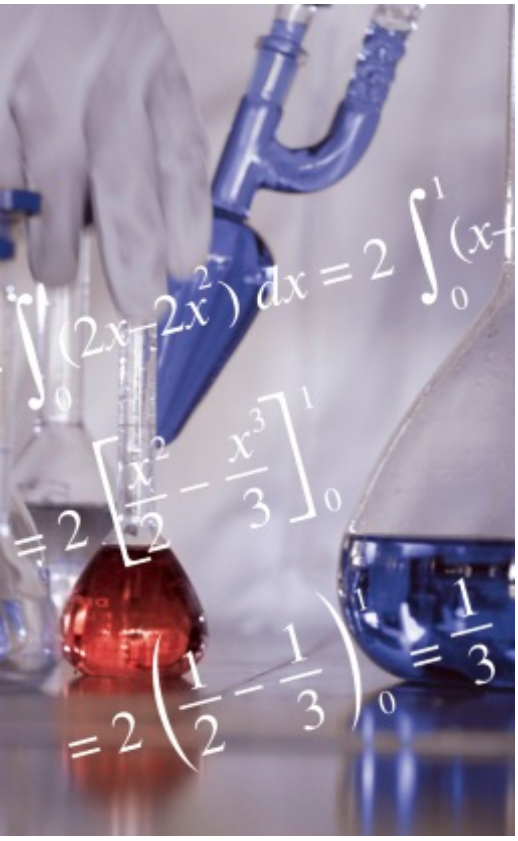
Report

05/06

Faculty of

Natural and Agricultural Sciences



Faculty of Natural and Agricultural Sciences
UNIVERSITEIT VAN DIE VRYSTAAT • UNIVERSITY OF THE FREE STATE • YUNIVESITHI YA FREISTATA

Report 05/06

Faculty of Natural and Agricultural Sciences

Issued by:
Faculty of Natural and Agricultural Sciences,
University of the Free State

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Revision of bibliographical data
Mercia Coetzee

Layout and cover design
Chrysalis advertising and publishing

Photographers
Gerhard Louw
Stephen Collett

Printing
Print 24

The Afrikaans version is also available on a compact disc
from the dean's office or on the university's website at
www.ufs.ac.za.

Cover page: Aspects of natural and agricultural sciences.

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Preface

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 obtained 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 substructure 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

Department of

Chemistry

"The new momentum injected in the department re-iterated 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 Proff. 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 Proff. 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 Bezuidenhoudt, 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 Proff. 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. Bezuidenhoudt 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, computational chemistry and reaction kinetics. Two sub-foci concentrate on applications to medicine (radiopharmaceutical and chemotherapeutical 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: Proff. 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.

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 Vöelkopf, Business Development Manager of Applied Biosystems in Canada and Prof. Jan van der Westhuizen, head of the division, Organic Chemistry at the department.

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 CANSA was sourced. Funding under the Swedish International Cooporation 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 hypoxy 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

metal intermediates, which led to new collaboration with prominent leaders in the field such as Proff. 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, Proff. Vincent Brandt and Kobus Steenkamp retired during 2006. Research groups were headed by Proff. Van der Westhuizen, Bezuidenhoudt, 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.

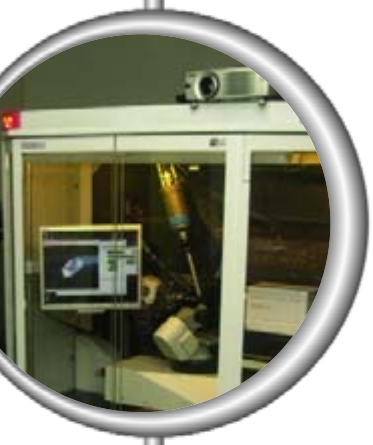
In 2006 more than R2,5 million in funding was secured by this group from agencies such as the NRF, FARMOVS-PAREXEL, THRIP, Thuthuka, Sasol, the Department of Nuclear Medicine at the UFS and the Central Wattle Co.

The group endeavoured to build more research capacity through short visits and collaboration with international experts such as Proff. 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 Proff. Van der Westhuizen, Bezuidenhoudt 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. Bezuidenhoudt 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. Bezuidenhoudt. 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 oxigenated compounds from olefins via expoxidation utilising phtalocyanine based catalysts, development of impoved technology for the synthesis of m-cresol from xylene, utilisation of borosalicylic 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 Ghandi 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 Tsotetsi (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 ICCC37 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: Proff. Steve Basson, Vincent Brandt, André Roodt, Jannie Swarts, Ben Bezuidenhoudt
Professor Extraordinary: Prof. Hans Hundt
Affiliated Professors: Proff. Daneel Ferreira, Rui Carvalho.
Associate Professors: Proff. 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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Research outputs

Publications

Blom, B., Overett, M.J., Meijboom, R. & Moss, J.R. 2005. New palladium alpha-diimine complexes containing dendritic wedges for ethene oligomerisation. *Inorganica Chimica Acta* 358: 3491-3496.

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Fourie, E. & Swarts, J.C. 2006. *Synthesis, structural aspects and chemical kinetics of metallocene-containing phosphine and beta-diketonato ligands, complexed with rhodium(I).* Paper presented as poster at the 15th International Symposium on Homogeneous Catalysis (15ISHC), Sun City, South Africa.

Geethamma, V.G., Mokoena, M.A. & Luyt, A.S. 2006. *Effect of oxidized wax on the properties of linear low-density polyethylene-clay nanocomposites.* Paper presented as poster at the UNESCO/IUPAC Conference on Macromolecules, Stellenbosch, South Africa.

Hennion, C., Roodt, A. & Meijboom, R. 2005. *Mechanistic investigation of the equilibrium behaviour of tertiary* aryl stibine *and phosphite complexes of rhodium(I).* Paper presented as poster at the Catalytic Society of South Africa (CATSA) 2005 Conference, Eskom Convention Centre, Midrand, South Africa.

Hennion, C., Roodt, A. & Meijboom, R. 2005. *Mechanistic investigation of the equilibrium behaviour of tertiary* aryl stibine *and phosphite complexes of rhodium(I)*. Invited oral presentation at the South African Chemical Institute (SACI) one day Meeting on Organometallic Chemistry and Homogeneous Catalysis (15ISHC), Riviera-on-Vaal, Vanderbijlpark, South Africa.

Hill, T.N. & Roodt, A. 2006. *Olefinic interactions with late transition metal centers: Cyclooctadiene mimicing venus fly trap structures.* Paper presented as poster at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.

Hill, T.N. & Roodt, A. 2006. *Olefinic interactions with platinum group metal centres.* Paper presented as poster at the 15th International Symposium on Homogeneous Catalysis (15ISHC), Sun City, South Africa.

Janse van Rensburg, J.M. & Roodt, A. 2006. *Organophosphorous ligands for the fine tuning of electronic and steric properties in rhodium(I) oxinato complexes.* Paper presented as poster at the 15th International Symposium on Homogeneous Catalysis (15ISHC), Sun City, South Africa.

Janse van Rensburg, J.M. & Roodt, A. 2006. *Steric and electronic effects in rhodium(I) phosphine oxinato complexes.* Invited oral presentation at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.

Janse van Rensburg, J.M., Roodt, A., Muller, A. & Meijboom, R. 2005. *Steric and electronic effects of bulky phosphite rhodium(I) oxinato complexes.* Paper presented as poster at the Catalytic Society of South Africa (CATSA) 2005 Conference, Eskom Convention Centre, Midrand, South Africa.

Janse van Rensburg, J.M., Roodt, A., Muller, A. & Meijboom, R. 2005 *Steric and electronic effects of bulky phosphite rhodium(I) oxinato 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.

Kirk, M. 2005. *Halide exchange in bisphosphine ruthenium alkylidene complexes.* Invited oral presentation at the South African Chemical Institute (SACI) one day Meeting on Organometallic Chemistry and Homogeneous Catalysis (15ISHC), Riviera-on-Vaal, Vanderbijlpark, South Africa.

Kirsten, L. & Roodt, A. 2005. *Rhodium(I) Vaska-type phosphite complexes as model homogeneous catalysts.* Paper presented as poster at the Catalytic Society of South Africa (CATSA) 2005 Conference, Eskom Convention Centre, Midrand, South Africa.

Kirsten, L., Steyl, G. & Roodt, A. 2006. *A reactivity study on Rh(I) phosphite vaska-type complexes in homogeneous catalysis.* Paper presented as poster at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.

Kirsten, L., Steyl, G. & Roodt, A. 2006. *A solution and solid state investigation on rhodium(I) phosphite Vaska-type complexes for homogeneous catalysis.* Paper presented as poster at the 15th International Symposium on Homogeneous Catalysis (15ISHC), Sun City, South Africa.

Krupa, I. & Luyt, A.S. 2006. *Shape stabilized phase change materials based on low density polyethylene and paraffin waxes.* Paper presented as poster at the UNESCO/IUPAC Conference on Macromolecules, Stellenbosch, South Africa.

Kuhn, A. & Conradie, J. 2006. *Electrochemical and structural aspects of β-diketonato complexes of titanocene(IV).* Paper presented as poster at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.

Langner, E.H.G. 2006. *DFT studies on a series of Corrolazines.* Invited oral presentation at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.

Langner, E.H.G., Davis, W.L., Shago, R.F. & Swarts, J.C. 2006. *Spectroscopic and liquid crystal properties of Phthalocyanine Macromolecules with biomedical applications*. Paper presented as poster at the 15th International Symposium on Homogeneous Catalysis (15ISHC), Sun City, South Africa.

Luyt, A.S., Guduri, B.R. & Mishra, S. 2006. *EVA-clay nanocomposites*. Invited oral presentation at the International POLYCHAR-14 Congress, Nara, Japan.

Makunya, N.M. & Roodt, A. 2005. *Tertiary phosphine induced migratory carbonyl insertion in cyclopentadienyl complexes of Fe(III).* 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.

Maree, C.E., Nyokong, T. & Swarts, J.C. 2006. *Innovative approaches to the treatment of cancer.* Paper presented as poster at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.

Meijboom, R. & Roodt, A. 2005. *Dendrimers for the immobilization of homogeneous catalysts.* Paper presented as poster at the Catalytic Society of South Africa (CATSA) 2005 Conference, Eskom Convention Centre, Midrand, South Africa.

Meijboom, R. & Roodt, A. 2005. *Organometallic dendrimers.* 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.

Meijboom, R. & Roodt, A. 2005. *Silver complexes as anti-arthritic and anti-inflammatory agents.* Invited oral presentation at the Cancer Association of South Africa (CANSA) Workshop, Pretoria, South Africa.

Meijboom, R. & Roodt, A. 2006. *Dendrimers for the immobilization of homogeneous catalysts.* Invited oral presentation at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.

Meijboom, R. & Roodt, A. 2006. *Ligand modified cobalt carbonyl complexes as hydroformylation catalysts.* Paper presented as poster at the 15th International Symposium on Homogeneous Catalysis (15ISHC), Sun City, South Africa.

Meijboom, R., Muller, A. & Roodt, A. 2005. *Packing behaviour in Rh(I) phosphite Vaska-type 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.

Mishra, A.K., Mishra, S.B. & Luyt, A.S. 2006. *Low density polyethylene-wood fibre-silica nanocomposites: Thermal and mechanical properties.* Paper presented as poster at the UNESCO/IUPAC Conference on Macromolecules, Stellenbosch, South Africa.

Mishra, S.B. & Luyt, A.S. 2006. *EVA-clay nanocomposites: Thermal and mechanical properties.* Paper presented as poster at the UNESCO/IUPAC Conference on Macromolecules, Stellenbosch, South Africa.

Mngomezulu, M.E., Krupa, I. & Luyt, A.S. 2006. *Phase change materials based on polyethylene, paraffin wax and wood flour*. Paper presented as poster at the UNESCO/IUPAC Conference on Macromolecules, Stellenbosch, South Africa.

Mogudi, B., Meijboom, R. & Roodt, A. 2006. *Phosphite substituted cobalt carbonyl catalysts. Synthesis, characterisation and catalytic activity in hydroformylation of olefins.* Paper presented as poster at the 15th International Symposium on Homogeneous Catalysis (15ISHC), Sun City, South Africa.

Mogudi, B., Meijboom, R. & Roodt, A. 2006. *Solution behaviour of cobalt catalysts for homogeneous hydroformylation reactions.* Paper presented as poster at the Catalytic Society of South Africa (CATSA) 2006 Conference, Mossel Bay, South Africa.

Mogudi, B., Meijboom, R. & Roodt, A. 2006. *Solution behaviour of cobalt catalysts for homogeneous hydroformylation reactions.* Paper presented as poster at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.

Mogudi, B., Roodt, A. & Meijboom, R. 2005. *Solution behavior of cobalt model catalysts for homogeneous hydroformylation reactions*. Paper presented as poster at the Catalytic Society of South Africa (CATSA) 2005 Conference, Eskom Convention Centre, Midrand, South Africa.

Mogudi, B., Roodt, A. & Meijboom, R. 2005. *Synthesis, crystal structure and hydroformylation activity of triphenylphosphite modified cobalt catalysts.* 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.

Molefi, J.A., Krupa, I. & Luyt, A.S. 2006. *Phase change conductive polymer composite materials.* Paper presented as poster at the UNESCO/IUPAC Conference on Macromolecules, Stellenbosch, South Africa.

Motaung, T.E., Mishra, S.B. & Luyt, A.S. 2006. *Thermal and mechanical properties of LDPE-g-MAH-silica nanocomposites.* Paper presented as poster at the UNESCO/IUPAC Conference on Macromolecules, Stellenbosch, South Africa.

Mtshali, T.N. & Purcell, W. 2006. *Crystallographic and kinetic study of the formation of the tricyanonitrido(pyridine-2-carboxylato-κN, κO)rhenate(V) ion [ReN(η^2-pic)(CN)$_3$]$^{2-}$.* Paper presented as poster at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.

Mtshali, T.N., Purcell, W. & Basson, S.S. 2006. *Rhenium(V) complexes as models for the nitrogen transfer catalysts.* Paper presented as poster at the 15th International Symposium on Homogeneous Catalysis (15ISHC), Sun City, South Africa.

Muller, A., Meijboom, R., Roodt, A., Otto, S. & Oskarsson, A. 2005. *Solid state packing behaviour in pseudo Vaska-type complexes.* Paper presented as poster at the Catalytic Society of South Africa (CATSA) 2005 Conference, Eskom Convention Centre, Midrand, South Africa.

Muller, A., Meijboom, R., Roodt, A., Otto, S. & Oskarsson, A. 2005. *Solid state packing behaviour in pseudo Vaska type 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.

Muller, A., Roodt, A. & Otto, S. 2005. *Rapid phosphorous ligand evaluation utilizing selenocyanate.* Paper presented as poster at the Catalytic Society of South Africa (CATSA) 2005 Conference, Eskom Convention Centre, Midrand, South Africa.

Muller, A., Roodt, A. & Otto, S. 2005. *Rapid phosphorous ligand evaluation utilizing selenocyanate*. 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.

Muller, A., Roodt, A. & Otto, S. 2006. *Determining phosphorous ligand electronic properties.* Paper presented as poster at the 15th International Symposium on Homogeneous Catalysis (15ISHC), Sun City, South Africa.

Muller, A., Roodt, A. & Otto, S. 2006. *Rapid phosphorous ligand evaluation utilizing selenocyanate.* Invited oral presentation at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.

Nhlapo, L.P. & Luyt, A.S. 2006. *Thermal and mechanical properties of polyethylene-sisal fiber composites compatibilized with modified paraffin waxes.* Paper presented as poster at the UNESCO/IUPAC Conference on Macromolecules, Stellenbosch, South Africa.

Nonjola, P.T.N. & Swarts, J.C. 2006. *Synthesis, characterisation, electrochemistry and phase change thermodynamics of new ferrocene-containing beta-diketonato rhodium(I) complexes with long chain alkyl substituents.* Paper presented as poster at the 15th International Symposium on Homogeneous Catalysis (15ISHC) Sun City, South Africa.

Nonjola, P.T.N., Langner, E.H.G., Conradie, J., Ghosh, A. & Swarts, J.C. 2006. *Synthesis, characterisation, electrochemistry and phase change thermodynamics of new ferrocene-containing beta diketones with long-chain alkyl substituents and their rhodium(I) complexes.* Invited oral presentation at the 37th International Conference on Coordination Chemistry (ICCC37), Cape Town, South Africa.

Roodt, A. 2005. *Continued quest for electronic properties of tertiary phosphine ligands.* Invited oral presentation at the Inorganic 2005 Congress, Pietermaritzburg, South Africa.

Roodt, A. 2005. *Radionuclide tracers for the evaluation of chemotherapeutic agents.* Invited oral presentation at the Cancer Association of South Africa (CANSA) Workshop, Pretoria, South Africa.

Roodt, A. 2005. *Reconciling solid state and solution properties: X-ray crystallography in homogeneous catalysis.* Invited oral presentation at the Catalytic Society of South Africa (CATSA) 2005 Conference, Eskom Convention Centre, Midrand, South Africa.

Roodt, A. 2005. *Solid state and solution properties: X-ray crystallography in homogeneous catalysis.* Keynote lecture presented at the CARMAN 2005 Symposium: National Physical Chemistry Conference, Eskom Convention Centre, Midrand, South Africa.

Roodt, A. 2006. *And then there were phosphines....* Invited oral presentation at the 15th International Symposium on Homogeneous Catalysis (15ISHC) Sun City, South Africa.

Roodt, A. & Meijboom, R. 2006. *Coordination chemistry of the coin metals with special emphasis on silver.* Invited oral presentation at the 3rd Moroccan School for Crystallography, Agadir, Morocco.

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-arthritic and anti-inflammatory agents.* Paper presented as poster at the CANSA 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 tropolonato 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 β-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 β-diketonato complexes of titanium(IV).* Invited oral presentation at the Inorganic 4th Chianti Electro-chemistry 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 betadiketonato 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 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.

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**
Total 2005	**1111**	**56**	**45**	**1141**	**2353**

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**
Total 2006	**1182**	**51**	**39**	**1222**	**2494**

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**
Total 2005	**870**	**62**	**24**	**626**	**1582**

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**
Total 2006	**987**	**56**	**36**	**651**	**1730**

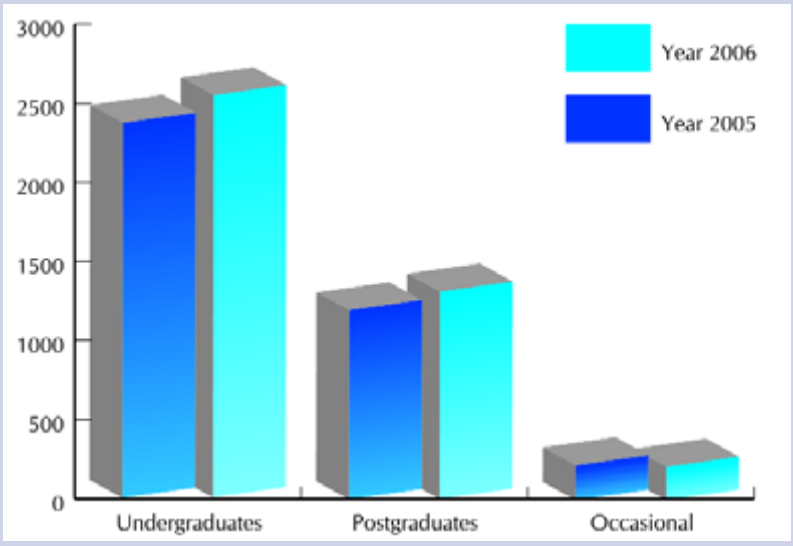
Total

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**
Total 2005	**1981**	**118**	**69**	**1767**	**3935**

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**
Total 2005	**2169**	**107**	**75**	**1873**	**4224**



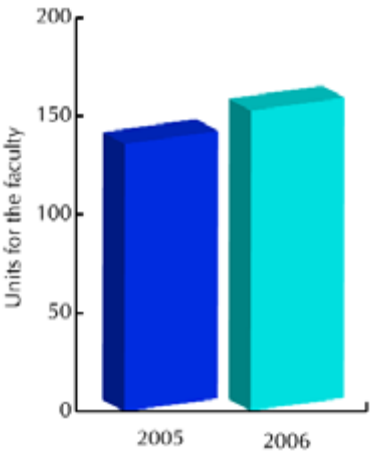
Student figures

Student nationallity

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
Total	**3935**	**4224**

Research outputs

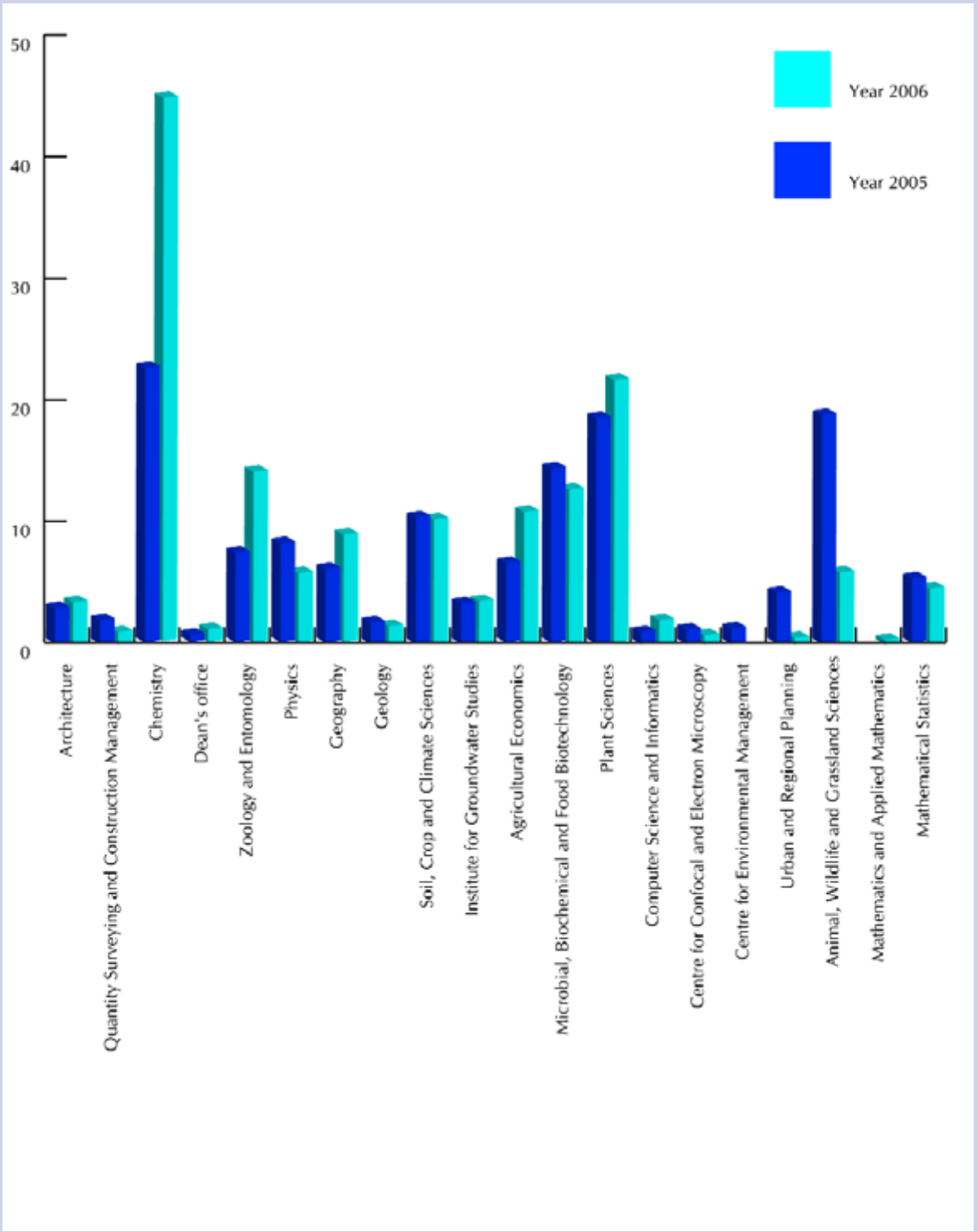
for the Faculty of Natural and Agricultural Sciences



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

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	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

L

LExEn	Life in Extreme Environments

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 Oganisation
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
SANCU	South African National Consumer Union
SANPAD	South Africa-Netherlands Research Programme on Alternatives in Development
SAPOA	South African Property Owners' Association
SAPS	South African Police Services
SAQA	South African Qualifications Authority
SASAS	South African Society for Animal Science
SASQUA	Southern African Society for Quaternary Research
SAVAH	South African Association of Visual Arts Historians
SBE	Sustainable Built Environments
SEDA	Small Enterprise Development Agency
SMME	Small, Medium and Micro Enterprises
SRC	Student Representative Council
SRL	Sustainable Rural Livelihood
SSAG	Society of South African Geographers

T

THRIP	South African National Research Foundation Thrust for Industry-Related Projects
TUE	Technical University Eindhoven

U

UCT	University of Cape Town
UFS	University of the Free State
UJ	University of Johannesburg
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USA	United States of America
USAID	United States Agency for International Development
UTCHEM	University of Texas Chemical Compositional Simulator
UWC	University of the Western Cape

W

WARFSA	Water Research Fund of Southern Africa
WATOC	World Association of Theoretically Orientated Chemists
WFP	World Food Programme
WITS	University of the Witwatersrand
WRC	Water Research Commission
WUA	Water Users' Association