cobalt (I) complexes and ruthenium dimerisation to form Ru-Ru metal-metal bonds. The third thrust is on polymers and metallocenes in medicine and catalysis, where a key success was the anchoring of phosphines, ferrocenes and morpholine oxides on hydrophilic and hydrophobic polymers.

Dr Conradie's group in the Physical Chemistry division focused on the quantum and computational chemistry of transition metal complexes and high-valent transition



The department and FARMOVS-PAREXEL received three mass spectrometers valued at R6 million from Applied-Biosystems in Canada, one of the biggest suppliers of mass spectrometers in the world. Standing next to one of the mass spectrometers are, from the left: Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences, Dr Irene Kamara, Senior Lecturer at the department, Dr Kenneth Swart, Senior Director and head of the bioanalytical section of FARMOVS-PAREXEL, Mr Uwe Voelkopf, Business Development Manager of Applied Biosystems in Canada and Prof. Jan van der Westhuizen, head of the division, Organic Chemistry at the department.

metal intermediates, which led to new collaboration with prominent leaders in the field such as Prof. Stephen Lippard and Stephen Koch from Massachusetts Institute of Technology (MIT), USA and Penny Brothers from Auckland, New Zealand. Another thrust involves the synthesis, kinetics, electrochemistry, X-ray crystallography and computational chemistry on beta-diketonato titanocene and titanium complexes, which may be effective catalysts in a variety of processes such as the Diels-Alder reaction and C-C bond forming reactions. An additional focus is on the beta-diketonato-carbonyl complexes of rhodium which resulted in the successful implementation of NMR and computational chemistry techniques, yielding more insight into the stereochemistry of the different intermediates formed during the iodomethane oxidative addition.

For **Organic Chemistry** 2005 was a year of strategic planning and consolidation since two senior colleagues, Prof. Vincent Brandt and Kobus Steenkamp retired during 2006. Research groups were headed by Prof. Van der Westhuizen, Bezuidenhout, Drs Bonnet and Irene Kamara. One post-doctoral associate, Dr Ivana Jarak and 17 students supported the research. Dr Kamara terminated her service at the UFS in December 2006.

Prof. Van der Westhuizen, in conjunction with Drs Bonnet and Kamara, acquired R670 750 from the NRF in 2005 with an additional amount of approximately R1 million in THRIP funding for other projects. Industrial research projects such as the incorporation of specific isotopes in the synthesis of internal standards in the pharmaceutical industry, syntheses of radiopharmaceuticals for the Department of Nuclear Medicine at the UFS and polyphenolic adhesives for the wattle industry were a few research activities.

In 2006 more than R2,5 million in funding was secured by this group from agencies such as the NRF, FARMOVS-PAREXEL, THRIP, Thuthuka, Sasol, the Department of Nuclear Medicine at the UFS and the Central Wattle Co.

The group endeavoured to build more research capacity through short visits and collaboration with international experts such as Prof. Ferreira from the University of Mississippi, USA and Carvalho from the University of Coimbra in Portugal. Prof. Van der Westhuizen attended a short course in NMR spectroscopy at Bruker, in Zürich, Switzerland. The group managed seven Ph.D. and 13 M.Sc. students as well as a postdoctoral associate from Croatia.

In 2006 different research thrusts were identified in the Organic Chemistry group, the first being the synthesis of biologically active molecules (usually nitrogen-containing), initiated to produce internal standards for FARMOVS-PAREXEL, and another being collaboration with Prof. Anton Otto at the UFS Faculty of Health Sciences on new biologically active radio-labeled compounds. This initiative is reliant upon the synthetic expertise of Prof. Van der Westhuizen, Bezuidenhout and Dr Bonnet.

A further focus of the group is on bio-analytical chemistry, an important new initiative implemented during 2006, which required a significant administrative effort. This thrust includes both pure and applied bio-analytical chemistry, initiated when FARMOVS-PAREXEL offered equipment and also to obtain sponsors for equipment, to supply expertise to present courses and to provide students from the outset. It consists of the overarching development of methods to extract medical compounds from body fluids (mostly solid phase extraction), to quantify these compounds (mostly by Liquid Chromatographic Mass Spectrometry, LCMS), and to train M.Sc. students in bio-analytical procedures as practised by FARMOVS-PAREXEL. These methods are applicable to all organic compounds that occur at low concentrations in any medium. At the same time, in applied bio-analytical chemistry, the groundwork was laid in using the bio-analytical skills obtained during the M.Sc. course described



Dr Thato Mtshali, Junior Lecturer at the department, busy with synthesis and chemical analysis.



Researchers from the Department of Chemistry were fortunate to have discussions with Prof. Robert Grubbs, 2006 Nobel laureate in Chemistry, during two international conferences. On the photo are, at the back, third from the left Prof. André Roodt, Departmental Chairperson and next to him (wearing black) is Prof. Grubbs.

above, to develop enzyme-based bio-assays and screening of plant extracts for biological activity with the aim of discovering and commercialising new medicines.

Yet another thrust in the Organic section includes flavonoid chemistry, since the UFS has a long tradition of excellence in this field. The experience of Prof. Bezuidenhout and the appointment of Prof. Ferreira as extraordinary visiting professor in 2006 significantly strengthened and secured expertise in this regard. Projects in additional fields which were terminated at the end of 2006, were a confidential project on indigenous teas headed by Prof. Steenkamp, and a project under Dr Kamara on the evaluation of indigenous plants for bio-active antibacterial compounds.

The **Process Chemistry** thrust is headed by Prof. Bezuidenhout. The Sasol-funded chair in Organic Chemistry was established in the beginning of 2006 and by the end of the year had already attracted five postgraduate students and was co-supervising another ten, shared with other groups. This includes a sub-thrust on Organometallic synthetic procedures, while research is focused on the production of oxygenated compounds from olefins via epoxidation utilising phthalocyanine based catalysts, development of improved technology for the synthesis of m-cresol from xylene, utilisation of borosalicyclic acid in organic synthesis and hydrogenation of alpha-beta unsaturated ketones. Mr Johannes van Tonder spent three weeks on a brief research visit to Prof. David Cole-Hamilton at the University of St Andrews in Scotland. One paper was published and another two were accepted for publication, while

several conferences were attended and posters presented.

The Frank Warren conference in Cape Town in January 2006 was attended by eight group members, with one paper presented by Dr Kamara and six posters presentations. Various international conferences were attended and Prof. Brandt and Dr Kamara gave oral presentations at the American Chemical Society meeting in Seattle, USA in September 2006. Dr Bonnet spent five weeks in the laboratories of Prof. Ferreira at the University of Mississippi, USA to synthesise flavonoids, and Dr Kamara spent four weeks with Prof. Ferreira to study bio-assay techniques.

**Polymer science research** is the niche area of Prof. Luyt at the Department of Chemistry at the Qwaqwa Campus. His group comprises two postdoctoral associates, Drs Babu Guduri and Shivani Mishra, three Ph.D. students, Ms Moipone Mokoena and Ms Seadimo Senokwane, both UFS personnel, as well as Mr Jonathan Molefi and five M.Sc. students. Dr Vladimir Djokovic of Serbia visited this group twice in tri-monthly sessions. Research focuses on physical properties of polymer/wax mixtures, polymer/natural fibre composites and polymer nanocomposites. Three M.Sc. degrees were conferred and the group produced 17 published articles in accredited international journals during 2005.

Prof. Luyt also attended a polymer conference in Kottayam, India, where he presented an invited lecture. A formal NRF-financed collaborative agreement between his group and that of Prof. Sabu Thomas from Mahatma Gandhi University in India

was approved for 2006-2008. Prof. Luyt also received the 2005 faculty award for his excellent research output.

In 2006 Prof. Luyt's group comprised three postdoctoral associates and nine students, and the research focus continued on physical properties of polymer/wax mixtures, polymer/natural fibre composites and polymer nanocomposites. Prof. Luyt and his group did exceptionally well in terms of research, given the infrastructure shortage and relatively high work load. Ms Dorine Dikobe was awarded her M.Sc. degree during the October 2006 graduation ceremony, while Mss Mpondi Stuurman (M.Sc.), Buyi Jacobs (Ph.D.) and Mr Tsietsi Tsoetsi (M.Sc.) submitted their theses.

Prof. Luyt further managed to source funding to buy two large pieces of equipment, namely a Perkin Elmer Pyris DSC and a Perkin Elmer Diamond DMA, which are extensively used in research and honours training. He further received about R900 000 in research funding from the Institutional Research and Development Programme (IRDP) of the NRF and the UFS central research fund. Ten research papers and one research book chapter were published, while 12 papers were presented at national and international conferences.

**The Analytical group**, led by Proff. Basson and Purcell and also collaborating with Prof. Hendrik Swart from the Department of Physics, was actively pursuing practical and economically viable ways of curbing cable theft from Eskom power lines in 2005. A long-term strategy is to reduce the economic value of these goods through chemical intervention and surface studies. Mr Von Eschwege, who was appointed to the group in 2005, is targeted to manage user requirements and training of personnel and postgraduates on the NMR apparatus. Three articles were published in international journals whilst three Ph.D. and two M.Sc. students were active in research in 2005.

Mr Von Eschwege obtained his Ph.D. degree at the end of 2006. Ms Rebotsamang Shago, a current Ph.D. student and fellow of the AW Mellon Foundation, was appointed as lecturer, strengthening the group. Proff. Purcell and Basson successfully negotiated a project from the National Energy Commission of South Africa (NECSA) for the development of analytical methodology regarding zirconium and hafnium. The department acquired an inductively coupled plasma (ICP) and atomic absorption apparatus as well as an additional UV/vis spectrophotometer, which adds impetus to the analytical thrust. Successful supervision led to Mr Mtshali completing his Ph.D. degree in 2006, and as a fellow of the AW Mellon Foundation, he was appointed in the department. Three papers in international journals were published and three students are currently in the group.

### Attendance of conferences, seminars, memberships of committees

- Prof. Roodt was Vice-Chairman of the organising committee of the successful 37th International Conference on Coordination Chemistry (ICCC37) held in Cape Town in August 2006.
- He also chaired the opening ceremony for ICC37 and the plenary session of Prof. Van Eldik, Germany, and served on the organising committee of the 15th International Symposium on Homogeneous Catalysis (15ISHC) at Sun City in August 2006, where he was invited to present a lecture. At both of these conferences, Prof. Robert Grubbs, Nobel Prize winner for Chemistry in 2006, was a guest speaker. Prof. Grubbs has had extensive interaction with students from the UFS.
- As member of the Executive Committee of the European Crystallographic Association (ECA), and a member of the International Scientific Committee of the 24th European Crystallographic Meeting to be held in August 2007, Prof. Roodt attended a workshop in Agadir, Morocco, during May 2006, giving a keynote

“A nuclear magnetic resonance apparatus worth R11 million was purchased. This is the most powerful of its kind on the African continent.”



Learners busy with practical lessons during the annual Minquiz science quiz competition.



Proff. Jannie Swarts (left), professor at the department, André Roodt (middle), Departmental Chairperson and Piet van Leeuwen (right) from the University of Amsterdam during a lecture presented by Prof. Van Leeuwen on the Main Campus.

lecture. He was also invited to serve on the THRIP panel of the South African NRF for Process Manufacturing for the period 2006-2008. He was re-elected to the Executive Committee of the ECA and elected as chairperson of the committee, which annually awards the prestigious Max Perutz Prize of the ECA for 2006-2008.

- Prof. Roodt also acted as Inorganic Editor for the *South African Journal of Chemistry*, was on the editorial board of the *Journal of Coordination Chemistry*, and was invited to be co-editor for the International Union of Crystallography (IUCr) journal, *Acta Crystallographica E*.
- Prof. Swarts visited Prof. Bill Geiger (USA) on collaborative research in electrochemistry, Princeton Applied Research

factory in the USA for electrochemistry training, and was a session chair on Bioinorganic Chemistry, at the 37th International Conference on Coordination Chemistry in Cape Town in August 2006. Prof. Swarts gave lectures at the Cape Town conference and also at the Inorganic 4th Chianti Electrochemistry Meeting (MM-4th ChEM) in Siena, Italy in July 2006, covering electrochemistry of inorganic and organometallic compounds.

Prof. Swarts and Mr Ernie Langner also visited the Mettler Factory in Switzerland for training on differential scanning calorimetry and thermodynamics training.

Prof. Luyt was an invited lecturer and session chairperson at the international conference, POLYCHAR -14, presented in Nara, Japan in April 2006.

## Academic staff

### Main Campus

**Professors:** Prof. Steve Basson, Vincent Brandt, André Roodt, Jannie Swarts, Ben Bezuidenhout

**Professor Extraordinary:** Prof. Hans Hundt

**Affiliated Professors:** Prof. Daneel Ferreira, Rui Carvalho.

**Associate Professors:** Prof. Walter Purcell, Kobus Steenkamp, Robert Dennis, Jan van der Westhuizen

**Affiliated Associate Professor:** Prof. Fanie Otto

**Senior Lecturers:** Drs Deon Visser, Jeanet Conradie, Irene Kamara

**Lecturers:** Drs Karel von Eschwege, Susan Bonnet, Messrs Johan Venter, Ernie Langner

**Junior Lecturer:** Dr Thato Mtshali

**Subject Co-ordinators:** Dr Marietjie Versteeg, Ms Rina Meintjes

### Qwaqwa Campus

**Professor:** Prof. Riaan Luyt

**Lecturers:** Mr Percy Hlangothi, Mss Moipone Mokoena, Buyiswy Jacobs

**Junior Lecturers:** Mss Dorine Dikobe, Mpondi Stuurman, Mr Rantooa Moji

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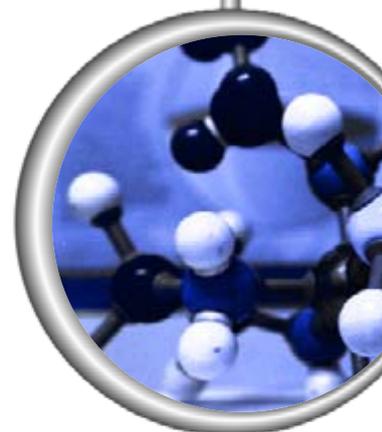
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# Research outputs

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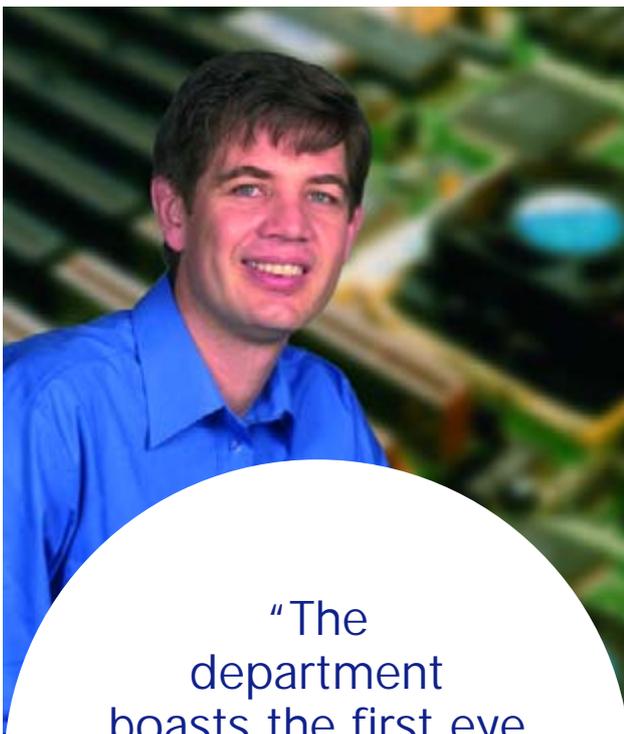
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- Roodt, A., Muller, A. & Otto, S.** 2006. *Solid state packing behaviour in pseudo Vaska-type complexes*. Paper presented as poster at 23rd European Crystallographic Meeting, Leuven, Belgium.
- Sam, Z.A. & Roodt, A.** 2005. *Gold complexes as anti-arthritis and anti-inflammatory agents*. Paper presented as poster at the CANSAs Workshop, Pretoria, South Africa.
- Sam, Z.A. & Roodt, A.** 2006. *Coordination chemistry and substitution behaviour of gold(I) complexes*. Invited oral presentation at the Gold 2006: 4th International Conference on Gold Science, Technology and Its Applications, Limerick, Ireland.
- Sam, Z.A. & Roodt, A.** 2006. *Coordination chemistry and substitution behaviour of gold(I) complexes*. Invited oral presentation at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.
- Sam, Z.A., Roodt, A. & Elmroth, S.** 2005. *Gold(I) phosphine complexes with potential application in catalysis*. Paper presented as poster at the Catalytic Society of South Africa (CATSA) 2005 Conference, Eskom Convention Centre, Midrand, South Africa.
- Sam, Z.A., Roodt, A. & Elmroth, S.** 2005. *Study of gold(I) complexes with linear and bidentate phosphines*. Paper presented as poster at the South African Chemical Institute (SACI) one day Meeting on Organometallic Chemistry and Homogeneous Catalysis (15ISHC), Riviera-on-Vaal, Vanderbijlpark, South Africa.
- Shago, R.F. & Swarts, J.C.** 2006. *Synthesis and characterization of porphyrins covalently bound to water-soluble polymeric drug carriers for biomedical applications*. Invited oral presentation at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.
- Steyl, G.** 2006. *The many faces of tropolone chemistry: Ligands and complexes*. Invited oral presentation at the Indaba 5 Workshop, South African Crystallographic Society, Kruger National Park, South Africa.
- Steyl, G. & Roodt, A.** 2005. *Crystallographic and theoretical investigation on tropolono and palladium(II) coordination behaviour*. Paper presented as poster at the Catalytic Society of South Africa (CATSA) 2005 Conference, Eskom Convention Centre, Midrand, South Africa.
- Steyl, G. & Roodt, A.** 2006. *Computational study of coordination modes of 2-(amino)-1-cyclopentene-1-dithiocarboxylate and associated derivatives*. Invited oral presentation at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.

- Steyl, G., Roodt, A. & Engelbrecht, H.P.** 2005. *Spectroscopic and theoretical investigation of isomers of  $[Re(O)_2(Eten)_2]^+$  complexes*. Paper presented as poster at the Catalytic Society of South Africa (CATSA) 2005 Conference, Eskom Convention Centre, Midrand, South Africa.
- Steyl, G., Roodt, A. & Engelbrecht, H.P.** 2005. *Spectroscopic and theoretical investigation of isomers of  $[Re(O)_2(Eten)_2]^+$  complexes*. Paper presented as poster at the South African Chemical Institute (SACI) one day Meeting on Organometallic Chemistry and Homogeneous Catalysis (15ISHC), Riviera-on-Vaal, Vanderbijlpark, South Africa.
- Steyl, G., Roodt, A. & Engelbrecht, H.P.** 2005. *Spectroscopic and theoretical investigation of isomers of  $[Re(O)_2(Eten)_2]^+$  complexes*. Paper presented as poster at the Conference of the World Association of Theoretically Orientated Chemists (WATOC 05), Cape Town, South Africa.
- Stuurman, N.F. & Conradie, J.** 2006. *Synthesis and chemical kinetics of phenyl-containing  $\beta$ -diketonato complexes of rhodium*. Paper presented as poster at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.
- Swarts, J.C.** 2006. *New titanium(IV) complexes with ruthenocene-containing ligands derived from titanocene dichloride*. Invited oral presentation at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.
- Swarts, J.C.** 2006. *Synthesis, structure and electrochemistry of ruthenocene-containing  $\beta$ -diketonato complexes of titanium(IV)*. Invited oral presentation at the Inorganic 4th Chianti Electrochemistry Meeting (MM-4th ChEM), Siena, Italy.
- Swarts, J.C.** 2006. *Titanium(IV) complexes with metallocene-containing ligands derived from titanocene dichloride*. Paper presented as poster at the 22nd International Conference on Organometallic Chemistry, Zaragosa, Spain.
- Tsotetsi, T.A. & Conradie, J.** 2006. *Synthesis and electrochemical aspects of new  $\beta$ -diketonato titanium(IV) complexes*. Paper presented as poster at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.
- Venter, G.J.S., Roodt, A. & Meijboom, R.** 2006. *Coordination of selective coin metals by group 15 ligands*. Paper presented as poster at the Catalytic Society of South Africa (CATSA) 2006 Conference, Mossel Bay, South Africa.
- Venter, G.J.S., Roodt, A. & Meijboom, R.** 2006. *Group 15 ligand coordination to selective coin metal centres*. Paper presented as poster at the 15th International Symposium on Homogeneous Catalysis (15ISHC) Sun City, South Africa.
- Venter, G.J.S., Roodt, A. & Meijboom, R.** 2006. *Selective coin metal coordination with group 15 ligands*. Paper presented as poster at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.
- Venter, J.A., Basson, S.S. & Roodt, A.** 2006. *Mechanistic elucidation of the oxidative addition of rhodium(I) complexes of N-aryl-N-nitrosohydroxylamines*. Paper presented as poster at the 15th International Symposium on Homogeneous Catalysis (15ISHC) Sun City, South Africa.
- Venter, J.A., Basson, S.S. & Roodt, A.** 2006. *Structural and kinetic contributions in the mechanistic elucidation of the oxidative addition of cupferrate and neocupferrate complexes of rhodium(I)*. Paper presented as poster at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.
- Visser, H.G., Purcell, W. & Basson, S.S.** 2006. *Hydroxide ion catalyzed bridge cleavage in cobalt(III) nitrilotriacetate complexes*. Paper presented as poster at the 15th International Symposium on Homogeneous Catalysis (15ISHC) Sun City, South Africa.
- Visser, H.G., Purcell, W. & Basson, S.S.** 2006. *Hydroxide ion catalyzed bridge cleavage in cobalt(III) nitrilotriacetate complexes*. Invited oral presentation at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.
- Von Eschwege, K.G., Conradie, J. & Swarts, J.C.** 2006. *Casting brighter light on photochromic reactions of metal dithizonates*. Paper presented as poster at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.

Department of

# Computer Science and Informatics



“The  
department  
boasts the first eye  
tracker in Africa that  
allows free eye  
movement.”

Prof. Janse Tolmie.

## Overview

In the pursuit of the Faculty of Natural and Agricultural Sciences and the university's strategic priorities for 2005, the Department of Computer Science and Informatics was active in the areas of education, research and community service. In order to ensure that our students obtain relevant and market-related training, the department switched to the teaching of a new programming language called C#.

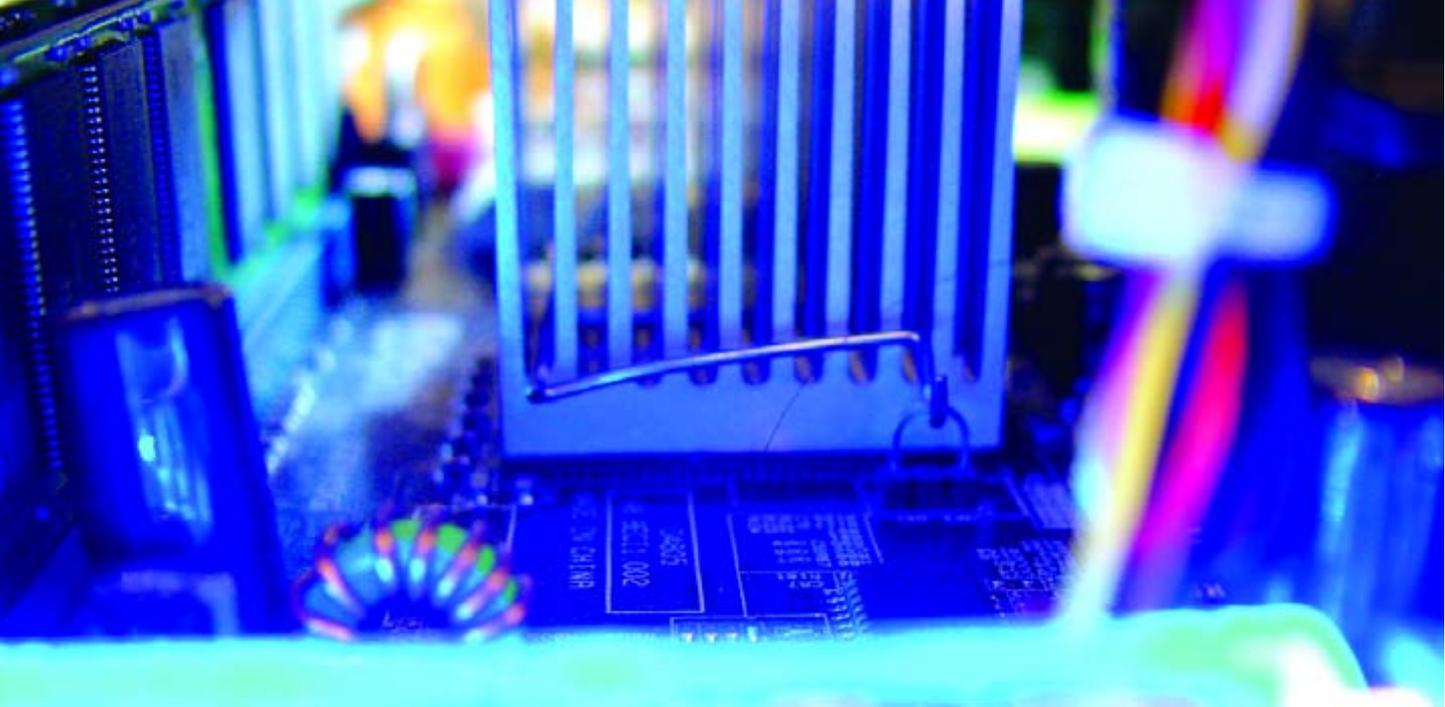
Community involvement was done in several ways: Prof. Pieter Blijnaut and Dr Anelize van Biljon acted as external moderators for Umalusi and Ms Nancy de Sousa trained officials from the Free State Department of Education in project management. Ms de Sousa was also involved in the phasing in of the use of computers at schools in the Bloemfontein area.

The department took part in the Bloemfontein Technology Project, which teaches computer literacy to learners from previously disadvantaged communities. Short courses in computer literacy were also presented to the community.

Research in the department was boosted tremendously by the establishment of the Telkom Centre of Excellence in 2005. The centre focuses on research in human-computer interaction and is equipped with sophisticated sight-tracking apparatus which makes it possible to analyse computer use. The Departments of Mathematical Statistics and Physics at the UFS were also involved in activities at the centre. Besides Telkom, Microsoft is also involved as a donor. Bursaries from Telkom were awarded to two students and Prof. Blijnaut is acting as director of the centre.

In 2005/06 research in the centre focused on human-computer interaction and data warehousing. A significant amount of research was conducted in these areas and research results led to a number of national and international publications.

The centre acquired an eye tracker for research purposes. This apparatus has many research possibilities, not only for Computer



At the eye tracker are from the left: Prof. Janse Tolmie, Departmental Chairperson, Ms Anne Jansen from the supplier Tobii Technologies in Sweden, and Prof. Pieter Blignaut.

Science, but also for other disciplines such as Psychology, Occupational Therapy and Marketing. This is the first eye tracker in Africa that allows free eye movement.

The centre's eye tracker opened up many opportunities for research projects in human-computer interaction. New research with great future potential focused on the quantification of usability studies, and a contract usability study was conducted for a group in Germany.

Research was also undertaken in the areas of human-computer interaction, knowledge-based systems, data warehouses and information systems. Several international publications were submitted on these topics. A

group of laboratory computers were set up as a Linux cluster to perform powerful calculations. This cluster is also used for simulations in a project that focuses on the optimisation of a programming language.

In 2006 the department was involved in a project on action research in e-learning, conducted in one of the undergraduate courses. This project was closely linked to the university's interest in blended learning. On postgraduate level, it became evident that programmes that enable students to combine management modules and IT management modules with pure IT modules, have become very popular. The number of honours students increased to more than 50 during the year.

## Academic staff

### Main Campus

**Professors:** Proff. Janse Tolmie, Pieter Blignaut, Theo Mc Donald, Hans Messerschmidt

**Senior Lecturer:** Dr Lizette de Wet  
**Lecturers:** Drs Liezel Nel, Anelize van Biljon, Messrs Andries Burger, Deon du Plessis, Dana Kotze, Eduan Kotze, Johan van Rooyen, Ms Engela Dednam

**Junior Lecturers:** Messrs Rouxan Fouché, Philip Penning, Fanie Riekert, Ray Shih, Johan Pretorius, Ms Annelie Naudé

### Qwaqwa Campus

**Senior Lecturer:** Dr Mike Kyobe  
**Junior Lecturers:** Messrs Jacques Eysela, Walter Gwiba, Molapo Jonathan, Isaac Mokhotla, Frederick Mudavanhu, Benedict Sebastian, Mss Nidhi Mary-John, Victoria Mochochonono, Ruth Wario

### Vista Campus

**Lecturer:** Ms Nancy de Sousa  
**Junior Lecturers:** Messrs Rudolf Oosthuizen, Timothy Mahloko, David Ramatlotlo

### Contact details

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Website: [www.ufs.ac.za/cs](http://www.ufs.ac.za/cs)

# Research outputs

## Publications

**Blignaut, P.J. & Cruywagen, I.** 2005. Development of an information kiosk for a large transport company: Lessons learned. *Journal of Cases on Information Technology* 7(4): 27-45.

**Blignaut, P.J. & McDonald, T.** 2006. Die implikasies van lees- en skryfvoorkeurtaal met betrekking tot internettoegang vir Suid-Afrikaanse gebruikers. *Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie* 25(3): 165-171.

**De Wet, L. & Van Aswegen, W.** 2005. Determining the usability of computer input devices by Parkinson's disease sufferers. *SA Family Practice* 47(1): 58-59.

**Messerschmidt, H.J. & Messerschmidt, J.J.E.** 2006. Die kategorisering van onderskikkings: Enkele kenmerke van dat-samestellings. *Southern African Linguistics and Applied Language Studies* 24(1): 7-22.

**Nel, E.** 2006. Enhancing collaborative learning in a blended learning environment: Applying a process planning model. *Systemic Practice and Action Research* 19(6): 553-576.

## Chapters in books

**Blignaut, P.J., Burger, A.J., McDonald, T. & Tolmie, C.J.** 2005. Computer attitude and anxiety. In *Encyclopedia of Information Science and Technology, Volume I-V*, edited by M. Khosrow-Pour. USA: Idea Group Publishing. pp. 495-501.

**Messerschmidt, H.J., Messerschmidt, J.J.E., Blanckenberg, L. & Van der Westhuizen, J.** 2005. In *Semi-automatic generation of LA grammars, multilingualism and electronic language management*, edited by W. Daelemans, T. Du Plessis, C. Snyman & L. Teck. Pretoria: Van Schaik. pp. 70-80.

**Kyobe, M.E.** 2006. Entrepreneur behaviors on E-Commerce security. In *Encyclopedia of E-Commerce, E-Government, and Mobile Commerce Idea Group Inc.*, edited by M. Khosrow-Pour. USA: Information Resources Management Association. pp. 437-444.

## Conference contributions

**Beelders, T., Blignaut, P.J. & McDonald, T.** 2005. *A word processor prototype to assess the effect of culture on usability*. Paper presented at the Southern African Telecommunication Networks & Applications Conference, Drakensberg, South Africa.

**Beelders, T., McDonald, T. & Blignaut, P.J.** 2005. *A proposed study to determine the effects of culture on the usability of word processors*. Proceedings of the 4th Conference on Human-Computer Interaction in Southern Africa, Johannesburg, South Africa. pp. 29-33.

**Blignaut, P.J. & McDonald, T.** 2005. *Capturing usability data on-the-go*. Paper presented at the 5th International Conference on Measuring Behavior, Wageningen, The Netherlands.

**De Wet, L. & McDonald, T.** 2006. *Gender and cultural differences (if any): South African school children and computer games*. Paper presented at the 5th International Conference on Computer and Games, Turin, Italy.

**Kyobe, M.E.** 2005. *Addressing E-crime and computer security issues in small organisations in South Africa*. Paper presented at the European Management and Technology Conference, Rome, Italy.

**McDonald, T.** 2006. *Neurobdb: A database application for processing neutron water meter data*. Paper presented at the Combined Congress of the South African Society of Crop Production and the Soil Science Society of South Africa, Durban, South Africa.

**McDonald, T. & Blignaut, P.J.** 2005. *The effect of cultural differences on the efficiency of searches on a university website*. Paper presented at the 11th International Conference on Human-Computer Interaction, Las Vegas, USA.

**Nazir, A. & McDonald, T.** 2006. *Challenges in developing a cost-effective data warehouse for a tertiary institution in a developing country*. Proceedings of the 7th International Conference on Data, Text and Web Mining: Business Applications and Management Information Engineering, Prague, Czech Republic. pp. 389-397.

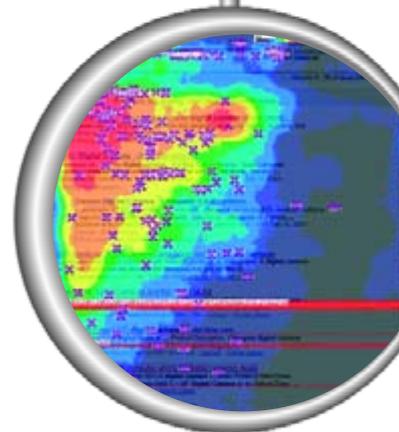
**Nazir, A. & McDonald, T.** 2006. *Lessons learned in developing a data warehouse for a tertiary institution in South Africa*. Paper presented at the 2nd Foundation of Tertiary Institutions of the Northern Metropolis (FOTIM) International Quality Assurance Conference, Pretoria, South Africa.

**Nel, E.** 2006. *Enhancing online collaboration practices in South African undergraduate classrooms*. Paper presented at the 8th Annual Conference on World Wide Web Applications, Bloemfontein, South Africa.

**Nel, E.** 2006. *Voices from a South African blended learning classroom: Reflections based on an action research diary*. Paper presented at the 2006 Conference of the Education Association of South Africa (EASA), Bloemfontein, South Africa.

**Nel, L.** 2005. *Incorporating student feedback in the enhancement of online collaborative activities*. Proceedings of the 4th International Conference on Technology in Teaching and Learning in Higher Education, University of Peking, Beijing. Edited by C. Spirou & Q. Wang. pp. 209-213.

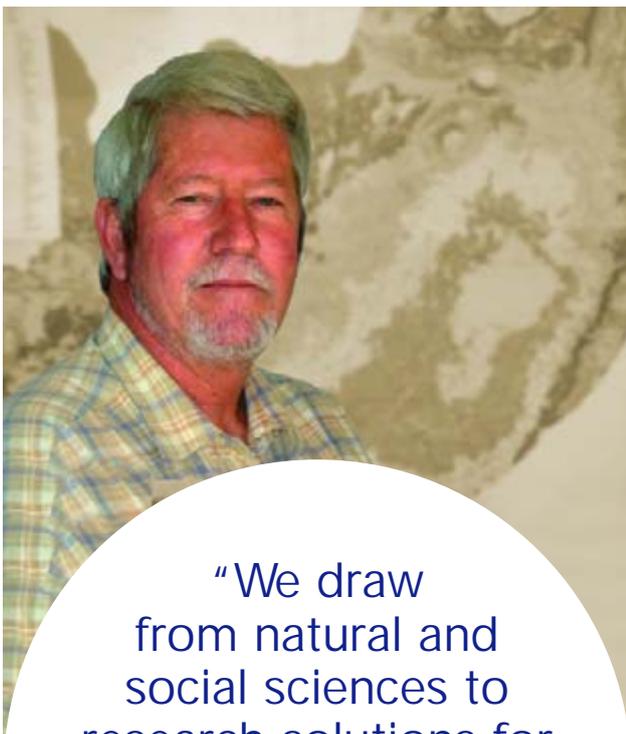
**Nel, L. & Wilkinson, A.C.** *Design for interaction: The implementation of a collaborative e-learning approach in undergraduate education*. Proceedings of the 4th International Conference on Technology in Teaching and Learning in Higher Education, University of Peking, Beijing. Edited by C. Spirou & Q. Wang. pp. 215-219.





Department of

# Geography



“We draw from natural and social sciences to research solutions for problems in the human and bio-physical worlds.”

Prof. Peter Holmes.

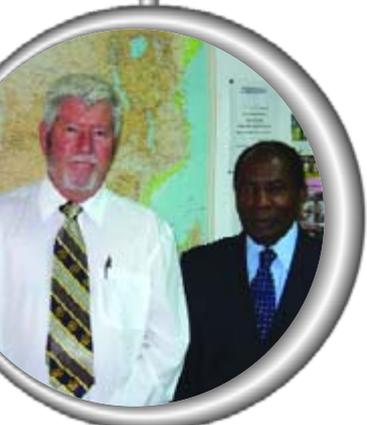
## Overview

In the light of the strategic aims of both the university and the Faculty of Natural and Agricultural Sciences, the Department of Geography continues to make its mark in terms of teaching, community service, and in particular, research. The number of publications in accredited journals, as measured against the staff complement at the Bloemfontein Campus, demonstrates the considerable productivity of the department in terms of measurable outputs.

The Geographical Information Systems (GIS) laboratory, under the direction of Dr Charles Barker, was expanded in 2005 with the addition of 12 new computers, bringing the total to 28. The GIS software was upgraded and additional programmes were purchased to facilitate the teaching of remote sensing, image processing, photo interpretation and photogrammetry at undergraduate level. In addition, new software and an upgraded network permit interactive on-screen teaching. The GIS facility continues to serve the GIS needs of the wider university community. The Physical Geography laboratory was also upgraded, thanks to the purchase, through the faculty's equipment drive, of new equipment for soil and sediment analyses.

In 2006 there was a significant expansion in the number of undergraduate students enrolling for Geography programmes through the Faculties of Natural and Agricultural Sciences and the Humanities. This put a strain on both human and physical resources, particularly with regard to GIS practical classes. The GIS laboratory was again upgraded in terms of the software needed to teach this hands-on subject to both undergraduate and postgraduate classes.

International visitors to the department during 2005/06 included the distinguished academic, Prof. David Thomas of the University of Oxford in the United Kingdom (UK), who is a world-renowned expert in the field of environmental change in arid environments, Dr Giles Wiggs, an expert on aeolian sediment transfer, also from Oxford and Dr Mark Bateman from the University of Sheffield in the UK. They are involved in research on environmental change in the western Free State under the leadership of Prof. Peter Holmes, Departmental



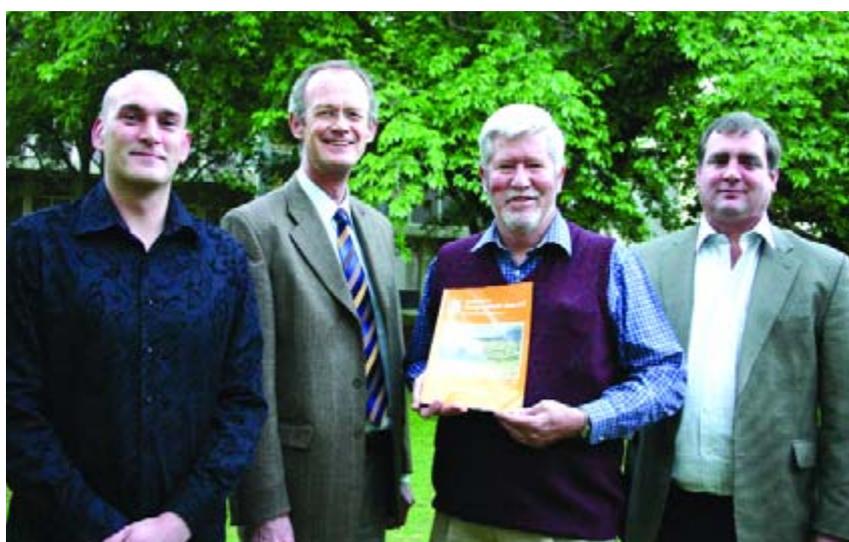
Chairperson. The research is funded by the National Research Foundation (NRF).

Community service manifested itself on both the Bloemfontein and Qwaqwa Campuses in terms of Prof. Willie van Zyl and Mr Alex Adjei's training of tourism officers in Lesotho and the Free State. The strategy in terms of the training in Responsible Tourism was to empower communities to understand and promote responsible tourism in their local environments. Selected tourism officials from all local municipalities in the Free State attended the workshops. Prof. Van Zyl and Mr Adjei continued with the training of government officials (Community Environmental Workers). This initiative was sponsored by the Department of Environmental Affairs and Tourism. Mr Adjei was involved in devel-

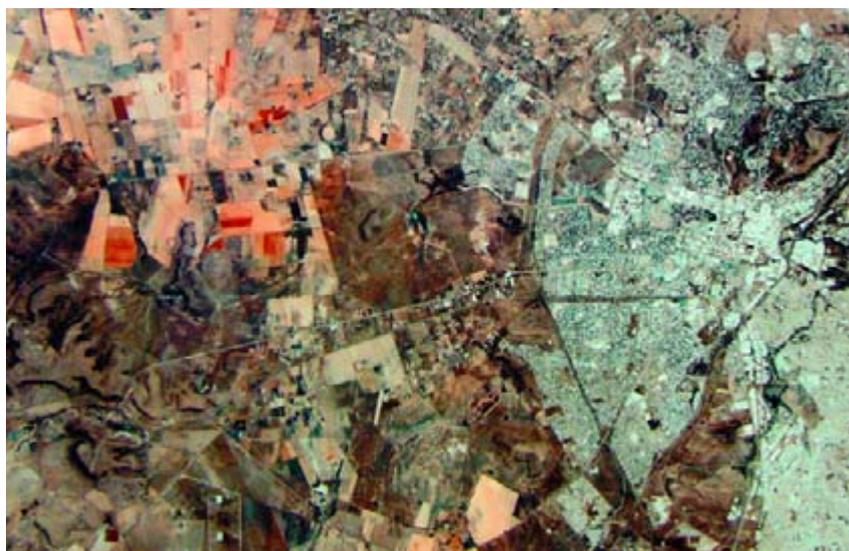
oping the Maluti-A-Phofung Local Municipality's tourism sector plan. A group of 24 tour operators from Lesotho was also trained on the Qwaqwa Campus. This initiative involved all staff members of the Department of Geography on the Qwaqwa Campus.

Ms Sheila Vrahimis served on the South African National Parks Board during 2005 and the first half of 2006. Dr Gustav Visser (now Prof. Visser) served in both 2005/06 on the Standards Generating Body for Geography of the South African Qualifications Authority (SAQA).

Both the Qwaqwa and Bloemfontein Campuses were actively involved in hosting Geography learners from various Free State and Northern Cape high schools, introducing them to the subject and its career possibilities.



The department launched a special edition of the South African Geographical Journal, entitled: *A Geography of the Free State*. Some of the guests attending the occasion are, from the left: Prof. Gustav Visser, Lecturer in the department and co-author of this special edition of the journal, Teuns Verschoor, Vice-Rector: Academic Operations at the UFS, Peter Holmes, Departmental Chairperson and co-author of the special edition of the journal, and Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences at the UFS.



ASTER satellite photo of Bloemfontein.

"A highlight of 2006 was the publication of a special issue of the *South African Geographical Journal* entitled: *A Geography of the Free State.*"

The situation regarding postgraduate student numbers remains strong, with two doctoral students, 24 master's students and 17 honours students registered at the department in 2005 and four doctoral students, 16 master's students and 21 honours students registered in 2006.

In 2005 a group of students attended the annual Student Conference presented by the Society of South African Geographers (SSAG) in Belville, Cape Town. A group of students also attended the Student Conference in 2006, in Pietermaritzburg.

Proff. Holmes and Visser presented papers at international conferences during 2005, but the highlight of the year was the Biannual Conference of the Society of South African Geographers held in Bellville, Cape Town. Eight of the ten academic staff members (all but one from the Bloemfontein Campus, plus two from the Qwaqwa Campus) presented papers. In addition, Ms Liesel Cronjé, departmental secretary on the Bloemfontein Campus, presented a paper based on her recently completed M.Sc. in medical geography.

In 2006 three staff members presented papers at international conferences, including a plenary address by Prof. Visser at the International Geographical Union conference in Brisbane, Australia. In addition, Prof. Visser presented papers at both the main conference and the pre-conference symposium

before visiting the University of Otago, New Zealand, where he presented papers at the Department of Tourism's Research Seminar Series.

A highlight of 2006 was the publication of a special issue of the *South African Geographical Journal* entitled: *A Geography of the Free State*. This was co-edited by Proff. Visser and Holmes. It is the first time in the history of the journal that an issue devoted to the geography of a single province has been published.

Staffing has remained reasonably stable, with one additional staff member, Ms Robyn Mellet, being appointed on a three-year contract as a junior lecturer on the Qwaqwa Campus as from 2006. Later in 2006 Ms Mellet resigned. Prof. Nico Kotze moved from Bloemfontein to the University of Johannesburg to take up an academic appointment as head of Geography and Prof. Van Zyl was seconded to the post of academic co-ordinator on the Qwaqwa Campus. There is a strong likelihood of new appointments on both campuses in 2007.

Ms Vrahimis and Ms Tobeka Mehlomakhulu moved from the Vista Campus to the Bloemfontein Campus in 2005, thus bringing the complement of academic staff on this campus to seven, with four academic staff members on the Qwaqwa Campus from the beginning of 2006. Mrs Vrahimis' experience in working with under-prepared students will benefit the four-year B.Sc. degree programme greatly.

Dr Visser was promoted to senior lecturer at the beginning of 2005 and was appointed as associate professor in 2006. He received an Y1 rating in the previous round of NRF evaluations.

Ms Eldalize Kruger, who has commenced her Ph.D. studies under the guidance of Dr Barker, was promoted from junior lecturer to lecturer, while Dr Barker received a special increment in recognition of his administrative and teaching contributions within the department.

The department now demonstrates established research expertise in Human Geography (with the focus on tourism-led urban regeneration), Physical Geography (focusing on late Quaternary palaeo-environments) and in GIS. It is rapidly consolidating its identity in both teaching and research within these fields.

Prof. Van Zyl and Mr Alex Adjei of the Qwaqwa Campus are NRF grant holders and are involved in tourism research in the Eastern Free State. The potential for research into resource management in the Eastern Free State is being investigated by Dr Hennie Claassen.



Wind erosion in the Free State is a potential problem.

## Academic staff

### Main Campus

**Professor:** Prof. Peter Holmes

**Associate Professors:** Proff. Gustav Visser, Nico Kotze

**Senior Lecturers:** Dr Charles Barker,  
**Lecturers:** Mss Tobeka Mehlomakhulu, Sheila Vrahimis, Eldalize Kruger

### Qwaqwa Campus

**Associate Professor:** Prof. Willie van Zyl

**Senior Lecturer:** Dr Hennie Claassen  
**Lecturer:** Mr Alex Adjei

## Contact details

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Website: www.ufs.ac.za

# Research outputs

## Publications

**Boardman, J., Holmes, P.J., Bateman, M.D. & Rhodes, E.J.** 2005. Colluvial fan gravels, depositional environments and luminescence dating: A Karoo case study. *South African Geographical Journal* 87: 73-79.

**Cronjé, L. & Barker, C.H.** 2006. Tuberculosis in the Free State Province: Present trends, future prognosis. *South African Geographical Journal* 88(1): 39-47.

**Dippenaar, S. & Kotze, N.** 2005. People with disabilities and nature tourism: A South Africa case study. *Social Work* 41(1): 96-108.

**Holmes, P.J. & Barker, C.H.** 2006. Geological and geomorphological controls on the physical landscape of the Free State. *South African Geographical Journal* 88(1): 3-10.

**Hoogendoorn, G., Mellett, R. & Visser, G.** 2005. Second homes as urban tourism: Case studies from South Africa. *Urban Forum* 16(2/3): 112-154.

**Kotze, N.J.** 2005. An analysis of the key characteristics of the Free State Province's tourism product. *Acta Academica Supplementum* 4: 46-84.

**Kotze, N.J.** 2006. Housing the elderly in South Africa: A Free State case study. *South African Geographical Journal* 88(1): 32-38.

**Kruger, E. & Chapman, O.A.** 2005. Quality aspects of Environmental Impact Assessment Reports in the Free State Province, South Africa. *South African Geographical Journal* 87: 52-57.

**Marker, M.E. & Holmes, P.J.** 2005. Landscape evolution and landscape sensitivity: The case of the Southern Cape. *South African Journal of Science* 101: 53-60.

**Msilimba, G.G. & Holmes, P.J.** 2005. A landslide hazard assessment and vulnerability appraisal procedure: Vunguvungu/Banga Catchment, Northern Malawi. *Natural Hazards* 34: 199-216.

**Rogerson, C.M. & Visser, G.** 2005. Tourism in urban Africa: The South African experience. *Urban Forum* 16(2/3): 63-87.

**Rogerson, C.M. & Visser, G.** 2006. International tourist flows and urban tourism in South Africa. *Urban Forum* 17(2): 199-213.

**Schuurmans, N. & Visser, G.** 2005. On poor whites in post-apartheid cities: The case of Bloemfontein. *Urban Forum* 16(4): 259-294.

**Visser, G.** 2005. Festival tourism in South Africa: Progress and prospect. *Urban Forum* 16(2/3): 155-175.

**Visser, G.** 2006. A tourism development strategy for the Free State Province. *Acta Academica, Supplementum* 4: 117-137.

**Visser, G.** 2006. An analysis of current tourism trends in South Africa and the Free State. *Acta Academica, Supplementum* 4: 1-45.

**Visser, G.** 2006. Post-script: A regional geography of the Free State. *South African Geographical Journal* 88(1): 111-113.

**Visser, G.** 2006. South Africa has second homes too! An exploration of the unexplored. *Current Issues in Tourism* 9(4/5): 351-383.

**Visser, G. & Kotze, N.** 2006. The Free State tourism economy: Current dynamics, immediate challenges and future research prospects. *South African Geographical Journal* 88(1): 88-101.

**Visser, G., Kotze, N. & Rogerson, C.M.** 2005. A tourism development strategy for the Free State Province. *Acta Academica Supplementum* 4: 117-137.

**Vrahimis, S. & Visser, G.** 2006. Institutional impediments to the implementation of the Maloti Drakensberg Transfrontier Conservation and Development Project: The case of the Free State Government. *South African Geographical Journal* 88(1): 102-110.

## Chapters in books

**Donaldson, R. & Kotze, N.J.** 2006. Polokwane: From an apartheid to a transformed South African City. In: *Kulturgeographie der Stadt, Band 111*, edited by P. Gans, A. Priebis & R. Wehrhahn. Germany: University Kiel. pp. 509-521.

**Visser, G.** 2005. The local development impacts of backpacker tourism: Evidence from the South African experience. In *Local Economic Development in the Developing World: The experience of Southern Africa*, edited by E. Nel & C.M. Rogerson. New Brunswick: Transaction Publishers. pp. 267-296.

## Conference contributions

**Adjei, A.** 2005. *Sustainable tourism, pro-poor tourism, responsible tourism and fair trade in tourism - convergence or divergence?* Paper presented at the Society of South African Geographers Biennial Conference, University of the Western Cape, Bellville, South Africa.

**Adjei, A.** 2006. *Rural migration reversed: The impact of second homes on the black community of Clarens in the Eastern Free State, South Africa.* Paper presented at the International Tourism Conference, University of Lodz, Poland.

**Barker, C.H.** 2005. *The applicability of SRTM data for topographical modelling in South Africa.* Paper presented at the Society of South African Geographers Biennial Conference, University of the Western Cape, Bellville, South Africa.

**Cronjé, L.** 2005. *An investigation into the 2001 distribution of tuberculosis in the Free State.* Paper presented at the Society of South African Geographers Biennial Conference, University of the Western Cape, Bellville, South Africa.

**Holmes, P.J., Bateman, M.D. & Carr, A.S.** 2005. *Past coastal reconfigurations of the Southern Cape coast, South Africa.* Paper presented at the Southern African Society for Quaternary Research, Biennial Conference, Bloemfontein, South Africa.

**Holmes, P.J., Bateman, M.D. & Carr, A.S.** 2005. *Past coastal reconfigurations of the Southern Cape, South Africa.* Paper presented at the Society of South African Geographers Biennial Conference, University of the Western Cape, Bellville, South Africa.

**Holmes, P.J., Bateman, M.D. & Carr, A.S.** 2006. *The Barrier Dunes of the Southern Cape, South Africa: Evidence of long-term marine-terrestrial recycling.* Paper presented at the Southern

African Association of Geomorphologists Biennial Conference, University of KwaZulu-Natal, Pietermaritzburg, South Africa.

**Holmes, P.J., Bateman, M.D., Thomas, D.S.G., Barker, C.H. & Wiggs, G.F.S.** 2006. *Aeolian activity and Lunette dune sedimentation on the Free State Highveld of South Africa.* Paper presented at the 6th International Conference on Aeolian Research, University of Guelph, Canada.

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**Kotze, N.J.** 2005. *Housing the elderly in South Africa: A case study from the Free State Province.* Paper presented at the Society of South African Geographers Biennial Conference, University of the Western Cape, Bellville, South Africa.

**Mehlomakhulu, T.C.** 2005. *The integrated sustainable rural development programme in Maluti-a-Phofung: What does it mean for youth?* Paper presented at the Society of South African Geographers Biennial Conference, University of the Western Cape, Bellville, South Africa.

**Van Zyl, W.F.** 2005. *Gear up for responsible tourism.* Paper presented at the Society of South African Geographers Biennial Conference, University of the Western Cape, Bellville, South Africa.

**Visser, G.** 2005. *Responsible tourism and tourism-resort development in South Africa: A contradiction in terms?* Paper presented at the Society of South African Geographers Biennial Conference, University of the Western Cape, Bellville, South Africa.

**Visser, G.** 2006. *Homonormalising heterosexual leisure spaces: The case of Bloemfontein.* Paper presented at the International Geographical Union (IGU) Conference, Brisbane, Australia.

**Visser, G.** 2006. *The South African Research Foundation's researcher rating system: International connections and local disjunctures.* Paper presented at the International Geographical Union (IGU) Conference: Commission on Tourism, Leisure and Global Change Pre-Symposium, Brisbane, Australia.

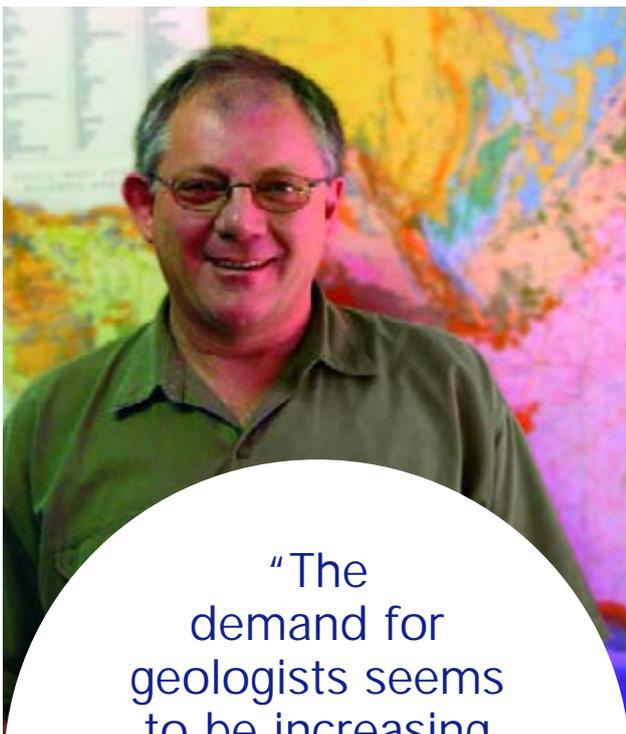
**Visser, G.** 2006. *Tourism after oil? Re-thinking Southern African pro-poor opportunities.* Paper presented at the International Geographical Union (IGU) Conference, Brisbane, Australia.

**Visser, G. & Schuurmans, N.** 2005. *Unvoiced and invisible: Reflections on white poverty in post-apartheid South Africa.* Paper presented at the Royal Geographical Society and Institute of British Geographers Conference, London, UK.

**Vrahimis, S.** 2005. *Institutional impediments in the development of nature based tourism potential on provincial reserves in the Free State.* Paper presented at the Society of South African Geographers Biennial Conference, University of the Western Cape, Bellville, South Africa.

Department of

# Geology



“The demand for geologists seems to be increasing with exploration programmes on a global scale.”

Prof. Willem van der Westhuizen.

## Overview

The vision of the Department of Geology is to play a prominent role in a global geological context by means of innovative and entrepreneurial paradigms and actions.

In 2005 the department boasted with 19 honours students. This trend continued with 2006 following the same pattern with an increase in activities and student numbers. Honours student numbers rose to 23, the highest number in the history of the department. This growth is linked to the economy and the increase in commodity prices, with the demand for geologists increasing as a result of exploration programmes on a global scale.

In both 2005/06 honours students have completed or are in the process of completing a number of research projects on gold mines amongst others, and research has been conducted into the geological effects of blasting in the Phalaborwa Mine.

The continued rise in student numbers, as well as the demand for graduates in geology in South Africa, has continued unabated. The gold and platinum industries especially, are employing many of our graduates. Students with honours degrees were employed by uranium, gold and platinum mining and exploration companies.

During 2005 two Ph.D. students, Dr Gerard Letlatsa and Dr Leon Jacobson, completed their studies. The titles of their theses are respectively: *Geological conditions and environmental impact of the Mohale Dam, Lesotho Highlands Water Project* and *The application of compositional analysis to provenance studies of archaeological pottery in Southern Africa: A geochemical perspective using XRF spectrometry.*

Two more Ph.D. projects were initiated, both of which are related to the Uranium Research Project. These are entitled: *A subsurface basin analysis of the Karoo Supergroup in the Springbok Flats area, north of Pretoria* and *Environmental toxicity and exploration techniques in the Karoo Uranium Province.*

In 2006 one Ph.D. project was initiated which is jointly supervised by Proff. Marian Tredoux from the Department of Geology and Peter

“Students with honours degrees were employed by uranium, gold, platinum mining and exploration companies.”

Holmes from the Department of Geography. It is entitled: *A new perspective on the geohydrological and surface processes controlling the depositional environment at the Florisbad archaeozoological site.*

In 2005 nine M.Sc. students researched various aspects of geology including gold and

platinum research, coal geology, base metals, meteorites, sedimentology, and Mineral Resource Management (mineralogy/metallurgy).

During 2006 one M.Sc. student completed his studies. The title of his thesis is: *The relationship between geological structures and shortwall mining at Matla Collieries, Mpumalanga.*

In 2005 six degrees and one postgraduate diploma in Mineral Resource Management (MRM) were awarded, while 2006 saw the awarding of two MRM degrees and two postgraduate diplomas to students who completed their studies. Workshops for the MRM courses were conducted in Midrand and in Pretoria.

Prof. Tredoux, Dr Christoph Gauert, Ms Annegret Lombard and two students travelled to Mozambique to attend the 21st Colloquium of African Geology, where a number of research papers were read. Dr Gauert and Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences also travelled to Germany to attend the 5th Annual Meeting of the *Inkaba Ye Africa* project, a collaboration project between German and South African scientists. Prof. Tredoux visited the Environmental Inorganic Geochemistry

Group laboratory (EIGG) at Curtin University of Technology in Perth, Australia as well as the Department of Geology at the University of South Australia in Adelaide to discuss collaboration. She also attended the 16th Annual VM Goldschmidt Conference in Melbourne where she and co-authors read two papers.

Prof. Tredoux recorded eight radio sessions on *Radio Sonder Grense* and *Radio Rosestad*. In addition to her postgraduate students at the UFS, she is also co-supervisor of two M.Sc. students at the University of Cape Town.

Ms Lombard attended the 3rd Conference of the Association of African Women Geoscientists in El Jadida, Morocco where she presented some of her research on meteorites. She also organised the prestigious Alex du Toit Memorial Lecture that was presented by Prof. Uwe Reimold.

Equipment is an integral part of the department. The department gratefully acknowledges support of the faculty in the purchase of a new AXIOS XRF spectrometer for analysing rocks and minerals. This state-of-the-art piece of equipment will add value to research in the department and will also be of use to other departments in the Faculty of Natural and Agricultural Sciences.



Chromite layers at the Dwarsrivier National Monument site in Mpumalanga.

Other equipment in the department includes:

- **Electron microprobe:** This piece of equipment has been operational since 1984. It contributed to research and publications until 2005.
- **X-ray diffraction:** The diffractometer is 16 years old and is still functioning effectively. X-ray diffraction also finds application in other departments in the faculty.
- **Fluid inclusion laboratory:** This laboratory has also contributed data for research over the past two decades. In 2006 fluid inclusion research was applied in the field of semi-precious stones (tanzanite).
- **Research Microscope:** During 2006 the department purchased ten Olympus research microscopes for teaching purposes. These microscopes will enhance research, especially in the fields of mineralogy and petrology.

The department has worked in collaboration with a number of institutions both locally and internationally:

#### Local

- Department of Geology, University of Natal, Durban
- Department of Geology, University of Pretoria
- Department of Geology, University of the Witwatersrand
- Department of Geology, University of Cape Town
- Kumba Resources
- BHP Billiton plc.
- Harmony Mining Company Ltd.
- Eysizwe Coal
- Council for Geosciences, Pretoria
- South African Committee for Stratigraphy
- XStrata SA (Pty) Ltd.
- Metorex (Pty) Ltd.
- African Rainbow Minerals (Pty) Ltd.
- Exxaro Resources Ltd.

#### International

- Department of Geology, Imperial College, London, UK
- Royal School of Mines, Department of Geology, UK
- Department of Geology, Martin Luther University of Halle-Wittenberg, Germany
- GKSS Research Centre Geesthacht, Germany
- Federal Institute for Geosciences and Natural Resources (BGR) in Hannover, Germany
- French National Centre for Scientific Research (CNRS), Nancy, France
- Global Mineral Resources Assessment Project Central to Southern Africa (*US Geological Survey*)
- Department of Geology, University of Modena e Reggio Emilia, Italy

For 2005/06 the department received funding to the value of R2 158 664 from a number of institutions.

Staff members in the department are currently conducting research on uranium. A sharp rise in the price of uranium created an urgent need for such research. The price of the metal has, since January 2003, increased from US\$9 to over US\$36 per pound in January 2006 and to US\$ 75 in January 2007. This increase in the price led to an escalating interest in uranium ores, especially as a result of declining fossil fuel reserves and increasing oil prices. Work on uranium and molybdenum mineralisation commenced early in 2005 on a contractual basis between the department and an international mining and exploration company. This company approached the department to conduct research, and a contract for R1,4 million over three years has been negotiated.

The research continued during 2006 and included the nature and genesis of uranium deposits as well as the geology and stratigraphy of the central Karoo region, mineralogy of U-mineralisation, geochemistry of the ore deposits, geo-botanical aspects, radon occurrences, exploration techniques, analytical methods, fluid movement through different formations and factors controlling pathways and areas of mineralisation. Other departments in the faculty also participate in a variety of projects. As these projects progress, a number of students will be working towards higher degrees in these fields. As the project progresses, a number of students will be working towards higher degrees in these fields. An M.Sc. student, Mr Peter Saffy, started a research project and has completed field work in the Aberdeen and Beaufort West area. This research could be extended to a number of other countries in Africa and elsewhere.

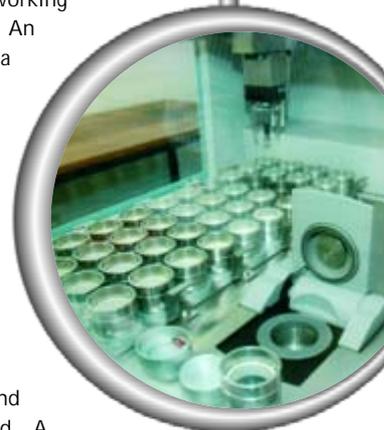
Another topic researched by the department is that of the Witwatersrand gold deposits. This topic forms part of the department's traditional research domain. Interesting research on both the Free State goldfields and the West Rand goldfields is presently being conducted. A study on the pre-B Reef topography in the Free State goldfields is assisting with the prediction of the continuation of mineralised areas. Mineralogical studies and structural interaction in the Carletonville area are revealing new insights into the origin of the Witwatersrand gold mineralising event.

Another traditional area of research in the department is the Namaqua Metamorphic Complex. Publications from earlier research are still forthcoming, and researchers from this department are probably the most knowledgeable in South Africa in this field. Some research is still being conducted on selected aspects of this field.

The Ventersdorp Supergroup has formed an important component of the research in the department for many years. Although recently scaled down, this research will receive renewed attention in the years to come.

Researchers are also conducting research in the field of African geology. A new thrust will be directed towards Tanzania where many opportunities exist. A number of students have already been identified for postgraduate studies in Tanzania. Staff members and students will be involved in research covering the petrology of mafic complexes as well as the genesis and distribution of semi-precious stones such as gem-quality zoisite ("tanzanite").

In 2006 one student, Ms Palesa Langa, was doing mineralogical and geochemical as well as fluid inclusion research under the supervision of Prof. Reyno Scheepers and Dr Gauert. More stu-



dents will enrol for magister projects during 2007.

Sedimentological research on various aspects such as alluvial diamond occurrences and comparative studies relating to similarities between the deposition of modern analogues with ancient examples from the Witwatersrand deposits are also being investigated.

Research on rare minerals is also on-going and the possibility of acquiring new equipment such as a mineral analyser will open up new avenues of research.

Economic geology research on ore genesis is being investigated by Dr Gauert and students. Dr Gauert and M.Sc. student, Mr Lourens Joubert, are researching the ore genesis and geochemistry of the Nkomati Ni-Cu-PGE mine (XStrata), Uitkomst Complex near Badplaas. Dr Gauert and honours students also completed research on the Verge-noeg Fluorite-Hematite Deposit near Rust de Winter (Metorex (Pty) Ltd.).

Platinum geochemistry is being researched by Prof. Tredoux and Dr Gauert with their postgraduate students.

Research into meteorites also forms part of this department's activities. This is done by Ms Lombard under the supervision of Prof. Tredoux.

Structural and stratigraphical aspects of the rocks of the Kango Group are being researched by Dr Hermann Praekelt and students.

### Academic staff

**Professor Researcher:** Prof. Willem van der Westhuizen

**Associate Professors:** Proff. Wayne Colliston, Marian Tredoux

**Senior Lecturers:** Drs Christoph Gauert, Hermann Praekelt (Programme Director)

**Junior Lecturers:** Mr Nicolaas Scholtz, Ms Annegret Lombard

**Part-time Professors:** Proff. Aylva Schoch, Reyno Scheepers

**Part-time Lecturer:** Mr Leon Nel (resigned at the end of 2006)

**Affiliated Lecturers:** Prof. Gerhard Beukes, Messrs Johan Loock, Petrus Laurens, Petrus Grobler, Andre Dunne, Derek Hall, Ms Vanessa Lickfold, Judith Diedericks

### Contact details

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Honours students from the department visited the Sheba Mine (gold mine) in Barberton during the annual student tour in September 2006. They used this opportunity to investigate one of the new stops.

# Research outputs

## Publications

Coetzee, M.S., Beukes, G.J., De Bruijn, H. & Bisschoff, A.A. 2006. Geochemistry and petrogenesis of tholeiitic intrusions of possible Bushveld-age in the Vredefort Dome, South Africa. *Journal of African Earth Sciences* 45: 213-235.

Colliston, W.P. & Schoch, A.E. 2006. The distribution and diagnostic features of deformed plutonic rocks in two terranes of the Namaque mobile belt along the Orange (Gariep) River, South Africa. *South African Journal of Geology* 109(3): 369-392.

De Bruijn, H., Schoch, A.E., Fairwood, D.S. & Van der Westhuizen, W.A. 2005. The geology and petrochemistry of the Mashikiri formation along the Olifants River Section, Kruger National Park, South Africa. *South African Journal of Geology* 108(2): 173-186.

Gauert, C.D.K. 2005. Stratiform cotecule-barite-sulphide horizons in the sediment-hosted Tsongori-Omupokko Pb-Cu-Ba-Zn-Ag prospects, Kaokoland, Namibia. *South African Journal of Geology* 108(1): 87-118.

Praekelt, H.E., Colliston, W.P. & Schoch, A.E. 2006. Lithostratigraphy of the Koeris Formation (Bushmanland Group). *Lithostratigraphic Series No. 41*.

Van Heerden, J., Loock, J.C. & Nondula, N. 2006. The type locality of *Horus obscurus* (Tullgren) (Arachnida: Pseudoscorpiones: Oligipidae). *Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg* 14(174): 321-329.

Whitelaw, H.T., De Bruijn, H., Schoch, A.E. & Van der Westhuizen, W.A. 2005. Isotopic relationships of epigenetic Pb-Zn mineralization in the Ventersdorp Supergroup near Douglas, Northern Cape Province. *South African Journal of Geology* 108(2): 187-198.

## Chapters in books

Johnson, M.R., Van Vuuren, C.J., Visser, J.N.J., Cole, D.I., De Villiers Wickens, H., Christie, A.D.M., Roberts, D.L. & Brandl, G. 2006. Sedimentary rocks of the Karoo Supergroup. In *The Geology of South Africa*, edited by M.R. Johnson, C.R. Anhaeusser & R.J. Thomas. Pretoria: Geological Society of South Africa, Council for Geoscience. pp. 463-501.

Loock, J.C. & Branagan, D.F. 2005. Famous geologists: Du Toit. In *Encyclopedia of Geology (2)*, edited by R.C. Shelley, L. Robin, M. Cocks & I.R. Plimer. Elsevier: Oxford. pp.188-193.

Scheepers, R. & Schoch, A.E. 2006. The Cape Granite Suite. In *The Geology of South Africa*, edited by M.R. Johnson, C.R. Anhaeusser & R.J. Thomas. Pretoria: Geological Society of South Africa, Council for Geoscience. pp. 423-434.

Scholtz, N., Scholtz, O.F. & Potgieter G.P. 2005. Potential environmental impact resulting from inadequate remediation of uranium mining in the Karoo Uranium Province, South Africa. In *Uranium in the environment*, edited by B.J. Merkel & A. Hasche-Berger. Berlin: Springer. pp. 789-799.

Van der Westhuizen, W.A., De Bruijn, H. & Meintjes, G.J. 2006. The Ventersdorp Supergroup. In *The Geology of South Africa*, edited by M.R. Johnson, C.R. Anhaeusser & R.J. Thomas. Pretoria: Geological Society of South Africa, Council for Geoscience. pp. 187-208.

## Conference contributions

Altermann, W., Alkimi, F.F., Frei, M., Gauert, C. & Martins-Neto, M. 2006. *Sedimentary facies and tectonic setting of the 2.6 Ga Vryburg Fm*. Proceedings of the Colloquium of African Geology 21st Congress, Associacao Geologica Mineira de Mocambique, Maputo, Mozambique. pp. 227-229.

Botha, C.F., Du Preez, P.J. & Scholtz, N. 2006. *'n Ondersoek na 'n moontlike verband tussen uraanerts en plantegroei: Beaufort-Wes distrik, Karoo Uraanprovinsie*. Poster presented at the Congress of the "Suid-Afrikaanse Akademie vir Wetenskap en Kuns: Afdeling Biologiese Wetenskappe", Potchefstroom, South Africa.

Buys, S., Scholtz, N. & Gauert, C.D.K. 2006. *Toepassing van 'n eksplorasiëprogram in die Karoo Uraan Provinsie, Suid-Afrika*. Poster presented at the Congress of the "Suid-Afrikaanse Akademie vir Wetenskap en Kuns: Afdeling Biologiese Wetenskappe", Potchefstroom, South Africa.

Du Plessis, M.H. & Scholtz, N. 2006. *Die gebruik van afstandswaarneming in eksplorasië vir uraan afsettings*. Poster presented at the Congress of the "Suid-Afrikaanse Akademie vir Wetenskap en Kuns: Afdeling Biologiese Wetenskappe", Potchefstroom, South Africa.

Du Plessis, M.H. & Scholtz, N. 2006. *Remote Sensing as an exploration method for uranium*. Paper presented at the Student Geocongress 2006, Eskom Conference Centre, Midrand, Johannesburg, South Africa.

Gauert, C.D.K. 2005. *Geochemistry and provenance of clastic metasedimentary host rocks of the Rosh Pinah Zn-Pb-Ag (-Cu-Au) deposit, Southern Namibia*. Paper presented at the 8th Biennial Meeting of the Society for Applied Geology (SGA): Basin Evolution - Base and Precious Metal Mineralization in Sediments, Beijing, China.

Gauert, C.D.K. 2005. *The validity and range of proximity indicators to SHMS deposits in metamorphic terranes: Namibian case studies*. Paper presented at the Annual Meeting of the Geological Society of South Africa Congress, School of Geological Sciences, University of KwaZulu-Natal, Durban, South Africa.

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Gauert, C.D.K. 2006. *Metallogenic analysis of base-metal S/VHMS deposits in metamorphic terranes*. Poster presented at the 12th International Association on the Genesis of Ore Deposits (IAGOD) Symposium, Session S5: Traces of heat-and-mass supply for formation of giant ore accumulations, Moscow, Russia.

Gauert, C.D.K., Kennedy, H., Du Plessis, M.H. & Terblanche, H. 2006. *Lithological diversity of the Vergenoeg fluorite-hematite deposit, South Africa*. Proceedings of the Colloquium of African Geology 21st Congress, Associacao Geologica Mineira de Mocambique, Maputo, Mozambique. pp. 289-291.

Gauert, C.D.K., Kennedy, H., Terblanche, H. & Du Plessis, M.H. 2006. *Genetic aspects of the Vergenoeg Fluorite-Magnetite Deposit, Bushveld Igneous Complex, Rust de Winter, South Africa*. Poster presented at the Student Geocongress

2006, Eskom Conference Centre, Midrand, Johannesburg, South Africa.

Greenewald, H., Butler, H.J.B. & Scholtz, N. 2006. *Anura as biologiese indikator by ongerehabiliteerde uraanmyne*. Poster presented at the Congress of the "Suid-Afrikaanse Akademie vir Wetenskap en Kuns: Afdeling Biologiese Wetenskappe", Potchefstroom, South Africa.

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Joubert, L.P., Gauert, C.D.K., Davidson, M. & Van Lente, B. 2006. *The role of post-intrusive, deformational processes in ore reserve consideration at Nkomati Nickel Mine, Mpumalanga Province, South Africa*. Proceedings of the Colloquium of African Geology 21st Congress, Associacao Geologica Mineira de Mocambique, Maputo, Mozambique. pp. 288-291.

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Kennedy, J.H. & Scholtz, N. 2006. *Paleo-omgewing ondersoek van die Mooifontein Uraan afsetting, Karoo Supergroep deur strukturele, geofisiese en sedimentologiese interpretasies*. Poster presented at the Congress of the "Suid-Afrikaanse Akademie vir Wetenskap en Kuns: Afdeling Biologiese Wetenskappe", Potchefstroom, South Africa.

Kennedy, J.H., Scholtz, N., Loock, J.C. & Nel, L. 2006. *Stratigraphy and genesis of the Mooifontein Uranium Deposit, Edenburg District*. Poster presented at the Student Geocongress 2006, Eskom Conference Centre, Midrand, Johannesburg, South Africa.

Kruger, R. & Van der Westhuizen, W.A. 2005. *Selective mining at Thabazimbi Iron Ore Mine (South Africa)*. Proceedings of the Iron Ore 2005 Conference, Australasian Institute for Mining and Metallurgy, Fremantle, Australia. pp. 241-248.

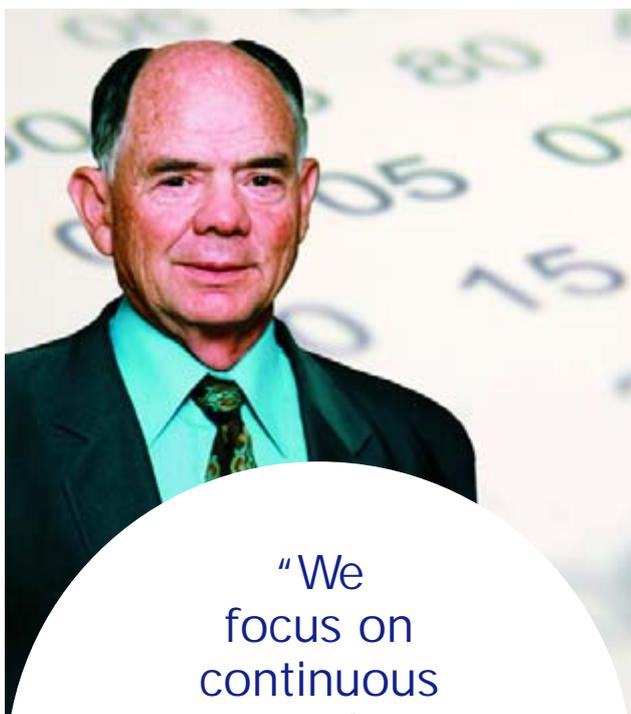
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Rochford, K. & Tredoux, M. 2006. *An evaluation of the educational impact of the EarthWise geoscience project on a disadvantaged rural community in South Africa*. Proceedings of the 5th Global Congress on Engineering Education, Faculty of Engineering, Monash University, Australia. pp. 277-280.

- Scholtz, N. & Poller, R.G.** 2006. *Use of Apis Mellifera in biogeochemical exploration in the Karoo Uranium Province*. Poster presented at the Student Geocongress 2006, Eskom Conference Centre, Midrand, Johannesburg, South Africa.
- Scholtz, N. & Scholtz, O.F.** 2005. *Potential environmental impact resulting from inadequate remediation of uranium mining in the Karoo Uranium Province, South Africa*. Paper presented at the Annual Meeting of the Geological Society of South Africa Congress, School of Geological Sciences, University of KwaZulu-Natal, Durban, South Africa.
- Scholtz, N., Poller, R.G. & Stevens, G.** 2006. *Geochemical and biomonitoring analysis of Bloemspruit, Bloemfontein*. Paper presented at the Student Geocongress 2006, Eskom Conference Centre, Midrand, Johannesburg, South Africa.
- Scholtz, N., Poller, R.G. & Stevens, G.** 2006. *Vergelykings-analise tussen die gebruik van geochemiese en biomonitoringsdata vir besoedeling in Bloemspruit, Bloemfontein*. Paper presented at the Congress of the "Suid-Afrikaanse Akademie vir Wetenskap en Kuns: Afdeling Biologiese Wetenskappe", Potchefstroom, South Africa.
- Scholtz, N., Scholtz, O.F. & Potgieter, G.P.** 2006. *Identification of uranium and molybdenum indicator plants in the Karoo Uranium Province*. Poster presented at the Colloquium of African Geology 21st Congress, Associacao Geologica Mineira de Mocambique, Maputo, Mozambique.
- Scholtz, O.F., Scholtz, N. & Potgieter, G.P.** 2006. *Geïndusseerde uraan fitoekstraksie deur gebruik te maak van sitroensuur en hoë biomassa gewasplante*. Poster presented at the Congress of the "Suid-Afrikaanse Akademie vir Wetenskap en Kuns: Afdeling Biologiese Wetenskappe", Potchefstroom, South Africa.
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- Scholtz, R.G. & Scholtz, N.** 2006. *Biospeleologiese bestudering in 'n karst sisteem gevorm in vroeë proterosoïse gesteentes, Suid-Afrika*. Poster presented at the Congress of the "Suid-Afrikaanse Akademie vir Wetenskap en Kuns: Afdeling Biologiese Wetenskappe", Potchefstroom, South Africa.
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- Tredoux, M. & Toensing, S.** 2006. *EarthWise: Increasing science literacy in rural communities*. Proceedings of the Colloquium of African Geology 21st Congress, Associacao Geologica Mineira de Mocambique, Maputo, Mozambique. pp. 464-465.
- Tredoux, M., Garuti, G., Zaccarini, F. & Cloete, M.** 2006. *Sub-microscopic phases in the Bon Accord Ni ore body, Barberton, South Africa*. Paper presented at the 16th Annual V M Goldschmidt Conference, Melbourne, Australia.

# Mathematical Statistics



“We focus on continuous research on statistical inference with a strong Bayesian flavour.”

Prof. Daan de Waal.

## Overview

During 2005 the department presented courses in Mathematical Statistics, Statistics and Actuarial Science to approximately 2 000 students per semester, 30 of which were postgraduate students. The department had an additional 1 000 students registered in e-degree courses and also on the Kimberley, Qwaqwa and Vista Campuses. A total of 80 courses were presented, with eight Ph.D. and eight master's students registered.

During 2006 a total of 200 more students than the previous year registered for courses in Mathematical Statistics, Statistics and Actuarial Science. One hundred and forty-two of these students were postgraduate students. An additional 760 students were registered in the department in e-degree courses, as well as on the Vista, Qwaqwa and Kimberley Campuses. A total of 61 courses were presented and 11 Ph.D. and six master's students were registered.

Research in the department, not only during 2006, but also on an ongoing basis, focuses on statistical inference with a strong Bayesian flavour. The emphasis lies in areas such as Survival Analysis (Prof. Max Finkelstein), Extreme Value Analysis (Prof. Daan de Waal), Linear Mixed Models (Prof. Abrie van der Merwe) and Change Point Analysis (Prof. Piet Groenewald). Other research fields of interest include Data Mining (Dr Isabelle Garisch) and Time Series (Dr Martin van Zyl).

The modelling of water inflow in the Gariep Dam in the Free State Province for hydro power stimulation through Eskom is done continuously in the Risk Laboratory.

Projects that have been running for some time are the Eskom-related research projects that form part of the activities of the Risk Laboratory, and the projects of the Flemish South African co-operation agreement between the UFS, the North-West University the Katholieke Universiteit Leuven and Diepenbeek University.

The Water Research Commission (WRC) project, with respect to the radar data on the inflow of water into the Caledon River, begun in January 2001 in co-operation with Eskom and the weather office in Bethlehem. This project will continue to exist.

“Prof. Finkelstein was announced a 2005 South African Statistical Association Fellow at the 52nd Annual Conference of the South African Statistical Association.”

Prof. Daan de Waal participated in an international research project in Belgium in association with Proff. Jan Beirlant and Jef Teugels of the Katholieke Universiteit of Leuven on extreme values modelled. This project will continue for the next three years (2005 – 2007). Prof. De Waal also visited Leuven in May 2005 where he delivered a paper entitled: *Choice of the threshold through the entropy of the Dirichlet process when applying Peaks over Thresholds (POT)*.

Prof. Finkelstein is involved in an ongoing project with the Max Planck Institute for Demographic Research on models of biological aging and with the St. Petersburg Elektropribor Institute on reliability of complex systems.

Prof. De Waal was appointed as member of the South African Council for Statistics for a period of three years by Mr Trevor Manuel, Minister of Finance. Prof. Finkelstein was

announced a 2005 South African Statistical Association Fellow at the opening ceremony of the 52nd Annual Conference of the South African Statistical Association held at Rhodes University in Grahamstown.

During 2005/06 staff members from the department actively participated in seminar lectures, research projects, departmental technical reports and national and international conferences and workshops. The department also received a number of visitors that presented seminar lectures.

In 2005 the staff numbered 19 full-time members, five part-time members and three assistants. However, Prof. Groenewald and Dr Piet Steyn retired at respectively 27 and 21 years of service to the department and Dr Albertus Pretorius, Senior Lecturer and Director of the Actuarial Programme, resigned.

Dr Carin Lombaard obtained her Ph.D. in 2006.



The department celebrated its 50th birthday in November 2006 during a gala event in the Centenary Complex on the Main Campus in Bloemfontein. Prof. Daan de Waal, Departmental Chairperson, addressing guests.



## Academic staff

### Main Campus

**Professors:** Prof. Daan de Waal, Max Finkelstein, Piet Groenewald, Abrie van der Merwe, Robert Schall

**Senior Lecturers:** Drs Isabelle Garisch, Albertus Pretorius, Piet Steyn, Martin van Zyl

**Lecturers:** Messrs Delson Chikobvu, Dries Naudé, Kobus Bekker, Michael von Maltitz (contract appointment), Sean van der Merwe (contract appointment), Mss Carin Lombaard, Linda van der Merwe, Andrehette Nel

**Part-time Lecturers:** Dr Cay van der Merwe, Mss Maryn Brussow, Ingrid Erasmus, Lizanne Raubenheimer, Wallina Oosthuizen, Elizabeth Ntja, Messrs Frans Koning, Thomas Kotelo

### Vista Campus

**Professors:** Prof. Jacobus de Wet

**Lecturers:** Dr Inet Kemp

### Contact details

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# Research outputs

## Publications

- De Waal, D.J. & Van Gelder, P.H.A.J.M. 2006. Modelling of extreme wave heights and periods through copulas. Accepted for publication in *Extremes* 8(4).
- Finkelstein, M.S. 2005. Lifesaving explains mortality decline with time. *Mathematical Biosciences* 196(2): 187-197.
- Finkelstein, M.S. 2005. On some reliability approaches to human aging. *The International Journal of Reliability, Quality and Safety Engineering* 12(4): 337-346.
- Finkelstein, M.S. 2005. On stochastic comparison of population densities and life expectancies. [Online]. *Demographic Research* 13(6): 144-161.
- Finkelstein, M.S. 2005. Stochastic modeling of a human life span: A reliability oriented approach. *Communications in Dependability and Quality Management* 8(3): 39-44.
- Finkelstein, M.S. 2005. Why the mixture failure rate is bent down. *South African Statistical Journal* 39: 23-34.
- Finkelstein, M.S. 2006. On relative ordering of mean residual lifetime functions. *Statistics and Probability Letters* 76: 939-944.
- Finkelstein, M.S. & Esaulova, V. 2005. On the weak IFR aging of bivariate lifetime distributions. *Applied Stochastic Models in Business and Industry* 21: 265-272.
- Finkelstein, M.S. & Esaulova, V. 2006. Asymptotic behaviour of a general class of mixture failure rates. *Advances in Applied Probability* 38: 244-262.
- Finkelstein, M.S. & Esaulova, V. 2006. Mixture failure rate ordering. *Communications in Statistics, Theory and Methods* 35: 11.
- Finkelstein, M.S. & Vaupel, J. 2006. The relative tail of longevity and the mean remaining lifetime. [Online]. *Demographic Research* 14(6): 111-138.
- Groenewald, P.C.N. & Mokgathe, L. 2005. Bayesian computation for logistic regression. *Computational Statistics and Data Analysis* 48: 857-868.
- Van der Merwe, A.J. & Bekker, K.N. 2006. A Bayesian analysis with the Bühlmann-Straub credibility model in the case of normality. *Journal of Actuarial Practice* 13: 33-60.
- Van der Merwe, A.J. & Bekker, K.N. 2006. A computational Bayesian approach to the balanced Bühlmann credibility model. Accepted for publication in *South African Statistical Journal*.
- Van der Merwe, A.J. & Delpont, D.H. 2006. Credibility intervals for the ratio of means of two populations which contains Zero and Log-normally distributed observations. *Journal for New Generation Science* 4(2): 66-77.
- Van der Merwe, A.J., Pretorius, A.L. & Meyer, J.H. 2005. Tolerance intervals for the unbalanced one-way random effects model using a Bayesian procedure. Accepted for publication in *Journal of Quality Technology*.
- Van der Merwe, A.J., Pretorius, A.L. & Meyer, J.H. 2006. Bayesian tolerance intervals for the unbalanced one-way random effects model using a Bayesian procedure. *Journal of Quality Technology* 38(3): 280-293.

## Chapters in books

- Finkelstein, M.S. 2005. Mortality in varying environment. In: *Probability, statistics and*

*modeling in public health*, edited by M. Nikulin, D. Commenges & C. Huber. New York: Springer. pp. 145-157.

Finkelstein, M.S. 2005. On simple systems with continuous output. In: *Modern statistical and mathematical methods in reliability*, edited by A. Wilson, N. Limnios, S. Keller-McNulty & Y. Armijo. Singapore: World Scientific. pp. 169-176.

Finkelstein, M.S. & Esaulova, V. 2006. Failure rates in heterogeneous populations. In: *Handbook of Engineering Statistics*, edited by H. Pham. Germany: Springer. pp. 369-386.

## Reports

- Bekker, K.N. 2005. *Estimation of parameters and quantiles of the Wakeby distribution: A compromise*. Report no. 347 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Bekker, K.N. 2005. *Parameter estimation for the Wakeby distribution: A simulation study*. Report no. 348 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Bekker, K.N. & Van der Merwe, A.J. 2005. *Credibility theory in actuarial science: A full Bayesian approach*. Report no. 341 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Brüssow, M.E. & Van der Merwe, A.J. 2005. *A Bayesian analysis of the linear calibration problem*. Report no. 343 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Clark, J. & Steyn, P.W. 2005. *Coverage probabilities and the nominal confidence level*. Report no. 342 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- De Waal, D.J. 2005. *Predictive density derived from the Dirichlet process on goodness of fit of extreme modeling*. Report no. 352 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- De Waal, D.J. & Beirlant, J. 2005. *Choice of the threshold through the entropy of the Dirichlet process when applying pot*. Report no. 351 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- De Waal, D.J., Beirlant, J. & Dierckx, G. 2006. *Bayes estimate of the Weibull tail index*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- De Waal, D.J., Beirlant, J. & Dierckx, G. 2006. *Predicting high quantiles through the dirichlet process on extreme modeling*. Report no. 362 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- De Waal, D.J., Ngesi, K. & Nel, A. 2005. *Predicting inflow into the Gariiep dam using a linear time series model*. Report no. 346 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- De Waal, D.J., Van Gelder, P.H.A.J.M. & Nel, A. 2005. *Estimating joint tail probabilities on rhine discharges through the logistic copula*. Report no. 355 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.

Erasmus, R.A. & Groenewald, P.C.N. 2005. *Bayesian disease mapping: A study of the relative risks of various diseases in the Republic of Botswana*. Report no. 349 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.

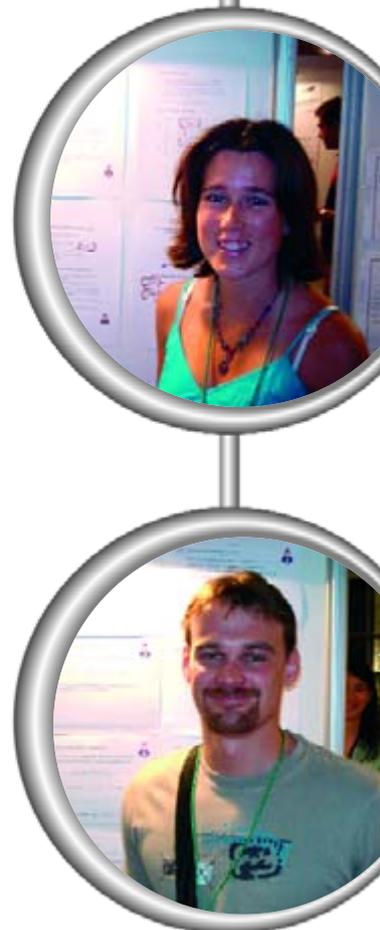
Finkelstein, M.S. 2005. *Aging: Damage accumulation versus increasing mortality rate*. Report to Max Planck Institute for Demographic Research (MPIDR), Rostock, Germany. WP-2005-018.

Finkelstein, M.S. 2005. *On some approaches to defining virtual age of degrading systems*. Report no. 354 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.

Finkelstein, M.S. 2006. *On engineering reliability concepts and biological aging*. Report to Max Planck Institute for Demographic Research (MPIDR), Rostock, Germany. WP-2006-021.

Finkelstein, M.S. 2006. *Shocks: Damage and degradation models*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.

Finkelstein, M.S. & Esaulova, V. 2005. *Asymptotic behaviour of mixture failure rates*.



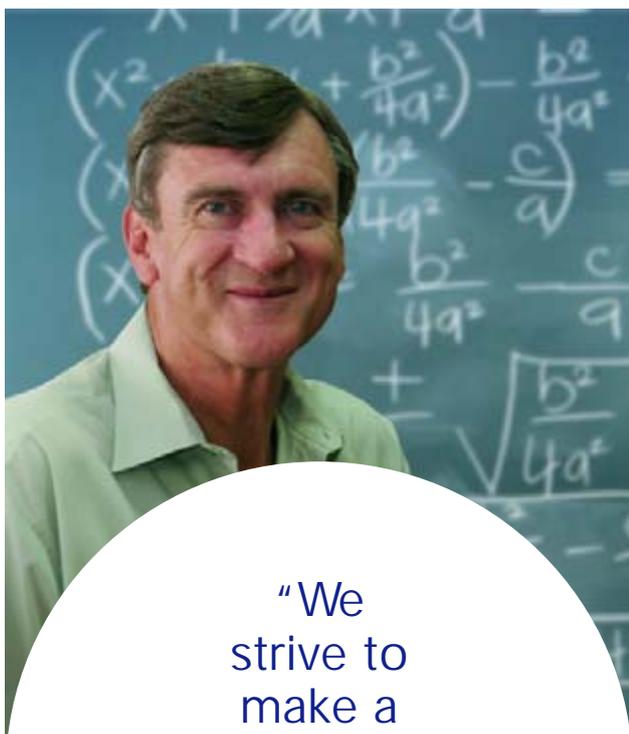
- Report to Max Planck Institute for Demographic Research (MPIDR), Rostock, Germany. WP-2005-023.
- Finkelstein, M.S. & Esaulova, V.** 2005. *On mixture failure rate ordering*. Report to Max Planck Institute for Demographic Research (MPIDR), Rostock, Germany.
- Finkelstein, M.S. & Esaulova, V.** 2006. *On asymptotic failure rates in bivariate frailty competing risks models*. Report to Max Planck Institute for Demographic Research (MPIDR), Rostock, Germany. WP-2006-023.
- Finkelstein, M.S. & Esaulova, V.** 2005. *Failure rates in heterogeneous populations*. Report no. 353 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Garisch, I. & Groenewald, P.C.N.** 2006. *Calculating the probability of consensus decision-making using expert information*. Report no. 367 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Groenewald, P.C.N.** 2006. *Change-points in linear regression*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Hugo, J. & Van der Merwe, A.J.** 2005. *Bayesian tolerance intervals for the balanced one-way random effects model with non-normal measurement errors*. Report no. 356 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Kruger, A. & Van der Merwe, A.J.** 2006. *Bayes prediction in regression analysis with normal and T-errors*. Report no. 368 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Liebenberg, C-M., Van der Merwe A.J., Van Rooyen, L.C. & Bekker, K.N.** 2006. *The Skew Distributions with applications to Bayesian Linear Models*. Report no. 359 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Nel, A. & De Waal, D.J.** 2005. *Probabilities of an overflow in the Gariep Dam*. Report no. 350 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Nel, A., Bekker, K.N. & De Waal, D.J.** 2005. *Fitting the Wakeby distribution to the 20-day block maximum inflows into the Gariiep dam*. Report no. 345 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Nel, A., De Waal, D.J. & Van Gelder, P.H.A.J.M.** 2006. *Estimating joint tail probabilities through the Logistic Copula*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Nel, A., Pretorius A.L. & De Waal, D.J.** 2005. *The Egarch model applied to Eskom data*. Report no. 344 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Nel, A., Pretorius, A.L. & De Waal, D.J.** 2005. *Models of Eskom pricing data*. Report no. 340 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Ngesi, K. & De Waal, D.J.** 2006. *Predicting inflow into the Gariep Dam using time series models*. Report no. 361 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Ngesi, K. & De Waal, D.J.** 2006. *Predicting inflow to the Gariep Dam*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Ntja, M.E. & De Waal, D.J.** 2006. *Relationship between the tail above the threshold and the mean of certain distributions with applications*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Ntja, M.E., De Waal, D.J. & Nel, A.** 2006. *Selecting the threshold for peaks over threshold methods in extreme value analysis*. Report no. 360 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Schall, R.** 2006. *The empirical coverage of confidence intervals: Point estimates and confidence intervals for confidence levels*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Steyn, P.W. & Rabele, T.E.** 2006. *Mantel – Haenszel tests and related topics*. Report no. 364 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Thupeng, W.M. & De Waal, D.J.** 2006. *Posterior predictive assessment of fit for Dirichlet Process Based Generalized Pareto Model*. Report no. 366 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Van der Merwe, A.J. & Delpont, D.** 2006. *Credibility intervals for the ratio of means of two populations which contains Zero and Log-normally distributed observations*. Report no. 363 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Van der Merwe, A.J., Liebenberg, C. & Venter, J.** 2006. *Skew distributions with applications to Bayesian Regression Models*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Van der Merwe, S., Garisch, I. & Van der Merwe, C.** 2006. *Data mining: A comparative summary*. Report no. 358 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Van der Rijst, M., Hugo, J. & Van der Merwe, A.J.** 2005. *Performance of confidence intervals in one-factor random models for balanced and unbalanced data*. Report no. 357 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Veraverbeke, N.** 2006. *Nonparametric estimation problems under dependent censoring*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.

## Conference contributions

- Bekker, K.N. & De Waal, D.J.** 2006. *Estimating extreme quantiles for the 20-day maximum inflows into Gariiep Dam: An approach based on two distributions in DA [Fréchet]*. Poster presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.

- De Waal, D.J.** 2006. *Using the Dirichlet process to select the threshold in extreme modeling*. Paper presented at the Astro Workshop, Statistical and Applied Mathematical Sciences Institute (SAMSI), Duke University, USA.
- De Waal, D.J. & Nel, A.** 2006. *Estimating joint tail probabilities through the logistic copula*. Paper presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.
- Finkelstein, M.S.** 2005. *Biological aging*. Paper presented at the Mathematical and Statistical Methods Conference, University of California at Berkeley, USA. (Invited speaker).
- Finkelstein, M.S.** 2005. *Models of imperfect repair*. Paper presented at the European Safety and Reliability Conference (ESREL 2005), Gdansk, Poland. (Invited speaker).
- Finkelstein, M.S.** 2005. *Statistical modeling and inference in life sciences*. Paper presented at the Lifetime Data Analysis Conference, Potsdam, Germany. (Invited speaker).
- Finkelstein, M.S.** 2005. *Stochastic modeling of a human life span*. Paper presented at the Stochastic Models in Reliability, Safety, Security and Logistics Conference, Beer Sheva, Israel.
- Finkelstein, M.S.** 2006. *On virtual age modelling*. Paper presented at the Accelerated Life Time Congress, Anger, France.
- Finkelstein, M.S.** 2006. *Reliability approaches to biological aging*. Paper presented at the European Safety Reliability Conference, Estoril, Portugal.
- Finkelstein, M.S.** 2006. *Shock models*. Paper presented at the Workshop on Aging, Max Planck Institute, Rockstock, Germany.
- Finkelstein, M.S.** 2006. *Stochastic models of aging*. Paper presented at the Statistical Methods for Biomedical and Technical (BIOSTAT) 2006 Conference, Limassol, Cyprus.
- Finkelstein, M.S. & Esaulova, V.** 2006. *Bivariate mixture failure rate models*. Paper presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.
- Hugo, J. & Van der Merwe, A.J.** 2006. *Bayesian tolerance intervals for the balanced one-way random effects model with student-t distributed measurement errors*. Paper presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.
- Nel, A. & De Waal, D.J.** 2006. *Multivariate extreme values*. Poster presented at the Valencia / ISBA 8th World Meeting on Bayesian Statistics, Gran Hotel Bali, Benidorm, Spain.
- Thupeng, W. & De Waal, D.J.** 2006. *Goodness of fit measures using a Bayesian approach*. Paper presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.
- Van der Merwe, S.** 2006. *The Dodgy finder*. Paper presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.
- Von Maltitz, M.J.** 2006. *Relative risk in currencies: Comparing the South African Rand with the Brazilian Real, the Japanese Yen and the Euro*. Paper presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.

# Mathematics and Applied Mathematics



“We strive to make a difference.”

Prof. Dana Murray.

## 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.

At postgraduate level, the department had four Ph.D. students in 2005, of whom three were specialising in Applied Mathematics and one in Mathematics. One of these Ph.D. students, Mr Patrick Mbambo, is a fellow of the AW Mellon Foundation and had a contract appointment as junior lecturer at the Qwaqwa Campus. The department had one M.Sc. student, who is in the process of completing his studies in graph theory.

Prof. Schalk Schoombie took research leave during the second semester of 2005. He completed two projects, each leading to a research article. The projects entailed a study of false modulations in the solving of a numerical difference scheme for the Van der Pol equation, and a Benjamin Feir analysis of the modulation stability of the Korteweg de Vries equation. In both cases use was made of a discreet multiple scale technique. Both articles were submitted for publication.

In 2006 Mrs Julia van Niekerk was promoted to the position of senior lecturer in recognition of her excellence in teaching. Prof. Herman le Roux retired at the end of the year. The department acknowledges and appreciates his dedication, especially during the incorporation of the Vista Campus.

Prof. Schoombie initiated several projects in collaboration with Prof. Eben Maré of the University of Pretoria. These projects included:

- A general study of the ability of central difference methods to approach the modulations of weak non-linear disturbances of simple harmonic movement.
- Techniques to solve the Black-Scholes comparison numerically on the real line and on the half real line.
- The use of high order central differential techniques for the numerical solving of non-linear dispersive wave comparisons.



Proff. Maré en Schoombie also initiated two other projects, each involving a Ph.D. student:

- The numerical calculations of singular evolution points and their classification in the case of chaotic population models, using the principles of adaptive dynamics.
- Developing a model to predict conflict between three and more persons in a working environment.

Prof. Johan Meyer conducted research in ring and module theory, as well as near-ring theory in 2005 with Ms Karen Howell, a Ph.D. student. In 2006 he continued his research on near-rings and near-fields together with Ms Howell, also focusing on near vector spaces.

Prof. Meyer delivered a paper on work in the group near-rings during the 19th International Congress on Near-Rings and Near-Fields held in August 2005 in Chi-Tou, Taiwan. This paper covered work that he had done the previous year in collaboration with Prof. Groenewald of the University of Port Elizabeth. An article in this context was submitted for publication.

In 2005 Proff. Meyer and Alain Clout submitted an article about certain identities which was accepted for publication in the *International Journal of Mathematics Education of Science and Technology*. Furthermore, the article: *Tolerance intervals for the unbalanced one-way random effects model, using a Bayesian procedure* by Van der Merwe, Pretorius and Meyer, was accepted for publication in the *Journal of Quality Technology*.

Prof. Jo Schröder from the Qwaqwa Campus submitted an article in the field of combinatorica for publication in 2005. He also delivered a lecture entitled: *Schröder numbers of arbitrary integer slope* at the annual congress of the South African Mathematics Society in Grahamstown. Prof. Clout continued his fundamental research in the field of fractional order derivatives and the possible applications thereof in groundwater studies. A start was also made in comparative studies on the relationships between fractional order derivatives and fractals.

In April 2006 Prof. Meyer attended a symposium on training and research during the Pan African Mathematics Olympiad at the Kenya Institute of Education in Nairobi, Kenya, where he delivered a talk on the Nautilus Mathematics Project in the Free State Province.

During July 2006, Prof Meyer visited Prof. W-F Ke of the National Cheng-Kung Univer-

sity in Tainan, Taiwan, where he worked on planarity in matrix near-rings. He also delivered three research talks on group near-rings, matrix near-rings and forcing linearity. In August 2006 he attended the International Congress of Mathematicians in Madrid, Spain.

In November 2006 Prof. Meyer was the main organiser of the 49th Annual Conference of the South African Mathematics Society, held on the Main Campus in Bloemfontein. There were 130 delegates, delivering 90 research papers (in four parallel sessions) on various topics such as Graph Theory, Combinatorics, Algebra, Dynamical Systems, Topology, Functional Analysis, Operator Theory, Mathematical Physics, Computational Methods, Category Theory, the History and Teaching of Mathematics, Financial Mathematics and the Application of Mathematics in the Sciences. In addition, five invited speakers delivered plenary talks in the areas of Pure Mathematics, Applied Mathematics and the Teaching of Mathematics.

Prof. Meyer helped to compile the final round paper for the senior division (Grades 10-12) of the South African Mathematics Olympiad during October 2006.

Prof. Jo Schröder from the Qwaqwa Campus took research leave during the second semester of 2006. During this time he worked at the Department of Mathematics of the Freie Universität Berlin. He benefited not only from a number of well-equipped scientific libraries in Berlin, but also from talks and seminars presented by colleagues. He submitted two articles in the field of combinatorics for publication and delivered an invited lecture entitled: *Schröder Zahlen beliebiger ganzzahliger Steigung* at the Mathematics Colloquium of the Freie Universität.

Prof. Clout developed a new postgraduate course on Fractional Calculus. He also continued the fundamental research on the topic of partial derivatives of non-integer orders and their applications in ground-water modelling.

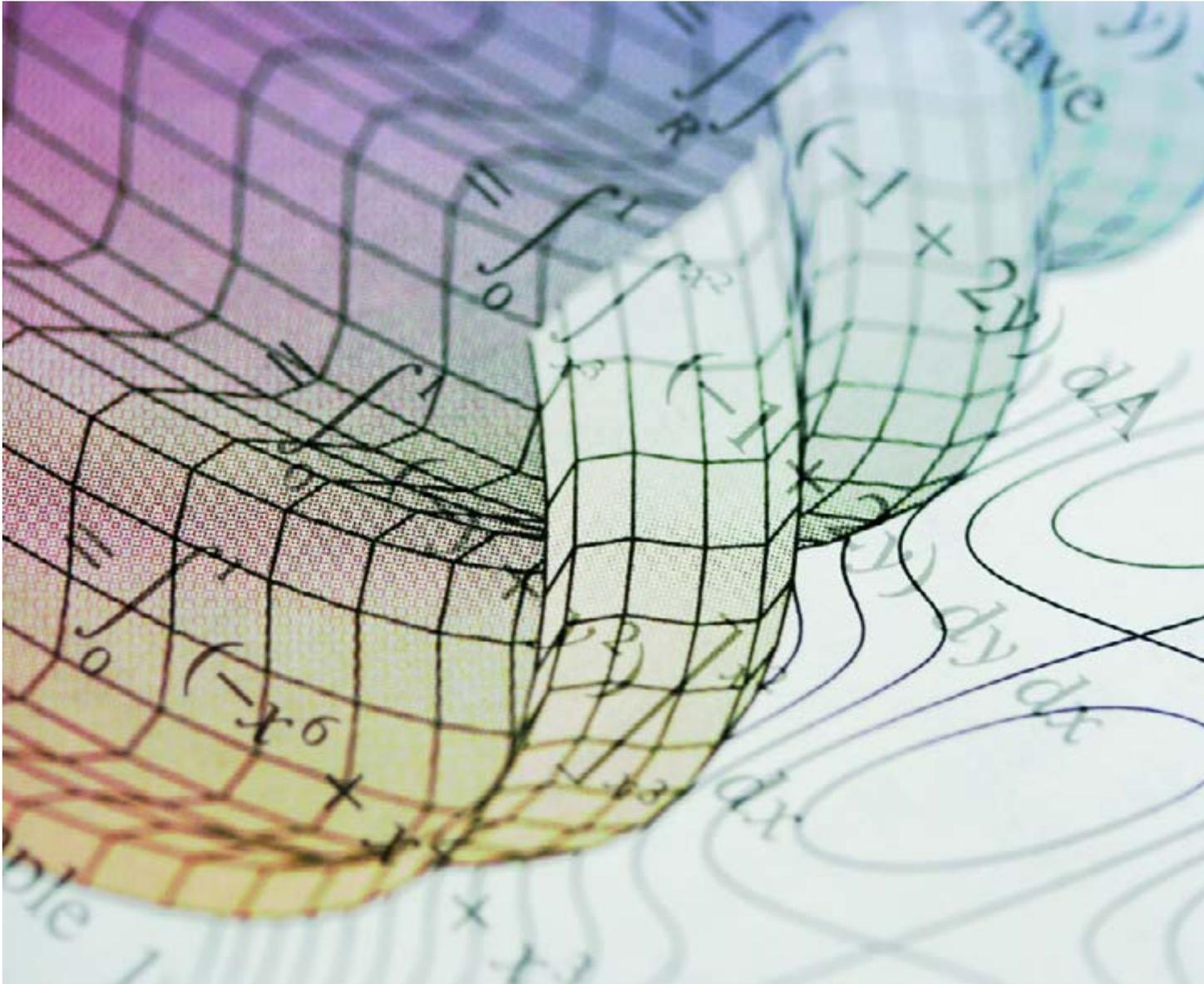
Dr Samantha Dorfling researched a new graph invariant called the completion number of a graph. She studied its relationship to the (circular) chromatic and (circular) clique numbers of simple and perfect graphs. The main idea was to find better approximations for the latter invariants.

In the area of community service, Prof. Meyer and Mr Christiaan Venter were closely involved during 2005/06 with the Nautilus Mathematics Project, which is presented quarterly at Grey College in Bloemfontein. This project is an attempt to moti-

vate talented learners from the Free State Province, as well as certain parts of the Northern Cape, to perform better in Maths Olympiads. Prof. Meyer and Mr Venter were also involved in the preparation of the Free State team that took part in the inter-provincial Maths competition. Over the past few years, these teams (both juniors and seniors) have fared relatively well compared to teams from the rest of the country, mainly because of the intensive

coaching that they receive through the Nautilus Project.

The department took part in the UFS 2006 Open Day and made a contribution towards the popularisation of Mathematics at the National Maths Week held in Kroonstad and Bloemfontein. Mr Venter again organised the involvement of the Faculty of Natural and Agricultural Sciences in the Sasol Science Expo held in Sasolburg.



## Academic staff

### Main Campus

**Professors:** Proff. Johan Meyer, Schalk Schoombie, Dana Murray, Alain Cloot

**Senior Lecturers:** Dr Hubertus Bargenda, Ms Julia van Niekerk

**Lecturers:** Dr Samantha Dorfling, Mr Chistiaan Venter, Ms Ansa Kleynhans

**Temporary Lecturers:** Mss Magrietha Theron, Yvette Erasmus, Martie Jacobs, Martie Calitz, Anita Swart, Marina Botha

### Qwaqwa Campus

**Associate Professor:** Prof. Jo Schröder

**Temporary Lecturers:** Messrs Patrick Mbambo, Nalapan Sebastian, Neo Tsosane, Ms Christa Faber

### Vista Campus

**Professor:** Prof. Herman le Roux

**Associate Professor:** Prof. Thomas Acho

### Contact details

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## Research outputs

### Publications

**Cloot, A.H.J.J. & Meyer, J.H.** 2006. An interesting family of identities. *International Journal of Mathematics Education in Science and Technology* 37(2): 247-252.

**Van der Merwe, A.J., Pretorius, A.L. & Meyer, J.H.** 2006. Tolerance intervals for the unbalanced one-way random effects model, using a Bayesian procedure. *Journal of Quality Technology* 38(3): 280-293.

### Conference contributions

**Meyer, J.H.** 2005. *Prime ideals in group near-rings*. Paper presented at the 19th International Conference on Near-rings and Near-fields, Chi-Tou, Taiwan.

**Schoombie, S.W. & Maré, E.** 2006. *Spurious behaviour of leapfrog schemes for some perturbed harmonic oscillators*. Paper presented at the 30th Annual Symposium on Numerical and Applied Mathematics, Stellenbosch, South Africa.

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# Microbial, Biochemical and Food Biotechnology



“Quality undergraduate training enhances quality postgraduate research.”

Prof. James du Preez.

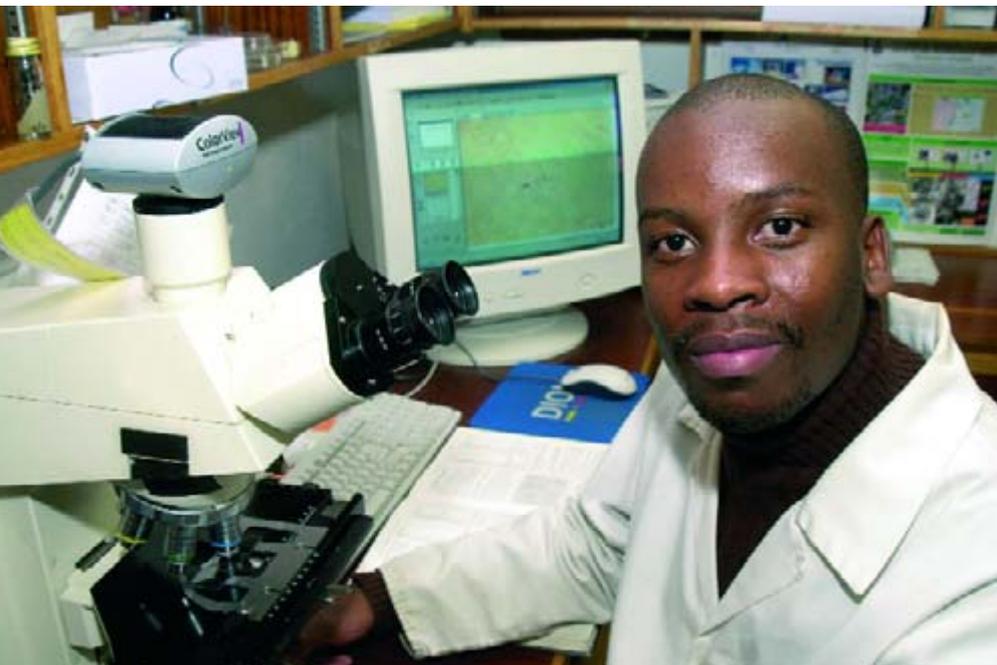
## Overview

The Department of Microbial, Biochemical and Food Biotechnology offers training in the broad disciplines of Biochemistry, Microbiology, Biotechnology, Food Science and Consumer Science at an undergraduate level as well as at B.Sc. Honours, M.Sc. and Ph.D. levels. A particular strength of the department is the close association between the disciplines of biochemistry and microbiology, resulting in a dynamic interchange of ideas and expertise.

Most of the academic staff in the disciplines of microbiology and biochemistry have ratings from the National Research Foundation (NRF) and research in the department is funded by a wide range of national and international agencies. This translates to the postgraduate students and postdoctoral fellows being trained in cutting-edge science by internationally recognised researchers.

The department was awarded the status of a Microbiological Resources Centre (MIRCEN) by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 1996, with the mission of serving as a resource of yeast cultures and training for Southern Africa. The MIRCEN yeast culture collection is the largest of its kind in the southern hemisphere, and is a valuable research resource in the department, as well as nationally and internationally.

One of the highlights of 2005 was the implementation of the strategic equipment plan of the Faculty of Natural and Agricultural Sciences. The department's first priority was to address the backlog in essential equipment required for undergraduate training, as the provision of good laboratory facilities for undergraduates is regarded as essential for quality training, which in the end enhances quality postgraduate research. To this end, 40 binocular oil-immersion microscopes and 20 spectrophotometers at a total value of R724 584 were purchased, exclusively for undergraduate training. Research requirements were not neglected, however, and during 2005 the department also received R471 425, which was used to purchase equipment for postgraduate training and research, including a diode array HPLC, an electrophoresis unit and a real time PCR machine. The latter was



Mr Olihile Sebolai in the laboratory.

mainly funded by external research funds with a R71 000 contribution from the UFS.

In 2006 several major opportunities to boost research and postgraduate training were realised. Prof. Hugh Patterton was successful in his application to obtain a bioinformatics node established at the UFS as a faculty facility, which will link with the national bioinformatics network. The aim of the UFS node is to perform internationally competitive research in bioinformatics, contribute to capacity building in bioinformatics by the training of students at under- and postgraduate levels, and to present training workshops to students and staff. The bioinformatics node will also be involved in providing computational support to projects that include bioinformatics components. The node will be housed in the Biotechnology Annex on the Main Campus in Bloemfontein, and apart from powerful, modern computing equipment for research purposes, the node will also include a 20-workstation lecturing facility for bioinformatics and related teaching.

Prof. Patterton also received a R1 million award from the NRF National Equipment Programme for the acquisition of a two-dimensional protein gel scanner as well as a microarray slide scanner. The placement of these instruments as well as the presence of the bioinformatics node is expected to significantly expand research activities in high throughput biology, particularly in genomics and in proteomics, at the UFS. Furthermore, an NRF Research Niche Area (RNA) in High

Throughput Biology was awarded to a consortium of UFS scientists led by Prof. Patterton. This opens up a new avenue of funding from the NRF. Numerous grant applications were subsequently successfully submitted in this new RNA.

Another major development towards the end of 2006 was the award of a huge BioPAD contract for research in biotechnology. This involves the establishment of a Platform for Metagenomics, with BioPAD and the UFS as partners, which forms part of a network of specialist platforms. This platform, which will be managed by Dr Esta van Heerden, aims at the further development of the infrastructure and expertise for accessing the microbial biodiversity in extreme environments by direct extraction of genetic material from the environment and isolation of specialist microbial consortia. This follows the successful completion of a similar BioPAD-funded project by the group under the leadership of Prof. Derek Litthauer, Drs Van Heerden and Lizelle Piater, and will kick off in 2007. A substantial investment in new equipment will also be made. Dr Piater was also awarded an NRF grant to purchase a Nanodrop spectrophotometer to the value of R86 000, the only one on campus.

The increased research and training activities arising from these awards will put a severe strain on the existing departmental infrastructure. This scenario was already foreseen in 2004, with the result that by the end of 2006 planning officially started for upgrading the biotechnology building on the Main Campus, which will also make provision for the increased demand for laboratory space. Some of the extremely urgent minor improvements to certain key laboratories would already be done early in 2007.

Changes and improvements to the undergraduate Biochemistry and Microbiology learning programmes and module content were implemented in 2005, including a switch from half semester to full semester modules, to better align them with modern requirements, and to improve student learning and success rates. In 2005 a total of 15 honours, eight M.Sc. and seven Ph.D. degrees were conferred on students of the department, and in 2006 17 honours, ten M.Sc. and five Ph.D. degrees.

With the appointment of Dr Betty Lodolo of South African Breweries Limited (SAB) as affiliate senior lecturer, the department had four affiliated academics plus two professors extraordinary who, through lectures and interaction with staff and students, provided invaluable enrichment in the training and research of undergraduate and postgraduate students as well as academic staff. This is exemplified by the recent success of Mr Olihile Sebolai, an



One of the largest groups of students from the department so far, presented their research on yeast nanorobotics (nanotechnology) at three international conferences in Europe in 2006.

M.Sc. student in Microbiology who, under the guidance of Prof. Lodewyk Kock, made an important discovery that could hold promise in the field of nanotechnology. His thesis was awarded six academic prizes by the faculty and UFS, including that of the best thesis overall and he was awarded honorary colours by the UFS Student Representative Council (SRC). Several papers arising from his dissertation were published in international journals and he was interviewed by the *Voice of America* as well as by International *Reuters* TV. He was also highlighted as SA Young Achiever in the *CEO Magazine* (Celebrating Excellence in Organisations, Vol. 4 (4) – 2005), received a commendation from Ms Naledi Pandor (national Minister of Education) as well as a Free State Province Premier's Excellence Award.

Other students who excelled in 2005 included Mr Dirk Opperman, Ph.D. student in Biochemistry, who was one of only five students world-wide and the only South African student, selected to participate in a congress of the National Aeronautics and Space Administration (NASA) in Colorado, United States of America (USA). Two students from the Veterinary Biotechnology Research group, Ms Kulsum Kondiah and Ms Charlotte Boucher, presented lectures at the Virology Africa 2005 conference, an international congress hosted in Cape Town. In addition, Ms Catrine Strauss, a final year Ph.D. student in Microbiology, was the only representative from Africa to present a talk

at the 24th International Specialised Symposium on Yeasts held in Oropesa, Spain.

Apart from the above, the department was well represented at other national and international congresses and symposia in 2005. Four academics and 11 postgraduate students attended the congress of the SA society for Biochemistry and Molecular Biology in Stellenbosch, where they presented three lectures and nine posters. Academic staff members also participated in the following events: Joint Meeting of the Divisions of the International Union of Microbiological Societies (IUMS) 2005, joint meeting of the divisions of the IUMS in San Francisco, USA, World Veterinary Poultry Association Congress in Istanbul, Turkey, Association of Avian Veterinarians Conference in Monterey, California, American Federation of Aviculture Congress in Miami, USA and the 51st International Congress of Meat Science and Technology in Baltimore, USA.

The department again maintained a high profile at various congresses in 2006. The 14th biennial congress of the South African Society for Microbiology in Pretoria was attended by nine academic staff members and 22 postgraduate students who presented lectures and posters. During this meeting Prof. Koos Albertyn stepped down as president of the society. Dairy Symposium 2006, a meeting of the South African

“Several workshops regarding edible oil misuse and accompanying adverse health effects were presented.”

Society for Dairy Technology held in Gordons Bay, was attended by two academic staff members, one post-doctoral student and four students. Four members of the department attended the South African Society for Biochemistry and Molecular Biology Conference in Pietermaritzburg. Prof. Martie Smit presented a lecture at the meeting of the Catalysis Society of South Africa in Mossel Bay. Further afield, six postgraduate students, one post-doctoral student and three staff members associated with the Lipid Biotechnology research group, presented eight posters and three lectures at three international conferences in Europe, namely the 2nd International Conference on Non-mammalian Eicosanoids, Bioactive Lipids and Plant Oxylipins in Berlin, Germany, the 3rd European Conference on Computational Mechanics in Lisbon, Portugal and the 25th International Specialised Symposium on Yeasts in Helsinki, Finland. This was probably the largest contingent of students from the department so far to present their research overseas. The Lipid Biotechnology Group also co-organised the conference in Berlin.

A student, Ms Jacqueline van Marwijk, presented a paper on the biological synthesis of gold nanoparticles at an international congress on gold in Limerick, Ireland. This congress was also attended by Dr Van Heerden. Some students travelled abroad for research purposes. Mr Opperman paid short visits to the Universidad Autónoma de Madrid, Spain to conduct research for his Ph.D. on gene expression in thermophilic microorganisms, and to the Centro de Astrobiología (CSIC-INTA), where he was joined by M.Sc. student Mr Armand Bester to investigate

transcription and translation levels of various proteins. These visits were funded by grants from the Oppenheimer Trust and industry. Dr Arno Hugo presented a poster at the 52nd International Congress of Meat Science and Technology in Dublin, Ireland. Prof. James du Preez, Departmental Chairperson, and Bennie Viljoen presented lectures at the 6th European Symposium on Biochemical Engineering Science (ESBES) in Salzburg, Austria and at the 8th International Mycological Congress in Cairns, Australia, respectively. Prof. Rob Bragg undertook an extensive trip to South America where he presented various seminars on biosecurity in the poultry industries in Argentina, Ecuador and Columbia.

International projects with Hungary and Norway on indigenous fermented foods and beverages led to research visits by Prof. Viljoen and three students to the Norwegian University of Life Sciences Oslo, Norway and one student visited the Corvinus University of Budapest, Hungary. Mr Olivier Jean-Luc Habimana from the Norwegian University of Life Sciences, Norway, in turn spent four months in the Food Biotechnology group, UFS, on the project. Prof. Viljoen presented his inaugural lecture on microbial interactions in foods, with emphasis on yeasts, in 2005.

A workshop to discuss external quality monitoring in the edible oil industry of South Africa was held at the UFS in 2006. This meeting resulted from the activities of the South African Fryer Oil Initiative (SAFOI) headed by Prof. Kock, which currently monitors edible oils in the food industry.



Guests attending Prof. Rob Bragg's inaugural lecture are, from the left: Prof. James du Preez, Departmental Chairperson, Bragg, Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences and Frederick Fourie, Rector and Vice-Chancellor of the UFS.

The workshop was attended by major role players in the fast-food sector and various distributors of edible oils, a representative of Agri Inspec (a forensic investigation company collaborating with inter-state and government structures to combat fraud and international trade irregularities) and Mrs Ina Wilken, Chairperson of the South African National Consumer Union (SANCU) and keynote speaker at this workshop. These role players all pledged their support for the implementation of a quality-monitoring system for the whole food industry, as exemplified by the SAFOI seal of quality currently displayed on some brands of sunflower oil, cottonseed oil and palm oil that are destined for use by restaurants and fast food outlets. Mrs Wilken expressed the viewpoint that the SAFOI seal of quality should also be extended to include all the smaller oil containers used by households. Several workshops by Prof. Kock regarding edible oil misuse and accompanying adverse health effects were also presented to the national media in Pretoria, Johannesburg, Durban and Cape Town. This resulted in several articles in the major newspapers of South Africa such as the *Star*, *Business Report*, *Mercury*, etc.

Community service also enjoyed high priority. In 2005 Drs Van Heerden and Piater led several eager microbiology and biochemistry postgraduate students to the Koot Niemann School outside Bloemfontein to give pupils from Grades 8-10 a hands-on introduction to the world of microbiology. The following year they once again presented the annual winter school for biology teachers, with the focus on how to use normal household materials to do biology experiments. They also presented a lecture entitled: *Biotechnology: A career for women of today!* at a Women's Day Programme of the National Museum in Bloemfontein. Both Prof. Litthauer and Dr Van Heerden were invited to present lectures at the Boyden Observatory in 2005, Dr Piater was invited to give a public talk during the National Science Week 2005 at the UFS, under the auspices of the Department of Science and Technology, and Drs Piater and Van Heerden addressed the Bloemfontein Club 100 Ladies in a lecture entitled: *Is there life out there?*

During March 2005 some of the staff and students exchanged cerebral for physical activities. Ten members of the department braved the fierce Cape wind and completed the Cape Argus Pick 'n Pay Cycle Tour. Winds of change affected the staff situation in the department:

Dr Bethuel Nthangeni, Lecturer, resigned at the end of March to take up a research position at the Biosciences division of the Council for Scientific and Industrial Research (CSIR). In the interests of strategic planning, the department filled the vacancy at the level of associate professor by the appointment of Prof. Patterton, who as a researcher had an NRF B-rating. Another new appointment was Dr Maryna de Wit as Lecturer in Food Science. Ms Dorothy Riekert, Senior Lecturer in Consumer Science, retired at the end of 2005. Prof. Bragg was promoted to professor, Du Preez to senior professor and Dr Carlien Pohl to researcher. Dr Pohl subsequently had the opportunity to spend three months doing research in the Eicosanoid Research Group of Prof. Santosh Nigam in Berlin, Germany. Dr Pohl was also appointed as Lecturer to fill the vacancy arising from the resignation of Dr Evodia Setati in 2006, who accepted a position at the University of KwaZulu-Natal. Also in 2006, Dr Koos Albertyn was promoted to associate professor and Prof. Bragg's entertaining inaugural lecture was on the control of infectious avian diseases. The year 2006 started on a sombre note, however, when Ms Wilma Ras, who worked in the department's financial administration section, passed away.

During 2005 the following staff members were appointed to national and international boards/panels: Prof. Kock as member of the Assessment Panel for Microbiology and Plant Pathology of the NRF, Prof. Viljoen to the editorial board of the journal *Food Microbiology*, and Prof. Du Preez as an associate editor of the *World Journal of Microbiology and Biotechnology*. In 2006 two academics improved their NRF research rating, namely Dr Celia Hugo to a C2 and Prof. Du Preez to a B2 rating. The department has a total of 12 NRF-rated researchers, including four B-rated scientists.

### Research Groups

The department comprises three divisions, namely Microbiology and Biochemistry, Food Science and Consumer Science. Within these divisions there are various research groups. Although the overall research theme of the department is the broad field of microbial, biochemical and food biotechnology, the heterogeneous departmental composition causes some activities to fall outside this field.

In the **Food Science division**, Prof. Garry Osthoff and his team investigated the biochemical contribution of yeasts in cheese ripening



## “Progress was made towards the development of a DNA vaccine for the control of the Beak and Feather Disease virus.”



in 2005. They found that accelerated cheese ripening by yeast inoculation was due to adapted proteolysis, which in turn pointed towards plasminogen activation and glutamate dehydrogenase activity. A couple of yeasts associated with dairy products have so far been identified to contain one or both of these enzyme activities. They also researched the milk of Africa's wild animals and found that higher levels of oligosaccharides are present in the milk of antelopes, with extremely high levels in elephant milk. The fatty acid profile of the milk of lion and elephant showed extreme levels of some types. The African buffalo, in turn, contains more casein relative to whey proteins. In 2006 they continued this line of investigation, describing the chemical composition of the milk of two more African wild cat species, namely the cheetah and the serval. Although similarities between lion and cat milk were observed, unique compositions were found regarding fatty acids and saccharides. Prof. Osthoff foresees that when these milks are better understood, they could serve as guidelines according to which the milk of the domesticated species could be improved by genetic means. Dr Arno Hugo and Mrs Carina Bothma collected data on the effect of dietary inclusion of conjugated linoleic acid on chemical and sensory quality of pork.

Prof. Osthoff and Dr De Wit embarked on research of the food qualities of the cactus pear. South Africa is the only country in the world that still possesses plants that originated from Burbank, USA. Although food and fodder qualities of a few of the 42 cultivars are known, detailed food quality data on most of the cultivars are lacking.

The sensory qualities of foodstuffs is an important aspect of the above research projects and, with a grant from the PA and Alice Malan trust fund, the sensory laboratory was upgraded to fulfil this function. Dr Koos Myburgh and Mr Piet Botes (head of the departmental analytical laboratory)

worked on the detection of milk adulteration in collaboration with the Dairy Standards Agency. The department's analytical techniques for this purpose have been accredited by the national Department of Agriculture.

Prof. Hester Steyn and her postgraduate students in the **Consumer Science division** initiated research in 2005 on the development of *Agave americana* fibres and the wild silk from *Gonometa postica*, both available in Southern Africa. The aim of these projects is to develop exotic natural fibre products and to create job opportunities for people in rural areas. This division has also become involved in the Lengau community development project of the faculty.

Under the leadership of Prof. Viljoen and aided by postdoctoral students Drs Analie Hattingh and Henry Gadaga, the **Food Biotechnology research group** continued to progress in the field of food microbiology with specialisation in dairy products and yeasts. One of the Ph.D. projects completed in 2006 by Mr Ameha Kebede from Ethiopia on indigenous fermented products paved the way for a totally new scientific focus area. Based on these results, the group has already successfully applied for a multilateral network project from the Norwegian Council of Universities Committee for Development, Research and Education (NUFU) including Norway and Zambia as co-workers and a grant totalling more than R6 million was awarded. The group was further successful in obtaining a grant from the PA and Alice Malan trust fund on the same topic.

Infectious coryza, a serious poultry disease in many countries around the world caused by *Avibacterium paragallinarum*, remains the major focus of the research activities of Prof. Rob Bragg and his **Veterinary Biotechnology research group**. The possibilities of developing a molecular serotyping scheme for the bacterium in the form of the ERIC PCR system, which has proven useful for other species of bacteria, were also investigated. Unfortunately, no correlation between the ERIC PCR method and the conventional serotyping system was found. Prof. Bragg was invited to Israel to assist the veterinary authorities of that country with the control of infectious coryza. This trip resulted in the interesting finding that the viral strain causing the problems in Israel was the same strain that has been causing substantial problems in South Africa. Prior to this it was thought that the strain was limited to Southern Africa. The UFS research group has also been involved in a large project with Onderstepoort Biological Products on the improvement of their infectious coryza vaccine. It is hoped that this vaccine will be launched in South Africa during 2007.

The research project on the oncolytic effects of Newcastle disease virus was completed in 2006, which revealed that there were substantially more receptors for the ND virus on cancer cells compared to normal cells, indicating that the ND virus had potential as a possible treatment of cancer. A novel technique for the rapid detection of virulent viruses, which would be particularly useful for laboratories in developing countries, was established. Prof. Bragg and his group also made progress towards the development of a DNA vaccine for the control of the Beak and Feather Disease virus. It is hoped that the first animal experiments will start in 2007. Some time was spent developing various serological techniques required to evaluate the vaccine. This involved the development and testing of ELISA systems using expressed coat protein and whole virus. The objective was to establish whether the expressed coat protein could be used in future serological techniques. Another project on parrot diseases is the isolation and characterisation of an Adenovirus from parrots. The virus has been successfully isolated and molecularly characterised. It is hoped that a vaccine will be established and tested during 2007. A new project on the investigation of the diversity of *Mycoplasma galliseptium* in poultry has already established that a substantial diversity exists in the South African strain.

In the **Fermentation Biotechnology research group** led by Prof. Du Preez, one of the Ph.D. projects completed in 2005 was on the production of leukotoxin (LKT) by the animal pathogen *Mannheimia haemolytica*, the principal causative agent of shipping fever pneumonia in cattle. A vaccine based on the toxoid of LKT provides protection against this disease, but the current procedures for the commercial production of LKT yields only very low levels of the LKT protein. This bacterium is difficult to cultivate due to its nutritionally fastidious nature. Through a systematic investigation of its growth characteristics and nutritional requirements by using mainly continuous cultures, a culture medium and cultivation protocol was developed that facilitated an LKT concentration 45 times greater than that obtained in the standard culture medium. A provisional patent has been registered. Another Ph.D. project, in collaboration with SAPP, was completed on xylanase production by fungal strains for potential application in the pulp and paper industry, using spent sulphite liquor (SSL) as carbon feedstock. Fungal strains were selected and cultivation conditions determined for xylanase production. It was demonstrated that the application of crude preparations of this enzyme obtained from the submerged cultivation of certain *Aspergillus* strains reduced the usage of chlorine dioxide in the bleaching stage of pulp manufacture up to 30% without compromising pulp brightness. Furthermore, the utilisation of industrial waste waters such as SSL to produce xylanases for on-site use at the paper mills would contribute to the development of effluent-free technology and would impact positively on the environment.

Research on the production of health-promoting oligosaccharides, known as prebiotics, also continued in the group under the leadership of Prof. Stephanus Kilian. It was shown that a number of yeasts produced oligosaccharides at high levels, warranting further investigation into the potential prebiotic effect of these compounds. Significant differences between the intestinal microbiota of layer hens and broilers regarding the composition of health-promoting bacteria were found. In addition, a number of yeasts that can use the prebiotic neokestose were identified as potential probiotics for use in synbiotic preparations.

In 2006 Prof. Du Preez together with Dr Pohl and Mr Botes initiated a research project on the fermentation of Agave juice extract in collaboration with Agave Distillers (Pty) Ltd., the only company in the world outside Mexico that produces Agave spirit (known in Mexico as tequila). This project is aimed at improving the efficiency of the process. In a collaborative effort between Prof. Albertyn



Ms Nandi Mfenyana, a post-graduate student at the department, investigating dead chickens embryos infected with a parrot adenovirus.

(**Molecular Biology research group**, see below) and Prof. Du Preez, the regulation and physiological role of the alcohol dehydrogenase (ADH) isozymes in *Saccharomyces cerevisiae* (baker's or wine yeast) were investigated, using aerobic glucose-limited continuous cultures and batch cultures of multiple *adh* deletion mutants of *S. cerevisiae*.

An Innovation Fund project in collaboration with CSIR Biosciences and members of the department, with most of the research conducted in the **Molecular Biology research group** under the leadership of Prof. Albertyn, resulted in the sale of the intellectual property rights generated by this project by the UFS in 2005 to a start-up biotechnology company for an amount of R14 million. This research, initiated in this department some years ago by Prof. Smit, entailed the development of a generic platform for the heterologous expression of specific hydrolase enzymes in a yeast host and was made possible due to a longstanding collaboration with Dr. J-M. Nicaud of INRA, France.

In 2006 one of the research projects completed in the **Molecular Biology research group** under the supervision of Prof. Albertyn, in collaboration with Prof. Smit of the **Biocatalysis research group**, resulted in the successful expression of epoxide hydrolases from different hosts, including yeasts, plants, humans and insects in the yeast *Yarrowia lipolytica*. A study on the development of a transformation system for the bacterium *Avibacterium paragallinarum*, undertaken in collaboration with Prof. Bragg of the **Veterinary Biotechnology research group**, was the first step in the development of a live vaccine against this important poultry pathogen. Under the supervision of Prof. Albertyn, Ph.D. student Ms Olga de Smidt succeeded in the difficult task of constructing multiple alcohol dehydrogenase (*adh*) deletion mutants of *Saccharomyces cerevisiae*. This paved the way for further physiological studies, in collaboration

“Equipment for monitoring evolved gasses, seismic activity and microbial biodiversity was installed in a laboratory almost 3.6 km below the surface.”

with Prof. Du Preez of the **Fermentation Biotechnology research group**, on the regulation and function of the ADH isozymes in *S. cerevisiae*.

Twelve years of research on the hydroxylation of hydrocarbon molecules by cytochrome P450 monooxygenases and over-expression of cytochrome P450 monooxygenase systems in the alkane degrading yeast *Yarrowia lipolytica* by Prof. Smit and Albertyn from the **Biocatalysis and Molecular Biology research groups**, respectively, led to an invitation to join c\*change, the Department of Science and Technology's - NRF Centre of Excellence in Catalysis based at the University of Cape Town. Being a collaborator in c\*change brings new opportunities for focused research in an interdisciplinary and multi-institutional environment. Funding from c\*change and the UFS made the acquisition of a multi-bioreactor system valued at R412 000 possible. Dr Syed Kajamohidden from India joined this group in 2006 in a post-doctoral position funded by c\*change to investigate monooxygenases for alkane activation.

In the **Lipid Biotechnology group**, two Ph.D. students and one M.Sc. student obtained their degrees in 2005 with Prof. Kock as the main supervisor. These projects concerned yeast taxonomy as well as investigations concerning nanotechnology and antifungal agents. These were highlighted by the NRF in the April 2005 issue of *News@nrf*. In addition, Ms Strauss completed her Ph.D., discovering that oxylipins played an important role in yeast flocculation – an important phe-

nomenon in the brewing industry. She also researched some of her findings at the headquarters of SAB under the supervision of Dr Lodolo. Thirteen articles were published or accepted for publication since the start of these studies. A photograph from this research was selected for the cover page of all issues in 2006 of one of the top international yeast journals, *FEMS Yeast Research* as well as the November issue of the *Canadian Journal of Microbiology*. Research highlights of this research group since 1982 in collaboration with the Centre for Confocal and Electron Microscopy were published in the November 2005 issue of *Bult*, a publication of the UFS targeted at alumni.

Prof. Litthauer and Drs Van Heerden and Piater lead the **Extreme Biochemistry research group** where the main research focus areas are extreme metagenomics and environmental sustainability. The South African deep mines are a fascinating source of genetic material and microbial isolates. Since 2001 the group has been the South African base from which the Life in Extreme Environments (LEEN) project, funded by NASA and the National Science Foundation, USA is being run. As a result, the first ever process of rigging an underground laboratory at a depth of almost 3,6 km below the surface (in one of the world's deepest mines!) was instigated during 2005 in an endeavour to do long-term monitoring of microbial diversity in holes drilled into active fault zones. This Natural Earthquake Laboratory in South African Mines (NELSAM) underground laboratory, which is a collaborative effort between scientists from the USA, Germany, Japan and South Africa, is nearing completion with the installation of equipment for monitoring evolved gasses, seismic activity and the microbial biodiversity in the ultra deep environment. Undoubtedly, this must certainly be the deepest biochemistry laboratory in the world! As important, though, will be the monitoring of functional gene expression by real-time PCR, for which purpose a real-time cyclor was purchased during 2005, and hopefully later also by DNA microarray.

Dr Van Heerden collaborates closely with the UFS Institute for Groundwater Studies and the first attempt at establishing a biological barrier using bacteria from the environment to redirect groundwater flow was successful. They were also instrumental in solving the Delmas contaminated water crisis with the Free State Department of Water Affairs and Forestry, by identifying the origin of the contamination using state-of-the-art molecular biology techniques.

The statistical methodology that was previously developed in the **Epigenomics re-**

**search group** of Prof. Patterson and incorporated into open source software, was used for the analysis of the expression of stress-related genes in *Saccharomyces cerevisiae*. An analysis of the genomic positions of these genes revealed that co-regulated and stress-related genes were often situated in close proximity on chromosomes. This physical clustering probably allowed for a degree of co-evolution, but, more importantly, was likely due to transcriptionally competent neighbourhoods in chromatin. These findings were published in *BMC Evolutionary Biology* (Impact Factor 4.5) in 2006.

#### Academic staff

**Professors:** Prof. James du Preez, Rob Bragg, Stephanus Kilian, Lodewyk Kock, Derek Litthauer, Martie Smit, Bennie Viljoen

**Professors Extraordinary:** Prof. Edgar DaSilva, Santosh Nigam

**Associate Professors:** Prof. Garry Osthoff, Hugh Patterson, Hester Steyn, Koos Albertyn

**Affiliate Associate Professor:** Prof. Mary DeFlaun

**Senior Lecturers:** Drs Arno Hugo, Celia Hugo, Koos Myburgh, Esta van Heerden, André van Tonder

**Affiliate Senior Lecturers:** Drs Chris du Plessis, Colin Kenyon, Bettie Lodolo

**Lecturers:** Drs Maryna de Wit, Bethuel Nthangeni, Lizelle Piater, Evodia Setati, Carlien Pohl, Ms Carina Bothma

**Junior Lecturers:** Mss Sonia van Zyl, Petro Swart

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# Research outputs

## Publications

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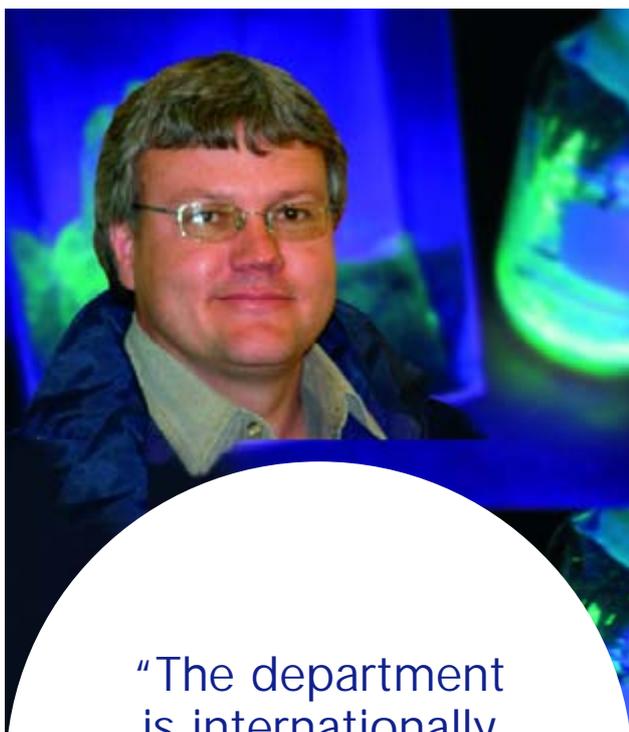
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Department of

# Physics



“The department is internationally recognised.”

Prof. Hendrik Swart.

## Overview

The Department of Physics strives for quality teaching in Physics, comparable to international standards.

During 2005/06 the department was in the enviable position of having a number of highlights in terms of academic excellence as well as in terms of direct contributions to the benefit of the Faculty of Natural and Agricultural Sciences and the community. The sustainability of the department's initiatives also received a boost as a result of outside funding and the consolidation of overseas research collaboration as well as contact with industry. The incorporation of the Qwaqwa Campus was also furthered by the appointment of new staff.

The department maintains a high rate of research outputs. In 2005, 17 articles in accredited scientific journals were published and more than 25 contributions to national and international congresses were made. In 2006 altogether 22 articles were published in accredited scientific journals and 30 contributions to national and international congresses were made.

Students from the department walked away with several prizes during the 2005/06 annual conference of the South African Institute of Physics (SAIP). During the conference held in 2005 the winners were: Messrs Heinrich Joubert (best publication in Solid State Physics and/or Materials Science resulting from an M.Sc. degree, and best Ph.D. poster in Condensed Matter Physics and Materials Science), Piet Maphoto (best M.Sc. poster in Applied and Industrial Physics), Mr Richard Harris (best M.Sc. poster in Condensed Matter Physics and Materials Science) and Ms Elmé Breedt (best M.Sc. lecture in Astrophysics).

In 2006 the winners were: Messrs Martin Ntwaeaborwa (best Ph.D. lecture), Heinrich Joubert (best Ph.D. publication), Richard Harris (best M.Sc. lecture), Brian van Soelen, (best M.Sc. poster in Astrophysics) and Ms Lisa Coetsee (best M.Sc. poster).

Proff. Hendrik Swart, Departmental Chairperson, and Koos Terblans were respectively elected as vice-chairperson and secretary of the

“The department is internationally recognised for its expertise in phosphor luminescence and accretion-driven outbursts in the universe.”

Condensed Matter Physics and Material Science Specialist Group of SAIP.

The International Union of Pure and Applied Physics (IUPAP) declared 2005 as the World Year of Physics. In recognition of this declaration, the great contribution of Physics to the development of technology and its importance in our everyday lives featured strongly during the National Science Week in 2005.

The project for this part of the country reached thousands of learners and members of the public through exhibitions, public lectures, radio interviews, and educational programmes at the National Museum, in Bloemfontein the Research Institute of Education Planning (RIEP) at the UFS and the Boyden Observatory. A special exhibit on the work and life of Albert Einstein featured during the university's open days and was followed by a science awareness day at the Boyden Observatory in collaboration with the Amateur Astronomy Society of Bloemfontein. “Albert Einstein” also visited the Main Campus in Bloemfontein and presented several shows on the life of Einstein.

Fundamental contributions were made in research, one of which was in the field of phosphor-luminescence. In 2006 the department became involved in a collaboration agreement with the Council for Scientific and Industrial Research (CSIR) to provide a solution for the illumination of streets and roads in townships. The project is based on the use of sunlight to activate nanomaterial in for example cement and paint. At night the cement or paint radiates the light. Nano phosphors are luminescent powders that consist of particles a millionth of a millimeter in size. These particles provide light as soon as they are illuminated by for instance sunlight. The amount of time that light can be provided by these particles is determined by the impurities in the material. This research is being done in co-



An amount of R3,9 million was made available by the Council for Scientific and Industrial Research in 2006 for the further development of a project in which sunlight can activate nano material during the day in materials such as cement and paint. At night the cement or paint can radiate light in public areas or private homes. Here is Prof. Hendrik Swart, Departmental Chairperson, with a piece of nano phosphor. **Photo: Volksblad**

operation with the University of Zululand. The project has also received extensive coverage in the media.

Active participation in an international planet search project at the Boyden Observatory was rewarded by the detection

of the first "earth-like" exoplanet. This detection also received good coverage in the media and resulted in a publication in the highly acclaimed scientific journal *Nature*.

Another highlight was that Mr Martin Ntwaeaborwa obtained a Ph.D. in Physics in 2006. He showed that energy is transferred in oxide-based micro scale and nanoscale phosphors doped with rare-earth elements.

Proff. Swart, Terblans and Dr Ntwaeaborwa attended the 53rd International Symposium of the American Vacuum Society (AVS) in San Francisco, United States of America (USA) in November 2006. Proff. Swart and Wiets Roos also attended the *Asian Pacific Conference on Surface Science and Engineering* in Hong Kong in December 2006. After a long period of absence from the annual conference of the Microscopy Society of Southern Africa, Dr Ted Kroon and Mr Shaun Cronjé attended the 45th conference in Port Elizabeth. Dr Matie Hoffman attended the *Theoretical and Experimental Foundations of Recent Quantum Technologies Conference* in Durban.

Research in the department is done by two groups, namely the Solid State and the Astrophysics groups:

### Solid State Research Group

Teamwork has been the strong driving force for the research done by this group, led by Prof. Swart, a B-rated National Research Foundation (NRF) researcher.

Although the main objective of solid state research is fundamental in nature, the present collaboration with industries such as the National Metrological Laboratory (NML), CSIR, MINTEK, the Armaments Corporation of South Africa (ARMSCOR), Delta batteries and Mittal Steel SA (formerly known as Iscor), in 2005/06 is substantial.

Other developments during 2005/06 included:

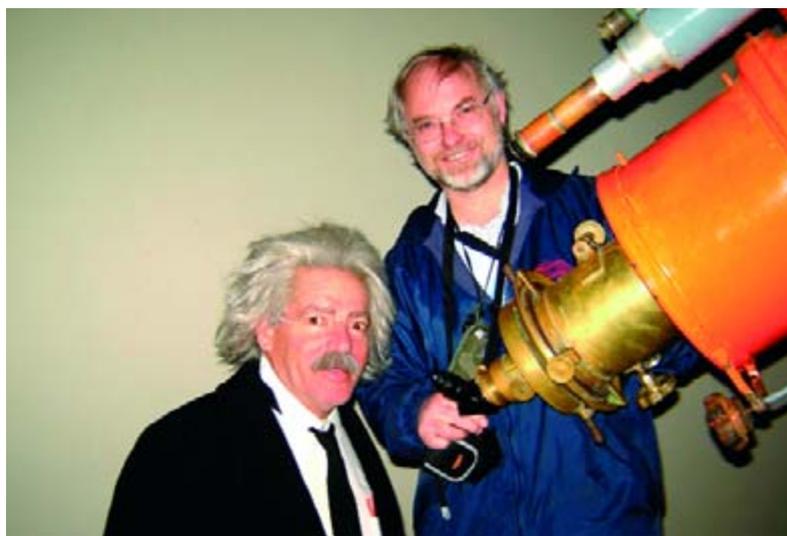
- Group members employed surface-sensitive techniques to solve problems in the fields of corrosion of steel and degradation of phosphors used in field emission displays. The phosphor research was expanded to include luminescent nanoparticles.
- Research capabilities of staff members as well as the development of quality postgraduate students were also improved. The main goal of the research, to deliver well-trained students, was achieved throughout.
- The department continued upgrading its apparatus and equipment. New units were developed to be internationally competitive in the field of segregation studies, both in theoretical modelling as well as in experimentally modelling. The accurate control of sample temperature during Auger electron spectroscopy measurements was obtained using a pulsed heater current. In 2005 a new Atomic Force Microscope and a Fluorescence Spectrophotometer were bought with money obtained by the faculty for new research equipment. An X-ray photo electron spectroscope was donated by the NML to the group. Two of the surface characterisation laboratories were named after Proff. Pieter Viljoen and Gerrit van Wyk, former heads of the department and great leaders of the solid state group.
- Characterisation of the microstructure and extended defects of shaped charge liners was started in 2005. The new spectrophotometer will be used to study the degradation of phosphors in industrial applications. A new initiative from Mr Ntwaeaborwa in which nano phosphors are grown locally, was successfully incorporated in the same year. The group proved again, experimentally, that the internationally well-accepted electron-stimulated surface reaction model by Swart and Holloway is also valid for the degradation of other phosphor materials.



Students from the department won five prizes during the 51st annual conference of the South African Institute of Physics, presented in 2006 at the University of the Western Cape. The award winners were, from the left, back: Messrs Martin Ntwaeaborwa, best Ph.D. lecture, Heinrich Joubert, best Ph.D. publication, Ms Lisa Coetsee, best M.Sc. poster, Messrs Richard Harris best M.Sc. lecture, and Brian van Soelen, best M. Sc. poster in Astrophysics; front: study leaders Proff. Pieter Meintjes, Koos Terblans and Hendrik Swart, Departmental Chairperson. Proff. Swart and Terblans were also elected as vice-chairperson and secretary of the Condensed Matter Physics and Material Science of the institute.



In 2005 the UFS became the first university in South Africa to award a masters degree in Physics to students who have completed the National Astrophysics and Space Science Programme. Here are, from the left: Prof. Peter Dunsby, University of Cape Town, Ms Elmé Breedt, student from Pretoria, Mr Edward Jurua, student from Uganda, and Prof. Pieter Meintjes, leader of the Astrophysics Research Group at the department.



During "Albert Einstein's" visit to the UFS, Dr Matie Hoffman, Senior Lecturer at the Department of Physics, showed him the Boyden Observatory.



In 2005 Mr Martin Ntwaeaborwa and Prof. Terblans joined the group of Prof. Paul Holloway at University of Florida, USA for their sabbatical leave. Mr Ntwaeaborwa also visited the University of Pennsylvania, USA for three months at the end of that year. A total of eight M.Sc. and eight Ph.D. students were involved in the research effort.

In addition, the group also helped Delta EMD to slow down severe localised wear in a calciner retort at the company's Black Rock plant. Millions of rands will be saved through this effort.

The international scientific community is starting to acknowledge the group for its work on segregation and degradation models. This is proven by the large number of citations the group has received over the past couple of years.

### **Astrophysics Research Group**

The group focused mainly on magneto hydro dynamic instabilities and turbulence in accretion-driven systems.

The group is led by Prof. Pieter Meintjes, C2-rated NRF researcher, and supported by Dr Hoffman, who leads the scientific educational outreach programme of the Boyden Observatory.

To complement these studies, the UFS astrophysics research group participated in high profile international planet search and gamma-ray burst follow-up programmes in 2005/06. The Boyden 1,5 m telescope played an integral role in these programmes.

For the astrophysics research group, 2005 was a year of several highlights. From a very small beginning a few years ago, the astrophysics research and educational programme has grown to where it plays a fundamental role in the graduate, educational and research programmes of the department. In 2005 three new honours students enrolled, while three M.Sc. students (Messrs Edward Jurua and Hannes Calitz and Ms Elmé Breedt) graduated in the astrophysics programme.

The growing reputation of the UFS astrophysics group has resulted in two of the three M.Sc. graduates joining the group from the National Astrophysics and Space Science Programme (NASSP), hosted by the University of Cape Town (UCT) in 2005. Prof. Meintjes was also a guest lecturer of the NASSP programme in the field of astrophysical fluid dynamics. He presented two research colloquiums, one at UCT and another at the University of the Western Cape. During 2005 one new Ph.D. student,



Standing at the Watcher robotic telescope are, from the left: Mr Victor Litera, electronic technician from the University College of Dublin in Ireland, and Dr Matie Hoffman, Senior Lecturer from the department.

“In terms of research the astrophysics group participated in an observation campaign resulting in the first planet detected with the micro lens technique in 2005.”

Mr Francois Squirra from the North-West University (Potchefstroom Campus), joined the astrophysics group. In 2006, three Ph.D. and four M.Sc. students continued their graduate studies in the astrophysics programme under Prof. Meintjes’s supervision.

In terms of research the astrophysics group participated in an observation campaign resulting in the first planet detected with the micro lens technique in 2005. This detection resulted in a *Nature* publication with three UFS researchers among the list of international authors. To complement this, three other research publications appeared, one in the proceedings of an international conference and two in high profile international journals.

The fundamental role of the UFS-Boyden astrophysics programme and the strategic positioning of the observatory for the department’s international campaigns, resulted in the group receiving a R150 000 grant from the UFS in 2005 to purchase a brand new Apogee back-illuminated CCD camera (R120 000 + import) for participation in these international campaigns.

This is an extremely valuable addition to the research infrastructure of the UFS astrophysics programme. The camera has a quantum efficiency of 80% in the wave-band between the red and blue, which will result in a significant improvement in the data

quality, as well as enabling the detection of much fainter stars than currently achievable. This will significantly strengthen the position of the group in the international arena.

The growing research activity of the astrophysics research programme also resulted in the programme receiving healthy NRF funding amounting to R540 000 for the period 2005-2008. An additional R120 000 per year for the past few years was also received from the programme’s USA collaborators aimed at funding an observer for joint international observation campaigns.

The strategic positioning of the UFS-Boyden site also resulted in the University College of Dublin in Ireland renting one of the buildings since 2005 to host a very sophisticated 16-inch research class telescope. The telescope will be used mainly for gamma-ray burst follow-up observations (gamma-ray bursts are cataclysmic explosions in space releasing enormous amounts of energy through the emission of high energy photons, namely gamma-rays) and the search for exoplanets (planets associated with stars outside the Solar system). This resulted in an additional income of approximately R74 000 per year used for the upgrading of the site, as well as for funding the internet link to the UFS Main Campus.



Five master’s degrees in Physics were awarded in 2006. This is the biggest group of master’s degrees in the history of the department awarded during a graduation ceremony. From the left, are: Mr Richard Harris, Ms Puleng Ramoshebi, Prof. Hendrik Swart, Departmental Chairperson, Ms Lisa Coetsee and Mr Etienne Wurth. One of the students, Mr Gerhard Olivier, was absent when the photo was taken.

## Academic staff

### Main Campus

**Professor:** Prof. Hendrik Swart

**Associate Professor:** Proff. Koos Terblans, Pieter Meintjes, Wiets Roos  
**Senior Lecturers:** Drs Matie Hoffman, Ted Kroon

**Lecturers:** Mr Martin Ntwaeaborwa

### Qwaqwa Campus

**Senior Lecturers:** Dr Francis Dejene

**Lecturers:** Messrs Piet Mapotho, Justice Msomi, Jappie Dolo, Moses Mothudi, Richard Ocaya

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# Research outputs

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# Zoology and Entomology



“We prepare our students for a career in adventure...”

Prof. Jo van As.

## Overview

The Department of Zoology and Entomology is organised into six research groups each with its own objectives and specific study area. There is also a satellite department on the Qwaqwa Campus.

The groups collectively 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.

### Aquatic Parasitology

In 2005 the group consisted of Proff. Jo van As and Linda Basson, Dr Liesl van As, Mss Candice Jansen Van Rensburg, Elindi Jansen Van Rensburg, Hafeleni Matete and Zerene Lotter, as well as Messrs Josephus Fourie and Clyde Lamberts. In 2006 Ms Deidré West joined the group and Ms Lotter and Mr Fourie left the group.

During the autumn recesses of 2005/06 the group took the third-year Zoology students on the annual excursion to the Potberg Environmental Centre in the De Hoop Nature Reserve in the Western Cape. Staff and students from the Zoology and Botany divisions on the Qwaqwa Campus have been taking part in this excursion since 2005.

In 2005 Prof. and Dr Van As, together with postgraduate students, attended the opening of the Krokovango Crocodile Farm in the Okavango Panhandle in Botswana. The Leseding Research Project of the Aquatic Parasitology group was announced during this visit. The emphasis of this project is on the fish parasite biodiversity of the Okavango Delta.

Construction at the Leseding Research Camp started in December 2004 and was completed in June 2005. Several field trips were undertaken during 2005/06 by the group to the research camp:

- In June 2005 colleagues and students from the University of Johannesburg's Department of Zoology as well as staff and students from the Department of Biology of the University of



“The emphasis of the Leseding Research Project is on the fish parasite biodiversity of the Okavango Delta.”

Limpopo joined the UFS staff and postgraduate students to conduct surveys for various fish parasite projects.

- From September to October 2005 a trip which focused on surveys about the annual catfish run was undertaken to sample information not only on fish activities and parasites, but also on the variety of birds found to be associated with the run. This annual phenomenon was also filmed by Homebrew for *KykNet* and broadcast on *Groen* in 2006.
- In 2006 Prof. and Dr Van As, together with undergraduate and postgraduate students, visited the research camp during the June/July recess and again in September and December for research on fish parasites.

In 2005 Ms Melanie Andrews, with a dissertation entitled: *A review of the Family Ergasilidae (Copepoda: Poecilostomatoida) of Africa*, received her M.Sc. degree. The Junior Neitz medal was awarded to her during the year for the best M.Sc. in Parasitology at a South African university.

Ms Candice Jansen van Rensburg attended the 34th congress of the Parasitological Society of Southern Africa at Magoebaskloof, hosted by the Department of Zoology of the University of Limpopo.

Prof. Basson, Dr Candice and Ms Elindi Jansen van Rensburg attended the 44th Microscopy Society of Southern Africa's annual conference in Pietermaritzburg, hosted by the University of KwaZulu-Natal.

In 2006 Dr Candice Jansen van Rensburg received her Ph.D. in Zoology. Her thesis: *Digenetic trematodes of freshwater fishes from the Okavango River and Delta, Botswana*, is to date the most comprehensive contribution on the biodiversity of African fish parasitic flatworms. These parasitic worms all have complicated lifecycles which include stages

occurring in snails, fishes and fish-eating birds. In her thesis she describes 18 different lifecycles which include ten new species.

Prof. Basson attended the congress of the Parasitology Association of Southern Africa (PARSA) in Windhoek, while the congress of the Microscopic Association of Southern Africa, held in Port Elizabeth, was attended by Prof. Van As, Drs Van As, Candice Jansen van Rensburg and Ms Robin Lyle.

### Arachnology

The group consisted of Mr Charles Haddad and Ms Lyle.

In January 2005 Mr Haddad hosted the 8th African Arachnid Colloquium in conjunction with the National Museum in Bloemfontein. Apart from all the local spider enthusiasts, the following guests from abroad also attended the colloquium: Dr Rudy Jocqué (Royal Museum for Central Africa in Tervuren, Belgium), Mr Dirk Kunz (Senckenberg Museum in Frankfurt, Germany), Messrs Milan Rezac and Franticek Stahlavsky (Charles University in Prague, Czech Republic) and Ms Meg Cumming (from Harare in Zimbabwe).

In 2005/06 field work was done at among others the Ndumo Game Reserve in KwaZulu-Natal and the Erfenis Dam Nature Reserve in the Free State Province as part of long-term projects. Mr Haddad also joined two Slovenian researchers, Drs Matjaz Kuntner and Gregorz Atljancic, for three weeks of field work in KwaZulu-Natal during April 2006, which involved studying the biology of golden orb-web spiders (Nephilidae) and their relatives. Various conservation areas were visited, including Ndumo Game Reserve, Tembe Elephant Park, Kosi Bay Nature Reserve, Sodwana Bay National Park, Hluhluwe-Umfolozzi Nature Reserve and the Greater St Lucia Wetlands Park. As part of studies funded by the National Research Fund (NRF) for Corinnidae spiders, field work was conducted for a week along the Wild Coast in the Eastern Cape, and in Botswana, Namibia and Zambia for a three-week period.

In 2005 Ms Lyle received her B.Sc. Honours and has enrolled for her master's, focusing on the systematics of the sac spider subfamily Trachelina. Apart from attending the 8th African Arachnid Colloquium in Bloemfontein in January 2005, the Arachnologists also attended the 31st Congress of the South African Association of Botanists in Bloemfontein in January 2005 and the 15th Congress of the Entomological Society of Southern Africa in Grahamstown in July 2005.

Ms Lyle attended the annual congress of the Microscopy Society of Southern Africa

during December 2006 and presented a paper on the systematics of the genus *Austrachelas*.

### Pesticide Resistance Testing Facility

In 2005 the group consisted of Mss Ellie Van Dalen (permanent staff member), Sharon Terry, Deidré West and Mr Adri Jordaan. In 2006 Ms Christa du Rand joined the group as a permanent staff member.

The collaborators are Prof. Leon Fourie from Clinvet International for circulation of tick reference strains, Dr Barry Hymann from Novartis as contact with farmers in problem areas and Prof. Ivan Horak, of the Department of Veterinary Tropical Diseases at Onderstepoort, University of Pretoria.

The brand new state-of-the-art molecular biology facility used by this group was completed in 2005. In 2006 the facility was fully operational and used for determining tick resistance to chemical control by employing conventional resistance testing.

A project commissioned by Bater for the detection of tick resistance to chemical control in the area previously known as the Transkei in the Eastern Cape, was completed in collaboration with Clinvet International and Prof. Horak. Three different tick species were collected from cattle at 50 different dip tanks and tested against three Acaricides by means of two tick resistance-testing techniques. Contract research in collaboration with Pfizer Animal Health for the registration of a tick control chemical for use in Kenya, was also conducted.

In 2006 a contract for resistance testing over a three-year period was negotiated with Bayer Animal Health (Pty) Ltd. The contract will commence in 2007. Much has also been done to promote the services of the facility to potential clients. This included a promotional presentation at the annual meeting of the Health Professions Council of South Africa (HPCSA), a television insert on *AgriTV* and an article in the *Farmers Weekly*. A web site called [www.ticks.co.za](http://www.ticks.co.za), describing the services of the facility, was also developed and launched.

The purchase of equipment for use in the investigation and developing of molecular techniques for the determination of tick resistance is nearly completed. The outstanding equipment will be acquired early in 2007 to ensure a more accurate determination of the development of resistance.

### Etho Ecology

In 2005 the group consisted of Prof. Ordino Kok, Messrs Hennie Butler, Johan van Niekerk and Pieter le Roux, Mss Elisma Theron and Lindi Heyns. Ms Theron left the group in 2006 and Mss Elylia Erasmus, Hanlie Groenewald and Hanri Grünewald joined the group.

In 2005/06 group members undertook an honours excursion to the Willem Pretorius Nature Reserve. An article on cattle egrets published by this team was nominated as the best contribution in the *South African Journal of Natural Science and Technology* for 2004.

The group continued in 2005/06 with research on an uranium project, in collaboration with the UFS Department of Geology. In 2006 specific attention was given to the uses of frogs as biological indicators of unrehabilitated mines were investigated. Attention was also given to the influence of such mines on the small mammal population.

Other research during 2005/06 included the general biology and ecology of larks in Central Free State and the general biology of the rock dove in the Bloemfontein area.

In 2006 attention was also given to the feeding behaviour of giraffes in the Central Free State. Research on larger animals included the comparative behaviour and ecology of the red hartebeest and the black wildebeest. A study of the etho-ecology of the blesbok and the bontebok with special reference to hybridisation was undertaken in



Dr Liesl van As and students busy preparing the laboratory for field work.



The "office" at the Leseding Research Camp is a tree house where one can escape from the heat. Here is Prof. Jo van As, Departmental Chairperson, at work.



During a visit to the Leseding Research Camp in 2006 are, from the left, front: Dr Ursula Viljoen, wife of Prof. Niel Viljoen, Chief Director: Operations at the UFS, and Prof. Viljoen; back: Proff. Frederick Fourie, Rector and Vice-Chancellor of the UFS, Jo van As and Ms Annamaria Fourie, wife of Prof. Fourie.

collaboration with the genetics division of the Department of Plant Sciences at the UFS.

Prof. Kok was invited in 2006 as a guest speaker to an international congress at St. Louis in Missouri, United States of America (USA) on the danger of birds at domestic airports.

### Medical, Veterinary and Forensic Entomology

In 2005 the group consisted of Prof. Theuns van der Linde, Mss Sonja Brink and Janine Kelly, Messrs Kobus Kolver and Goddie Prinsloo (Ph.D. students), and Mss Tembisa Majola and Sonnika Otto (M.Sc. students). In 2006 Messrs Julian Liebenberg and Shaun

Hoffman, and Ms Annerie Botha (honours students) joined the group.

Although Prof. Van der Linde was kept busy supervising his students in 2005, he found time to do several crime investigations with the South African Police Services (SAPS) and wrote reports, presented training courses for the SAPS and informal lectures to various interested groups such as The Rotary Club and *Die Voortrekkers*. He also attended the 15th Entomological Congress in Grahamstown during July 2005, took part in a live radio interview on *Radio 702* about Forensic Entomology, wrote an article for *Beeld* on forensic entomology following the Lee Matthews case, acted as external examiner for an M.Sc. thesis from the National University of Lesotho and acted as referee of manuscripts from *African Entomology*.

During 2006 significantly more students registered for the Entomology 300 course. Twelve students registered for the various Entomology modules while in 2005, only three students were enrolled. Three honours students completed their research projects (year projects). Mr Liebenberg studied aspects of the bio-ecology of biting midges (*Culicoides spp.*), Mr Hoffman did a forensic entomology project and Ms Botha studied the morphology of biting lice (*Damalinia limbata*) on Angora goats with the aid of the scanning electron microscope. Doctoral degrees were awarded to Mr Prinsloo and Ms Kelly during the September graduation ceremony.

One publication in an accredited scientific journal was published by this group during 2006. Prof. Van der Linde also acted as reviewer of manuscripts from *African Entomology* and *Kudu*.

Various criminal investigations were undertaken during 2006 in collaboration with the SAPS and State Pathologists. Confidential reports were also submitted.

During June 2006 the second and third-year students visited the research institutes of the Agricultural Research Council (ARC) at Potchefstroom and Pretoria during the bi-annual excursion. A chemical company, Crompton Chemicals in Boksburg, was also visited. Prof. Gerhard Prinsloo, Professor Extraordinary arranged the visit. Prof. Van der Linde and Mr José Parau accompanied the students.

### Insects on New Crops Programme

In 2005 the group consisted of Prof. Schalk Louw, Messrs Charles Haddad (part-time Ph.D. student), Vaughn Swart (full-time Ph.D. student in Environmental Management) and De Villiers Fourie (full-time M.Sc. student), Mss Fransie van Deventer (part-time M.Sc. student) and L. Theron (part-time



Students busy with water quality measurements in the flood levels of the Okavango Delta.



Researchers launching Barbus a remote controlled underwater observation apparatus used for studying the catfish pack hunting in the Okavango Delta.

M.Sc. student), Mr Johan Pretorius (part-time M.Tech. student), and Mr Burgert Muller (full-time B.Sc. Honours student). In 2006 Ms Van Deventer left the group and Ms Francisca Jordaan (full-time B.Sc. Honours student) joined the group.

In 2005/06 the Insects on New Crops Programme (INCroP) did research on pistachio nuts (client: Industrial Development Corporation, Green Valley Nuts in Prieska), walnuts (client: Industrial Development Corporation, Rotondo Walnuts in Aliwal North), cactus pear (client: SA CactusNet), kenaf (client: Sustainable Fibre Solutions in Cape Town) and hoodia (client: Phytopharm and Unilever in the United Kingdom (UK)). In 2006 the group also conducted research on the blue agave (client: Agave Distillers in Graaff-Reinet).

Ms Fransie van Deventer obtained an M.Sc. in Entomology with a dissertation entitled: *Diversity and seasonality of Chrysomelidae (Coleoptera) on kenaf, Hibiscus cannabinus L. (Malvaceae), with special reference to preference indices of Podagraca testacea (Chapuis) (Alticinae)*. The degree was awarded at the September 2005 graduation ceremony.

Prof. Louw was the founder and executive committee member of the UFS Centre for Plant Health Management (CePHMa) that was officially opened in October 2005 on the Main Campus in Bloemfontein. He was also a member of the organising committee of the 2006 International Cactus Pear Conference held in March 2006 on this campus under the auspices of CePHMa and served as editor of the conference proceedings, which were published as a book.



There is no division of work at the Leseding Research Camp. Here nets are cast to catch fish.

## Academic staff

### Main Campus

**Professors:** Proff. Jo van As, Linda Basson, Ordino Kok, Schalk Louw, Theuns van der Linde

**Professors Extraordinary :** Proff. Leon Fourie, Gerhard Prinsloo

**Senior Lecturers:** Drs Liesl Van As, Léan van der Westhuizen

**Lecturers:** Dr Candice Jansen van Rensburg, Messrs Hennie Butler, Charles Haddad, Ms Ellie van Dalen

**Affiliated Researchers:** Proff. Dawie Kok, Ivan Horak, Drs Johan Welman, Jennifer Botha

### Qwaqwa Campus

**Lecturers:** Dr Michael Cunningham, Messrs Sibusiso Mtshali, Johann van As, Ms Hafeleni Matete

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## Research outputs

### Publications

**Ali, K., Louw, S.VdM. & Swart, W.J.** 2005. Components and mechanisms of resistance in field pea, *Pisum sativum* lines to the pea aphid, *Acyrtosiphon pisum*. *International Journal of Tropical Insect Science* 25(2): 114-121.

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**Van As, J. & Du Preez, M.** 2006. The ukhahlamba / Drakensberg Park. In *Essence of a Land: South Africa and its World Heritage Sites*, edited by T.E. Hauf & M. Du Preez. Kingston WA, USA: Tim Hauf Photography.

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**Louw, S.VdM.** 2006. *Towards the management of Paramecops stapeliae on Hoodia gordonii plants*. Annual Report to Phytopharm plc, UK & CePHMa, University of the Free State, Bloemfontein, South Africa. (Co-operative Agreement).

**Louw, S.VdM. & Fourie, DeV.** 2005. *Pesticide bioassays on Atelocera raptorica (Hemiptera: Pentatomidae) at Green Valley Nuts: Diurnal trial*. 2005 Report to Green Valley Nuts, Prieska, South Africa.

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- Hoodia gordonii plants. First Term - Quarterly Report to Phytopharm plc, UK & CePHMa, University of the Free State, Bloemfontein, South Africa. (Co-operative Agreement).
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- ## Conference contributions
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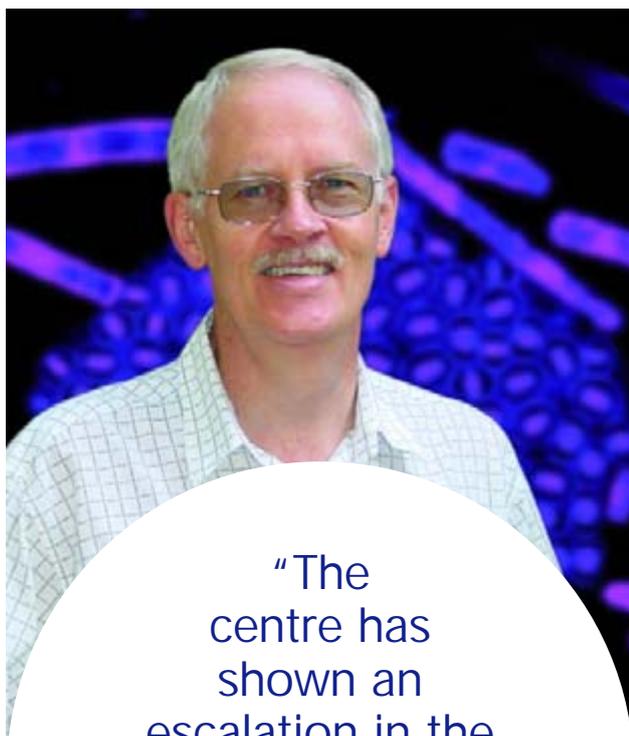
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# Centres





# Confocal and Electron Microscopy



“The centre has shown an escalation in the utilisation of its facilities since its establishment in 2003.”

Prof. Pieter van Wyk.

## Overview

Research and training outputs at the Centre for Confocal and Electron Microscopy (CCEM) are determined by the period of use of the apparatus and laboratories, as well as by the publications and conference presentations of the users.

The CCEM is a service facility of the Faculty of Natural and Agricultural Sciences available to departments and external users. Researchers and students of this faculty form the principal user group and several researchers and students from other universities and abroad periodically use the facilities through collaborated research projects. The centre has shown a steady escalation in the use of its facilities since its establishment in 2003, and the apparatus has been used by several postgraduate students for research and study purposes.

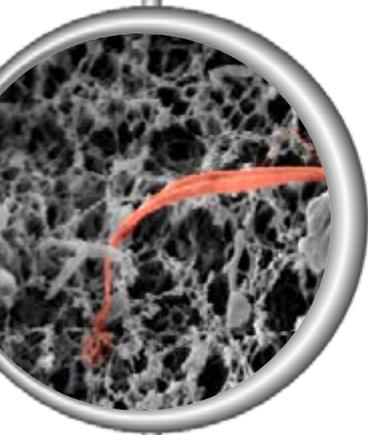
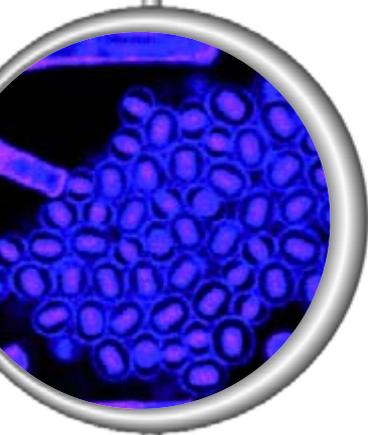
In 2005 the CCEM presented several courses to honours students in the departments of Zoology and Entomology, Microbial, Biochemical and Food Technology and Plant Sciences at the UFS. The duration of each of these courses is three days and they are presented separately to each group. Various postgraduate students from these departments used the apparatus for their research and study projects.

The new Shimadzu scanning electron microscope installed in 2006 was a welcome and useful addition to the centre. A workshop was presented to introduce the new microscope to researchers at the UFS.

A workshop was also presented in collaboration with the Department of Zoology and Entomology for researchers in the preparation of material for the confocal microscope to promote the application of this microscope. A guest presenter, Ms Anne Grobler, was invited from the North-West University.

The most recent microscope installed is a Nikon confocal laser scanning microscope, which produces three-dimensional images of fluorescing biological samples.

Several research activities culminated in a collaborated research project with the Lipid Biotechnology group of the Department of



The installation of the new Shimadzu scanning electron microscope. Staff of the centre undergoing training by the Japanese engineer.

Microbial, Biochemical and Food Technology. An international symposium was attended in Berlin by postgraduate students of this research group under the supervision of Proff. Lodewyk Kock and Pieter van Wyk, Director of the centre.

The outstanding quality of research at the CCEM was highlighted when one of the images photographed with the confocal microscope was published on the cover of an international journal for yeast research (*Federation of European Microbiological Societies (FEMS) Yeast Research 6*).

The centre was also honoured by a visit from Prof. George Lindsey, a researcher from the University of Cape Town (UCT), together with one of his Ph.D. students. They made use of the centre for the third consecutive year (2004-2006) for a confocal microscope research project.

Staff from the centre not only assisted researchers with their research and training outputs, they also presented a number of papers at the congress of the Microscope Society of Southern Africa held in Port Elizabeth in December 2006. Prof. Van Wyk delivered a presentation at this congress, entitled: *Solving some yeast growth phenomena using confocal microscopy*. He received the Leica prize as the best confocal microscope presentation at the conference.

Ms Beanérlí Janecke presented a paper at the same congress entitled: *Creating a database for future identification of mammals from hair in leopard scats*. This is a project undertaken in collaboration with a M.Sc. student, Mr Jackson Chaka, from the Department of Animal, Wildlife and Grassland Sciences at the UFS.

#### Academic staff

**Associate Professor:** Prof. Pieter van Wyk

**Research Officer:** Ms Beanérlí Janecke

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# Research outputs

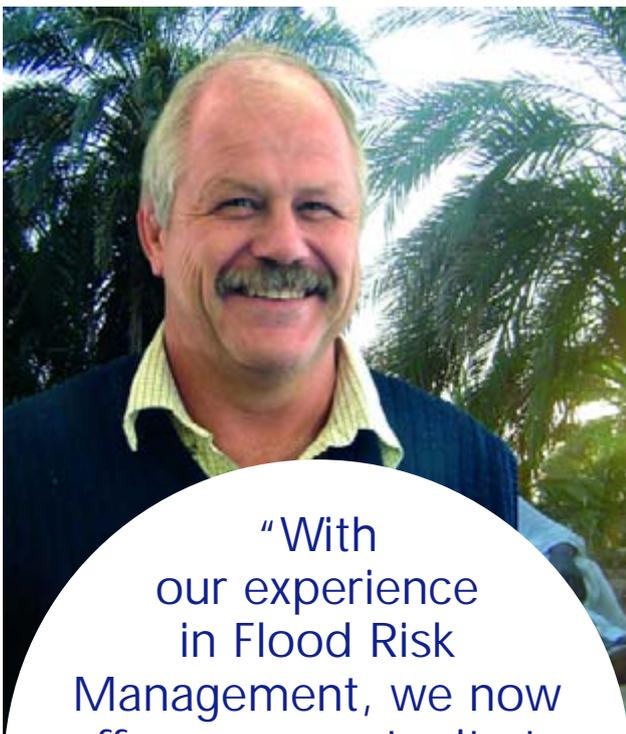
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- Ncango, M.D., Pohl, C.H., Sebolai, O.M., Botes, P.J., Strauss, C.J., Joseph, M., Van Wyk, P.W.J., Nigam, S. & Kock, J.L.F.** 2006. *Forced release of hat-shaped ascospores in Ascoidea corymbosa*. Poster presented at the 14th Biennial Congress of the South African Society for Microbiology, Pretoria, South Africa.
- Pohl, C.H., Strauss, C.J., Van Wyk, P.W.J. & Kock, J.L.F.** 2006. *Yeast "nanobots"*. Paper presented at the 3rd European Conference on Computational Mechanics Solids, Structures and Coupled Problems in Engineering, Lisbon, Portugal.
- Strauss, C.J., Kock, J.L.F., Van Wyk, P.W.J., Botes, P.J. & Nigam, S.** 2006. *Inverse flocculation in Saccharomyces cerevisiae*. Paper presented at the 2nd International Conference on Non-mammalian Eicosanoids, Bioactive Lipids and Plant Oxylipins, Berlin, Germany.
- Strauss, C.J., Kock, J.L.F., Van Wyk, P.W.J., Lodolo, E.J., Botes, P.J. & Nigam, S.** 2005. *Cell walls and yeast flocculation: The role of oxylipins*. Paper presented at the 24th International Specialized Symposium on Yeasts, Castellon, Spain.
- Swart, C.W., Botes, P.J., Van Wyk, P.W.J., Strauss, C.J., Nigam, S., Pohl, C.H. & Kock, J.L.F.** 2006. *3-Hydroxy oxylipins associated with Candida magnolia*. Poster presented at the 2nd International Conference on Non-mammalian Eicosanoids, Bioactive Lipids and Plant Oxylipins, Berlin, Germany.
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- Van Heerden, A., Strauss, C.J., Pohl, C.H., Van Wyk, P.W.J., Nigam, S. & Kock, J.L.F.** 2006. *Message in a bottle*. Poster presented at the 14th Biennial Congress of the South African Society for Microbiology, Pretoria, South Africa.
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- Van Marwijk, J., Van Heerden, E., Piater, L.A. & Gericke, M.** 2006. *Biological synthesis of gold nanoparticles*. Paper presented at the Gold 2006: 4th International Conference on Gold Science, Technology and Its Applications, Limerick, Ireland.
- Van Wyk, P.W.J., Kock, J.L.F., Van Heerden, A., Strauss, C.J., Pohl, C.H., Schoombie, S.W. & Nigam, S.** 2005. *Macro-messages in a micro-bottle*. Proceedings of the 44th Annual Conference of the Microscopy Society of Southern Africa, University of KwaZulu-Natal, Pietermaritzburg, South Africa. pp. 35-36.
- Van Wyk, P.W.J., Strauss, C.J., Kock, J.L.F. & Nigam, S.** 2006. *Application of electron and confocal laser scanning microscopy in observing oxylipins in fungal cells*. Paper presented at the 2nd International Conference on Non-mammalian Eicosanoids, Bioactive Lipids and Plant Oxylipins, Berlin, Germany.
- Verhoeven, R.L.** 2005. *Phylogenetic development in Apocynaceae*. Paper presented at the 31st Annual Congress of the South African Association of Botanists, University of the Free State, Bloemfontein, South Africa.



# Disaster Management Training and Education Centre for Africa (DiMTEC)



“With our experience in Flood Risk Management, we now offer an opportunity to prospective students to share in this knowledge.”

Mr Andries Jordaan.

## Overview

Prior to 2006 the Disaster Management Training and Education Centre for Africa (DiMTEC) formed part of the Department of Agricultural Economics. In 2006, for the first time, the centre began operating on its own, independent of the department. The popularity of the master's course exceeded all expectations, with student numbers increasing from only 9 in 2002 to 35 in 2006. In 2006, 60 students enrolled, of which 21 students were from countries other than South Africa.

The centre managed to secure a bursary scheme to the amount of R2,3 million for disaster management students. This bursary scheme is funded by the Department of Science and Technology (DST) and it enables students to gain experience in disaster management in different government departments while completing their studies.

The centre presented a number of short courses on Sphere Project and Minimum Standards in Disaster Response, Overview of Disaster Management and Political Strategic Planning. Most of the courses were presented in Bloemfontein, and one of the courses was presented in Bulawayo, Zimbabwe. The 242 attendants included South Africans, Zimbabweans and even a resident of Nigeria. The centre was also involved in projects such as the Disaster Risk Assessment for Eden Municipality in the Eastern Cape and the Free State Disaster Management Framework.

Students from the centre presented exhibitions at the annual conference of the Disaster Management Institute of South Africa. Mr Jordaan attended and contributed to the panel discussion of the Disaster Management Seminar: Towards a Resilient Southern Africa: Strategic Leadership Issues in Disaster Management, which was held in Cape Town.

Mr Jordaan also attended and contributed to the expert panel discussion on a workshop of the Lesotho Wool and Mohair Industry in Maseru, Lesotho.



A group of delegates attending a course that was conducted in Zimbabwe. The delegates are from non-government organisations, churches, the United Nations and community organisations.



Mr Andries Jordaan (middle), Director of DiMTEC, with some of the date farmers in Sudan. Here they are sitting on the banks of the Nile River, 300 km's north of Khartoum near the Merowe Dam. Mr Jordaan was doing financial impact studies for the Merowe Dam resettlement project.

The centre is represented on both provincial and national committees. Mr Andries Jordaan, Director of the centre, serves on the South African Qualifications Authority (SAQA) Scoping Team for Disaster Management Training in South Africa as well as the Free State Disaster Management Advisory Forum.

### Academic staff

**Director:** Mr Andries Jordaan  
**Junior Lecturers:** Messrs Teuns van der Linde (contract appointment), Pios Ncube (contract appointment)  
**External Lecturers:** Messrs Schalk Carstens, Anthony Keston

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## Research outputs

### Reports

**Jordaan, A.J.** 2006. *Agricultural impact assessment: Proposed Kendall Power Station.* Report to Ninham Shand, Cape Town, South Africa.

**Jordaan, A.J.** 2006. *Agricultural impact assessment: Proposed Vaal South Power Station.* Report to Ninham Shand, Cape Town, South Africa.

**Jordaan, A.J.** 2006. *Agricultural research and extension at the Merowe Dam irrigation resettlement scheme.* Report to Lahmeyer International, Khartoum, Sudan.

**Jordaan, A.J.** 2006. *Economic and financial feasibility study for Merowe Dam irrigation project resettlement scheme.* Report to Lahmeyer International, Khartoum, Sudan.

**Jordaan, A.J.** 2006. *Institutional development for resettled farmers at the Merowe Dam irrigation resettlement scheme.* Report to Lahmeyer International, Khartoum, Sudan.

**Jordaan, A.J.** 2006. *Livestock production at the Merowe Dam resettlement irrigation scheme.* Report to Lahmeyer International, Khartoum, Sudan.

**Jordaan, A.J.** 2006. *Unleashing markets and trade opportunities for Merowe Dam resettlement scheme.* Report to Lahmeyer International, Khartoum, Sudan.

**Jordaan, A.J., Van der Merwe, H.J., Van Staden, J.J., Van Rensburg, J. & Luttig, P.** 2006. *Agricultural report.* Report to Richtersveld Irrigation Farms and Legal Resources Centre, Cape Town.

### Conference contributions

**Jordaan, A.J.** 2006. *Disaster risk assessment: Thumb sucking or scientific risk quantification: What are we busy with?* Paper presented at the Disaster Management Institute of South Africa

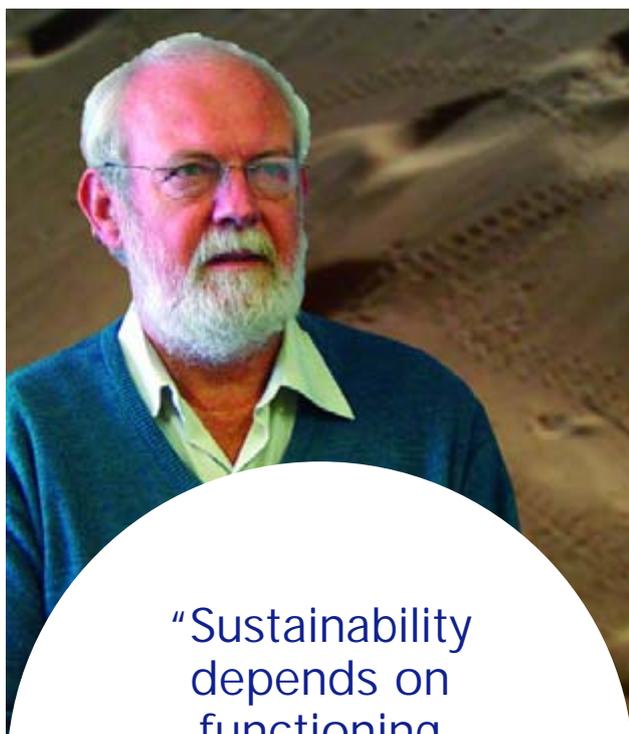
(DMISA) Annual Conference, Hartenbos, South Africa.

**Jordaan, A.J.** 2006. *The role of women in agriculture.* Paper presented at the Small Enterprise Development Agency (SEDA) South African Women Small Cooperatives Annual Congress, Phutaditaba, South Africa.

**Jordaan, A.J. & Van Schalkwyk, H.D.** 2006. *The Lesotho wool industry: Gain or pain for Lesotho's economy?* Paper presented at the 44th Annual Conference of the Agricultural Economics Association of South Africa (AEASA), Grahamstown, South Africa.

**Ncube, P. & Jordaan, A.J.** 2006. *How natural is natural disasters? Socio-economic, politics and the environment: The underlying factors for a lasting solution to disaster risk reduction.* Paper presented at the Disaster Management Institute of South Africa (DMISA) Annual Conference, Hartenbos, South Africa.

# Environmental Management



“Sustainability depends on functioning environmental services.”

Prof. Maitland Seaman.

## Overview

The Centre for Environmental Management in the Faculty of Natural and Agricultural Sciences, incorporating the BloemWater Chair in Water Environmental Management, has established an envied niche for itself in South Africa, so much so that other universities have either copied its name or taken over the framework of its master's programme in Environmental Management. The niche is based on three intertwined components, namely the master's and doctoral programmes, a research component, and short courses.

The centre, with Prof. Maitland Seaman as Director, is now a recognised centre of expertise in aquatic ecology, which carries out a number of applied projects and provides appropriate services to communities in the central part of South Africa. BloemWater, the regional water services agency, plays a central role in the development of this part of the business. Prof. Seaman is also the incumbent of the BloemWater Chair in Water Environmental Management.

The programme is an integrated one. As the environment presents a very wide field, there is a perceived need to produce graduates with a healthy overview of the South African environment. Graduates are in demand by large companies, local authorities and nature conservation bodies.

The master's programme developed gradually and strongly around Project Management, Environmental Assessment, Environmental Management Systems, Integrated Environmental Management and Sustainable Development, into which a number of special skills and disciplines are inextricably woven.

From about 100 applicants, the master's programme takes in about 40 students annually. The intake increases in diversity every year. In 2005/06 most of the students were from the Southern African Development Community (SADC), and a few from the rest of Africa, making this a truly continental programme. The programme is based on 37 full days of contact time at the Main Campus in Bloemfontein, split into one session per semester.

“Research at the centre is based on water environmental management, which also forms an important part of the master’s programme.”

Approximately 50 lecturers are used for presenting classes, half of whom are contracted in from government and the private sector because of their competence in specialist practice within the broad field of environmental management.

In both 2005 and 2006 seven students were registered for their Ph.D. degrees respectively. In 2005 Mr Harold van Niekerk, completed his studies with a thesis on: *Microbiological monitoring of freshwater systems in South Africa*. Mr. Peter Kuyler completed his studies in 2006 with a thesis on: *Application of multi-criteria analysis in land use decisions*. In Both 2005 and 2006 another three full-time students were funded by the centre from contract income respectively.

The centre also signed a co-operative agreement with the Catholic University of Leuven in 2005 to conduct research on temporary water ecology.

Research in the centre is based on water environmental management, which also forms an important part of the master’s programme. While the centre has a number of

research contracts and appointments, its anchor contract is with BloemWater to bio-monitor the Modder and associated rivers, forming an important contribution to the national River Health Programme. The study, which started in 1998, is probably the most comprehensive study providing the longest and broadest data base of any river health programme study in the country. The team on this study covers the geomorphology, riparian vegetation, water quality, algae, invertebrates and fish, ensuring that a broad base of expertise is built up.

The centre has also been contracted by the Water Research Commission (WRC) to examine the environmental water requirements in non-perennial systems as an ultimate basis for water allocation in the drier half of South Africa. The team for this project is mainly from the UFS, with contributions from the Council for Scientific and Industrial Research (CSIR), the University of Cape Town and Rhodes University.

The centre is involved with various projects of intensive bio-monitoring of water bodies



**Above**  
Fish sampling in the Seekoei River as part of the study of Environmental Water Requirements on non-perennial systems.

**Right**  
Determining the present ecological state of the Koranna Stream using macroinvertebrates and habitat assessment.

in the Southern Free State, notably the Modder, Riet and Caledon Rivers, as well as various dams and pans. It is also directly involved in water-quality monitoring of treated water in the Free State and Eastern Cape. The centre is therefore intimately involved in integrated water resources management and training for the community it serves.

A series of short courses for the Manguang Local Municipality on environmental management was presented during 2006. Prof. Seaman was appointed as a trustee of the Lesotho Bio-diversity Trust in the same year.

Through the motivation of the centre, the National Research Foundation (NRF) awarded the UFS a research niche area in Integrated Water Resources Management. This niche area forms part of the university's Strategic Cluster Initiative and the research will focus on Water Management in Water Scarce Areas. Prof. Seaman is the convenor of the cluster. Bursaries for master's and doctoral students form part of this grant from the NRF.

### Academic staff

**Director:** Prof. Maitland Seaman

**Senior Lecturer:** Dr Jan Roos

**Lecturer:** Ms Marinda Avenant

**Senior Professional Officer:** Ms Marie Watson

**Professional Officers:** Mss Limpho Letsela, Tascha Vos, Eloise Lamprecht, Marilie Carstens, Messrs Jurie du Plessis, Ockie Scholtz

**Associated Researchers:** Drs. Pieter Zietsman, James Brink, Nico Avenant

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Ms Marie Watson, Senior Professional Officer at the centre, identifying invertebrates at the Seekoei River.



Ms Marinda Avenant, Lecturer at the department and Mr Jurie du Plessis, Academic Assistant, measuring and identifying the catchments at the Modder River.

# Research outputs

## Research articles

**Vos, A.T. & Roos, J.C.** 2005. Causes and consequences of algal blooms in Loch Logan, an urban impoundment. *Water SA* 31: 385-392.

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**Roos, J.C.** 2005. *Waterkwaliteit assessering: Woonbuurt se reinigingswerke (Mafube/Frankfort distrik)*. Report to Mr Andre Swart, Agritrans CC, Paisley Farm, Frankfort, South Africa.

**Roos, J.C.** 2006. *Water quality study*. Report to Kwezi V3 Engineers and the Sol Plaatjie Municipality, South Africa.

**Rossouw, L., Avenant, M.F., King, J.M., Barker, C.H., Du Preez, P.J., Pelsler, A., Roos, J.C., Van Staden, J.J., Van Tonder, G.J. & Watson, M.** 2005. *Environmental water requirements in non-perennial systems*. Report to the Water Research Commission, WRC Report No. 1414/1/05.

**Seaman, M.T. & Watson, M.** 2006. *Ecological implications of siltation in the Caledon River upstream and downstream of Welbedacht Dam*. Report to Ninham Shand and BloemWater, South Africa.

**Seaman, M.T. & Watson, M.** 2006. *State of the environment for Cacadu Municipal District (excluding the Nelson Mandela Metropole)*. Report to the Cacadu District Municipality, South Africa.

**Seaman, M.T., Roos, J.C., Watson, M., Avenant, M.F. & Vos, A.T.** 2005. *State of the Modder River: 2003 – 2005*. A Quarterly Bio-monitoring Report to BloemWater, South Africa.

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**Swart, V.R.** 2006. *Situation analysis of the Orange River water quality utilized for irrigation*

*at Rotondo Walnuts, based on samples taken on 28 August 2006*. Report to Rotondo Walnuts, South Africa.

**Vermeulen, D. & Roos, J.C.** 2005. *Short review on water quality in Sterkspruit area*. Report to BloemWater, South Africa.

## Conference contributions

**Avenant, M.F.** 2005. *Fish as bio-indicators in a regulated non-perennial river*. Paper presented at the 32nd Conference of the Zoology Society of Southern Africa, Department of Zoology and Entomology, Rhodes University, Grahamstown, South Africa.

**Avenant, M.F., Rossouw, L., Seaman, M.T. & King, J.M.** 2005. *Environmental water requirements in non-perennial river systems*. Paper presented at the 32nd Conference of the Zoology Society of Southern Africa, Department of Zoology and Entomology, Rhodes University, Grahamstown, South Africa.

**Du Plessis, J.J. & Avenant, M.F.** 2005. *Die belangrikheid van droë-seisoen poele in funksionering as toevlugsoord vir visse in 'n nie-standhoudende rivier in die Vrystaat, Suid Afrika*. Paper presented at the 11th Annual Conference of the International Association for Impact Assessment, South African Affiliate, Thaba 'Nchu Sun, South Africa.

**Du Plessis, J.J. & Avenant, M.F.** 2005. *Fish as bio-indicators in a regulated non-perennial river*. Paper presented at the 32nd Conference of the Zoology Society of Southern Africa, Department of Zoology and Entomology, Rhodes University, Grahamstown, South Africa.

**Du Plessis, J.J. & Avenant, M.F.** 2006. *The role of a dry-season pool as refuge for fish in a non-perennial river in the Free State, South Africa*. Poster presented at the South African Association of Aquatic Scientists Conference, Pestana Rovuma Hotel, Maputo, Mozambique.

**Kaiser, W. & Avenant, N.L.** 2006. *The importance of including rodents in veld condition assessments: A case study*. Paper presented at the International Conference on Rodent Biology and Management (ICRBM3), Hanoi, Vietnam.

**Mellet, R. & Barker, C.** 2005. *Management and geomorphological processes of a highly regulated*

*river system: The Bloemspruit, Free State, South Africa*. Paper presented at the 11th Annual Conference of the International Association for Impact Assessment, South African Affiliate, Thaba 'Nchu Sun, South Africa.

**Roos, J.C. & Vos, A.T.** 2006. *Sediment quality and water interaction in Kamfers Dam, A saltpan, Kimberley*. Poster presented at the South African Association of Aquatic Scientists Conference, Pestana Rovuma Hotel, Maputo, Mozambique.

**Scott, K. & Watson, M.** 2005. *A biomonitoring study of a regulated river with specific reference to the Bloemspruit, Free State, South Africa*. Paper presented at the 11th Annual Conference of the International Association for Impact Assessment, South African Affiliate, Thaba 'Nchu Sun, South Africa.

**Seaman, M.T., Avenant, M.F., Rossouw, L. & King, J.M.** 2005. *Environmental water requirements in non-perennial systems*. Paper presented at the Water Research Fund of Southern Africa (WARFSA) Conference, Mbabane, Swaziland.

**Vanschoenwinkel, B., Seaman, M.T. & Brendonck, L.** 2006. *Linking community patterns with dispersal in a rock pool metacommunity*. Paper presented at the Workshop on Experimental Meta-populations in Evolutionary Biology, Montpellier, France.

**Vos, A.T. & Roos, J.C.** 2005. *In-lake nutrient management of Loch Logan: An urban impoundment*. Paper presented at the 11th Annual Conference of the International Association for Impact Assessment, South African Affiliate, Thaba 'Nchu Sun, South Africa.

**Watson, M.** 2005. *Assessment of a tool used in the determination of the ecological water requirement of a regulated river*. Poster presented at the 32nd Conference of the Zoology Society of Southern Africa, Department of Zoology and Entomology, Rhodes University, Grahamstown, South Africa.

**Watson, M.** 2006. *Invertebrates in a non-perennial river*. Poster presented at the South African Association of Aquatic Scientists Conference, Pestana Rovuma Hotel, Maputo, Mozambique.

# Lengau Agricultural Development Centre



“The centre provides training and support to small farmers.”

Dr. Léan van der Westhuizen.

## Overview

The Agricultural Skills Development, Training and Mentorship Programme is an initiative of the Faculty of Natural and Agricultural Sciences that utilises its academic capacity and facilities to make a significant difference in sustainable agriculture to the region, country and continent.

The UFS owns three experimental farms to the south of Bloemfontein. These farms are utilised for training, research and community service. Some of the farms are earmarked for agricultural skills development and training of emerging farmers, farm workers and entrepreneurs in agricultural business.

The facilities are also utilised and earmarked for alternative natural and agricultural skills development opportunities in brick-making, construction, value-adding and compost production. The buildings, facilities and a portion of the land of the Sydenham Experimental Farm are allocated to the Lengau Agricultural Development Centre.

These facilities are utilised to address the needs of newly-settled, emerging and commercial black farmers. Services range from livestock auctioneering, branding, dehorning, castration and primary herd care. The centre also serves as a centre for the education of under- and postgraduates, mentors, farmers and black entrepreneurs in many aspects of livestock, crop farming and agri-business.

In December 2004 the university, the Mangaung Local Municipality and the National African Farmers Union (NAFU) embraced the programme as partners in agricultural transformation and signed a memorandum of understanding.

The centre aims to simultaneously undertake systematic small farmer training, tackle local development issues, and enrich the curriculum in terms of research and training at the UFS. Some of the projects undertaken at the centre include:

- Training of community members of the Mangaung Local Municipality, particularly the residents of the informal settlement

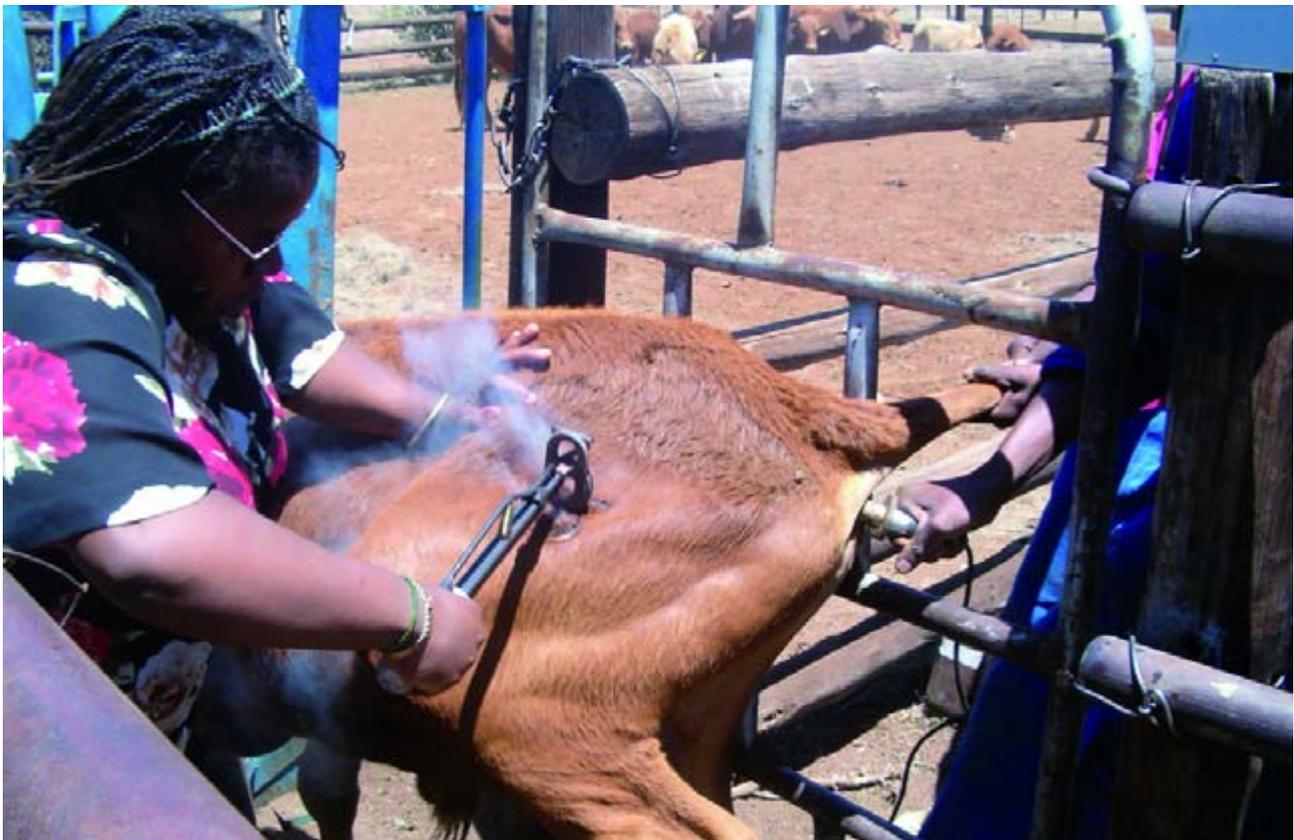
“During 2006 a number of outcomes were achieved by the centre in collaboration with several partners.”

- within the immediate vicinity of the experimental farms.
  - Training of emerging farmers who were recently allocated land under the land reform programme, but who are unable to make a success of their farming operations due to inexperience and lack of technical support.
  - Developing and presenting of short courses in practical agriculture in line with dominant conditions encountered by the target groups.
  - Farm demonstrations.
  - Research to identify factors that enhance competitiveness.
  - Strengthening the practical aspects of the curriculum for on-going community service learning of the students on the three campuses of the UFS.
  - An outreach programme through partnerships to extend the clientele through a "hub-and-spokes" framework to different parts of the country.
  - Providing a support facility to emerging commercial farmers where training and implementation assistance can be supplied to livestock and crop farmers.
  - Participating and assisting in Agri Black Economic Empowerment initiatives.
- Establishing an HIV/Aids prevention, care and support initiative amongst farmers, farm workers and associated communities.

During 2006 a number of outcomes were achieved by the centre in collaboration with several partners. In conjunction with the National Emergent Red Meat Producers' Organisation (NERPO) and Mangaung Local Municipality, 12 farmers' days were held in the Motheo district where farmers were skilled in vaccination, branding, dehorning, castration and tick control. They also received training and advice in bull selection for the improvement of livestock. More than 2 500 head of cattle were handled and 76 farmers attended the sessions. Six small and medium enterprises in branding, dehorning and dipping resulted from these sessions.

Eleven people were trained in broiler production skills at the centre. All are currently poultry farmers. A presenter from the Institute of Dairy Technology in Pretoria trained 15 persons on primary herd care.

Four hydroponic units were erected and vegetable production skills were offered to eight women. The project also provided seedlings to 70 households within the HIV/Aids programme of the Department of Social Development. Seventy HIV/Aids-



A training session in the branding of cattle.

affected households were trained in vegetable production, each managing a doorframe unit.

Five sessions on HIV/Aids prevention, care and support were presented to staff and project beneficiaries at the Lengau Agricultural Development Centre, Botshabelo and Thaba' Nchu. The objective of these sessions was to equip attendants with basic information on HIV/Aids and to impress upon them the importance of knowing one's status. Feedback received from the participants during and after the sessions was very positive.

The faculty in partnership with ECIAfrica (an indigenous economic development consultancy and capacity building organisation) launched the Agricultural Business Unit at the centre to promote agricultural linkages among producers and consumers, and to promote the development of Small, Medium and Micro Enterprises (SMME's) in the process. Funding for the initiative was obtained from the United States Agency for International Development (USAID). A project co-ordinator, assistant and seven part-time consultants were appointed within the project.

Five black cattle owners house approximately 240 head of cattle overnight in the feedlot pens.

One self-employed black woman managed six cycles of the 250-bird broiler house. Five black pig owners are utilising the 50-sow piggery at the centre.

Knitting equipment was funded and is utilised by three black women and one black man in a project of the Department of Consumer Sciences.

The auctioneering activities resulted in an average turnover of approximately R624 000 per month. One percent commission of the turnover is earned per auction session. The availability of a scale at



During a visit from the United States Agency for International Development to the Main Campus were, from the left, seated: Mss Deborah Kahatano, ECIAfrica, Dana Mullins, USAID, Juliana Rwelamira, ECIAfrica and Lynette van Niekerk, USAID; back: Mr Challa Mohloli, co-ordinator of the UFS USAID programme, Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences at the UFS, Dr Léan van der Westhuizen, Head of Lengau Agricultural Development Centre, and Ms Lieketseng Kolisang, Research Assistant at Lengau Agricultural Development.



A demonstration and training in dehorning.

the auctioning ring, and providing the black cattle owners with the necessary information, motivated more of them to utilise the facility to market their animals. The farmers also took note of the price-determining properties and are in the process of changing their stock accordingly.

The centre, in partnership with the Free State Provincial Department of Agriculture, is also involved in the revitalisation of six hydroponics projects in the Free State Province.

## Research outputs

### Publications

Mataxas, L., Thobejane, K., Netshiukhwi, G., Mokgothu, K., Morojele, E. & Mabula, E. 2005. Peri-urban renewal through agriculture: A case study of identified opportunities to alleviate poverty in JB Mafora Free State Province, South Africa. *ARC Report Series 7: 47.*

### Staff

**Senior Lecturer:** Dr Léan van der Westhuizen

**Personal Assistant and Community Service Officer:** Ms Kholofelo Thobojane

**Community Development Officer:** Ms Lolly Tlhomola

**Project co-ordinator in the Agricultural Business Unit:** Mr Challa Moahloli, Ms Lieketseng Kolisang (assistant)

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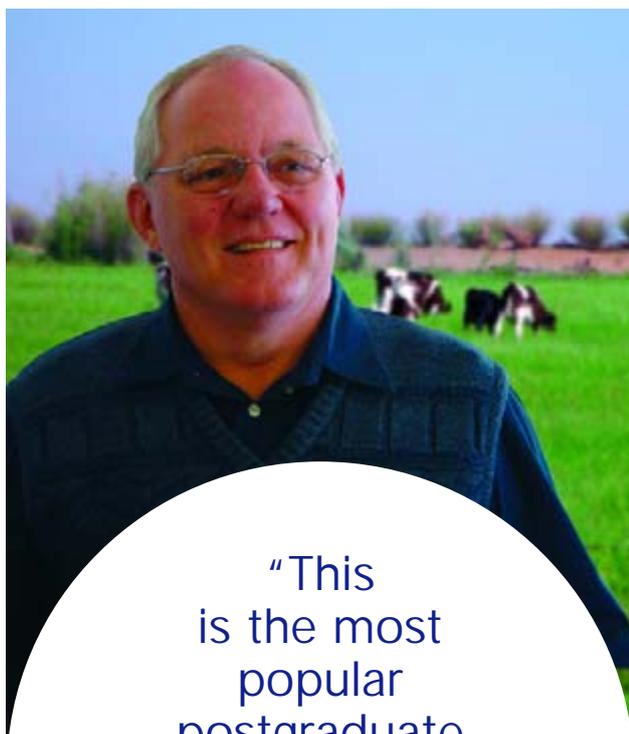
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A group of farmers receiving training in branding, dehorning and dipping.

# Sustainable Agriculture and Rural Development



“This is the most popular postgraduate agricultural study programme in Southern Africa.”

Prof. Izak Groenewald.

## Overview

The Centre for Sustainable Agriculture and Rural Development was established in 1994 by the Faculty of Natural and Agricultural Sciences, in order to offer postgraduate training with a multi-disciplinary approach by means of distance education, and to undertake research with a view to the development and maintenance of sustainable agricultural production systems.

The programme offered by the centre enables students to obtain a master's degree in Sustainable Agriculture (MSA). The UFS is the only university of its kind in Africa to offer this qualification.

As a result of the method of presentation, which entails distance education on a modular basis, the programme is very popular among local and international students. In addition to students from virtually all of the countries of the Southern African Development Community (SADC), students from Ireland, the United Kingdom (UK), the Netherlands, Denmark, Kenya and Ethiopia have completed the programme over the past few years.

Students come from all sectors of the agricultural milieu, including, inter alia, commercial and small farmers, as well as employees of the Department of Agriculture, the Agricultural Research Council (ARC), agricultural co-operatives or industrial institutions such as mining firms involved in the re-establishment of agricultural activities on their exploited grounds. Graduates can either apply their skills directly, for their own personal advantage, or engage in research and comprehensive activities in the domain of their employers or with private consultative enterprises.

Because the socio-economic environment of the farming industry is in a constant state of change, new skills and knowledge must continually be acquired in order to cope with the challenges of tomorrow in a sustainable manner. The programme develops students' technological, managerial and thinking skills in the agricultural industry, with a view to protecting natural resources, especially in respect of the endangered semi-arid areas.

New modules were developed during 2005/06, in order to adjust to the requirements of agriculturalists in respect to the format of part-

“The UFS is the only university of its kind in Africa to offer a masters degree in Sustainable Agriculture.”

A highlight of the year 2005 occurred when Dr Aldo Stroebel became the centre's first Ph.D. graduate. Dr Stroebel's research focused on the role of stock farming among rural communities in the northern region of the Limpopo Province. The research linked up with similar studies that he had conducted in a group context in Kenya, in collaboration with researchers from Cornell University in the United States of America (USA). Several scientific publications resulted from his research.

time agricultural training. This led to the development and implementation of new modules within various focus areas, namely sustainable plant and animal production systems, agri-business management, the adding of value, marketing and rural development.

In 2005, 48 students were selected for the programme. The student intake of 2006 once again confirmed the relevance of the programme, with approximately 50 students being selected from amongst more than 100 candidates. There were applicants from various SADC countries, such as Namibia, Lesotho, Swaziland, Zambia and Botswana, as well as other African countries, including Ethiopia.

Collaboration with the following institutions has been established and maintained in various ways:

- National University of Lesotho
- University of Namibia
- University of Virginia, USA
- Cornell University, USA
- Royal Agricultural College, UK
- Imperial College London, Wye Campus
- Dronten Professional Agricultural University, Netherlands
- University of Wageningen, The Netherlands



Children in the Vhembe district of the Limpopo Province. The photo was taken during a research project which led to Dr Aldo Stroebel's Ph.D.



Attending the inaugural lecture of Prof. Edward Nesamvuni, Professor Extraordinary at the centre are, from the left: Prof. Izak Groenewald, Director of the centre, Nesamvuni, Neil Heideman, Vice-Dean: Faculty of Natural and Agricultural Sciences at the UFS and Magda Fourie, Vice-Rector: Academic Planning at the UFS.

“The year 2006 was characterised by the recognition of notable scientists and researchers as professors extraordinary.”



In front of the Main Building of the Royal Agricultural College for Science and Technology in the United Kingdom are, from the left: Dr Stephen Chadd, Prof. Izak Groenewald, Director of the centre and Dr Richard Baines. Drs Chadd and Baines are from the Royal Agricultural College for Science and Technology.

In 2005 Prof. Izak Groenewald, Director of the centre, was appointed to the editorial staff of the *Journal for Sustainable Agriculture*, an internationally recognised scientific journal.

The congress of the European Association for Animal Production (EAAP) was held in 2005 at Bled, Slovenia. During the congress, Prof. Groenewald delivered a paper on new tendencies in food provision for stock in rural areas.

The year 2006 was characterised by the recognition of notable scientists and researchers as professors extraordinary in the centre. Proff. Alice Pell of Cornell University in the USA and Edward Nesamvuni, formerly of the University of Venda but currently director in the Department of Agriculture, were honoured in this way.

A threefold collaboration partnership was established between the University of Venda, the University of Cornell in the USA and the UFS. It was later expanded to include the Department of Agriculture in the Limpopo Province. The nature of collaboration involves the identification of research opportunities, the creation of funding possibilities and the conducting of joint projects.

Furthermore, a visit was paid to the Royal Agricultural College for Science and Technology, as well as to the Wye Campus of the Imperial College London, both in the UK. These institutions offer similar learning programmes to the one at the UFS, and existing course contents and new ideas were exchanged.



The graduation ceremony of the first Ph.D. student of the centre. From the left, are: Prof. Alice Pell, Cornell University, USA, Dr Aldo Stroebel, graduate, prof. Frans Swanepoel, Director: Research Development at the UFS and Izak Groenewald, Director of the centre. Prof. Pell and Swanepoel were the co-promoters and Groenewald was the promoter.

#### Academic staff

**Director:** Prof. Izak Groenewald

**Professors Extraordinary:** Proff. Frans Swanepoel, Edward Nesamvuni, Alice Pell

**Contractual Professor:** Prof. Kobus Laubscher

**Senior Researchers:** Drs Aldo Stroebel, Florence Nherera

**Programme Co-ordinator:** Ms Mia Kirsten

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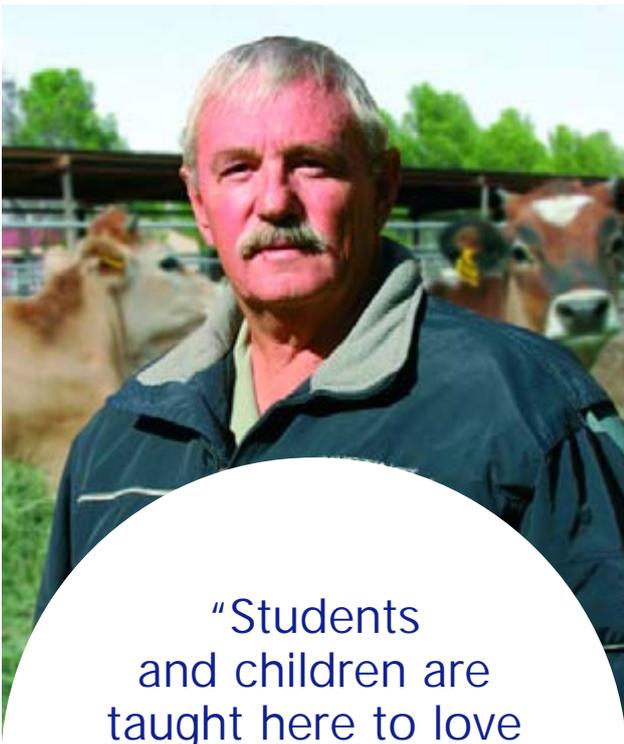
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# Experimental Farm





# Paradys Experimental Farm



“Students  
and children are  
taught here to love  
farm life.”

Mr Cobus van Dyk.

## Overview

The Paradys Experimental Farm is situated outside Bloemfontein, on the road to Reddersburg. In 2005/06 the farm's management started focusing on agricultural schools, pre-primary and primary schools in the area to create an awareness of agriculture and farm life amongst learners.

One of the outcomes has been the Free State Youth Show Championships, which has been presented on the farm annually since 2005. In 2006 the Free State team was announced after the Youth Show Championships by Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences. The faculty also sponsored the team's official wear for the National Youth Show Championships, held in Worcester in the Western Cape.

During the same year the farm buildings were upgraded and a boundary fence was erected around the farm. The farm also became a popular venue for the presentation of information days for commercial and upcoming farmers.

In 2005 the dairy parlour on the farm, which housed 15 Friesian and Jersey cows, was extended to accommodate 88 cows. Jersey SA donated two heifers, the existing Afrikaner stud grew from 70 to 173 cows, the Dorper stud was extended and goats were acquired to extend the small stock.

Another focus point of the farm is student training. Various departments in the faculty use the farm for research purposes and for practical training of undergraduate and postgraduate students.

In 2005 the farm was used by several agricultural organisations for experiments. Senwes conducted a successful feeding experiment with sheep and Meadows carried one out with calves.

A weather station was established with the help of Prof. Leon van Rensburg, Lecturer at the Department of Soil, Crop and Climate Studies, to determine forecasts in the weather pattern.

The popularity of the farm increased in 2006 and it was mainly used for farmers' days, training and the launch of agricultural equipment.

“Learners are actively involved with the farm by working there over weekends.”

Several school groups in the area also visited the farm.

The introduction of the farm to learners from agricultural schools was taken a step further with an agreement between the faculty and the Hendrik Potgieter Agricultural School in Reddersburg. In terms of this agreement, learners are actively involved with the farm by working there over weekends to gain practical experience.

Seven of the foremost stud farmers of the Afrikaner Cattle Breeders Society of South Africa have established a core herd on the farm. Each stud farmer donated five heifers



In 2006 the Free State team for the National Youth Show received a sponsorship for clothing from the faculty. Here are, in front: Elmé Smith, from President Brand Primary School in Bloemfontein; back, left: Werner Smit, from Hendrik Potgieter Agricultural School in Reddersburg, Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences at the UFS, Mr Deon Nel, Headmaster of the Hendrik Potgieter Agricultural School and Jacques le Roux, from Landboudal High School in Jacobsdal.



Grade 1 learners from the Hendrik Potgieter Agricultural School in Reddersburg during a visit to the experimental farm.

to the project. In return, the farmers will annually receive a performance-tested bull or semen of a performance-tested bull from the core herd. With the establishment of this herd, a genetically outstanding herd will be created which will be used for the training of students, as well as for research and for information sessions for farmers. All the animals that cannot be used by the herd or the stud farmers will be made available for auctioning at the Paradys Experimental Farm. The herd will be kept under commercial conditions to ensure that only those animals that have adapted will be made available to the industry.

The UFS became the first tertiary institution in the world to mechanise the in-field rain water harvesting technique on a commercial scale by cultivating a summer crop on 100 ha at the experimental farm. Prof. Van Rensburg presented a farmers' day in May 2006 to demonstrate this technique. Most of the 100 farmers who attended

the day were from 42 rural communities in the Thaba 'Nchu area. A group of seven farmers from KwaZulu-Natal also attended.

The Department of Architecture at the UFS presented a workshop on the farm in July 2006 to demonstrate several building techniques. Students built houses of, among other things, hay bales and home-made clay stones. A new gardening method, Permaculture, was also demonstrated.

Part of the upgrading of the farm was the purchasing of a Keenan feeding mixer and a McCormick MC 115 tractor. The feeding mixer makes it possible to mix food for the 50 Jersey cows in a shorter period of time and less fuel is used in the process.

The purchasing of the tractor was made possible by a sponsorship of R100 000 by BUO Agri in Bullfontein, who serve as agents for McCormick. In 2006 about 300 ha of soil were used for the cultiva-



Attending the handing-over ceremony of the brand new McCormick tractor was, from the left: Mr Danie Nortjé, National Service and Product Manager of McCormick SA, Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences, Mr Ian Bothma, M.Sc. student at the UFS and Mr Jan Jacobs, Sales Agent of McCormick SA.



The in-field rain water harvesting technique was demonstrated during a farmers day to upcoming farmers from as far away as KwaZulu-Natal. Here are Prof. Leon van Rensburg, lecturer at the Department of Soil, Crop and Climate Studies and Mr Patrick Molatodi, Chairperson of the Tswelopele Small Farmers Association in a mealie land on the farm used especially for this purpose.

tion of mealies and wheat, which are used as basis for the feed of cows on the experimental farm.

The cultivars will in future also be used by postgraduate students for experiments. The farm will also in the future conduct experiments with seeds for seed companies.

#### Staff

Farm Manager: Mr Cobus van Dyk

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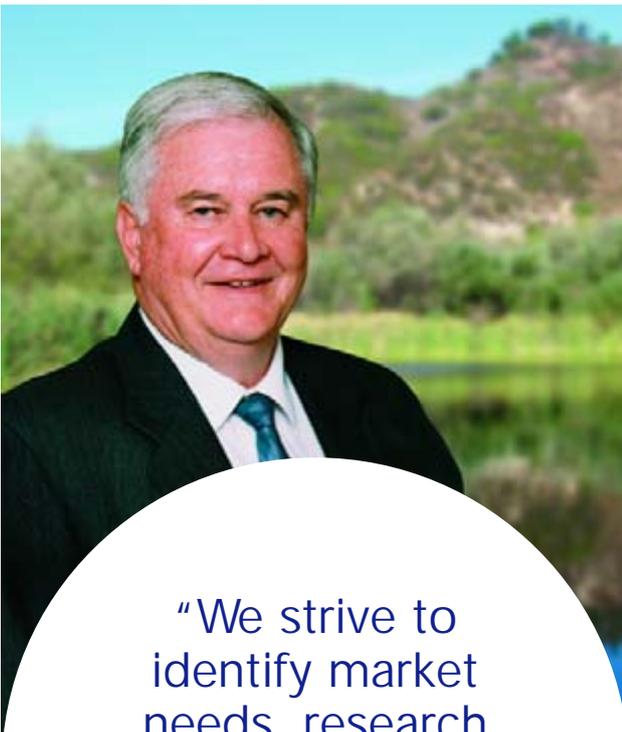
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# Institute





# Groundwater Studies



“We strive to identify market needs, research these and provide a service.”

Prof. Frank Hodgson.

## Overview

The Institute for Groundwater Studies (IGS) conducts research on a wide variety of water related topics. To date, more than 350 postgraduate students from South Africa and 14 other African countries have qualified in Geohydrology. Many of them are currently working in the United States of America (USA), Europe and Australia.

During 2005 Prof. Frank Hodgson, Director of the institute, was on long leave and Prof. Gerrit van Tonder acted on his behalf.

The IGS boasted 12 Ph.D., 19 M.Sc., and six honours students in 2005. The following highlights were achieved during the year:

- Staff members were involved in the groundwater pollution project of the United Nations Educational, Scientific and Cultural Organisation (UNESCO) and the United Nations Environment Programme (UNEP) in Africa.
- A 10-day visit to Sri Lanka was undertaken to assist their geohydrologists to assess the impact of the tsunami on the freshwater aquifers along the coast.
- Eight workshops on the South African Groundwater Decision Tool were presented throughout the country.
- A R2,5 million project was undertaken with the Department of Water Affairs and Forestry to develop groundwater-related software.
- Contracts were signed for research projects with the Water Research Commission (WRC), Sasol, Eskom, and BHP Billiton, amongst others.
- Eight papers were presented at the biannual South African Groundwater Conference. One Ph.D. student, Ms Adrie van Wyk, received the award for best student paper.
- Two papers were presented in Skellefteå, Sweden during the Securing the Future conference.
- Two papers were presented in England during the second conference on Processing and Disposal of Industrial and Mining Waste in Falmouth, Cornwall.
- Three researchers undertook a study trip to the University of Texas in Austin, USA. Intensive training in the model of the University of Texas Chemical Compositional Simulator (UTCHEM)



Mr Danie Vermeulen, Dr Ingrid Dennis and Prof. Gerrit van Tonder at the welcoming function with the governor (dressed in white) in Kandy, Sri Lanka.



Drilling of additional core boreholes for the dense non-aqueous phase liquids in fractured rock research.

for multiphase flow modelling was received.

- Projects for Sasol Mining and Sasol Synfuels were successfully completed.
- Discussions on research co-operation with the University of Perindiya in Kandy, Sri Lanka regarding seawater intrusion took place, and two Ph.D. students from the university were enrolled at the IGS.
- Prof. Dave Kramer from the University of Nevada in the USA visited the IGS for three weeks. He is renowned for his work on various topics, including dense non-aqueous phase liquids and isotope studies. During this time, Prof. Kramer presented lectures to IGS students, provided expert input into the current research, and gave a public lecture. Bilateral collaborations for the future were established.
- The contract with BloemWater for chemical analyses of water samples was renewed. The laboratory has also expanded its services by including bacteriology tests on water samples. Ms Henriette Human joined the laboratory.

In June 2005, Dr Brent Usher was invited to act as external evaluator for the final evaluation of a UNEP/UNESCO project entitled: *Assessment of Pollution Status and Vulnerability of Water Supply Aquifers of African Cities*. This project was a follow-up to the project: *The Urban Pollution of Surficial and Groundwater Aquifers in Africa*, which initiated efforts to promote inter-nation research into the topic. This involved 11 countries from across Africa. Dr Usher was involved in the mid-term training and review of the project in Mombasa, Kenya during May 2004 and was invited to act as external reviewer of the project upon its completion.

The evaluation included interviews in Cape Town during July 2005, with representatives from the 11 national institutions involved in the project. The participating countries were from among others West Africa, East Africa and Southern Africa. Field visits were also undertaken to Lusaka, Zambia and Addis Ababa, Ethiopia to interview staff from participating institutions, government officials and decision-makers, non-governmental organisations, and members of the public. The final evaluation report was written with Ms Catrina Perch from the UNEP Evaluation and Oversight Unit in Nairobi, Kenya. The report will be published soon in the form of a booklet distributed by UNEP, and on the UNEP website.

The Asian Tsunami of 26 December 2004 had a devastating impact across the Indian Ocean, causing unprecedented economic, human and environmental damage to the

countries in its path. The South African government is providing assistance to two of the countries affected by the tsunami, namely the Republic of the Maldives and Sri Lanka. Dr Ingrid Dennis was approached in 2005 to assist the South African government in this regard.

The IGS assessed the impact of the tsunami with regard to the groundwater training of local officials and initiated discussions for further co-operation with the UFS.

Prof. Van Tonder and Mr Danie Vermeulen visited Sri Lanka for ten days in December 2005 to assess the situation and thereafter presented the SA Water Support Group with an action plan. The plan consists of three phases:

- **Short term:** Assistance with training Sri Lankan geohydrologists in geophysical apparatus (2005).
- **Medium term:** Training all Water Board personnel in field procedures and computer-related issues (2006).
- **Long term:** Research co-operation between the IGS and the University of Perindiya in Kandy regarding seawater intrusion, with the involvement of two Ph.D. students. These students will enrol at the UFS in 2007.

During the trip, coastal aquifers on the west as well as the east coast were visited and fieldwork performed. Most of the work was done in the district of Ampara, in the eastern part of the country.

In 2006 Prof. Hodgson resumed his duties. During this year 15 Ph.D., 19 M.Sc. and five honours students were enrolled. The following highlights were achieved:

- A follow-up visit to Sri Lanka by Prof. Van Tonder, Dr Dennis and Mr Vermuelen to provide training to the country's geohydrologists at the Centre for Post-graduate Science in Kandy, to assess the impact of the tsunami on the aquifers and to facilitate longer term sustainable management of groundwater in Sri Lanka.
- The extension in scope of the current Geohydrological Software Development for Decision Support project with the Department of Water Affairs and Forestry to develop groundwater-related software and to provide training.
- The publication of several papers in international journals.
- The receiving of a research grant from Sasol to establish the IGS as a Centre of Excellence in South Africa.
- This grant resulted in collaboration with the United States Geologic Survey, as a result of which Dr Allen Shapiro, a pre-eminent expert on fractured rock

aquifers, visited the IGS and presented a series of workshops in Bloemfontein and Pretoria with Dr Usher and Ms Jennifer Pretorius from the institute.

- A short course on Fundamentals of Groundwater Chemistry was presented in Cape Town by Drs Usher and Walt Kelly, from the Illinois State Water Survey in the USA.
- The initiation of a Sasol/Eskom project to conduct collaborative research on sustainable salt sinks with the Universities of the Western Cape (UWC) and KwaZulu-Natal.
- Projects related to coal mine water volumes with all major mining companies were expanded. A result of this was the launching of a major water treatment works to convert mine water to drinking water in the Witbank area. The volumes and expected qualities were largely based on work undertaken in this field by Prof. Hodgson over a number of years.
- The signing of contracts and completion of projects for Sasol Research and Development, Fraser Alexander, Letseng Diamonds, Chemwes, Ingwe, Eskom, Sasol Synfuels and Gold Fields, amongst others.
- The IGS obtained a long-term appointment as external advisor to Sasol Mining to evaluate all groundwater and mine water-related aspects.
- The completion of the South African Groundwater Decision Tool, the Aquifer Management System, the Groundwater Dictionary and the Groundwater Resource Directed Measures software packages for the Department of Water Affairs and Forestry.
- The demonstration of the Aquifer Management System to national parliament in May 2006.
- The presentation of eight South African Groundwater Decision Tool workshops throughout South Africa by Dr Dennis and Mr Rainier Dennis in collaboration with the Department of Water Affairs and Forestry in August and September 2006.
- Involvement with the International Association of Hydrogeologists (IAH) to develop a World Bank/UNEP project proposal on global groundwater governance.
- Dr Usher was invited to present lessons and impacts from the UNEP/UNESCO Groundwater Pollution Project in Africa, at a special African Groundwater Session at the 4th World Water Forum in Mexico in March 2006.
- The Institute organised a five-day course on Reactive Transport Modelling using MT3DMS, PHREEQC and PHT3D with the Council for Scientific and Industrial Research (CSIR) and the Groundwater





Group of the UWC. The course was presented by three international experts in this field.

- The laboratory's contract with Bloem-Water for chemical analyses of water samples was extended.
- The publication of a book, *Groundwater Pollution in Africa*, which is a collection of peer-reviewed papers on this topic. It was co-edited by Dr Usher.
- The purchase of an electromagnetic borehole flow meter from the USA.
- The upgrading of the laboratory and installation of a Shimadzu ICP-MS analyser, and an HPLC system to extend the analytical capabilities of the laboratory.

In March 2006 Dr Usher was invited to present some of the lessons learned from the UNEP/UNESCO project Assessment of Pollution Status and Vulnerability of Water Supply Aquifers of African Cities in Mexico City at the 4th World Water Forum. One of the outcomes from this project was the publication of a peer-reviewed book on Groundwater Pollution in Africa. This book was peer-reviewed by Dr Usher. He was also invited by the International Association of Hydrogeologists to assist in the formulation of a project proposal for global groundwater governance and to attend meetings on this in Gland, Switzerland, in June 2006.

In December 2006 Prof. Van Tonder, Dr Dennis and Mr Vermeulen presented a workshop on the evaluation and management of groundwater resources to geohydrologists at

the University of Perindiya in Sri Lanka. The South African Disaster Management Fund carried the costs of the UFS staff.

#### Academic staff

**Professor/Director:** Prof. Frank Hodgson

**Professor:** Gerrit van Tonder

**Senior Lecturer:** Dr Brent Usher

**Researchers:** Dr Ingrid Dennis, Mr Danie Vermeulen

**Affiliated Researchers:** Prof. Jopie Botha, Messrs Rainier Dennis, Michael du Preez, Robel Gebrekristos, Sechaba Lenong, Mehari Menghistu, Niel Scholtz, Mss Michelle Pienaar, Jennifer Pretorius, Adrie van Wyk

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# Research outputs

## Publications

**Annandale, J.G., Jovanovic, N.Z., Hodgson, F.D.I., Usher, B.H., Aken, M.E., Van der Westhuizen, A.M., Bristow, K.L. & Steyn, J.M.** 2006. Prediction of the environmental impact and sustainability of large-scale irrigation with gypsiferous mine-water on groundwater resources. *Water SA* 32(1): 21-28.

**Havenga, A., Usher, B.H., Hodgson, F.D.I. & Van Tonder, G.J.** 2005. The use and applicability of flow models to quantify intermine flow in the Western Witbank coalfields. *Journal of the South African Institute of Mining and Metallurgy* 105(10): 687-694.

**Tilhaun, K., Botha, J.F. & Bennie, A.T.P.** 2006. Bromide movement and uptake under base and cropped soil conditions at Dire Dawa, Ethiopia. *South African Journal of Plant and Soil* 23: 1.

**Usher, B.H., Pretorius, J.A. & Van Tonder, G.J.** 2006. Management of a Karoo fractured-rock aquifer system – The Kalkveld Water User Association (WUA). *Water SA* 32(1): 9-20.

**Van Tonder, G.J. & Vermeulen, P.D.** 2005. The applicability of slug tests in fractured-rock formations. *Water SA* 31(2): 157-160.

**Vermeulen, P.D. & Usher, B.H.** 2005. Sulphate generation in South African underground and opencast collieries. *Environmental Geology* 49(4): 552-569.

**Vermeulen, P.D. & Usher, B.H.** 2006. An investigation into recharge in South Africa underground collieries. *Journal of the South African Institute of Mining and Metallurgy* 11: 771-786.

**Xu, Y. & Usher, B.H.** 2006. *Groundwater pollution in Africa*. London: Taylor & Francis.

## Chapters in books

**Usher, B.H. & Vermeulen, P.D.** 2006. The impacts of coal and gold mining on the associated water resources in South Africa. In *Groundwater Pollution in Africa*, edited by Y. Xu & B.H. Usher. London: Taylor & Francis. pp. 301-314.

**Xu, Y. & Usher, B.H.** 2006. Issues of groundwater pollution in Africa. In *Groundwater Pollution in Africa*, edited by Y. Xu & B.H. Usher. London: Taylor & Francis. pp. 3-12.

## Conference contributions

**Dennis, I.** 2005. *The South African groundwater decision tool*. Paper presented at the Integrated Water Resources Planning System Symposium, National Botanical Gardens, Pretoria, South Africa.

**Dennis, I., Usher, B.H., Pretorius, J.A., Jovanovic, N., Titus, R., Clarke, S. & Cave, L.** 2005. *Managing groundwater contaminants in South Africa's aquifers*. Paper presented at the Biennial South African Groundwater Conference, CSIR International Conference Centre, Pretoria, South Africa.

**Ellington, R.G., Usher, B.H. & Van Tonder, G.J.** 2005. *Quantification of the impact of irrigation on the groundwater resource in the Vaalharts Irrigation Scheme*. Paper presented at the Biennial South African Groundwater Conference, CSIR International Conference Centre, Pretoria, South Africa.

**Kotze, J., Van Tonder, G.J., Dennis, I. & Zimmermann, S.** 2006. *Determination of sustainable wellfield yield considering*

*groundwater surface water interaction*. Paper presented at the IASTED International Conference, Gaborone, Botswana.

**Labuschagne, P.F., Matfield, F. & Usher, B.H.** 2005. *Geohydrological management approaches for site closure at AngloGold's South African Operations*. Paper presented at the 2nd International Symposium on Processing & Disposal of Mineral Industry Wastes (PDMIW 05), Falmouth, Cornwall, UK.

**Pretorius, J.A., Phophi, T.S., Hohne, S. & Usher, B.H.** 2005. *Ensuring sustainable development by including NAPLs in South African groundwater management*. Paper presented at the Biennial South African Groundwater Conference, CSIR International Conference Centre, Pretoria, South Africa.

**Usher, B.H.** 2005. *Advances in groundwater management in mining*. Paper presented at the WISA Minewater Division One Day Symposium on Developments in Mine Water Management: 5 Years Onwards, REGM, Randfontein, South Africa.

**Usher, B.H.** 2005. *Assessment of pollution status and vulnerability of water supply aquifers of African cities: What was the impact?* Paper presented at the UNEP/UNESCO Sponsored International Workshop on Groundwater Protection in Africa, University of Western Cape, Bellville, South Africa.

**Usher, B.H.** 2005. *Assessment of water quality prediction tools at underground collieries in the Highveld coalfield of South Africa*. Paper presented at the 2nd International Symposium on Processing & Disposal of Mineral Industry Wastes (PDMIW 05), Falmouth, Cornwall, UK.

**Usher, B.H.** 2005. *Influences on coal minewater volumes and qualities and potential management options*. Paper presented at the Olifants River Forum / SACEPA Environmental Conference, Kriel, South Africa.

**Usher, B.H.** 2005. *Technical issues related to mine closure in the Witbank coalfield*. Paper presented at the WISA Mine Water Division Conference on Mine Closure, REGM, Randfontein, South Africa.

**Usher, B.H.** 2005. *Water quality issues in rural groundwater supply*. Paper presented at the SIDA International Hard Rock Hydrogeology Symposium, Pretoria, South Africa.

**Usher, B.H.** 2006. *Impacts and lessons learned from the UNEP/UNESCO 11-Country project*. Paper presented at the 4th World Water Forum on Groundwater Resources Management and Protection in Africa, Mexico City, Mexico.

**Usher, B.H.** 2006. *Lessons from African groundwater pollution studies*. Paper presented at the Conference of the African River and Lake Basin Organisation, Kampala, Uganda.

**Usher, B.H.** 2006. *Lessons from six years of pollution studies in Africa*. Paper presented at the International Workshop on Groundwater in Africa, Cape Town, South Africa.

**Usher, B.H. & Cruywagen, L.M.** 2006. *Mine water drainage prediction (South African perspective)*. Paper presented at the 2nd WISA Mine Water Division Conference, REGM, Randfontein, South Africa.

**Usher, B.H., Pretorius, J.A., Van Tonder, G.J. & Van der Merwe, J.** 2005. *Management of a*



*Karoo fractured rock aquifer system – The Kalkveld Water User Association (WUA)*. Paper presented at the Biennial South African Groundwater Conference, CSIR International Conference Centre, Pretoria, South Africa.

**Usher, B.H., Yibas, B. & Zhao, B.** 2005. *Upscaling of kinetic geochemical tests for water quality prediction at underground collieries*. Paper presented at the International Securing the Future Conference on Mining and the Environment, Metals and Energy Recovery, Skellefteå, Sweden.

**Van Tonder, G.J., Vermeulen, P.D., Dennis, I. & Usher, B.H.** 2005. *Common errors hydrogeologists made when assessing groundwater flow systems: Examples over 30 years*. Paper presented at the Biennial South African Groundwater Conference, CSIR International Conference Centre, Pretoria, South Africa.

**Van Wyk, A. & Usher, B.H.** 2005. *Biobarrier formation to facilitate hydraulic control as part of groundwater remediation strategies*. Paper presented at the Biennial South African

Groundwater Conference, CSIR International Conference Centre, Pretoria, South Africa.

**Vermeulen, P.D.** 2005. *Determination of the impact of mine water irrigation on groundwater resources*. Paper presented at the Olifants River Forum / SACEPA Environmental Conference, Kriel, South Africa.

**Vermeulen, P.D.** 2005. *Factors influencing water quantities and qualities in the Mpumalanga Coalfields*. Paper presented at the South African Institute for Mining and Metallurgy Conference, Carnival City, South Africa.

**Vermeulen, P.D. & Hodgson, F.D.I.** 2005. *Recharge in South African underground collieries*. Paper presented at the Biennial South African Groundwater Conference, CSIR International Conference Centre, Pretoria, South Africa.

**Vermeulen, P.D. & Usher, B.H.** 2005. *Determination of the impact of mine water irrigation on groundwater resources*. Paper presented at the International Securing the Future Conference on Mining and the Environment, Metals and Energy Recovery, Skellefteå, Sweden.

# Statistical data of the faculty



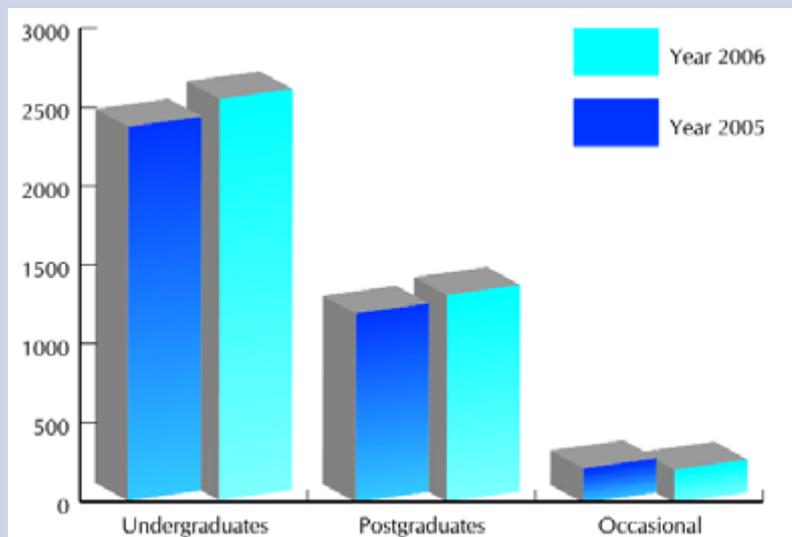
# Student figures

Faculty of Natural and Agricultural Sciences, 2005/06

Male					
2005					
Description	African	Coloured	Indian	White	Total
Undergraduate	676	31	26	724	1457
Postgraduate	351	22	15	400	788
Occasional	84	3	4	17	108
<b>Total 2005</b>	<b>1111</b>	<b>56</b>	<b>45</b>	<b>1141</b>	<b>2353</b>
2006					
Description	African	Coloured	Indian	White	Total
Undergraduate	729	28	21	768	1546
Postgraduate	385	21	16	431	853
Occasional	68	2	2	23	95
<b>Total 2006</b>	<b>1182</b>	<b>51</b>	<b>39</b>	<b>1222</b>	<b>2494</b>

Female					
2005					
Description	African	Coloured	Indian	White	Total
Undergraduate	563	41	11	394	1009
Postgraduate	206	16	11	221	454
Occasional	101	5	2	11	119
<b>Total 2005</b>	<b>870</b>	<b>62</b>	<b>24</b>	<b>626</b>	<b>1582</b>
2006					
Description	African	Coloured	Indian	White	Total
Undergraduate	641	39	17	401	1098
Postgraduate	243	15	17	234	509
Occasional	103	2	2	16	123
<b>Total 2006</b>	<b>987</b>	<b>56</b>	<b>36</b>	<b>651</b>	<b>1730</b>

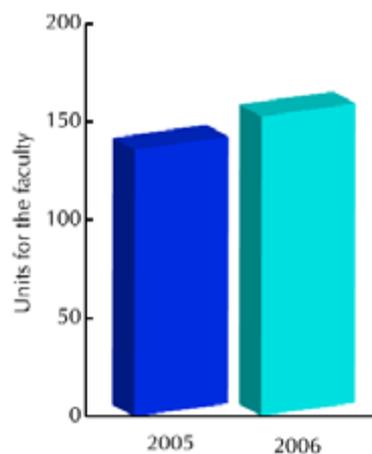
Total					
2005					
Description	African	Coloured	Indian	White	Total
Undergraduate	1239	72	37	1118	2466
Postgraduate	557	38	26	621	1242
Occasional	185	8	6	28	227
<b>Total 2005</b>	<b>1981</b>	<b>118</b>	<b>69</b>	<b>1767</b>	<b>3935</b>
2006					
Description	African	Coloured	Indian	White	Total
Undergraduate	1370	67	38	1169	2644
Postgraduate	628	36	33	665	1362
Occasional	171	4	4	39	218
<b>Total 2006</b>	<b>2169</b>	<b>107</b>	<b>75</b>	<b>1873</b>	<b>4224</b>



Student figures

Student nationality		
Nationality	2005	2006
Angola	1	
Asian countries	21	18
Botswana	20	20
European countries	6	6
Lesotho	142	142
Malawi	2	1
Mauritius		2
Mozambique	8	7
Namibia	40	42
No information	1	
North America	4	4
Other Africa	45	48
South Africa	3610	3893
South America		1
Swaziland	13	13
Zambia	4	6
Zimbabwe	18	21
<b>Total</b>	<b>3935</b>	<b>4224</b>

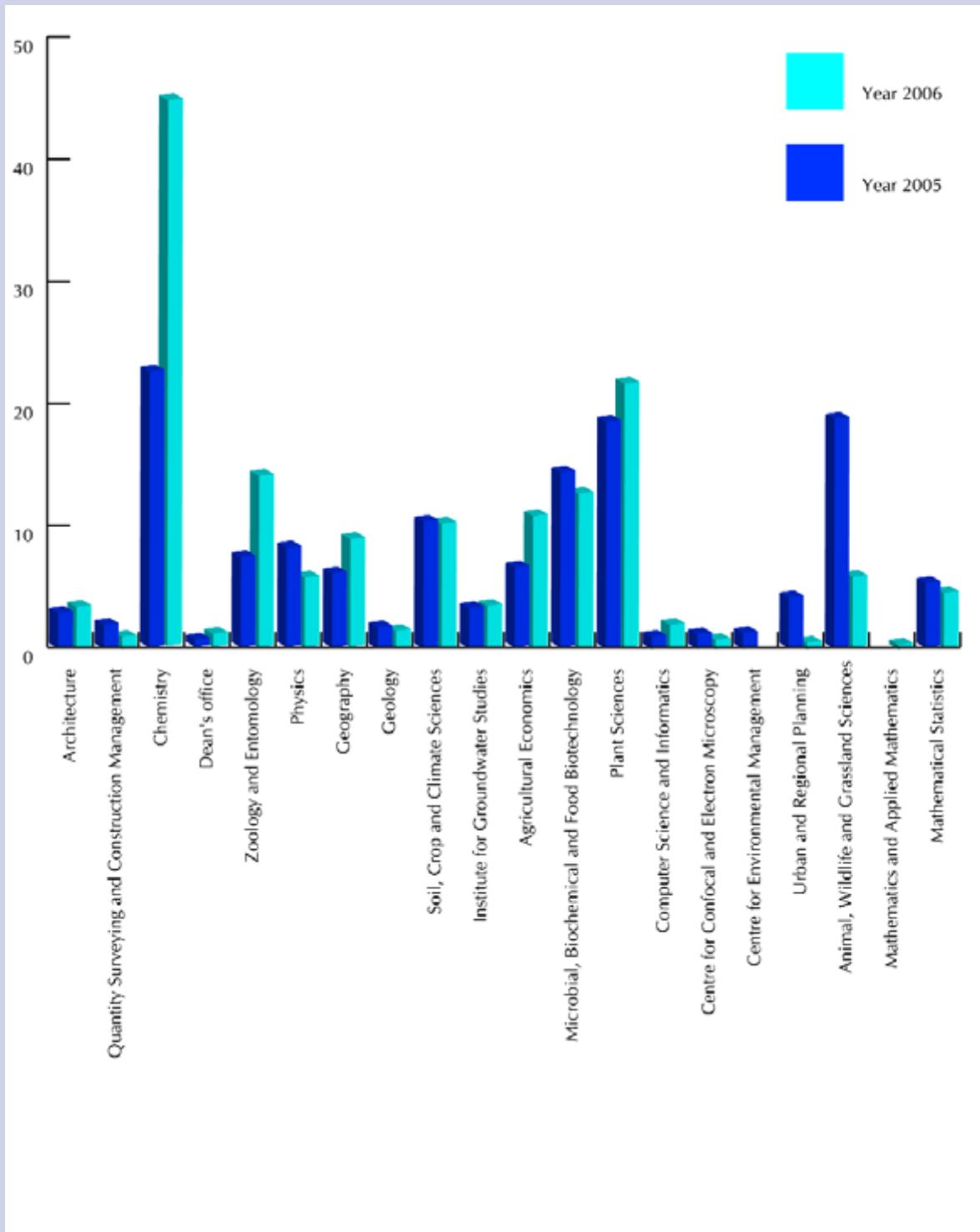
## Research outputs for the Faculty of Natural and Agricultural Sciences



Articles published in accredited approved research journals.

## Departmental research outputs

Articles published in accredited approved research journals, 2005/06





# Glossary



# Glossary

## A

ACIAR	Australian Centre for International Agricultural Research
AEASA	Agricultural Economics Association of South Africa
ALPRU	African Large Predator Research Unit
ARC	Agricultural Research Council
ARMSCOR	Armaments Corporation of South Africa
ARS	Agri Risk Specialists
ASAQS	Association of South African Quantity Surveyors
ASSA	Anatomical Society of South Africa
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
AVS	American Vacuum Society

## C

CANSA	Cancer Association of South Africa
CATSA	Catalysis Society of South Africa
CBD	Convention of Biological Diversity
CCEM	Centre for Confocal and Electron Microscopy
CePHMa	Centre for Plant Health Management
CfPB	Centre for People and Buildings
CIAT	International Centre for Tropical Agriculture
CIDB	Construction Industry Development Board
CIMMYT	International Maize and Wheat Improvement Centre
CIOB	Chartered Institute of Building
CIOB-SA	Chartered Institute of Building - South Africa
CSACEE	Central South African Council on Economic Education
CSIC-INTA	Centro de Astrobiología
CSIR	Council for Scientific and Industrial Research
CSIRO	Commonwealth Scientific and Industrial Research Organisation

## D

DEAT	Department of Environmental Affairs and Tourism
DiMTEC	Disaster Management Training and Education Centre for Africa
DMISA	Disaster Management Institute of South Africa
DST	Department of Science and Technology

## E

EAAP	European Association for Animal Production
EASA	Education Association of South Africa
ECA	European Crystallographic Association
EIGG	Environmental Inorganic Geochemistry Group
EPWP	Expanded Public Works Programme
ESBES	European Symposium on Biochemical Engineering Science
ESREL	European Safety and Reliability
ESRP	Economic and Social Rehabilitation Programme

## F

FAO	Food and Agriculture Organisation
FEMS	Federation of European Microbiological Societies
FMP	Facilities Management Programme
FOTIM	Foundation of Tertiary Institutions of the Northern Metropolis

FSRPO	Free State Red Meat Producers Organisation
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## G

GIS	Geographical Information Systems
Glen ADI	Glen Agricultural Development Institute
GM	Genetically Modified
GMBA	Gauteng Master Builders' Association
GMO	Genetically Modified Organisms
GWK	Griekwaland-Wes Koöperasie

## H

HIV	Human Immunodeficiency Virus
HPCSA	Health Professions Council of South Africa
HPLC	High Performance Liquid Chromatography
HSPCM	Health and Safety Programme for Construction Managers

## I

IAGOD	International Association on the Genesis of Ore Deposits
IAH	International Association of Hydrogeologists
ICCC	International Conference on Coordination Chemistry
ICEC	International Cost Engineering Council
ICID	International Commission on Irrigation and Drainage
ICP	Inductively Coupled Plasma
ICRBM	International Conference on Rodent Biology and Management
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDC	Industrial Development Corporation
IGS	Institute for Groundwater Studies
IITA	International Institute of Tropical Agriculture
INCRoP	Insects on New Crops Programme
INTSORMIL	International Sorghum and Millet Research Support Programme

## IPMA

IPMA	International Project Management Association
IPMP	Intensive Project Management Programme
IRDP	Institutional Research and Development Programme
IRWH	In-field Rainwater Harvesting
IUCr	International Union of Crystallography
IUMS	International Union of Microbial Societies
IUPAP	International Union of Pure and Applied Physics

## J

JFM	Journal of Facilities Management
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## L

LExEn	Life in Extreme Environments
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## M

MIRCHEN	Microbiological Resources Centre
MIT	Massachusetts Institute of Technology
MRM	Mineral Resource Management
MSA	Master's Degree in Sustainable Agriculture
MSSA	Microscopy Society of Southern Africa
MUCPP	Mangaung University Community Partnership Programme
MURP	Master's Degree in Urban and Regional Planning

## N

NaCOF	National Climate Outlook Forum
NAFU	National African Farmers Union
NAMC	National Agricultural Marketing Council
NASA	National Aeronautics and Space Administration
NASSP	National Astrophysics and Space Science Programme
NCEE	National Council for Economic Education
NDA	National Department of Agriculture
NECSA	National Energy Commission of South Africa
NELSAM	Natural Earthquake Laboratory in South African Mines
NERPO	National Emergent Red Meat Producers' Organisation
NGO	Non-Governmental Organisation
NML	National Metrological Laboratory
NMMU	Nelson Mandela Metropolitan University
NMR	Nuclear Magnetic Resonance
NRF	National Research Foundation
NUFU	Norwegian Council of Universities Committee for Development, Research and Education
NWGA	National Wool Growers' Association

## O

OABS	Optimal Agricultural Business Solutions
OECD	Organisation for Economic Co-operation and Development

## P

PARSA	Parasitological Association of Southern Africa
PDMIW	Processing and Disposal of Mineral Industry Wastes
POT	Peaks over Threshold
PPP	Public Private Partnership
PRT	Protein Research Trust

## R

RICS	Royal Institute of Chartered Surveyors
RIEP	Research Institute of Education Planning
RNA	Research Niche Area
RPO	Red Meat Producers' Organisation

## S

SA	South Africa
SAACE	South African Association of Consulting Engineers
SAB	The South African Breweries Limited
SACI	South African Chemical Institute
SACPCMP	South African Council for the Project and Construction Management Profession
SACPVP	South African Council for the Property Valuation Profession
SACQSP	South African Council for the Quantity Surveying Profession
SADC	Southern African Development Community
SAFMA	South African Facilities Management Association
SAFOI	South African Fryer Oil Initiative
SAIP	South African Institute of Physics
SAISC	Southern African Institute of Steel Construction
SAMSI	Statistical and Applied Mathematical Sciences Institute

SANCIAHS	South African National Committee for the International Association of Hydrological Sciences	SEDA	Small Enterprise Development Agency	UNEP	United Nations Environment Programme
SANCU	South African National Consumer Union	SMME	Small, Medium and Micro Enterprises	UNESCO	United Nations Educational, Scientific and Cultural Organisation
SANPAD	South Africa-Netherlands Research Programme on Alternatives in Development	SRC	Student Representative Council	USA	United States of America
SAPOA	South African Property Owners' Association	SRL	Sustainable Rural Livelihood	USAID	United States Agency for International Development
SAPS	South African Police Services	SSAG	Society of South African Geographers	UTCHEM	University of Texas Chemical Compositional Simulator
SAQA	South African Qualifications Authority	<b>T</b>		UWC	University of the Western Cape
SASAS	South African Society for Animal Science	THRIP	South African National Research Foundation Thrust for Industry-Related Projects	<b>W</b>	
SASQUA	Southern African Society for Quaternary Research	TUE	Technical University Eindhoven	WARFSA	Water Research Fund of Southern Africa
SAVAH	South African Association of Visual Arts Historians	<b>U</b>		WATOC	World Association of Theoretically Orientated Chemists
SBE	Sustainable Built Environments	UCT	University of Cape Town	WFP	World Food Programme
		UFS	University of the Free State	WITS	University of the Witwatersrand
		UJ	University of Johannesburg	WRC	Water Research Commission
		UK	United Kingdom	WUA	Water Users' Association
		UN	United Nations		

