Faculty of
Natural and Agricultural Sciences

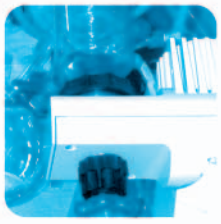
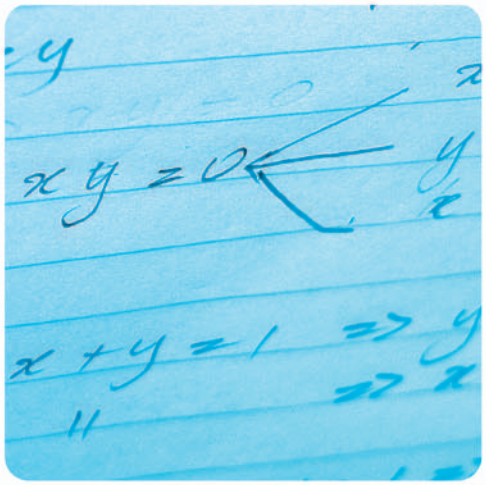
Report 2008










UNIVERSITEIT VAN DIE VRYSTAAT • UNIVERSITY OF THE FREE STATE • YUNIVESITHI YA FREISTATA

Faculty of Natural and Agricultural Sciences

Report 2008

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Preface

From the Dean's Office

In 2008 the Faculty of Natural and Agricultural Sciences once again lived up to its vision to be acknowledged as a faculty that is at the forefront of the practice of natural and agricultural science where the highest levels of quality and credibility are reflected.

During the year the faculty not only remained one of the leaders in training and career development in the natural and agricultural sciences, but it also made a concerted effort to enlarge its international footprint and to establish itself internationally. This is evident in the visits of staff from the faculty to universities such as the USA-based University of Minnesota and Virginia Polytechnic Institute and State University (Virginia Tech) and the extension of international agreements between the University of the Free State (UFS) and these institutions. The faculty also had the privilege of hosting a high-level delegation from the University of Minnesota on the Main Campus in Bloemfontein in August 2008.

The turmoil in the international markets firstly led to very high oil prices, which spilt over to the grain markets and high food prices. This, in turn, led to high inflation levels and therefore high interest rates. Eventually the exchange rate also deteriorated against the major currencies. In the latter part of the year the whole situation was turned upside down with the collapse of the financial markets. The faculty did not escape this and the price of equipment for which orders were placed sky rocketed. Innovative skills had to be applied to remain on track with our equipment strategy.

Although 2008 was an exceptionally difficult year for the UFS and the institution had to bear the brunt of the Reitz video and the reaction of the national and international community, the faculty still managed to perform and expand its core business.

The faculty offers multi-disciplinary and holistic courses to send skilled and capable students into the South African workplace and to empower the labour force. Our general and extended programmes are continuously assessed and improved in order to improve our throughput rates and quality of teaching.

The staff at the faculty worked tirelessly this year to broaden our product offering and to provide our students with the best quality teaching in the country. I applaud their efforts of expanding capacity, developing programmes and strengthening relationships both within and outside the faculty and the university.

Prof. Herman van Schalkwyk.

I also want to applaud the staff and students of the faculty with their achievements this year – whether it is on a personal level, in their capacity as staff member of their respective department/centre or for the faculty. To mention a few:

- Ms Estelle Heideman HIV/Aids coordinator of the Lengau Agricultural Development Centre, received a bursary to participate in a leadership programme in the United States of America (USA), which trains female leaders in South Africa who contribute to the prevention of HIV at a local, regional and national level;
- In the Department of Agricultural Economics, Prof. Johan Willemse, known for his contribution towards agriculture, was appointed on the non-executive board of Absa;

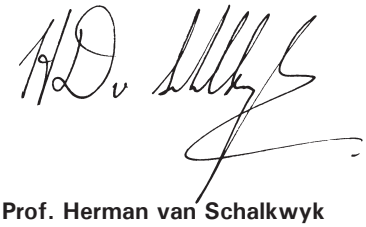
Staff in the dean's office

The staff working in the dean's office are, from the left, front: Ms Stefanie Naborn, Manager: Marketing and Liaison, Ms René Bloem, Secretary, Prof. Neil Heideman, Vice-Dean: Faculty of Natural and Agricultural Sciences; back: Mr Clasie Claassen, Assistant Administrative Officer, Mr Johan Kruger, Faculty Manager, Ms Lorinda Rust, Secretary, and Ms Mitzie Cloete, Typist/Clerical Assistant.

- Prof. James du Preez, Departmental Chair of the Department Microbial, Biochemical and Food Biotechnology, received the silver medal for exceptional published research awarded at the biennial conference of the South African Society for Microbiology hosted in Graham's Town. It was only the seventh time since 1986 that the medal was awarded;
- A study of the UFS about how the change in the packaging of DNA with cellular development is influenced by die expression of genes, in which Prof. Hugh Patterton played a leading role, was published in a leading peer-reviewed scientific journal *Proceeding of the National Academy of Sciences* of the USA (PNAS). The PNAS journal has an impact factor of 10, which means that studies published in this journal are referred to by ten other scientific studies within the scope of two years;
- Prof. Riaan Luyt, professor in Chemistry and head of the Natural Sciences Programme at the Qwaqwa Campus, received an honorary medal from the Polymer Institute of the Slovak Academy of Sciences during a conference hosted in the High Tatras mountains of Slovakia;
- Prof. Maryke Labuschagne from the Department of Plant Sciences was the recipient of the National Science and Technology Forum's (NSTF) research capacity-development award. A team consisting of Prof. Jan van der Westhuizen and Dr Susan Bonnet from the Department of Chemistry, Prof. Kenneth Swart and Prof. Thinus van der Merwe from FARMOVS-PAREXEL also received the innovation award for an outstanding contribution to science, engineering and technology by either an individual or a team over the last ten years from the NSTF;
- Prof. Maryke Labuschagne received a second prestigious national award for her research when the 2008 Cereal Science and Technology - SA's (CST-SA) Award for research and development was awarded to her; and
- Prof. Ivan Horak, extraordinary professor at the university's Department of Zoology and Entomology, became the third person in the history of the UFS to receive the D.Sc. degree.

In closing I would like to thank the faculty's lecturing staff for their support and enthusiasm during the past year. However, none of these achievements would have been possible without the interest and hard work of the administrative staff.

During 2008 we have all worked together to live up to the faculty's motto: "There is no substitute for excellence!" This report covers the activities of the faculty in 2008. It is a reflection of a year's commitment from a team of highly skilled academic and support staff.



Prof. Herman van Schalkwyk
Dean: Faculty of Natural and Agricultural Sciences
University of the Free State

Faculty news

Successful visit from delegation of the University of Minnesota

A senior delegation from the University of Minnesota in the United States of America (USA) paid a very successful visit to the University of the Free State (UFS) in May 2008 to explore ways of strengthening already existing ties between the two institutions.

Teacher training, capacity building in health sciences and student preparedness were among the areas of cooperation that were investigated, within the context of the Strategic Academic Cluster initiative of the UFS. Poverty reduction strategies were also a strong focus area.

The Faculty of Natural and Agricultural Sciences has had a cooperation agreement with the University of Minnesota's Department of Applied Economics since 2002 and the exchange of staff has been taking place on a regular basis. This agreement will be expanded and both institutions are now exploring the possibility of applying it across faculties. Both institutions have committed seed funding to formalise the cooperation agreement.

During the visit are, from the left: Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences at the UFS, Prof. Robert Jones, Senior Vice-President: System Academic Administration at the University of Minnesota, Dr Meredith Quiad, Associate Vice-President and Dean: International Programmes, University of Minnesota, Prof. Teuns Verschoor, Acting Rector of the UFS and Prof. Ezekiel Moraka, Vice-Rector: Student Affairs at the UFS.

50 years of Agriculture celebrated

The faculty celebrated 50 years of the teaching of agriculture at the UFS in November 2008. Part of the celebrations was a seminar with the theme "Challenges in a changing agricultural environment". Some of the guest speakers are, from the left: Mr Corwyn Botha, Chairman: Agri Business Chamber and Managing Director of the Cape Agri Group, Mr Motsepe Matlala, President of NAFU, Mr Hans van der Merwe, Executive Head: Agri SA, Prof. Herman van Schalkwyk: Dean: Faculty of Natural and Agricultural Sciences at the UFS, and Mr Sugar Ramakarane, Head: Department of Agriculture, Free State Province.

Winners of NSTF awards assist with recruitment of students

Here are, from the left: Dr Martin Ntwaeaborwa, senior lecturer at the Department of Physics and finalist in the category for black researchers, Prof. Kenneth Swart, FARMOVS-PAREXEL, Prof. Maryke Labuschagne, head of Plant Breeding at the UFS's Department of Plant Sciences and female recipient of the award for the development of research capacity over the past five to ten years, and Prof. Jan van der Westhuizen, Department of Chemistry at the UFS; front: Ms Kedibone Aphane, MRC. Prof. Swart and Prof. Van der Westhuizen were the leaders of the team who received the award for the development of innovation by a corporate organisation or institution.

Representatives of the South African Medical Research Council (MRC) visited the UFS to recruit students who want to study in the fields of science, engineering and technology. To assist with the recruitment, the winners of awards made by the National Science and Technology Forum (NSTF) earlier this year, made presentations to create an interest amongst students. The UFS had four finalists of whom two were the winners in their respective categories.

Young scientists learn what faculty can offer

Young science lovers gathered in Sasolburg for the annual Sasol TechnoX in August 2008. The faculty's exhibition captured the learners' attention through an interactive representation of the application fields of science. Delegates from the Departments of Mathematics and Applied Mathematics, Chemistry, Zoology and Entomology, as well as UFS Marketing stood ready to answer the questions of the 20 832 learners who attended the event. Pictured here is Theo Viljoen, M.Sc. student in Forensic Entomology, sharing interesting facts regarding insects with learners.

Two UFS academics appointed on the Land Bank Board

Prof. Herman van Schalkwyk (left), Dean: Faculty of Natural and Agricultural Sciences, and Mr Theo Potgieter from the UFS School of Management were appointed on the Land Bank Board in March 2008. Prof. van Schalkwyk was appointed as Director and Deputy Chairperson and Mr Potgieter as Director of the Board. The appointments were made by the Minister of Agriculture and Land Affairs, Ms Lulu Xingwana, and are effective for a period of four years.

UFS extends exchange agreement with USA university

Here are, from the left, front: Dr SK de Datta, Vice-Rector: International Affairs, VT, Prof. Herman van Schalkwyk, Dean of the Faculty of Natural and Agricultural Sciences, UFS, Dr Martin Ntwaeaborwa, senior lecturer at the Department of Physics, UFS; back: Prof. Jim McKenna, Department of Crop, Soil and Environmental Affairs, VT, Prof. Izak Groenewald, Director of the Centre for Sustainable Agriculture and Rural Development at the UFS and responsible for the faculty's international liaison, Dr Michael Bertelsen, VT's international office, Dr Aldo Stroebel, Head: Internationalisation at the UFS and Dr Liesel Herselman, senior lecturer at the Department of Plant Sciences, UFS.

A delegation from the faculty visited the Virginia Tech University (VT) in the USA in June 2008 to confirm and extend the existing student exchange agreements between the two institutions.

During the visit the agreement, which started in 1997, was extended for the next five years. More than 150 students from both institutions have already taken part in this exchange agreement and it is the most successful student exchange agreement that VT is involved in. Although agricultural students from the UFS initially took part in the agreement, it was extended to other departments in the faculty and also to the rest of the UFS.

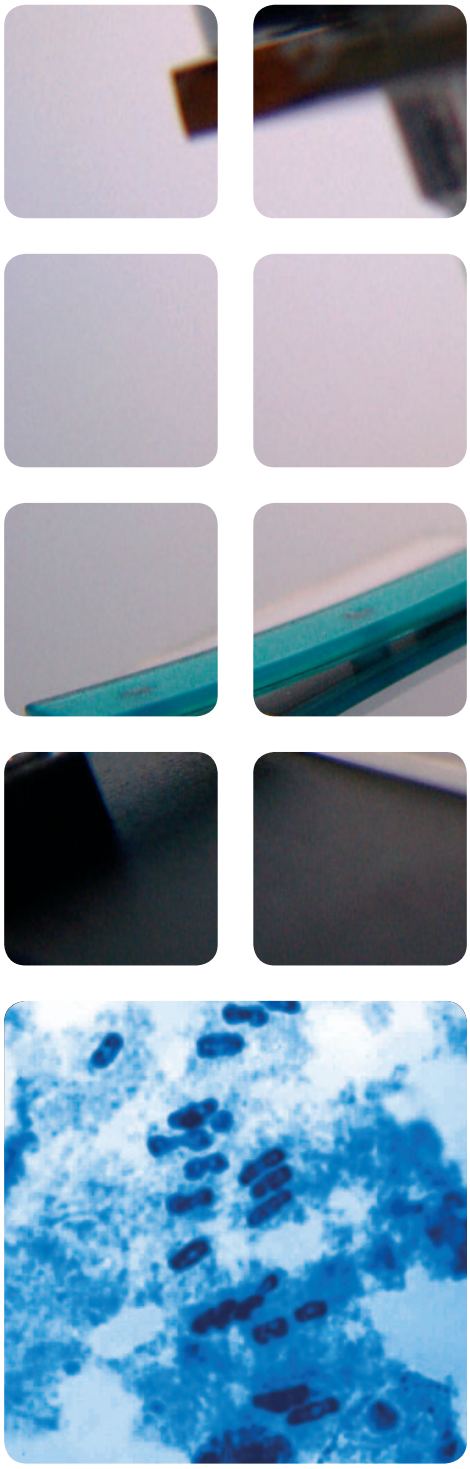
Itjoriseng Project launched

The faculty launched the Itjoriseng Project on the Main Campus in Bloemfontein in March 2008. The aim of the project is to improve the skills of teachers in the subjects Mathematics and Physical Science for Grades 10–12. "Itjoriseng" is the Sotho word for "sharpen yourself". At the launch were, from the left: Mr Mzamo Jacobs, Director: Curriculum Development for Further Education and Training, Free State Department of Education, Mr Johan Kruger, Faculty Manager, Ms Elna Marais, Chief Education Specialist: Curriculum Development, Free State Department of Education, and Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences at the UFS.

2007 Faculty report launched

The faculty once again produced another report in which the various departments and centres highlighted their activities for 2007. The report was so well received that a second edition had to be printed. Here are some of the departmental chairpersons during the launch of the report in June 2008.

Departments in the Natural Sciences



Department of Chemistry

"The further upgrading of our research equipment contributed to a sustained high research output." - Prof. André Roodt.

Prof. André Roodt.

Overview

The Department of Chemistry experienced a continued revival in quality and excellence in pursuit of the strategic priorities of the University of the Free State (UFS) and the Faculty of Natural and Agricultural Sciences.

Four postdoctoral associates, 27 M.Sc. and 29 Ph.D. students in different sub-disciplines led to sustained research output for 2008. More than 45 research articles were published in international accredited journals and numerous local and international congress presentations were made.

Several prominent scientists visited the departments in Bloemfontein and on the Qwaqwa campus, such as Profs Ola Wendt (Lund University, Sweden), Daneel Ferreira (University of Mississippi, United States of America (USA)), Dr Ettiene Snyders (Nuclear Energy Corporation of South Africa (NECSA)), Dr Desmond Young (SASOL), Dr Johann Nel (NECSA), Dr Cassie Carstens (NECSA), Prof. Albrecht Berkessel (Keulen University, Germany), Dr Johntho Dixon (SASOL Technology), Prof. Roger Hunter (University of Cape Town), Profs Massimo Messori and Paola Fabbri (Department of Materials Engineering, University of Modena and Reggio Emilia, Italy), Prof. Tibor Czigany, Dr Jozef Kovács and Mr Tamás Tábi (all from the Department of Polymer Engineering, Budapest University of Technology and Engineering, Budapest, Hungary), and Drs Igor Krupa and Igor Novak (Polymer Institute, Slovak Academy of Sciences, Bratislava, Slovak Republic).

These scientists presented lectures and held research discussions with researchers and postgraduate students in the departmental research seminar programme, which continued very successfully with around thirty research presentations during 2008.

Drs Gideon Steyl and Fanie Muller both received Y2 ratings from the National Research Foundation (NRF). Similarly, Prof. Jannie Swarts (C1), Prof. Walter Purcell (C3) and Dr Jeanet Conradie (C3) were rated by the NRF.

The upgrading of the Moerdyk and associated annexed building, which houses the department, continued, and the overall project, to the value of more than R50 million, will be completed over a three-year period. This unprecedented investment in Chemistry by university management and the commitment to create a highly competitive teaching and research unit, made good progress during 2008, in spite of several unfortunate delays. The first two phases of the total upgrade were completed and occupied in May 2008.

The further upgrading of the department's research equipment contributed to a sustained high research output. This new equipment strategy forms part of the university's vision to be inter-

nationally visible with quality research outputs in niche areas, to provide leadership in advanced training to the African continent student corps and to be an important player amongst South African universities as well as a competitor internationally.

The interruptions due to the renovation of the entire building posed a range of unique problems in terms of practical classes, theory and research, and placed significant stress on the department. In spite of these challenges, the enthusiasm of the staff was illustrated by the fact that most activities were continued without any significant interruptions throughout the year.

The support of senior management, particularly on faculty level by Prof. Herman van Schalkwyk, Dean of the Faculty of Natural and Agricultural Sciences, as well as faculty colleagues, in providing office and laboratory space and other support for Chemistry under- and postgraduate students, is again gratefully acknowledged.

A new agreement between the UFS and SASOL, worth R6 million for the 2008/2009 year, according to which process technology and research development catalysis reside in the department, was continued and supported by the continued seconding of Prof. Ben Bezuidenhoudt to the department.

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

To fulfill the need especially of previously disadvantaged students in the use of computers to work up and present experimental results scientifically, Dr Conradie presented courses in computer skills for undergraduate and postgraduate students in Chemistry. She continued WebCT which provides question and answer quizzes for computer-guided first-year chemistry revision.

Advanced topics in a number of courses in the B.Sc. honours programme were further introduced and refined by outside scholars, exposing the chemistry students to international teachers. These included lectures on natural product chemistry by Prof. Ferreira, industrial and organometallic chemistry by Prof. Bezuidenhoudt, and computational chemistry by Drs Jan-Albert van der Berg from SASOL and Gideon Steyl from the UFS in the standard honours courses in Organic and Inorganic Chemistry. The special honours course saw the refining of advanced topics in bioanalytical chemistry by Profs Ken Swart and Thinus van der Merwe from FARMOVS-PAREXEL, and on heterogeneous catalysis by Dr Thys Botha from SASOL.

The 14th successive science quiz competition, MINQUIZ, one of the faculty's community service flagships and jointly sponsored by the UFS and MINTEK, was successfully presented by Ms Ina du Plessis and Prof. Jannie Swarts. A group of 200 pupils, comprising the three top physical science learners of each secondary school in the Free State province, visited the Main Campus during March 2008 where they were exposed to information on career opportunities in Chemistry, Physics and Geology. Six winning schools in two categories were awarded monetary prizes to enhance their school science laboratories.

Colleagues in the department were involved in various committees, notably Prof. Jannie Swarts, who continued to contribute significantly in planning and negotiations to expand the equipment infrastructure of the faculty. Specifically, towards the end of 2008, Prof. Swarts negotiated support from the National Research Foundation (NRF) to the value of more than R10 million to expand the surface and physical chemistry/physics thrust, in collaboration with the Department of Physics at the UFS.

Ph.D. students in the laboratory synthesizing new compounds: Ms Marietjie Schutte (left), and Ms Truidie Venter.

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

Most lecturers were involved in continuous career guidance and laboratory demonstration sessions to individual and groups of school learners, and colleagues at both the campuses contributed to UFS open and Expo days.

Ten oral presentations were made on invitation at international conferences and venues as well as eighteen poster presentations at local and international venues, with more than 45 research papers published (see list below).

The NRF's Technology and Human Resource for Industry Programme (THRIP) application in Applied Process Chemistry from combined inputs of Inorganic, Physical and Organic Chemistry (Profs Roodt, Swarts, and Bezuidenhoudt) was successful and sourced an additional R1.2 million

The recipients of the National Science and Technology Forum (NSTF) award are, from the left: Dr Susan Bonnet, from the department, Prof. Thinus van der Merwe, FARMOVS-PAREXEL, Prof. Jan van der Westhuizen, from the department, and Prof. Ken Swart, FARMOVS-PAREXEL.

for the upgrade of equipment and extended capacity building.

Special honours were bestowed on groups in the department on two occasions.

Firstly, the organic section continued on the division's THRIP project, in collaboration with FARMOVS-PAREXEL, which undertakes the synthesis of isotope-labeled internal standards and metabolites in the support of novel bio-analytical clinical trials for th e registration of new medicines (locally and internationally). With this project, the FARMOVS-PAREXEL team at the Department of Chemistry, received the prestigious National Science and Technology Forum (NSTF) award for innovation and an outstanding contribution to Science, Engineering and Technology during the past ten years. The team consisted of Prof. Jan van der Westhuizen (team leader) and Dr Susan Bonnet from the Department of Chemistry and Prof. Kenneth Swart (co-leader) and Prof. Thinus van der Merwe from FARMOVS-PAREXEL. The NSTF awards give recognition to outstanding contributions of individuals and groups to science, engineering and technology. The NSTF represents government, the science councils (Agricultural Research Council (ARC), Medical Research Council (MRC) and the Council for Scientific and Industrial Research (CSIR)), the NRF, professional bodies, higher education (universities and the Department of Education), business and civil society. This is a most prestigious award to a scientist or team (in this case the FARMOVS-PAREXEL team at the Department of Chemistry at the UFS) in South Africa and represents recognition by the wider science and technology community in South Africa.

Secondly, Prof. Riaan Luyt received an honorary medal and certificate from the Polymer Institute, Slovak Academy of Sciences for long-standing and fruitful research collaboration with members of the institute.

On a sad note, Drs Reinout Meijboom and Fanie Muller left the UFS after appointment to senior lecturing positions at the University of Johannesburg.

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

Prof. Bezuidenhoudt attended the 10th International Symposium on Dioxygen Activation and Homogeneous Catalytic Oxidation (ADHOC-08) in Venice, Italy. Furthermore, five students accompanied him to the 10th Frank Warren Organic Conference of the South African Chemical Institute in the Kruger National Park. Apart from the five poster presentations by the students, Prof. Bezuidenhoudt also gave a lecture, the only one from the UFS. Prof. Bezuidenhoudt also acted as reviewer for the *Journal of Natural Products*, and sat on the Chemistry Evaluation Committee of the NRF.

The group acquired a new gas chromatograph worth R120 000, as well as a Maldi-Toff mass spectrometer worth R1.8 million, which was delivered in August, and for which Dr Charlene Marais and Ms Dudu Saku attended a week-long training course in Germany during December. Despite a lack of experience in the use of the Maldi-Toff instrument, important results in solving difficult research problems have already been obtained.

The **Polymer Science research area** is headed by of Prof. Riaan Luyt at the Qwaqwa Campus. His group comprises five masters and six Ph.D. students, and the research focuses on physical properties of polymer/wax mixtures, polymer/natural fibre composites and polymer nanocomposites. Chemistry at the Qwaqwa Campus again did exceptionally well in terms of research, given the infrastructure shortage and relatively heavy work load.

Collaboration on a national level was undertaken with Prof. Walter Focke, Institute for Applied Materials, University of Pretoria. Combined research resulted in two papers submitted to international peer-reviewed journals. Further collaboration exists with Dr Suprakas Sinha Ray, Nanotechnology Research Group, CSIR. Prof. Luyt is co-supervisor of three Ph.D. students working under the supervision of Dr Sinha Ray and Dr Andrew de Vries, Polymers and Bioceramics

Research Group, CSIR. Prof. Luyt is co-supervisor of one Ph.D. student working under the supervision of Dr De Vries.

International collaboration exists, via a formal SA-India bilateral agreement on latex-based nanocomposites, with Prof. Sabu Thomas, Institute for Macromolecular Science and Engineering, Mahatma Gandhi University, Kottayam, India. Furthermore, there is a formal SA-Slovakia inter-governmental project on phase change materials, in collaboration with Dr Igor Krupa, Polymer Institute, Slovak Academy of Sciences, Bratislava, Slovak Republic, and a formal SA-Italy inter-governmental project on nanoparticles for polymers reinforcement with Prof. Massimo Messori, University of Modena and Reggio Emilia, Modena, Italy. Finally, there is a formal SA-Hungary inter-governmental project on development and investigation of injection moulded, natural fibre reinforced composites using biodegradable matrix with Prof. Tibor Czigany, Department of Polymer Engineering, Budapest University of Technology and Economics, Budapest, Hungary.

The **Analytical division** currently consists of Prof. Walter Purcell, Dr Karel von Eschwege and Ms Rebotsamang Shago and is supported by five M.Sc. students.

Researchers in the analytical section are currently involved the establishment and evaluation of different digestion methods (microwave and fluxes) of plasma dissociated and natural occurring zircon as well as the quantification of the different elements in these minerals. Inductively coupled plasma optical emission (ICP OES), atomic absorption (AA) and ultraviolet/visible spectroscopy are mainly employed in the research. Cooperation with NECSA was established and currently they are funding three students to do research on the establishment of digestion methods and element quantification in plasma dissociated and natural zircon as well as tantalite minerals.

Preliminary investigations, in collaboration with Soil Sciences, are also involved to determine the possible pollution of irrigation water by agricultural activities in the Vaalharts Irrigation system.

Another study involves the investigation of photochromic reactions in different transition metal complexes, with potential applications in high density optical molecular switching mechanisms. Instrumental techniques such ultraviolet/visible, infrared, nuclear magnetic resonance, Cyclic-Voltammetry, Quantum Computational Chemistry (Amsterdam Density Function and Gaussian) and X-ray Crystallography are employed in these studies.

Dr Von Eschwege received research funding from the NRF under the Institution Redress and Development Programme (IRDP): Nanotechnology section, and successfully negotiated a research agreement with Prof. Heinrich Schwoerer of the Laser Institute (laser and ultra high speed spectroscopy) at the University of Stellenbosch to study rapid intra-molecular processes in light sensitive molecular processes. A number of mutual visits originated from this collaboration. Dr Von Eschwege further attended a Centre for High Performance Computing (CHPC) workshop at the University of KwaZulu-Natal: Quantum Computational Chemistry: Gauss-View. Prof. Purcell attended a workshop on ISO 17025: 2005 – Implementation for Testing Laboratories, held in Bloemfontein at the end of October 2008.

Mr Steven Lötter (M.Sc. student) gave an oral presentation at the "Studente Simposium van die Akademie vir Wetenskap en Kuns" that was held at the University of Pretoria in October 2008 and also at the Advanced Metals Initiative Conference presented by Department of Trade and Industry (DTI) in Johannesburg in November 2008. He also attended the TechnoX workshop held in Sasolburg at the end of July 2008, while Prof. Purcell and Dr Von Eschwege contributed to different Eskom Science Expo projects that were held at the UFS in July/August 2008.

The **Physical Chemistry division** has two research groups, one headed by Prof. Jannie Swarts, and the other by Dr Jeanet Conradie. Mr Ernie Langner is in the final stages of his Ph.D. studies.

Prof. Riaan Luyt (right) receives his honorary medal from the director of the Polymer Institute, Slovak Academy of Sciences, Dr Jozef Rychly.

Prof. Swarts and Dr Conradie are rated researchers by the NRF, and both held NRF research grants, while Mr Langner is holder of a Thuthuka NRF grant. The Swarts group was also funded by the Cancer Association of South Africa (CANSA), THRIP and industrially by research grants from SASOL.

Dr Conradie and Prof. Swarts both acted as reviewers for the NRF in evaluating the quality of the research outputs of other researchers and for advanced bursary applications. Prof. Swarts also serves in this capacity for the Irish Health Board. Both also frequently evaluate international publications as peer reviewers, are external examiners for M.Sc. and Ph.D. degrees of candidates at other universities, and act as moderators for third-year and honours courses at other universities.

The main research question of Prof. Swarts' research group concerns synthetic and physical chemistry aspects of multinuclear metallocenes. The group currently focuses on five projects, i.e., por-

phyrin and phthalocyanine compounds bearing metallocene substituents; titanocene, zirconocene, hafnocene, ferrocene, ruthenocene and osmocene derivatives especially in association with rhodium, iridium, silver, gold and copper; electrochemical, kinetic and thermal analyses of these complexes; medicinal aspects of these complexes; and industrial studies on carboxylato complexes in collaboration with SASOL.

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

The Swarts and Conradie groups have international collaboration with Prof. Abhik Ghosh (Department of Chemistry and Centre for Theoretical and Computational Chemistry, University of Tromsø, Norway) and Prof. Penelope J. Brothers (Department of Chemistry, The University of Auckland, New Zealand); Prof. Mike Cook at the University of East Anglia, Norwich, United Kingdom (UK) on phthalocyanine chemistry, Prof. Manuel Aquino at the Saint Francis Xavier University, Antigonish, Canada on metal carboxylates, and Prof. Bill Geiger at the University of Vermont, Vermont, USA on electrochemistry.

During 2008, Prof. Swarts paid research visits to Prof. Mike Cook, University of East Anglia, UK (phthalocyanine electrochemistry) and Prof. Alexei Vinkelstein from Moscow University in Russia (protein physics). Mr Chris Joubert visited Prof Henry Lang from Chemnitz, Germany (carboxylate chemistry). Dr Conradie paid a six week research visit to the Department of Physical Chemistry, University of Tromsø, Norway during October-November and gained advanced skills in the computational chemistry software Gaussian. Mr Langner visited Moscow, Russia and presented a poster lecture at the 5th International Conference on Porphyrins and Phthalocyanines. Prof. Swarts gave a lecture at the same conference. Two students, Mr Henno Gericke and Ms Nicola Barnard, and post-doc Eleanor Fourie gave poster presentations at the 10th International Symposium on Dioxygen Activation and Homogeneous Catalytic Ocidation (ADHOC-08), in Venice, Italy from 20-25 July and at an organometallic chemistry conference in Rennes, France.

The industrial research collaboration of the Swarts group led to visits by Dr Thys Botha (heterogeneous catyalysis), Dr Reinier Nel (carboxylate chemistry) and Dr Frans Prinsloo (aluminium chemistry), all from SASOL, on various industrial research issues.

Highlights from the Physical Chemistry division include the following: Prof. Swarts was Special Guest Editor for a special issue of the medical journal *Metal-Based Drugs* that was dedicated to new methods of anticancer drug delivery to diseased sites, new methods of treating cancer, and the development of new chemotherapeutic drugs. Furthermore, M.Sc. student Henno Gericke's conference contribution at the world's premier organometallic chemistry conference in Rennes, France, the 23rd International Conference on Organometallic Chemistry (ICOMC23), won the prize as best poster contribution of 950 international contributions. Another highlight was the second visit of Dr Conradie to the Scientific Computing and Modeling (SCM) offices in Amsterdam, The Netherlands in November 2008, to discuss and implement advanced applications of the Amsterdam Density Functional (ADF) programme. Ms Marianne Conradie, a Ph.D. student, received the bronze medal for her Afrikaans presentation *"'n Eksperimentele en kwantum berekeningschemiestudie van die reaksie tussen die karbonileringskatalisator [Rh((C$_4$H$_3$S)COCHCOR)(CO)(PPh$_3$)] en metieljodied (R = CF$_3$, C$_6$H$_5$, C$_4$H$_3$S)"* at the Student Symposium on Natural Science in Johannesburg on 31 October 2008.

Mr Langner lectured at a one-day teacher training course held by the university's Centre for Education Development (CED) in Kimberley. His Thuthuka grant also enabled Mr Langner to visit Russia and present a poster at the 5th International Conference on Porphyrins and Phthalocyanines (ICPP-5) in Moscow, Russia from 6-11 July 2008.

Research in **Inorganic Chemistry** concentrates on Coordination Chemistry with the primary focus on an integrated investigation of reaction mechanisms through the use of crystallography, spectroscopy, computational chemistry and reaction kinetics. Two research thrusts focus on industrial reactions/homogeneous catalysis/ applied process chemistry and applications to medicine (radiopharmaceutical and chemotherapeutical agents). This research in the group of Prof. Roodt continued and the infrastructure was expanded, supported by Dr Deon Visser, three contracted researchers at senior lecturer level, namely Drs Alfred Muller (crystallography), Reinout Meijboom (synthesis) and Gideon Steyl (computational chemistry), as well as Drs Thato Mtshali, Johan Venter and 14 postgraduate students. Altogether 24 research articles and more than 20 conference contributions, of which ten were invited oral presentations, were produced.

Dr Gideon Steyl gave an invited lecture at the world's premier organometallic chemistry conference in Rennes, France, the 23rd International Conference on Organometallic Chemistry (ICOMC23), while Dr Johan Venter made a poster presentation on this occasion. Mss Nicoline Cloete and Alice Brink gave poster presentations at the 16th International Symposium on Homogeneous Catalysis (ISHC16) in Florence, Italy, partly sponsored by the organising committee (under the leadership of Dr Mike Green from SASOL) of the 15th ISHC, held at Sun City, South Africa, during 2006. Dr Deon Visser gave an invited lecture at

the 6th International Symposium on Technetium and Rhenium in Port Elizabeth during October 2008.

Prof. Roodt, as principal applicant, successfully obtained funding of R700 000 under the NRF's Economic Growth and International Competitiveness (EGIC) for the next four years.

The homogeneous catalysis research in the Roodt group is driven in close collaboration with SASOL and the Department of Science and Technology at the University of Cape Town's Centre for Excellence in Catalysis, c*change. The research focus is on the conversion of simple feedstock molecules into value-added products and includes studies of classical reaction types such as carbonylation (synthesis of acetic acid and other products from methanol and carbon monoxide), hydroformylation (aldehydes and alcohols from olefins and synthesis gas) and oligomerisation (ethene). Collaboration with SASOL, the North-West University, the Universities of Johannesburg, Cape Town, Western Cape, and Lund (Sweden) forms part of this thrust.

Similarly, the medical research focus, in collaboration with the Universities of Missouri, USA (Dr Hendrik Engelbrecht), Lund, Sweden (Profs Ola Wendt, Ake Oskarsson and Lars Ivar Elding), Zurich, Switzerland (Prof. Roger Alberto), CANSA (Prof. Connie Medlen, Pharmacology, University of Pretoria) and PETLabs Pharmaceuticals (Dr Gerdus Kemp) showed good progress and several research reports and articles in international accredited journals were published. A spin-off of this research was the synthesis of model chemotherapeutic compounds which again yielded very positive results for future application.

Dr Gideon Steyl visited the group of Prof. Roger Alberto at the University of Zurich and collaborated with Prof. Alberto and Dr Fabio Zobi by providing computational expertise and results obtained at the UFS computer cluster. Two manuscripts were prepared based on these results.

Ph.D. Students collecting data on Apex Kappa single crystal X-Ray diffractometer; Nicoline Cloete (left) and Tania Hill.

The equipment in the inorganic group was further expanded by the aquisition of spectroscopy units with funding obtained from SASOL (Drs Chris Reinecke and Desmond Young) and PETLabs Pharmaceuticals (Dr Kemp), while funding under the THRIP programme, CANSA and the NRF was sourced.

A high-pressure stopped flow spectrometer and other related equipment worth more than R1 million was donated to the Roodt group by Prof. Lars Ivar Elding from the University of Lund, Sweden. This system is extremely important for the determination of intimate reaction mechanisms, and makes the department the only one in South Africa with this equipment, and one of only two in the Southern Hemisphere. The system was installed in December 2008.

The Roodt group took the third-year class, as part of their training in X-ray crystallography, on an excursion to the Kimberley diamond mine.

The **Organic Chemistry division** is headed by Profs Jan van der Westhuizen, Ben Bezuidenhoudt and Dr Susan Bonnet.

Prof. Daneel Ferreira of the University of Mississippi in the USA gave an honours course in the biosynthesis and organic chemistry of secondary metabolites in plants (January-February). Moreover, he was recognised for his contributions to organic chemistry, also at the UFS, by an honorary doctorate awarded at the April graduation ceremony.

Dr Rui de Carvalho of the University of Coimbra in Portugal gave an advanced course in structure elucidation with high resolution NMR in February. Mr Anwar Elbushra Mohammed Noreljaleel, lecturer at Omdurman Islamic the University in Sudan, spent 2009 in our Organic section. He used UFS expertise and equipment to complete his Ph.D. (Synthesis of Chalcones substituted by a Mannich side chain). Mr Bashir Elfaki Hamed Elfaki, lecturer at the Blue Nile University in Khartoum in Sudan, spent 2009 in the Organic laboratories to do research towards his Ph.D. thesis (Flavonoids from *Boscia salicifolia*, *Erythrina abyssinica* and *Ficus vasfa*). Dr Louis Ackerman, retired from the CSIR's bioprospecting and essential oils program, visited the division to assist with post-graduate training.

Dr Gabre Kemp received advanced training in triple quadrupole mass spectrometry by Applied Biosystems in Manchester, UK and Darmstadt, Germany during August 2008.

The organic section presented a four-day LCMS course in Novem-

ber 2008 in Bloemfontein, which was attended by 20 mass spectrometry professionals from all over South Africa (including researchers from the Medical Research Council, Agricultural Research Council, National Department of Agriculture, University of Pretoria and University of KwaZulu-Natal), and senior students from the UFS. It covered different aspects of mass spectrometry from ionization techniques, mass filters, detectors, MS/MS analysis, vacuum systems, LC-MS and LC-MS/MS techniques, quantification, fragmentation analysis, interpretation of spectra, as well as some applications.

Additional research related outputs:

Various researchers of the Department of Chemistry were involved in the university's research cluster initiative, i.e., the Material and Nanosciences Cluster (MNS). Profs Riaan Luyt, Jannie Swarts and André Roodt are three of the four focus area leaders, while Prof. Roodt is the interim cluster coordinator, appointed by the UFS. Seven students were supported from the MNS Cluster during 2008, which yielded more than 20 research papers. Prof. Jan van der Westhuizen participates in the Advanced Biomolecular research cluster of the UFS.

Prof. Roodt, as member of the Executive Committee of the European Crystallographic Association (ECA) and the International Scientific Committee of 25th European Crystallographic Meeting, attended the Executive Meetings in Budapest, Hungary (February 2008) and Osaka, Japan. He further attended an International Conference on Coordination Chemistry (ICCC) in Jerusalem, Israel as member of the planning committee of the series of these conferences. Prof. Roodt further served on the THRIP panel for 'Process Manufacturing' of the South African NRF, and also acted as co-editor for the International Union of Crystallography (IUCr) journal, *Acta Crystallographica E* and was on the editorial board of the *Journal of Coordination Chemistry*. He also had various consulting sessions with employees of SASOL as part of the agreement between UFS and SASOL.

By special invitation, Profs Roodt, Swarts and Bezuidenhoudt attended the special launch of the SASOL collaboration with South African university programme in Rosebank, Johannesburg.

Prof. Purcell was invited to serve as a member of the local scientific committee of the 6th International Symposium on Technetium and Rhenium in Port Elizabeth from 7-10 October 2008.

Prof. Luyt was invited to be a member of the international advisory board of the international journal *eXPRESS Polymer Letters.* ■

Staff

Main Campus:

Professors: André Roodt, Jannie Swarts

Affiliated Professors: Profs Daneel Ferreira, Rui Carvalho

Associate Professors: Profs Walter Purcell, Robert Dennis, Jan van der Westhuizen

Affiliated Associate Professor: Prof. Fanie Otto

Senior Lecturers: Drs Jeanet Conradie, Deon Visser, Alfred Muller, Reinout Meijboom, Gideon Steyl

Lecturers: Drs Susan Bonnet, Karel von Eschwege, Johan Venter, Ernie Langner, Thato Mtshali

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

Qwaqwa Campus:

Professor: Prof. Riaan Luyt

Lecturers: Dr Buyiswa Jacobs, Ms Moipone Mokoena, Ms Dorine Dikobe, Mr Tsietsi Tsotetsi, Ms Mpondi Molefe

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Research outputs

Research articles

Alberto, R. & Roodt, A. 2008. RheManTec 2007 - Joint Swiss / South African Research Symposium down the Manganese Triad. *Chimia* 62: 41.

Albrett, A.M., Conradie, J., Boyd, P.D.W., Clark, G.R., Ghosh, A. & Brothers, P.J. 2008. Corrole as a binucleating ligand: Preparation, molecular structure, and density functional theory study of diboron corroles. *Journal of the American Chemical Society* 130: 2888-2889.

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Chapters in books

Pothan, L., Luyt, A.S. & Thomas, S. 2008. Polyolefin/natural fiber composites. In *Polyolefin Composites,* edited by T. Kyu & D. Nwabunma. New Jersey: Wiley-Interscience. pp. 44-81.

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Conference contributions

Achilonu, M.C., Bonnet, S.L. & Van der Westhuizen, J.H. 2008. *Synthesis of proanthocyanidins Part 1: The first oxidative formation of the inter-flavanyl bond*. Poster presented at the International Union of Pure and Applied Chemistry (IUPAC) Conference on Organic Synthesis (ICOS17), Daejeon, South Korea. 22-27 June.

Achilonu, M.C., Bonnet, S.L., Van der Westhuizen, J.H. 2008. *Synthesis and structure elucidation of novel procanthoyanidins. Silver catalyzed C-C-bond formation*. Poster presented at the Bruker NMR User Meeting, Mkhuzi Game Reserve, South Africa. 23-25 July.

Barnard, N.I. & Swarts, J.C. 2008. *Hot Stuff!! Structural, optical and thermal properties of a DSC investigation of metal-carboxylates*. Poster presented at the 16th International Symposium on Homogeneous Catalysis (ISHC16), Florence, Italy. 6-11 July.

Barnard, N.I. & Swarts, J.C. 2008. *Mixed metallocenes: Ferrocene-containing betadiketonato titanium(IV) complexes*. Poster presented at the 23rd International Conference on Organometallic Chemistry (ICOMC23), Rennes, France. 13-18 July.

Bonnet, S.L., Montsho, R.M., Jarak, I. & Van der Westhuizen, J.H. 2008. *One pot synthesis and structure elucidation of free phenolic isoaurones. (Stereochemistry of tri-substituted alkenes).* Poster presented at the Bruker NMR User Meeting, Mkhuzi Game Reserve, South Africa. 23-25 July.

Brink, A., Roodt, A. & Visser, H.G. 2008. *Steric vs. electronic: Spatial variation of ligands affecting rhodium catalytic reaction.* Poster presented at the 16th International Symposium on Homogeneous Catalysis (ISHC16), Florence, Italy. 6-11 July.

Cloete, N., Roodt, A. & Visser, H.G. 2008. *Ethylene tetramerisation: Structural investigation of the chromium-based catalyst precursors*. Poster presented at the 16th International Symposium on Homogeneous Catalysis (ISHC16), Florence, Italy. 6-11 July.

Cloete, N., Roodt, A. & Visser, H.G. 2008. *Ethylene Tetramerisation: Structural investigation of the chromium-based catalyst precursors.* Poster presented at the Conference of the Catalysis Society of South Africa (CATSA), Parys, South Africa. 9-12 November.

Dikobe, D.G. & Luyt, A.S. 2008. *Morphology and thermal properties of PP/LLDPE/WP and MAPP/LLDPE/WP polymer blend composites*. Poster presented at the 10th Annual UNESCO/IUPAC (International Union of Pure and Applied Chemistry) Conference on Macromolecules and Materials, Berg-en-Dal Ruskamp, Kruger National Park, South Africa. 7-11 September.

Dikobe, D.G. & Luyt, A.S. 2008. *Thermal and mechanical properties of polymer blend/wood flour composites*. Oral presentation delivered at the 13th European Conference on Composite Materials (ECCM), Stockholm, Sweden. 2-5 June.

Engelbrecht, I., Muller, A.J. & Roodt, A. 2008. *Kinetic investigation of model iridium(acetylacetonato) systems for use in olefin interactions/ hydroformylation.* Poster presented at the Conference of the Catalysis Society of South Africa (CATSA), Parys, South Africa. 9-12 November.

Engelbrecht, I., Muller, A.J. & Roodt, A. 2008. *Kinetic investigation of model iridium(acetylacetonato) systems for use in hydroformylation.* Poster presented at the 39th National Convention of the South African Chemical Institute (SACI), Stellenbosch, South Africa. 30 November - 5 December.

Engelbrecht, I., Muller, A.J. & Roodt, A. 2008. *Olefin hydroformylation model reactions: Kinetic reactivity of iridium complexes.* Lecture delivered at the DST-NRF c*change Symposium, Parys, South Africa. 7-9 November.

Enow, C.A., Auger, A., Swarts, J.C. & Bezuidenhoudt, B.C.B. 2008. *Epoxidation of alkenes through the utilisation of non-peripherally substituted phthallocyanines.* Poster presented at the 10th International Symposium on Dioxygen Activation and Homogeneous Catalytic Oxidation (ADHOC-08), Venice, Italy. 20-25 July.

Enow, C.A., Auger, A., Swarts, J.C. & Bezuidenhoudt, B.C.B. 2008. *Epoxidation of alkenes through the utilisation of non-peripherally substituted phthallocyanines.* Poster presented at the Bi-National Organic Chemistry Conference (BOCC '08), Berg-en-Dal Ruskamp, Kruger Park, South Africa. 14-19 September.

Fourie, E. & Swarts, J.C. 2008. *Synthesis and electrochemistry of metallocene-containing rhodium(I) complexes*. Poster presented at the 23rd International Conference on Organometallic Chemistry (ICOMC23), Rennes, France. 13-18 July.

Fourie, E. & Swarts, J.C. 2008. *Synthesis and kinetic studies of metallocene-containing as well as fluorine-containing rhodium(I) complexes*. Poster presented at the 16th International Symposium on Homogeneous Catalysis (ISHC16), Florence, Italy. 6-11 July.

Gericke, H. & Swarts, J.C. 2008. *Synthetic, electrochemistry and structural aspects of ferrocene-containing tris-betadiketonato aluminium(III) complexes*. Poster presented at the 16th International Symposium on Homogeneous Catalysis (ISHC16), Florence, Italy. 6-11 July.

Gericke, H. & Swarts, J.C. 2008. *The synthesis and electrochemical communication of ferrocene-containing tris-betadiketonato aluminium(III) complexes*. Poster presented at the 23rd International Conference on Organometallic Chemistry (ICOMC23), Rennes, France. 13-18 July.

Han, Z., Bonnet, S.L. & Van der Westhuizen, J.H. 2008. *Syntheses of xanthine derivatives by photolysis of pentoxifylline: An ambident chromophore*. Poster presented at the Bi-National Organic Chemistry Conference (BOCC '08) of the South African Chemical Institute (SACI) and the Gesellschaft Deutscher Chemiker (GDCh), incorporating the 10th Frank Warren Conference in Organic Chemistry, Berg-en-Dal Ruskamp, Kruger Park, South Africa. 14-19 September.

Hill, T. & Roodt, A. 2008. *Crystallographic and computational aspects of cyclo-octadiene systems.* Poster presented at the 39th National Convention of the South African Chemical Institute (SACI), Stellenbosch, South Africa. 30 November-5 December.

Kirsten, L., Steyl, G. & Roodt, A. 2008. *Carboxylato Rh(I) phosphite complexes as catalyst precursors in hydroformylation.* Poster presented at the 39th National Convention of the South African Chemical Institute (SACI), Stellenbosch, South Africa. 30 November-5 December.

Kotzé, P.D.R., Brink, A., Roodt, A. & Visser, H.G. 2008. *Electronic variation of group 15 ligands affecting rhodium catalytic reactions.* Poster presented at the 39th National Convention of the South African Chemical Institute (SACI), Stellenbosch, South Africa. 30 November-5 December.

Kuo, C-M., Kamara, B.I. & Bezuidenhoudt, B.C.B. 2008. *Isolation and synthesis of compounds from* scilla natalensis. Poster presented at the Bi-National Organic Chemistry Conference (BOCC '08) of the South African Chemical Institute (SACI) and the Gesellschaft Deutscher Chemiker (GDCh), incorporating the 10th Frank Warren Conference in Organic Chemistry, Berg-en-Dal Ruskamp, Kruger Park, South Africa. 14-19 September.

Langner, E.H.G., Conradie, J., Ghosh, A. & Swarts, J.C. 2008. *A computational study of octa substituted tetrabenzocorrolazines*. Poster presented at the 5th International Conference on Porphyrins and Phthalocyanines (ICPP-5), Moscow, Russia. 6-11 July.

Luyt, A.S. 2008. *Paraffin wax in polymer blends and composites: Is it worth investigating?* Keynote lecture presented at the 39th National Convention of the South African Chemical Institute (SACI), Stellenbosch, South Africa. 30 November-5 December.

Mohomane, S.M. & Luyt, A.S. 2008. *Morphology and properties of polychloroprene nanocomposites.* Paper presented at the 24th Annual Meeting of the Polymer Processing Society, Salerno, Italy. 15-19 June.

Mohomane, S.M. & Luyt, A.S. 2008. *Thermal, mechanical, and morphological properties of polychloroprene/montmorillonite nanocomposites*. Poster presented at the 10th Annual UNESCO/IUPAC (International Union of Pure and Applied Chemistry) Conference on Macromolecules and Materials, Berg-en-Dal Ruskamp, Kruger National Park, South Africa. 7-11 September.

Mokoena, M.A. & Luyt, A.S. 2008. *Investigation of fibre reinforced HDPE composites crosslinked/grafted through siloxane linkage*. Poster presented at the 10th Annual UNESCO/IUPAC (International Union of Pure and Applied Chemistry) Conference on Macromolecules and Materials, Berg-en-Dal Ruskamp, Kruger National Park, South Africa. 7-11 September.

Molefi, J.A., Luyt, A.S. & Krupa, I. 2008. *Thermal and mechanical properties of phase change conductive polymer composite materials*. Poster presented at the 10th Annual UNESCO/IUPAC (International Union of Pure and Applied Chemistry) Conference on Macromolecules and Materials, Berg-en-Dal Ruskamp, Kruger National Park, South Africa. 7-11 September.

Monnahela, S.O., Carstens, P.A.B., Wagener, J.B., Moolman, D., De Waal, D. & Roodt, A. 2008. *Analysis of the ZrO_2 / HF reaction using Raman spectroscopy.* Poster presented at the 21th International Conference on Raman Spectroscopy, (ICORS 2008), Uxbridge, West London, UK. 17-22 August.

Motaung, T.E., Mishra, S.B. & Luyt, A.S. 2008. *Morphology and properties of sol-gel prepared LDPE silica nanocomposites.* Poster presented at the 10th Annual UNESCO/IUPAC (International Union of Pure and Applied Chemistry) Conference on Macromolecules and Materials, Berg-en-Dal Ruskamp, Kruger National Park, South Africa. 7-11 September.

Mtshali, T.N., Purcell, W. & Visser, H.G. 2008. *Synthesis and structural characterization of $[ReN(LL\text{-}k^2N,O)(CN)_3]^{2-}$ and $[ReN(LL\text{-}k^2N,N)(CN)_3]^{2-}$*. Poster presented at the 38th International Conference on Coordination Chemistry (ICCC38), Jerusalem, Israel. 20-25 July.

Mtshali, T.N., Purcell, W., Visser, H.G. & Basson, S.S. 2008. *Coordination chemistry of Re(V): Synthesis, characterization and kinetic studies of the formation of $[ReN(\kappa^2\text{-}LL)(CN)_3]^{2-}$ ions in aqueous media*. Lecture presented at the 6th International Symposium on Technetium and Rhenium-Science and Utilization (IST2008), Conference Centre of the Nelson Mandela Metropolitan University, Port Elizabeth, South Africa. 7-10 October.

Muller, T.J., Roodt, A. & Steyl, G. 2008. *Copper based building blocks for oxidation catalysis.* Poster presented at the Conference of the Catalysis Society of South Africa (CATSA), Parys, South Africa. 9-12 November.

Muller, T.J., Roodt, A. & Steyl, G. 2008. *Copper based building blocks for oxidation catalysis.* Poster presented at the 39th National Convention of the South African Chemical Institute (SACI), Stellenbosch, South Africa. 30 November-5 December.

Nhlapo, L.P. & Luyt, A.S. 2008. *Thermal and mechanical properties of the LDPE/sisal fibre composites compatibilized with modified paraffin waxes*. Poster presented at the 10th Annual UNESCO/IUPAC (International Union of Pure and Applied Chemistry) Conference on Macromolecules and Materials, Berg-en-Dal Ruskamp, Kruger National Park, South Africa. 7-11 September.

Purcell, W., Mtshali, T.N. & Visser, H.G. 2008. *A structural and kinetic comparison between $[ReO(H_2O)(CN)_4]^-$ and $[ReN(H_2O)(CN)_4]^{-2}$*. Paper presented at the 6th International Symposium on Technetium and Rhenium-Science and Utilization (IST2008), Conference Centre of the Nelson Mandela Metropolitan

University, Port Elizabeth, South Africa. 7-10 October.

Roodt, A. & Muller, A.J. 2008. *Solid state packing behaviour in pseudo Vaska-type complexes.* Poster presented at the 21st General Assembly and Congress of the International Union of Crystallography, Osaka, Japan. 23-31 August.

Roodt, A., Venter, G.J.S. & Meijboom, R. 2008. *Supramolecular coordination chemistry of silver(I) complexes with group 15 ligands.* Poster presented at the 38th International Conference on Coordination Chemistry (ICCC38), Jerusalem, Israel. 20-25 July.

Roodt, A., Venter, G.J.S. & Meijboom, R. 2008. *Supramolecular coordination chemistry of silver(I) complexes with group 15 ligands.* Poster presented at the 38th International Conference on Coordination Chemistry (ICCC38), Jerusalem, Israel. 20-25 July.

Schutte, M., Visser, H.G. & Roodt, A. 2008. *Crystallographic investigation of different* $[Re(CO)_3(L1)(L2)]^{n-}$ *complexes.* Poster presented at the 6th International Symposium on Technetium and Rhenium-Science and Utilization (IST2008), Conference Centre of the Nelson Mandela Metropolitan University, Port Elizabeth, South Africa. 7-10 October.

Schutte, M., Visser, H.G. & Roodt, A. 2008. *Crystallographic investigation of different* $[Re(CO)_3(L_1)(L_2)]^{n-}$ *complexes.* Poster presented at the 39th National Convention of the South African Chemical Institute, Stellenbosch, South Africa. 30 November-5 December 2008.

Steyl, G., Muller, T. & Roodt, A. 2008. *Copper oxidase catalysis: Oxidation of organic chemicals by direct dioxygencoupled turnover.* Invited lecture presented at the 23rd International Conference on Organometallic Chemistry (ICOMC23), Rennes, France. 13-18 July.

Steyn, M., Steyl, G. & Roodt, A. 2008. *Speciation and interconversion mechanism of mixed halo O,O- and O,N- bidentate ligand complexes of zirconium.* Paper presented at the Advanced Metals Initiative Conference 2008, Oppenheimer Conference Centre, Gold Reef City, Johannesburg, South Africa. 18-19 November.

Sunil, C.A., Langner, E.H.G., Marais, C. & Bezuidenhoudt, B.C.B. 2008. *Mechanism of the copper catalysed rearrangement of toluic acids to meta-cresol.* Poster presented at the Bi-National Organic Chemistry Conference (BOCC '08) of the South African Chemical Institute (SACI) and the Gesellschaft Deutscher Chemiker (GDCh), incorporating the 10th Frank Warren Conference in Organic Chemistry, Berg-en-Dal Ruskamp, Kruger Park, South Africa. 14-19 September.

Swarts, J.C. 2008. *Unusual scrambling reactions, atropisomerisation and electrochemical quantification of meso substituent polarization effects in ferrocene-containing porphyrins*. Paper presented at the 5th International Conference on Porphyrins and Phthalocyanines (ICPP-5), Moscow, Russia. 6-11 July.

Swarts, J.C., Auger, A. & Muller, A.J. 2008. *Unusual scrambling reactions and electrochemical quantification of meso substituent polarization effects of ferrocene-containing porphyrins*. Poster presented at the 23rd International Conference on Organometallic Chemistry (ICOMC23), Rennes, France. 13-18 July.

Van Tonder, B. & Bezuidenhoudt, B.C.B. 2008. *Synthesis of 4-arylflavan-3-ol lactones.* Poster presented at the Bi-National Organic Chemistry Conference (BOCC '08) of the South African Chemical Institute (SACI) and the Gesellschaft Deutscher Chemiker (GDCh), incorporating the 10th Frank Warren Conference in Organic Chemistry, Berg-en-Dal Ruskamp, Kruger Park, South Africa. 14-19 September.

Van Tonder, J.H., Robb, L.M., Bezuidenhoudt, B.C.B. & Cole-Hamilton, D.J. 2008. *Selective hydrogenation of* α,β*-unsaturated ketones*. Poster presented at the Bi-National Organic Chemistry Conference (BOCC '08) of the South African Chemical Institute (SACI) and the Gesellschaft Deutscher Chemiker (GDCh), incorporating the 10th Frank Warren Conference in Organic Chemistry, Berg-en-Dal Ruskamp, Kruger Park, South Africa. 14-19 September.

Venter, G.J.S., Steyl, G. & Roodt, A. 2008. *[Rh(bid)(CO)$_2$] complexes and their PX_3 derivatives: an oxidative addition study.* Poster presented at the 39th National Convention of the South African Chemical Institute (SACI), Stellenbosch, South Africa. 30 November-5 December.

Venter, J.A., Basson, S.S. & Purcell, W. 2008. *Unravelling the effect of phosphine ligands and solvents on the oxidative addition of rhodium(I) cupferrate complexes.* Poster presented at the 23rd International Conference on Organometallic Chemistry (ICOMC23), Rennes, France. 13-18 July.

Venter, J.A., Basson, S.S. & Purcell, W. 2008. *Unravelling the effect of phosphine ligands and solvents on the oxidative addition of rhodium(I) cupferrate complexes.* Poster presented at the 23rd International Conference on Organometallic Chemistry (ICOMC23), Rennes, France. 13-18 July.

Versteeg, M., Bezuidenhoudt, B.C.B. & Ferreira, D. 2008. *Stereoselective synthesis of isoflavonoids.* Lecture delivered at the Bi-National Organic Chemistry Conference (BOCC '08) of the South African Chemical Institute (SACI) and the Gesellschaft Deutscher Chemiker (GDCh), incorporating the 10th Frank Warren Conference in Organic Chemistry, Berg-en-Dal Ruskamp, Kruger Park, South Africa. 14-19 September.

Viljoen, J.A., Muller, A.J. & Roodt, A. 2008. *Speciation and interconversion mechanism of mixed halo O,O'- and O,N-bidentate ligand complexes of Hafnium.* Lecture delivered at the Advanced Metals Initiative Conference 2008, Oppenheimer Conference Centre, Gold Reef City, Johannesburg, South Africa. 18-19 November.

Visser, H.G., Schutte, M., Roodt, A. & Brink, A. 2008. *Rhenium(I) compounds in nuclear medicine. Crystallographica and kinetic investigation of different* $[Re(CO)_3(L1)(L2)]^{n-}$ *complexes.* Poster presented at the 6th International Symposium on Technetium and Rhenium-Science and Utilization (IST2008), Conference Centre of the Nelson Mandela Metropolitan University, Port Elizabeth, South Africa. 7-10 October.

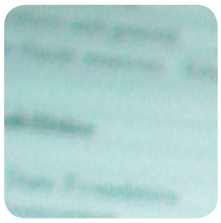
Wilhelm, A., Bonnet, S.L. & Van der Westhuizen, J.H. 2008. *Photochemistry of (+)-catechin and (-)-epicatechin*. Poster presented at the International Union of Pure and Applied Chemistry (IUPAC) Conference on Organic Synthesis (ICOS17), Daejeon, South Korea. 22-27 June.

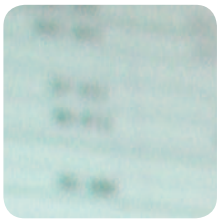
Wilhelm, A., Bonnet, S.L. & Van der Westhuizen, J.H. 2008. *Photochemistry of aromatic flavanoid derivatives*. Poster presented at the Bi-National Organic Chemistry Conference (BOCC '08) of the South African Chemical Institute (SACI) and the Gesellschaft Deutscher Chemiker (GDCh), incorporating the 10th Frank Warren Conference in Organic Chemistry, Berg-en-Dal Ruskamp, Kruger Park, South Africa. 14-19 September.

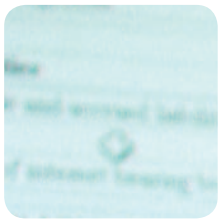
Statistical data

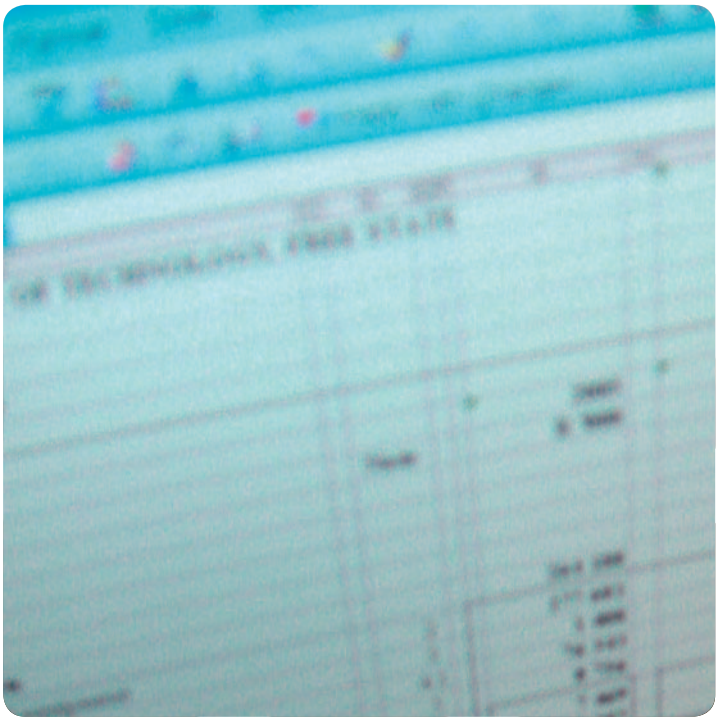


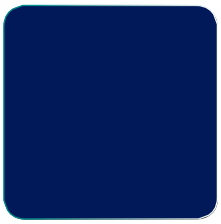
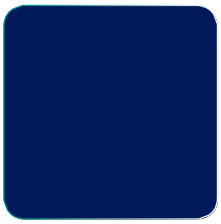
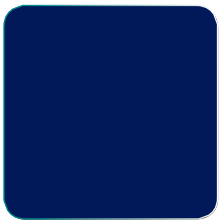






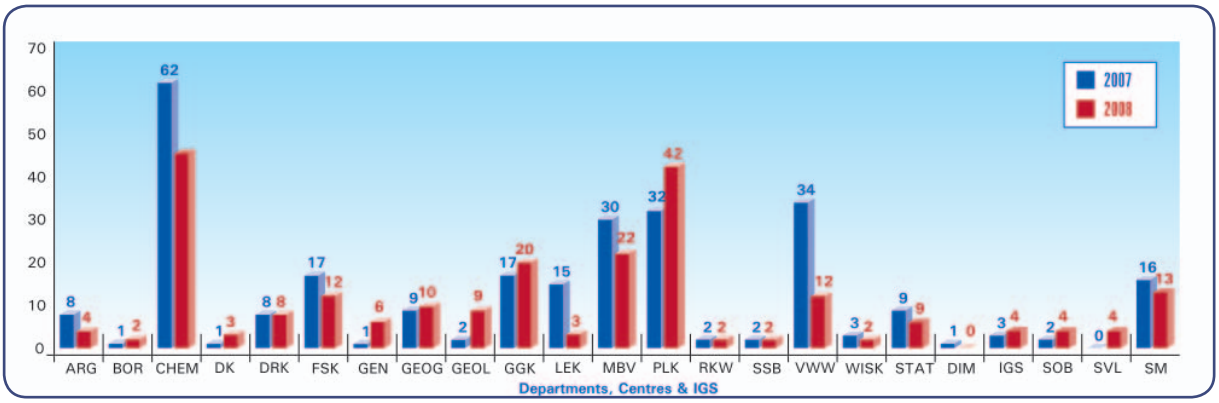
Research outputs: 2007-2008

List of abbreviations

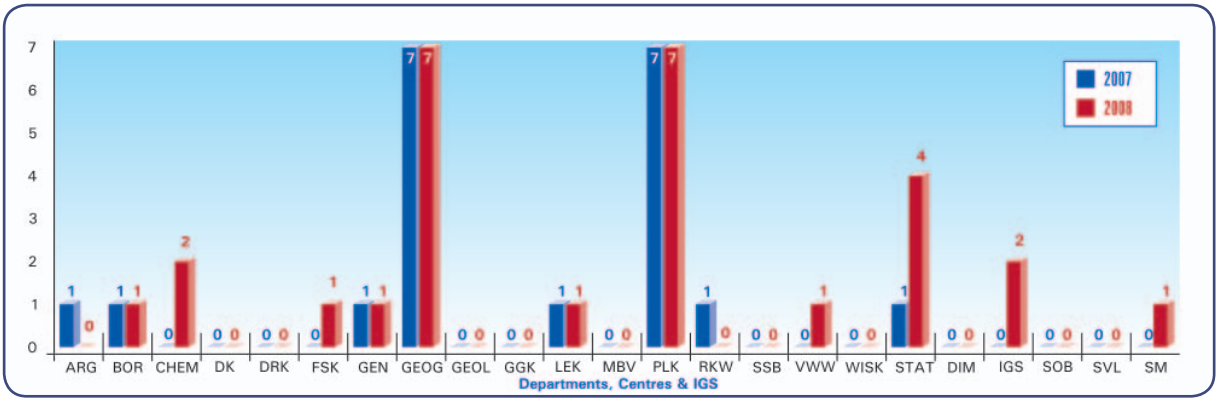
Abbreviation	Name
ARG	Department of Architecture
BOR	Department of Quantity Surveying and Construction Management
SOB	Centre for Environmental Management
CEM	Department of Chemistry
SM	Centre for Microscopy
SVL	Centre for Sustainable Agriculture and Rural Development
DK	Dean's Office
DRK	Department of Zoology and Entomology
FSK	Department of Physics
GEN	Department of Genetics
GEOG	Department of Geography
GEOL	Department of Geology

Abbreviation	Name
GGK	Department of Soil, Crop and Climate Sciences
IGS	Institute for Groundwater Studies
LEK	Department of Agricultural Economics
MBV	Department of Microbial, Biochemical and Food Biotechnology
PLK	Department of Plant Sciences
RKW	Department of Computer Science and Informatics
SSB	Department of Urban and Regional Planning
SRB	Disaster Management Training and Education Centre for Africa (DiMTEC)
VWW	Department of Animal, Wildlife and Grassland Sciences
STAT	Department of Mathematical Statistics and Actuarial Science
WISK	Department of Mathematics and Applied Mathematics

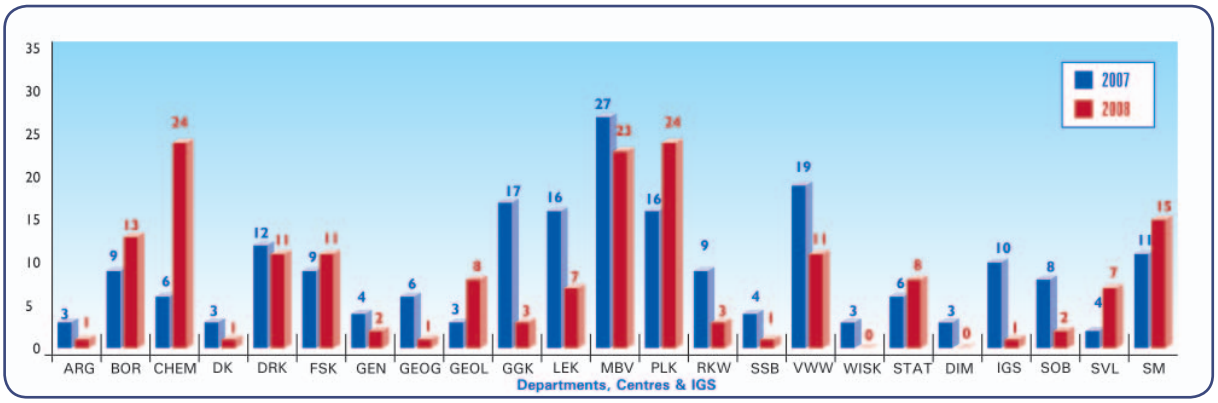
Accredited articles



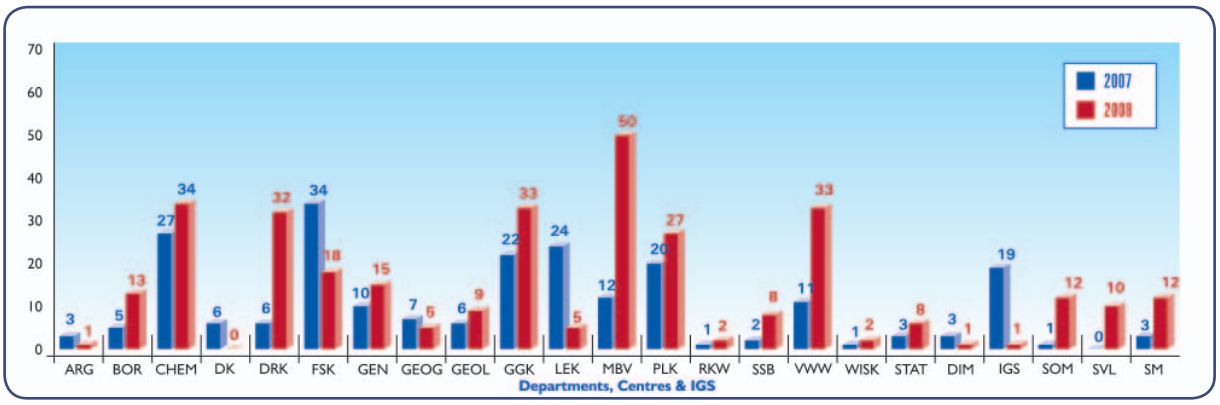
Books



International conferences



Local conferences



Student figures: 2007-2008

Student figures

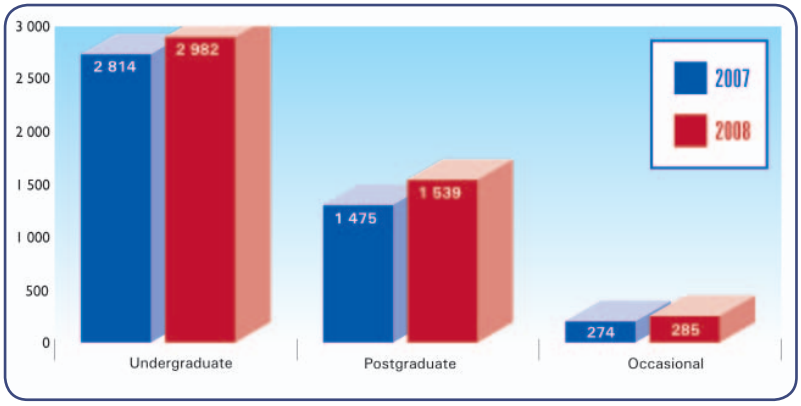
Year	Description	Black	Coloured	Asian	White	Total
2007	Undergraduate	1492	66	38	1218	2814
	Postgraduate	710	41	40	684	1475
	Occasional	230	6	2	36	274
*TOTAL		2432	113	80	1938	4563
2008	Undergraduate	1667	51	37	1227	2982
	Postgraduate	755	40	43	701	1539
	Occasional	260	5	1	19	285
* TOTAL		2682	96	81	1947	4806

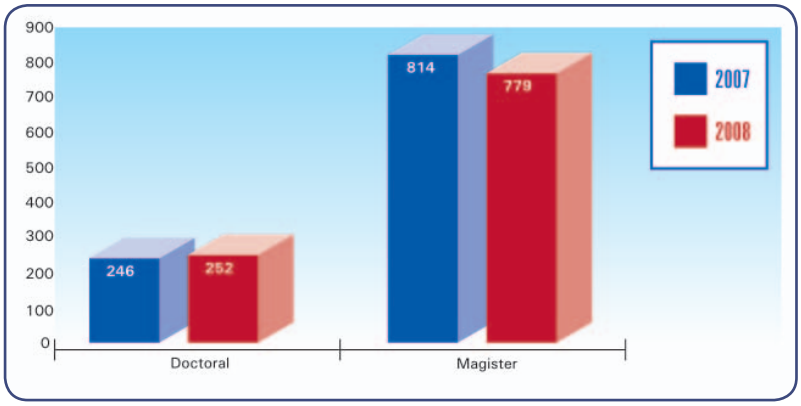
International students

Nationality	Year 2007	Year *2008
Angola	2	0
Asian countries	20	24
Botswana	17	23
Democratic Republic of the Congo	0	1
European countries	9	10
Lesotho	118	144
Malawi	3	5
Mauritius	2	3
Mozambique	4	7
Namibia	54	65
North America	15	5
Other African countries	47	69
South America	1	0
Swaziland	5	6
Zambia	7	7
Zimbabwe	48	60
Total	352	429

**2008 Final HEMIS figures not available*

Comparison for the Faculty of Natural and Agricultural Sciences





Glossary

Glossary

A

AACC - American Association for Cereal Chemists
AACE - Association for the Advancement of Cost Engineering
ADF - Amsterdam Density Functional Programme
ADG - Average Daily Grain
AEASA - Agricultural Economics Association of South Africa
AEON - the African Earth Observation Network
AGU - American Geophysical Union
AI - Artificial Insemination
ARC - Agricultural Research Council
ARV - Antiretroviral
ASC - Architecture Student Conference
ASAQS - Association of South African Quantity Surveyors
ASOCSA - Association of Schools of Construction of Southern Africa

B

BBSRC - Biotechnology and Biological Sciences Research Council
BMBF - Federal Ministry of Education and Research, Germany

C

CAA - Commonwealth Association of Architects
CANSA - Cancer Association of South Africa
CAB - Centro de Astrobiología
CED - Centre for Education Development
CePHMa - Centre for Plant Health Management
CHESD - Centre for Higher Education Studies and Development
CHPC - Centre for High Performance Computing
CIDB - Construction Industry Development Board
CIOB-SA - Chartered Institute of Building, South Africa
CSIR - Council for Scientific and Industrial Research Organisation
CSTA - Cereal Science and Technology Association
CUT - Central University of Technology

D

DiMTEC - Disaster Management Training and Education Centre for Africa
DMISA - Disaster Management Institute of Southern Africa
DRRW - Durable Rust Resistance in Wheat
DST - Department of Science and Technology
DWAF - Department of Water Affairs and Forestry

E

ECA - European Crystallographic Association
EGIC - Economic Growth and International Competitiveness
EMSA - Environmental Management Systems Association
EMS - Environmental Management Systems
EPWP - Expanded Public Works Programme

F

FAO - Food and Agricultural Organisation
FETWater - Framework Programme for Research Education and Training in Water
FMP - Facilities Management Programme
FSRDPP - Free State Rural Development Partnership Project
FTIR - Fourier Transform Infra Red Spectrometer

G

FGAP - Facility for Genomics and Proteomics
GIS - Geographical Information Systems
GMO - Genetically Modified Organisms
GRDM - Groundwater Resource Directed Measures
GSSA - Grassland Science Society of South Africa
GSSA - Geological Society of South Africa

H

HCI - Human-computer Interaction
HRTEM - High Resolution Transmission Electron Microscopy

I

IAMA - International Food and Agribusiness Management Association
IAU - International Astronomical Union
ICACS - International Conference on Atomic Collisions in Solids
ICCC - International Conference on Coordination Chemistry
ICEC - International Cost Engineering Council
ICRISAT - International Crops Research Institute for the Semi-Arid Tropics
ICSU - International Council for Science
IDC - Industrial Development Corporation
IGC - International Geological Congress
IGS - Institute for Groundwater Studies
IMWA - International Mine Water Association
INCRoP - Insects on New Crops Programme
IPMP - Intensive Project Management Programme
ISI - International Statistical Institute
ISME - International Society for Microbial Ecology
IT - Information Technology
IUMS - International Union of Microbiological Societies

L

LPI - Lunar and Planetary Institute
LRAD - Land Redistribution for Agricultural Development

M

MCEE - Minnesota Council on Economic Education
MDC - Maputo Development Corridor
MEC - Member of the Executive Council
MNS - Material and Nanosciences Cluster
MOU - Memorandum of Understanding
MRC - Medical Research Council
MSA - Masters in Sustainable Agriculture
MSSA - Microscopy Society of Southern Africa
MUCPP - Mangaung University Community Partnership Programme

N

NAMC - National Agricultural Marketing Council
NASA - National Aeronautics and Space Administration
NASSP - National Astrophysics and Space Science Programme
NBN - National Bioinformatics Network
NCEE - National Council for Economic Education
NDF - Neutral Detergent Fibre
NECSA - Nuclear Energy Corporation of South Africa
NERPO - National Emergent Red Meat Producers Organisation
NGO - Non-Governmental Organisation
NRF - National Research Foundation
NSTF - National Science and Technology Forum
NWGA - National Wool Growers' Association

O

OECD - Organisation for Economic Cooperation and Development

P

PAQS - Pacific Association of Quantity Surveyors
PDMS - Provincial Disaster Management Centre
PRT - Protein Research Trust

R

RDP - Redress and Development Programme
RIBA - Royal Institute of British Architects
RICS - Royal Institute of Chartered Surveyors
RIEP - Research Institute of Education Planning
RMMA - Red Meat Abattoirs Association
RPO - Red Meat Producers Organisation
RTPI - Royal Town Planning Institute

S

SA - South Africa
SAAPMB - South African Association of Physicists in Medicine and Biology
SAB - South African Breweries Limited
SABC - South African Broadcasting Corporation
SACAP - South African Council for the Architectural Professions
SACPCMP - South African Council for the Property Valuers Profession
SACPLAN - South African Council of Planners
SACQSP - South African Council for the Quantity Surveying Profession
SADC - Southern African Development Community
SAFA - South African Feedlot Association
SAFEFE - South African Foundation for Economic and Financial Education
SAFOI - South African Fryer Oil Initiative
SAIA - South African Institute of Architects
SAIM - Society for Industrial and Applied Mathematics
SAISC - Southern African Institute of Steel Construction
SANBI - South African National Biodiversity Institute
SANCID - South African Commission on Irrigation and Drainage
SANPAD - South African Netherlands Research Programme on Alternatives in Development
SANSA - South African National Survey of Arachnida
SAPOA - South African Property Owners Association
SAPPS - Symposium of the South African Pecan Producers Association
SAQA - South African Qualifications Authority
SASA - South African Statistical Association
SASHS - Southern African Society for Horticultural Sciences
SASM - South African Society for Microbiology
SAWMA - South African Wildlife Management Association
SAWSS - Southern African Weed Science Society
SCM - Scientific Computing and Modeling
SEG - Society of Economic Geologists
SEM - Scanning Electron Microscope
SLE - Senior Lecturer Equivalent
SSSSA - Soil Science Society of South Africa
SWMA - Southern African Wildlife Management Association

T

TEM - Transmission Electron Microscope
THRIP - Technology and Human Resource for Industry Programme

U

UCT - University of Cape Town
UEC - Unit for Earth Construction
UFS - University of the Free State
UJ - University of Johannesburg
UK - United Kingdom
UN - United Nations
UNESCO - United Nations Educational, Scientific and Cultural Organisation
UNU - United Nations University
UP - University of Pretoria
USA - United States of America
USAID - United States Agency for International Development
UWC - University of the Western Cape

W

WCAP - World Conference on Animal Production
WITS - University of the Witwatersrand
WRC - Water Research Commission