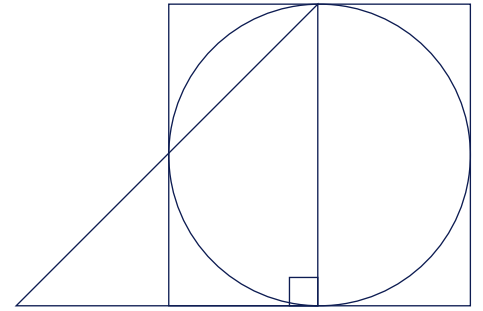


# Report

05/06



## Faculty of Natural and Agricultural Sciences



# Faculty of Natural and Agricultural Sciences

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# From the Dean's office



*Prof. Herman van Schalkwyk.*

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

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

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

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

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

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

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

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

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

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

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

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

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

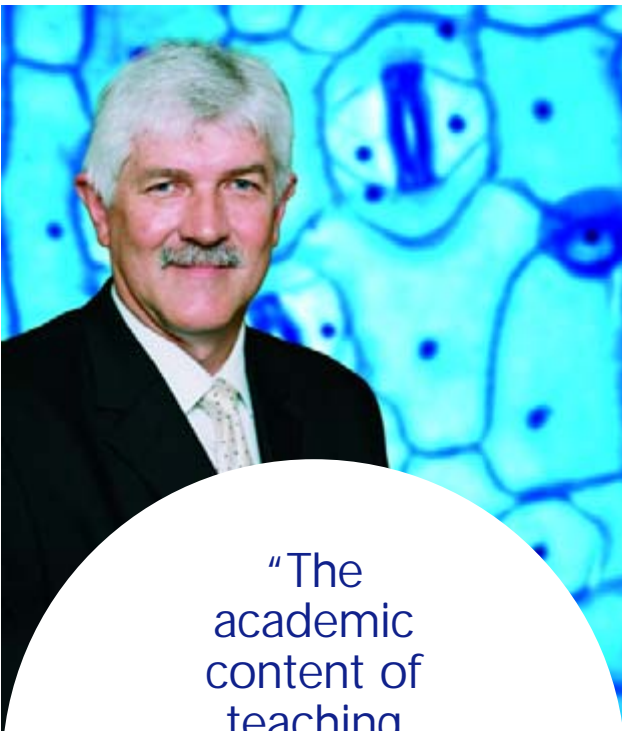
This report covers the faculty's activities in 2005/06. It is a reflection of two years' commitment on the part of a team of skilled and motivated academics and support staff.



**Prof. Herman van Schalkwyk**

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

# Plant Sciences



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

Prof. Sakkie Pretorius.

## Overview

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

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

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

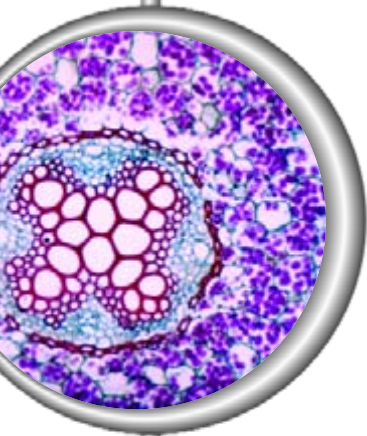
As part of the Faculty of Natural and Agricultural Sciences' innovative equipment initiative, the department was strengthened in 2005 by the acquisition of certain key items. A phospho-imager, a microscope with digital image analysis, spectrophotometers, high performance liquid chromatography (HPLC)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

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

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



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



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

### Botany

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

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



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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

### Plant Breeding

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



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

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

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

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

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

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

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

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

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

### Plant Pathology

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

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

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

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



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

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

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

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

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

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

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

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

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

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

## Genetics

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

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

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



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





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

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

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

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

### Academic staff

#### Main Campus

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

**Associate Professor:** Prof. Paul Grobler

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

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

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

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

#### Qwaqwa Campus

**Associate professor:** Prof. Rodney Moffett

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

**Junior Lecturer:** Mr Raymond Pitso

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# Research outputs

## Publications

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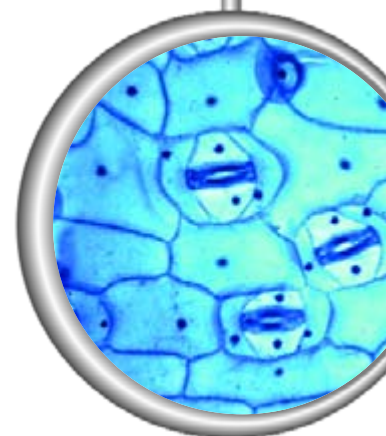
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# Statistical data of the faculty



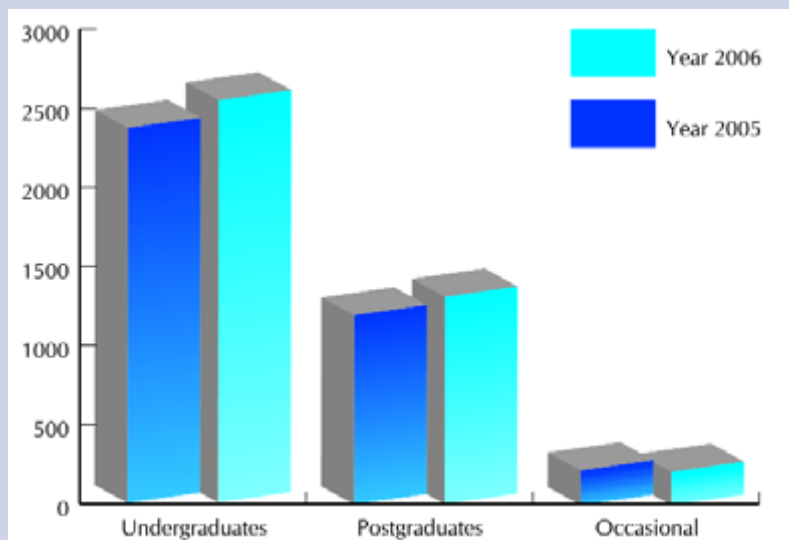
# Student figures

Faculty of Natural and Agricultural Sciences, 2005/06

Male					
2005					
Description	African	Coloured	Indian	White	Total
Undergraduate	676	31	26	724	1457
Postgraduate	351	22	15	400	788
Occasional	84	3	4	17	108
<b>Total 2005</b>	<b>1111</b>	<b>56</b>	<b>45</b>	<b>1141</b>	<b>2353</b>
2006					
Description	African	Coloured	Indian	White	Total
Undergraduate	729	28	21	768	1546
Postgraduate	385	21	16	431	853
Occasional	68	2	2	23	95
<b>Total 2006</b>	<b>1182</b>	<b>51</b>	<b>39</b>	<b>1222</b>	<b>2494</b>

Female					
2005					
Description	African	Coloured	Indian	White	Total
Undergraduate	563	41	11	394	1009
Postgraduate	206	16	11	221	454
Occasional	101	5	2	11	119
<b>Total 2005</b>	<b>870</b>	<b>62</b>	<b>24</b>	<b>626</b>	<b>1582</b>
2006					
Description	African	Coloured	Indian	White	Total
Undergraduate	641	39	17	401	1098
Postgraduate	243	15	17	234	509
Occasional	103	2	2	16	123
<b>Total 2006</b>	<b>987</b>	<b>56</b>	<b>36</b>	<b>651</b>	<b>1730</b>

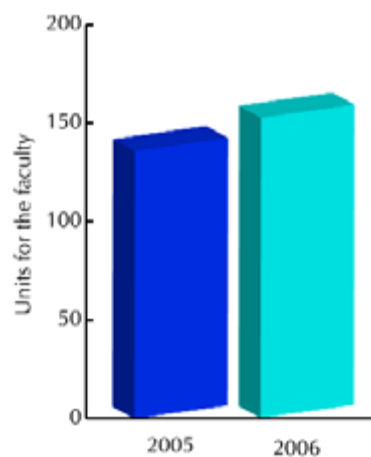
Total					
2005					
Description	African	Coloured	Indian	White	Total
Undergraduate	1239	72	37	1118	2466
Postgraduate	557	38	26	621	1242
Occasional	185	8	6	28	227
<b>Total 2005</b>	<b>1981</b>	<b>118</b>	<b>69</b>	<b>1767</b>	<b>3935</b>
2006					
Description	African	Coloured	Indian	White	Total
Undergraduate	1370	67	38	1169	2644
Postgraduate	628	36	33	665	1362
Occasional	171	4	4	39	218
<b>Total 2006</b>	<b>2169</b>	<b>107</b>	<b>75</b>	<b>1873</b>	<b>4224</b>



Student figures

Student nationality		
Nationality	2005	2006
Angola	1	
Asian countries	21	18
Botswana	20	20
European countries	6	6
Lesotho	142	142
Malawi	2	1
Mauritius		2
Mozambique	8	7
Namibia	40	42
No information	1	
North America	4	4
Other Africa	45	48
South Africa	3610	3893
South America		1
Swaziland	13	13
Zambia	4	6
Zimbabwe	18	21
<b>Total</b>	<b>3935</b>	<b>4224</b>

## Research outputs for the Faculty of Natural and Agricultural Sciences

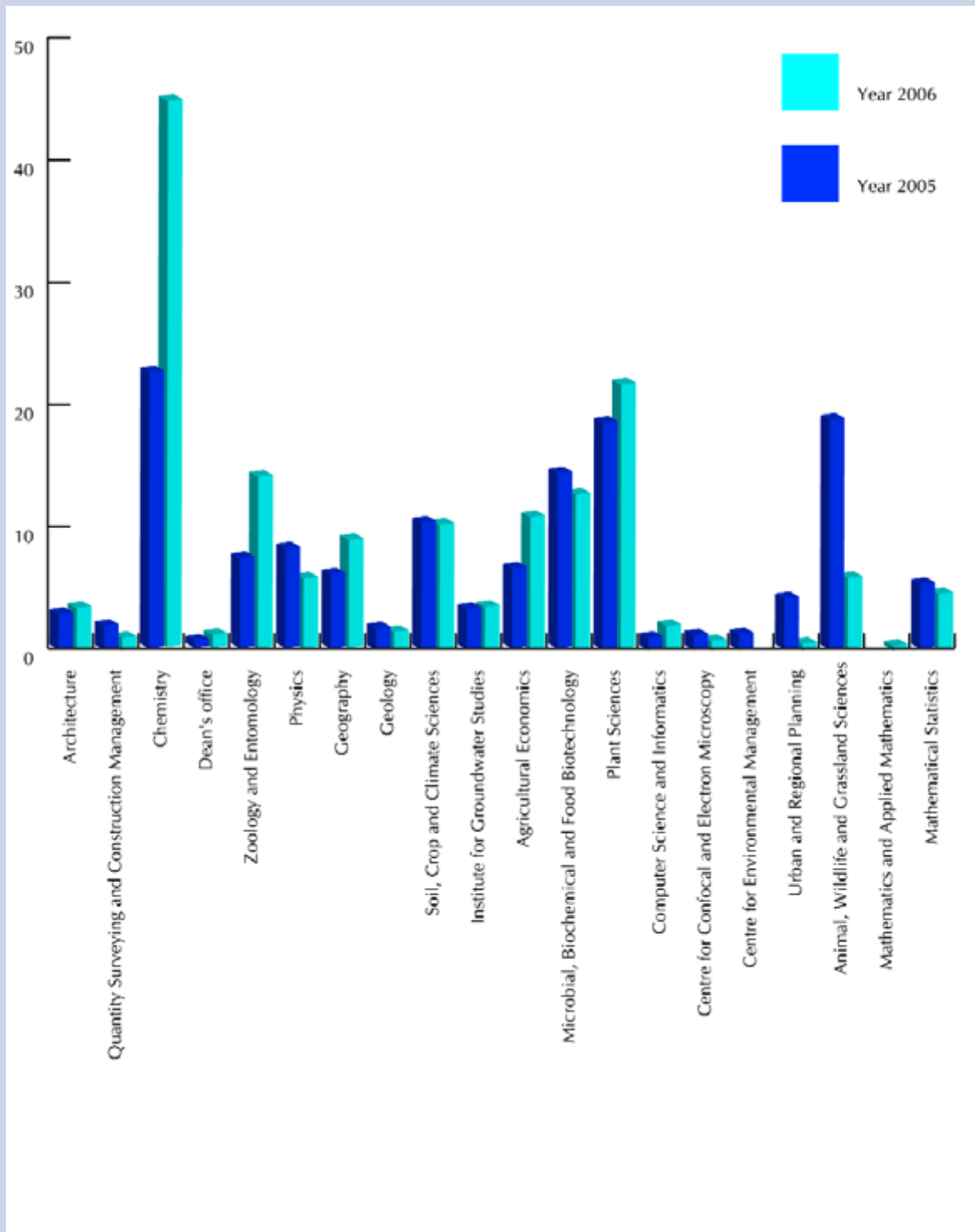


Articles published in accredited approved research journals.



## Departmental research outputs

Articles published in accredited approved research journals, 2005/06



# Glossary



# Glossary

## A

ACIAR	Australian Centre for International Agricultural Research
AEASA	Agricultural Economics Association of South Africa
ALPRU	African Large Predator Research Unit
ARC	Agricultural Research Council
ARMSCOR	Armaments Corporation of South Africa
ARS	Agri Risk Specialists
ASAQS	Association of South African Quantity Surveyors
ASSA	Anatomical Society of South Africa
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
AVS	American Vacuum Society

## C

CANSA	Cancer Association of South Africa
CATSA	Catalysis Society of South Africa
CBD	Convention of Biological Diversity
CCEM	Centre for Confocal and Electron Microscopy
CePHMa	Centre for Plant Health Management
CfPB	Centre for People and Buildings
CIAT	International Centre for Tropical Agriculture
CIDB	Construction Industry Development Board
CIMMYT	International Maize and Wheat Improvement Centre
CIOB	Chartered Institute of Building
CIOB-SA	Chartered Institute of Building - South Africa
CSACEE	Central South African Council on Economic Education
CSIC-INTA	Centro de Astrobiología
CSIR	Council for Scientific and Industrial Research
CSIRO	Commonwealth Scientific and Industrial Research Organisation

## D

DEAT	Department of Environmental Affairs and Tourism
DiMTEC	Disaster Management Training and Education Centre for Africa
DMISA	Disaster Management Institute of South Africa
DST	Department of Science and Technology

## E

EAAP	European Association for Animal Production
EASA	Education Association of South Africa
ECA	European Crystallographic Association
EIGG	Environmental Inorganic Geochemistry Group
EPWP	Expanded Public Works Programme
ESBES	European Symposium on Biochemical Engineering Science
ESREL	European Safety and Reliability
ESRP	Economic and Social Rehabilitation Programme

## F

FAO	Food and Agriculture Organisation
FEMS	Federation of European Microbiological Societies
FMP	Facilities Management Programme
FOTIM	Foundation of Tertiary Institutions of the Northern Metropolis

FSRPO	Free State Red Meat Producers Organisation
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## G

GIS	Geographical Information Systems
Glen ADI	Glen Agricultural Development Institute
GM	Genetically Modified
GMBA	Gauteng Master Builders' Association
GMO	Genetically Modified Organisms
GWK	Griekwaland-Wes Koöperasie

## H

HIV	Human Immunodeficiency Virus
HPCSA	Health Professions Council of South Africa
HPLC	High Performance Liquid Chromatography
HSPCM	Health and Safety Programme for Construction Managers

## I

IAGOD	International Association on the Genesis of Ore Deposits
IAH	International Association of Hydrogeologists
ICCC	International Conference on Coordination Chemistry
ICEC	International Cost Engineering Council
ICID	International Commission on Irrigation and Drainage
ICP	Inductively Coupled Plasma
ICRBM	International Conference on Rodent Biology and Management
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDC	Industrial Development Corporation
IGS	Institute for Groundwater Studies
IITA	International Institute of Tropical Agriculture
INCRoP	Insects on New Crops Programme
INTSORMIL	International Sorghum and Millet Research Support Programme

## IPMA

IPMA	International Project Management Association
IPMP	Intensive Project Management Programme
IRDP	Institutional Research and Development Programme
IRWH	In-field Rainwater Harvesting
IUCr	International Union of Crystallography
IUMS	International Union of Microbial Societies
IUPAP	International Union of Pure and Applied Physics

## J

JFM	Journal of Facilities Management
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## L

LExEn	Life in Extreme Environments
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## M

MIRCHEN	Microbiological Resources Centre
MIT	Massachusetts Institute of Technology
MRM	Mineral Resource Management
MSA	Master's Degree in Sustainable Agriculture
MSSA	Microscopy Society of Southern Africa
MUCPP	Mangaung University Community Partnership Programme
MURP	Master's Degree in Urban and Regional Planning

## N

NaCOF	National Climate Outlook Forum
NAFU	National African Farmers Union
NAMC	National Agricultural Marketing Council
NASA	National Aeronautics and Space Administration
NASSP	National Astrophysics and Space Science Programme
NCEE	National Council for Economic Education
NDA	National Department of Agriculture
NECSA	National Energy Commission of South Africa
NELSAM	Natural Earthquake Laboratory in South African Mines
NERPO	National Emergent Red Meat Producers' Organisation
NGO	Non-Governmental Organisation
NML	National Metrological Laboratory
NMMU	Nelson Mandela Metropolitan University
NMR	Nuclear Magnetic Resonance
NRF	National Research Foundation
NUFU	Norwegian Council of Universities Committee for Development, Research and Education
NWGA	National Wool Growers' Association

## O

OABS	Optimal Agricultural Business Solutions
OECD	Organisation for Economic Co-operation and Development

## P

PARSA	Parasitological Association of Southern Africa
PDMIW	Processing and Disposal of Mineral Industry Wastes
POT	Peaks over Threshold
PPP	Public Private Partnership
PRT	Protein Research Trust

## R

RICS	Royal Institute of Chartered Surveyors
RIEP	Research Institute of Education Planning
RNA	Research Niche Area
RPO	Red Meat Producers' Organisation

## S

SA	South Africa
SAACE	South African Association of Consulting Engineers
SAB	The South African Breweries Limited
SACI	South African Chemical Institute
SACPCMP	South African Council for the Project and Construction Management Profession
SACPVP	South African Council for the Property Valuation Profession
SACQSP	South African Council for the Quantity Surveying Profession
SADC	Southern African Development Community
SAFMA	South African Facilities Management Association
SAFOI	South African Fryer Oil Initiative
SAIP	South African Institute of Physics
SAISC	Southern African Institute of Steel Construction
SAMSI	Statistical and Applied Mathematical Sciences Institute

SANCIAHS	South African National Committee for the International Association of Hydrological Sciences	SEDA	Small Enterprise Development Agency	UNEP	United Nations Environment Programme
SANCU	South African National Consumer Union	SMME	Small, Medium and Micro Enterprises	UNESCO	United Nations Educational, Scientific and Cultural Organisation
SANPAD	South Africa-Netherlands Research Programme on Alternatives in Development	SRC	Student Representative Council	USA	United States of America
SAPOA	South African Property Owners' Association	SRL	Sustainable Rural Livelihood	USAID	United States Agency for International Development
SAPS	South African Police Services	SSAG	Society of South African Geographers	UTCHEM	University of Texas Chemical Compositional Simulator
SAQA	South African Qualifications Authority	<b>T</b>		UWC	University of the Western Cape
SASAS	South African Society for Animal Science	THRIP	South African National Research Foundation Thrust for Industry-Related Projects	<b>W</b>	
SASQUA	Southern African Society for Quaternary Research	TUE	Technical University Eindhoven	WARFSA	Water Research Fund of Southern Africa
SAVAH	South African Association of Visual Arts Historians	<b>U</b>		WATOC	World Association of Theoretically Orientated Chemists
SBE	Sustainable Built Environments	UCT	University of Cape Town	WFP	World Food Programme
		UFS	University of the Free State	WITS	University of the Witwatersrand
		UJ	University of Johannesburg	WRC	Water Research Commission
		UK	United Kingdom	WUA	Water Users' Association
		UN	United Nations		