



# Faculty Reports and **Highlights** from Research Findings



## Faculty of Economic and Management Sciences

### Message from the Dean

The vision of the Faculty of Economic and Management Sciences is to be at the forefront of relevant and innovative economic, financial and management research. In pursuit of this vision, the staff and students of the faculty excelled in their research output for 2006, maintaining the upward trajectory and exceeding the faculty's predetermined goal of DoE subsidised journal articles.

Academics in the faculty are encouraged to participate in national and international conferences and to pursue their studies both at the University and at international universities with whom the faculty has collaboration agreements. At present five young staff members are pursuing Masters and Doctoral degrees abroad.

During 2006, five of our staff members obtained their Masters and Doctoral degrees at the University, 44 staff members presented papers at national conferences and 52 staff members presented papers at international conferences.

The faculty also produced 16 Doctoral graduates and 192 Masters graduates. A further three staff members obtained their NRF ratings with another four in the process of completing their applications.

Each year the faculty awards a research trophy to the department that had the highest number of accredited units in the preceding year. In 2006, the trophy was awarded to the School of Public Management and Administration.

Research awards were also made to the best individual researchers. Dr Felicite Fairer-Wessels of the Department of Tourism Management received the award for the best junior researcher, while Proff Jerry Kuye, David Fourie and Dr Gerda van Dijk received the award for best senior researchers. Several researchers in the faculty also received national and international acknowledgement for the excellence of their research.

The academic journals of the faculty, the South African Journal of Economic and Management Sciences, Meditari Accountancy Journal and the Journal of Public Management and Administration were once again inundated with articles submitted for publication.

During the year the South African Journal of Economic and Management Sciences was accepted on the International Scientific Index (ISI) and the Journal of Public Management and Administration was accepted on the International Bibliography of the Social Science (IBSS).

The Research Committee of the faculty held a Research Forum during October 2006. At the forum academic staff identified the four research focus areas around which the majority of future research of the faculty will be clustered. The research focus areas are:

- Management, Transformation and Skills Development;
- Leadership, Governance and Ethics;
- Globalisation and Sustainable Growth and Development; and
- Business Processes and Modeling.

A number of research workshops were held during the year to develop the research and supervision capacity of academics in the faculty. Prof Johan Mouton presented two workshops on the supervision of Masters and Doctoral students, while Prof Chris Kapp presented a weeklong workshop on the writing of successful academic articles.

Numerous other research workshops are planned for 2007 and several departments have instituted "brown bag sessions" to discuss the research projects of their staff.

I would like to thank the members of the academic and administrative staff as well as our postgraduate students for their contributions in making 2006 a successful research year for the faculty.

The challenge now is to build research capacity, to improve continuously by raising our research output in 2007, both in terms of quality and quantity.

**Prof C Koornhof**

## Highlights

### Chartered accountancy as a career

Finding a balance between the demand and supply of quality chartered accountants (CA) has not only become a problem for the CA profession in South Africa, but also for institutions that produce these graduates.

As far back as the 1990s, researchers noted that the accounting profession in the United States of America (USA) was facing a major problem, namely to attract top students with substantial accounting knowledge as well as strong communication, technical and analytical skills required in the ever-increasing complex environment of the CA profession.

The purpose of this project was to examine factors that influence the career choice of students of various racial groups in South Africa in their pursuit of becoming chartered accountants.

First-year students at the University were used in this study as the introductory course shapes their perceptions of the profession, the aptitudes and skills needed for successful careers in accounting and the nature of career opportunities in accounting.

In order to attract and retain top quality students, it is necessary to identify the differentiating cultural factors, economic backgrounds and specifically the students' perceptions of the accounting profession.

In doing so, academia will be able to further improve and develop areas of the accounting curriculum that are responsible for attracting students to choose accounting as an academic major.

Findings indicated that performance in accounting at school was the most important factor that influenced the respondents' decision to become a CA, while the advice given by parents or relatives and the influence of school teachers were ranked second and third on the list for all three racial groups.

The least influential factor was visits by lecturers from the Department of Accounting. However, in an earlier survey conducted in 1995 in the USA, it was found that college instructors exerted the greatest influence (30%) on students' decision to study for a CA, followed by other practitioners in the field (18%), friends/acquaintances/relatives

(16%) and parents (16%). The influence of high school teachers and counsellors was rated lowest at 7%.

Additional findings indicate that all three racial groups ranked availability of employment as the most important benefit of a CA career and employment security as the second most important. The least important benefit was self-employment opportunities (Asians), potential to travel (Blacks) and size and reputation of the organisation (Whites).

All this indicates that more attention should be given to encouraging lecturers to visit schools in order more effectively to promote chartered accountancy as a career.

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## Women Entrepreneurship Programme

It is well-known that education and training are crucial for the development and creation of entrepreneurs. However, the lack of entrepreneurial training is entrepreneurs' most frequently mentioned weakness in South Africa.

Therefore, research was conducted by the Department of Business Management to find ways in which this weakness can be addressed. The aim of the project was to introduce and measure the effectiveness of the Women Entrepreneurship Programme (WEP). Furthermore, the research provides a model and foundation for future entrepreneurship training programmes.

WEP was developed by Dr Melodi Botha following a quantitative research project conducted in 2003. The findings of this research project identified a dire need for such a training intervention. The programme is presented by the University's Department of Continued Education (CE@UP).

WEP focuses on areas that are normally neglected in other entrepreneurship programmes and includes topics such as networking and support, the use of role models, confidence-building, and post-care training in the form of mentors and counsellors. WEP was measured on eight different levels.

To measure the effectiveness and impact of a training programme such as the WEP, four different levels are ordinarily used; namely: Reaction measures (do trainees like the programme?); learning measures (do they understand concepts in the programme?); behaviour measures (can they apply skills gained?); and results/success measures (does it make a difference?).

However, Botha also made use of key performance measures, which include: primary performance measures (growth in number of employees, turnover etc.); Proxy performance measures (geographical range of markets – national versus international markets); subjective measures (confidence in running a business); and Entrepreneurial performance measures (the desire to start a business or the desire for growth, the ownership of multiple businesses).

Some of findings with regard to the value of WEP indicate that respondents applied and improved various skills in their businesses, of which improving the management and operations of their businesses and improving motivation and confidence were the most frequently mentioned areas. Five potential women entrepreneurs started businesses and 36 start-up and already established women entrepreneurs started multiple businesses.

The findings of this study have helped to highlight the benefits derived by the WEP delegates and that they gained new entrepreneurial, as well as business skills and knowledge relevant to running a business; increased their confidence in their entrepreneurial abilities, and improved their employability, turnover, productivity and profit.

Furthermore it should be emphasised that it was statistically proven that WEP, as a training intervention, is effective in training potential, start-up and established women entrepreneurs in South Africa.

The results of the study confirmed that these women's businesses made a significant difference in their communities as the majority of them created jobs and opportunities in their communities.

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## Energy in the melting pot

South Africa is blessed (cursed?) with cheap and abundant energy in the form of coal, which leads to very heavy energy use. However, the quality of our coal is not good, and its consumption is not environmentally neutral. Its combustion contributes to air pollution including the increase in the concentration of atmospheric carbon, which is linked to climate change.

The market system, working through prices that are determined by demand and supply, is unable to take care of the coincidental side effects of our excessive energy consumption. Taxes could play a meaningful role in correcting for consumer energy behaviour.

The Department of Economics developed an integrated general equilibrium model for modeling the impact of a variety of policy instruments, such as environmental taxes, based on the behaviour of households and industries.

The aim with such a tax design is not primarily to raise the revenue for the fiscus, but rather to reduce the environmental (carbon) footprint; stimulate economic growth; and combat poverty.

In their studies they found that a tax on either the consumption of energy or on carbon emissions, recycled to the rest of the economy through a reduction in the tax on food (reduction in VAT), would achieve a triple-dividend in South Africa.

This research has led to two academic publications, one in a highly acclaimed international journal, while the work is currently being refined in conjunction with the National Treasury with the view to get the said taxes incorporated in legislation in South Africa.

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## Gravity model

The Investment and Trade Policy Centre (ITPC) at the Department of Economics created a gravity model for use by different divisions within the Department of Trade and Industry (dti). The gravity model allows the user to determine the most efficient sectors in terms of exports to various trading partners of South Africa. It is also used for policy simulation.

This study's main objective was to develop a methodology, or working tool for analysing international trade flows, based on the annual

bilateral trade volume between South Africa and its main trading partners.

The model uses panel data econometrics and is based on trade between South Africa and 147 trading partners within 33 sectors. The general idea behind the gravity model stems from the gravity theory in physics.

A flow is regarded as the resultant of the attraction between two objects. When the flows concern international trade, the objects are the exporting and importing countries. The “masses” of the countries are the sizes of their economies, from which a certain potential trade flow results.

The larger the economies of the countries, the larger the trade among them will be. The model shows both the actual and potential trade between countries. A comparative trade analysis between countries is thus very easy and shows where the potential trade is not exploited to the full. This model is a first for South Africa and is used for trade policy analysis in the dti.

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## Micro simulation tax models

The Bureau for Economic Policy and Analysis (BEPA) – the contract arm of the Department of Economics – and the National Treasury in conjunction with the South African Revenue Services (SARS) joined forces in 2003 to develop tax models that can be used to simulate the outcomes of tax policies as well as predict tax income.

This micro model brings a new dimension to tax analysis because the profile of taxpayers (both individuals and corporates) is taken into consideration when tax structures are designed. Previously, the profile of individual taxpayers was strictly limited to that of only tax filers while in the case of corporate institutions their profile was also limited to the information provided in their tax submissions.

Using the micro model constructed by BEPA, it is now possible to calculate the result of changes to household taxes in a specific region, age group, gender and income category, while in the case of companies, survey data in addition to the filer data, broadened the scope of indicators used in simulation and revenue forecasting. The impact thereof is that much more accurate analysis and forecasting techniques can now be implemented.

In 2006 this model was further expanded with funding from SARS and the National Research Foundation (NRF). The expansion includes an additional revenue source namely Value Added Tax (VAT).

Also, the corporate income tax model has been expanded to a full sectoral model which improves revenue forecasting given the sectoral differences in economic performance.

The most valuable contribution of this model is the fact that tax predictions can now be made with much greater accuracy. In the past, relevant authorities mainly used macro models, which often did not make provision for specific societies or sectors in the economy.

This meant that the different influences prevalent in those societies or sectors were not reflected accurately. The impact was that revenue was either under- or over estimated with severe consequences for the economy – especially the liquidity position of households and their saving behaviour.

BEPA feeds the outputs of its macro model into the micro simu-

lation model, which means that predictions are more detailed. This in turn leads to improved quality. Researchers are hopeful that this will help fiscal authorities to solve the dilemma they faced in the past as a result of inaccurate projections.

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## Pilot study for ecological restoration in the greater Giyani area

Environmental Offsets Investments Pty (Ltd) (EOI) is engaged in a pilot project restoring degraded savanna in the area east of Giyani next to the western border of the Kruger National Park. EOI is actively and on an ongoing basis assisted in its endeavours by the Department of Zoology (Conservation Ecology Research Unit) and the Department of Economics.

Preliminary findings of this pilot project - funded by the Department of Environmental Affairs and Tourism - indicate that it is indeed possible to link environmental, economic and social concerns through a unitary approach, thereby generating a range of synergies and achieving a suite of results.

Ecological restoration has become a very attractive and cost-effective economic development strategy. Parallel but not isolated from this pilot study the partners above, on request of the Limpopo Government, investigated the options of a district-wide ecological restoration initiative in the Sekhukhune District of the province.

Other findings indicate that more than 95% of the population of the district is eager to participate in a restoration project and that they are convinced that restoration will contribute to their quality of life.

As a result of both the pilot study and research conducted, the Limpopo Government accepted ecological restoration as one of its key strategic areas as described in the Premier's Provincial Growth and Development Study and is preparing full-scale implementation.

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## World Bank survey

The 2006 tax practitioner survey, carried out under the supervision of the World Bank Group (WBG) at the request of the National Treasury and SARS, aims to establish the tax compliance burden for small and medium sized enterprises (SMEs) in South Africa.

This survey (along with two related surveys targeted directly at formal SMEs and informal firms) is being conducted on a nation-wide basis. The National Treasury and SARS plan to use the results of this study, in cooperation with WBG, as a strategic input into policy formulation with regard to the tax compliance costs of SMEs.

One of these is the Tax Practitioner Survey, developed by WBG in consultation with the researcher as well as other professional institutions such as the South African Institute of Chartered Accountants (SAICA), the South African Institute of Professional Accountants (SAIPA) and the South African Certified Institute of Certified Bookkeepers (SAICB).

The results of this survey will provide the only evidence of its kind in South Africa and will be used by National Treasury and the South African Revenue Service (SARS) to make appropriate changes in terms of the design and enactment of reforms in the area of SME tax administration by the Government.

The survey ended in January 2007. A report containing the analysis and interpretation of the results is currently being prepared by the researcher and will be presented to SARS, National Treasury, SAICA, SAIPA and the SAICB within the next few months.

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## Child support grants

The growth in child poverty is a major concern in South Africa. The mere fact that the country introduced legislation in the form of Child Support Grants (CSG) in 1998 to address this societal problem does not mean it will disappear overnight. Nor does it mean that legislation will automatically be implemented with success. The aim of this research project was to investigate and identify shortcomings in the implementation of CSG in South Africa with special emphasis on policy implementation.

Findings indicate that unintended outcomes of the policy - for example administrative shortcomings, a lack of institutional collaboration or even the unexpected adaptation to CSG by beneficiaries were at the core of the problems experienced. The researcher argues that CSG will only have a positive effect on child poverty if effective implementation practices are introduced.

The research identified several critical variables that have a negative impact on successful implementation of CSG. These include correct policy content, nature and collaboration of the institutional context and policy context (networks of stakeholders and policies), commitment, skills, and support of the clients (beneficiaries). In addition, he found that one of the major stumbling blocks in the effective implementation of CSG policies is the fact that the responsibility for the implementation of CSG has been mainly that of the Department of Social Development and the social development departments in the respective provinces.

He recommends that this typical "silo" approach to implementation should make room for the networks approach to policy implementation. The different departments and other institutions should work together as networks to enhance the outcomes of the CSG. This implies that not only should related institutions collaborate, but also that the networks of policies that relate to the CSG should be integrated.

He cautions however, that this should not be seen as the cure-all, but that it will at least contribute to more successful implemen-

tation. He recommends that a proper research survey is undertaken, which is aimed at providing meaningful remedial actions and should focus on policy research and implementation.

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## Long distance trucking and the spread of HIV/AIDS

The global spread of HIV/AIDS and especially the burden of the disease on the economies of countries in sub-Saharan Africa show that governments, communities, non-governmental organisations and business need to respond to this growing pandemic.

Prof David Fourie and Ria Schoeman, a PhD student, conducted research into the long-distance trucking industry to determine the impact that HIV/AIDS has or may have on this sector over the long term.

Their research indicate that less than 10% of all operators who took part in the survey have conducted investigations to determine the impact of HIV/AIDS on their companies. Many participate on a national level in programmes for the trucking industry - doing the minimum or nothing at company level.

The researchers also found that many companies are hesitant to develop and implement HIV/AIDS workplace programmes. Approximately 65% of the operators have an HIV/AIDS policy in place, yet only 25% indicated that they have implemented the policies.

In addition, operators' responses to the pandemic seem to be linked to the size of the company. Large companies have more resources to develop and implement HIV/AIDS policies and programmes. The overall perception of most companies seems to be that HIV/AIDS will have a small to moderate impact on their business.

The researchers recommend that operators should be encouraged to develop and implement HIV/AIDS policies and programmes as a matter of urgency. Although the disease will not have a dramatic impact on the macro-economy, it will have an impact at company level, especially on a vulnerable industry such as the trucking industry.

In addition, the guidelines, policies and legislation relating to HIV/AIDS that are in place in South Africa should be enforced more rigorously. This will only be done if government provides the necessary political commitment and guidance and labour movements engage their membership to enforce the laws that are already in place.

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## Faculty of Education

### Message from the Dean

For five successive years, the Faculty of Education has achieved a constant upward growth or increase in publication research outputs in high quality national and international journals. Not only are more academics publishing research of high quality, but individual scholars are more productive in a wider range of journals than before.

While starting from a low base in a faculty with strong professional rather than research traditions, this trajectory in research output reflects the millions of Rands invested in the development of promising young scholars and the recruitment of leading talent in educational scholarship within and beyond the borders of South Africa.

A major drive in recent years was to shift the emphasis in publication towards the production of high quality scholarly books since this kind of output often counts more heavily in the social sciences and education.

The scholarly book is, in such fields, a marker of international standing in leading universities. In response to training of young academics on the subject *Writing Your First Scholarly Book*, more than a dozen such publications have emerged in the past two years through publishing outlets such as Routledge, Springer (formerly Kluwer), University Press of America, Trentham Books, and many others.

No research is possible at this level without sustained international funding and the faculty again achieved the feat of raising major funding, and in some cases renewing research funding contracts, from sources such as the Norwegian government, the European Union, the National Institutes of Health (USA) and many others.

The National Research Foundation (NRF) has made special scholarships available to staff and students on the basis of the top research dissertations delivered at *The Annual Post-Graduate Research Indaba*. The postgraduate student Indaba, now an institution in the faculty, provides a platform for emerging scholars to share their research among peers before venturing out onto the national stage, and for some, international conferences, to present their research designs and findings.

The faculty continues to produce relatively large numbers of highly qualified *doctoral graduates*, compared to other Faculties of Education, with the mandatory international examiner as part of the final assessment.

The PhD graduates are consistently highly rated by leading international scholars, again a result of an intensive doctoral support programme that enables education students to develop excellent research dissertations.

The introduction of *undergraduate research* initiatives was fully implemented in 2006 where student teachers are encouraged

to introduce structured reflection into their daily practice and to ask and investigate practical questions about their teaching. Research is placed in context, and designed to improve the practice of teaching. For students who decide to continue into postgraduate training, this initial exposure to research thinking has the added benefit of preparing them for advanced study.

The growing number of international postgraduate students contributed to a strengthening of the *comparative research* interests in the faculty. The registration of students from Namibia, Kenya, Mozambique, as well as students from Europe, North and South America and Asia, have together created research interests in education systems way beyond our borders.

The internationalisation of research, through such students, have enriched the quality of research and enhanced possibilities for international research collaboration—a prominent example being the Norwegian partnership in research development.

A foundation has been laid for strengthening the faculty's three major *research niche areas* in the next five years; these concentrated research areas are *studies in assessment, educational change, HIV/AIDS and education*.

In each of these three areas book contracts have been won, and a major scholarly monograph will appear in 2007. A fourth area has recently been added, namely, *research in distance education*, and a special focus of this work has been on the uses of mobile technologies in advancing learning in distance education.

The dramatic growth in the research activities and the research outputs of the Faculty of Education during 2006 has been phenomenal, by any account. The strong research capacity building logic that infuses all these actions makes these investments highly sustainable and satisfactory.

Prof Jonathan D. Jansen

## Highlights

### Helping children with disabilities: A new paradigm for early childhood intervention

A considerable amount of research has been directed towards the question of how children with disabilities can be supported and assisted in meeting the challenges imposed by their condition. Much of this research is "problem focused" – in other words, it concentrates on the disability itself and on ways in which it can be ameliorated or improved.

Researchers at the University's Centre for Augmentative and Alternative Communication (CAAC) have conducted a study that represents a radical departure from this paradigm. The three-year study, funded by the Swedish International Development Cooperation Agency in cooperation with the NRF, and undertaken in collaboration with the Children-Health-Intervention-Learning-Development (CHILD) programme at Mälardalen University, Västerås, Sweden, focuses on positive functioning and on ways to use existing processes in a child and family's interaction as a basis of intervention.

The study comprised four specific projects. The first explored the role of engagement in play and participation. It emphasised the gains and joy that a child may derive from active involvement in play activities.

A second project proceeded from the notion that a child's involvement in activities greatly depends on the extent to which the child's

interest and skill are accommodated in the nature and demands of those activities. The concept of activities, as described in the international classification of functioning, was explored as a basis for intervention.

A third project focused on social networks and their role in promoting positive family functioning, while the fourth explored aspects of current parental support systems in Sweden and South Africa and how these facilitate or inhibit positive family functioning.

The findings of all these projects emphasise the importance of looking beyond the disability in facilitating intervention of a young child within the family.

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## Teaching in the new South Africa at Merrydale High School

Merrydale High School is a school in Mitchells Plain, Cape Town. As in many other schools across South Africa, its teachers have to deal with increased work demands as well as with issues related to teacher identities, classroom management, curricula and pedagogy, and racial diversity and integration.

Dr Everard Weber of the Department of Curriculum Studies has made this school the subject of a groundbreaking case study in which teachers' work is viewed against the backdrop of its social context, the legacies of apartheid and the education reforms of the new government.

The research addresses several academic problems. One of these concerns the fact that, although South African scholars have conducted several analyses of macro-policies in education, hardly any work has been done to explain how these policies have been implemented on the ground.

Consequently, very little progress has been made to date in terms of elucidating the complex interrelationship between education policy and practice. The work also grapples with the pervasive influence of history and social dynamics on education.

Scholarly literature is largely silent on the question of whether, and how, this dimension ought to be incorporated into education policy studies. Weber's research not only demonstrates the importance of casting the research net wide enough to capture these macro-level variables; it also describes the outcomes of such an analysis.

Weber employed a qualitative research design that enabled him to generate discursive portraits of teaching at Merrydale High School. These demonstrate how pedagogy, subject content, school and national history, as well as the relations of power regarding school governance intersect and clash. Taken together, they present a powerful image of teaching as a deeply social enterprise.

The outcome of this research has been published as a book, and has received positive reviews from scholars in South Africa and abroad.

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## Restructuring of Jewish Schools in South Africa

The far-reaching changes that are sweeping South Africa have left some communities feeling uprooted from their identity and trapped in a vortex of uncertainty. Dr Chaya Herman of the Department of Education Management and Policy Studies investigated the manner in which Jewish community schools readjust and restructure their educational system in response to these internal and external change dynamics.

The study was based on data collected through interviews, recordings of meetings, participant and non-participant observation, document analysis and countless informal conversations with members of the community.

These were conducted during a controversial process of restructuring in the Jewish community schools in Johannesburg; this process took place between 2001 and 2003. The study revealed that the rapid change from oppressive past towards inclusive democracy in South Africa may sometimes generate significant counter-currents.

In the case of the Jewish community schools, the counter-current involved the confluence of two powerful, but seemingly irreconcilable, global dynamics: that of neo-liberalism and managerialism (often expressed in the notion that "schools should be run like a business"), and a renewed emphasis on ethnic and religious identity, often tending towards fundamentalism (frequently articulated in the phrase "We will become more Jewish").

These two currents, and the way they interacted with the particular characteristics of the community in question, gave momentum to the emergence of a new power elite that sought to reintroduce authoritarianism reminiscent of the previous social order.

The study suggests that formerly privileged minorities may attempt to sidestep ideological, political and social complexity through linear, quick fix solutions. Instead of providing the sought-after certainty, however, such developments may polarise a community and shift it towards ghettoisation and exclusivity.

The study, which formed part of a larger research project, was published by the HSRC as a book: Chaya Herman (2006). *Prophets and Profits: Managerialism and the Restructuring of Jewish Schools in South Africa*. HSRC Publishing, South Africa.

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## Assessing the current state of knowledge regarding educational leadership, management and governance in South Africa

The effectiveness of a country's education system depends to a large degree on the quality of its educational leadership, management and governance. Given the challenges surrounding education in South Africa today, the importance of supporting this dimension of teaching and learning through sound policy and informed decision-making cannot be overstated.

Policy and decision-making, in turn, depend on accurate information supported by thorough research. Unfortunately, South African research on this topic has tended to be somewhat haphazard and uncoordinated.

In order to address this shortcoming, research was commissioned by the Gauteng Department of Education through the Matthew Goniwe School for Leadership and Governance to establish “what we know” and “what we still need to know” about educational leadership, management and governance – both in South Africa and abroad.

The research project was directed by Prof Tony Bush of the University of Lincoln in the United Kingdom (UK). The project took the form of an extensive review of all relevant South African and international literature, including previous literature reviews, reviews of legislation, scholarly articles describing the results of empirical investigations, and material describing the application of good practice.

The research process was organised around two broad themes: leadership and management (including issues such as organisational theory, leadership, financial management and learner discipline) and school governance (addressing matters such as the role of learner representatives, community and parental involvement, the appointment of educators, training and the role of non-governmental organisations).

Research on school governance was coordinated by Dr Rika Joubert of the Department of Education Management and Policy Studies.

The outcome of this literature review was captured in an eighty-page report. The report contains a series of integrative, thematic summaries representing the current state of knowledge pertaining to leadership, management and school governance. It also offers recommendations for further empirical research.

The report emphasises the importance of holistic research and school-based studies that could support evidence-based policy and practice. As such, it lays the basis for a systematic approach to future commissioning and funding of research.

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## The right to freedom of expression: What does it mean in the school context?

The right to freedom of expression is viewed internationally as one of the cornerstones of democracy, and it is enshrined in our Constitution in the Bill of Rights. The recognition given to this right in the new South African dispensation stands in stark contrast with the previous regime, which was characterised by intolerance, oppression and a fear of speaking out against authority.

Greater freedom brings greater responsibility and complexity. One of the complexities inherent in the right to freedom of expression is that this right (as all other rights) is not absolute: it has to be balanced against other fundamental rights upheld in the Constitution.

For instance, hate speech cannot be justified on the grounds that it constitutes freedom of expression, since it conflicts with the right to human dignity. How well do young South Africans understand the right to freedom of expression and all its ramifications?

Dr Willie van Vollenhoven of the Department of Education Management and Policy Studies set out to answer this question through a study making use of questionnaires, focus group discussions and an in-depth interview.

The study focused on a context that has been one of the focal points in the imposition of the old value system and the struggle for

transformation in South African schools. Five Gauteng schools - three former White schools and two “township” schools - were selected to participate in the study.

The study yielded a number of interesting findings. For instance, some learners seem to absolutise the right to freedom of expression, expressing the view that the right to religious expression can under no circumstances be limited.

The study also revealed that authoritarianism - the view that authority must be obeyed unquestioningly - is still rife in our school system. Van Vollenhoven argues that this tendency poses a threat to the development of democracy.

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## Understanding the dynamics of international student circulation

The process of globalisation, which is well-recognised as a major driving force of change in the world's economy, also impacts on higher education. It happens more and more frequently that students from one country decide to continue their studies in another country – a phenomenon known as “international student circulation”.

Dr Chika Sehoole, together with four other scholars from Egypt, Indonesia, India and the Netherlands, conducted a collaborative study under the auspices of the Fullbright New Century Scholar programme aimed at developing a better understanding of this phenomenon and assessing its implication on higher education in various nations and regions.

The study involved a number of case studies focusing on degree-seeking students from the four developing countries and two regions (Europe and the USA); this was followed by a comparative analysis in which data from the various countries were pooled.

The results of the study revealed a degree of asymmetry between developing and developed countries: the former are primarily on the sending side of student mobility, while the latter (Europe and the USA, in particular) are primarily (but not exclusively) on the receiving side.

Nevertheless, it was found that increasing numbers of students from developing countries enrol for studies in other developing countries. South Africa, for instance, receives large numbers of students from Zimbabwe and Namibia, while Egypt is a powerful magnet for students from Muslim countries in Asia.

The study revealed a number of other interesting trends. One of these concerned the reasons why students decide to study abroad. Previously, the economic rationale had been assumed to be the dominant consideration.

The results generated by Sehoole and his fellow researchers show, however, that other factors (such as religion) appear to be gaining importance, and are partly responsible for changing patterns in student flow from Islamic countries.

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## The psychosocial effects of parental HIV disease on young children in poor urban communities

Prof Irma Eloff of the Department of Educational Psychology is involved in a five-year NIH-funded project aimed at assessing the psychosocial effects of parental HIV disease on young children living in poor rural communities in South Africa.

An additional aim of the study is to assess the effectiveness of interventions aimed at improving maternal functioning and helping mothers promote resilience in their children. In particular, the study focused on support interventions based on psychological theories of resilience.

The pilot phase of the study, which was completed in 2006, involved the design of such a theory-based intervention as well as the development and validation of several psychometric assessment instruments to measure resilience.

The assessment instruments were based on questionnaires developed in the USA. It was found that they needed repeated adjustment before they could be applied in the South African cultural context.

In addition to the challenges posed by translation, the transposition of assessment instruments and intervention strategies from one context to another was found to be complicated by cultural differences in the meanings assigned to certain psychosocial constructs.

Much of the literature concerning "resilience", for instance, has been written from an individualistic, Western perspective. Within this framework, resilience is strongly identified with independence and self-esteem. Within a traditional African context, however, resilience acquires a more collective flavour: it is viewed as a function of *inter-* (rather than *in-*) dependence.

The study also suggests that deficit-based assessment instruments (in other words, instruments that focus on problems and challenges) may paint a one-sided picture of the vulnerable child.

Eloff and her colleagues therefore argue for greater emphasis on *positive* psychological factors such as hope and resilience.

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## Evaluating the effectiveness of TeleTuks Schools in promoting learner participation

*TeleTuks Schools* was an outreach initiative of the University that involved over a hundred schools in deep rural communities throughout four South African provinces. Each school was equipped with a television set, a satellite receiver and a smartcard capable of decoding instructional broadcasts from an on-campus studio.

During transmissions, learners could phone in to the studio with questions or comments.

Despite the system permitting synchronous, bi-directional, oral communication during telelessons, learner participation was poor.

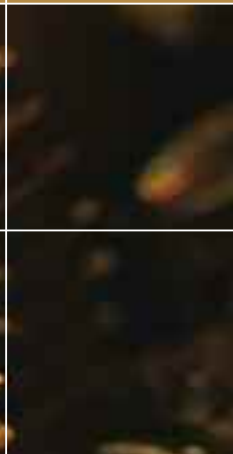
Dr Rinelle Evans of the Department of Social Studies Education conducted a study to identify the factors responsible for low learner reciprocity. Experiential interviews and analyses of video recordings provided rich qualitative data.

The initial proposition was that learners' poor English language proficiency inhibited overt participation. However, the findings revealed that, while the language barrier posed an obstacle, its effect was but a contributing factor.

Evans was able to identify several other factors that acted as obstacles with regard to learner participation. She clustered these factors into three themes. The first theme – which she termed "paradoxical perceptions" – related to the mismatch between learners' and presenters' interpretation of the televised context.

The second theme – "presenter nescience" – emphasised the fact that presenters were largely unaware of the many noise elements that interfered with their message. The third theme ("problematic practicalities and partnerships") encompassed various technical and practical difficulties that impinged on the anticipated interaction.

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## Faculty of Engineering, Built Environment and Information Technology

### Message from the Dean

Research forms an integral part of the activities of the Faculty of Engineering, Built Environment and Information Technology. It not only provides a sound basis for the programmes in the faculty, but also contributes to knowledge and its application in the fields and professions served by the faculty.

Departments were encouraged to develop research areas relevant to the areas served by the programmes offered, and staff members were encouraged to join and build existing and emerging research groups. Significant growth in the accredited research outputs by the faculty was achieved in 2006, and the quest is to improve on both the participation of staff and the number and quality of the outputs for the future.

The University was awarded a DST Research Chair in Artificial Intelligence for Prof Andries Engelbrecht of the Department of Computer Science, and we plan to establish a National Centre for Artificial Intelligence in the near future. During 2006 several more initiatives were launched to further develop research in the faculty as will be discussed in the following paragraphs.

Research as an integral part of our activities was furthered by internal research seminars and poster sessions by our staff and students, by increasing the research requirements of our graduate programmes, by focussing on research skills and achievement as part of the requirements for appointment and promotion of academic staff, and by pursuing opportunities to increase our research funding and facilities. The activities in the faculty were also made more accessible to the wider public through the publication of the Innovate magazine.

Departmental visitations by the faculty research committee, and other interested staff members, during which the departments presented their research planning and outputs, were used to increase awareness of the research activities in the faculty and to stimulate cross fertilization and cooperation. Interdisciplinary activities in telecommunications, computer security, and the built environment flowed from this. The excellent progress that some departments made with their research also served as a stimulus to others.

A publication workshop by a professional in communication, supported by senior researchers and a journal editor, was again held to develop the professional writing skills of emerging researchers and to facilitate publication of completed research. The workshops were well received, but made it clear that sustained effort will be required to continue to develop the skills of emerging researchers.

Conference participation by staff members was encouraged, and supported by the faculty, to increase the international exposure and cooperation of staff members. The feedback received is indeed very encouraging and contributed significantly to the research outputs achieved. Staff members also actively participated in the organising of conferences such as the World Housing Conference, which was held on the campus.

Consolidation of research activities was encouraged and several departments responded by focussing their research activities in such a way that sustainable groups were formed with the potential to significantly contribute, both locally and internationally. An example of this is the research groups in the department of Computer Science, namely Information and Computer Security Architectures (ICSA), Computational Intelligence (CIRG), Distributed Components and Middleware (Polelo), and Software Engineering – Theoretical and Applied Research (Festar/Espresso), which are already making significant international contributions.

International peer review of our research activities was increased by the appointment of leading researchers as external examiners for theses, encouraging peer review of our staff through the NRF rating system, and encouraging publication of research in leading international journals. We are indeed encouraged by the rising number of staff that received NRF ratings, and by the increased participation of leading international researchers in our activities.

Strong links with and support of the research in the faculty by industry was again achieved with most of the research projects receiving at least some support from industry. Typical examples are the industry support of the Industrial Metals and Minerals Research Institute in the Department of Materials Science and Metallurgical Engineering, which enables leading edge research on metals production and finishing, and of the Chair in Broad Band Multimedia Communications supported by Sentech in the Department of Electrical, Electronic and Computer Engineering.

The further development, application and commercialisation of research are priorities for the faculty. Thus the further development and commercialisation of silicon light emitting devices that has the potential to significantly enhance the speed of electronic devices by using these devices for on chip communication was taken further and additional funding and international cooperation are presently being pursued. The faculty is also involved with the development and commercialisation of software applications at the Coach Lab, housed on the Innovation Hub, with the support of industry.

HIV/AIDS is a disease demanding attention from every individual in South Africa. The faculty made several contributions to prevention and control of the disease. Researchers in the School of IT focussed on the employment of advanced ICT technologies in combating the devastating impact of HIV/AIDS, as part of the activities of the larger research area in Health Informatics. In the School of Engineering control theory is being utilized to design treatment strategies in cooperation with researchers in France.

We are indeed encouraged by the very significant progress that the faculty made with its research initiatives during 2006. We not only achieved a significant increase in formal research outputs, but also strengthened the foundations for sustained growth into the future. Increasing our physical infrastructure, research support, and the number of graduate students are priority challenges for solution in the near future.

**Prof RF Sandenbergh**

## Highlights

### Creating a virtual national address database

The "NAD on the Grid" research project, which is led by Serena Coetzee of the Department of Computer Science, investigates distributed address data maintenance. Also working on the project is Professor Judith Bishop.

The aim of the "NAD on the Grid" project is to investigate the use of grid computing and distributed database management technologies for a virtual national address database. The characteristic feature of such a virtual national address database is that it will not be located at any single physical place. Instead, the part of the database pertaining to a specific municipal area will reside at that municipality who are best placed to maintain the data. Through the use of distributed database management technologies these local databases will, however, be seamlessly integrated so that it appears to the user as a single, large database. Another important feature of the project is that it investigates the use of grid computing – in other words, the pooling and sharing of resources (processing power and hard drive space).

The advantage of grid computing in terms of establishing a virtual national address database is that it will allow smaller municipalities (who often do not have the funds to establish large computer databases) to house their databases in a pool of shared servers. The "NAD on the Grid" project is jointly funded by AfriGIS and the Department of Trade and Industry (dti) through THRIP.

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### Ability of quantity surveyors to offer affordable services

One of the functions of the South African Council for the Quantity Surveying Profession (SACQSP) is to publish a Tariff of Professional Fees for the industry. This tariff, which is reviewed on an annual basis, provides quantity surveyors and their clients with guidance concerning fair remuneration for the services being offered.

However, due to the growing competitiveness of the market, it has become the norm for South African quantity surveyors to offer reduced professional fees on construction projects. In some instances, these discounted fees are far below those recommended by the SACQSP.

A study was conducted to identify the criteria used by quantity surveying firms when calculating fees for construction projects, and also to investigate the relationship between the magnitude of the discount offered and the risk of making a financial loss on a project.

Data were collected by means of a questionnaire distributed to twenty quantity surveying firms of various sizes, all of them based in Gauteng.

The results of the study suggest that most quantity surveyors offer discounts on an ad hoc basis, and that some firms do not regularly conduct reconciliation at the end of a project to determine whether they have in fact made a profit.

An analysis of a number of projects also revealed that their

margins ranged from a loss of 79% to a profit of 364%. These findings indicate that quantity surveyors can make a profit on most projects – provided that the calculation of discounts takes into account relevant factors such as the type of project, its size and the amount of work in the office.

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### The future of South Africa's research and development sector

There is evidence to suggest that South Africa's research and development (R&D) capacity is currently undergoing a period of disinvestment and decay. However, it is difficult to pinpoint the exact nature and magnitude of the problem or to design appropriate policy interventions.

This difficulty partly derives from the fact that R&D *investment* often takes a long time to translate into R&D *output* (new knowledge, research publications, industrial innovations and the like). Hence, the link between these two variables is not readily amenable to quantitative analysis.

Saartjie Grobbelaar investigated the matter during research conducted for her PhD degree under the supervision of Prof Andre Buys of the Department of Engineering and Technology Management.

Her work brings dynamic systems modeling to bear on the problem. Such modelling has the advantage that it is able to elucidate feedback effects and time delays in the influence that variables exert on one another.

The first step in dynamic systems modeling is to identify the variables that have to be included in the model. To this end, Grobbelaar employed the Delphi technique (a structured discussion aimed at eliciting the consensus opinion of an expert panel) to identify and rank the most pressing issues facing the South African R&D system in the next twenty years.

The aggregated group opinion of the participants converged on two main themes: the poor prospects of retaining researchers and rejuvenating the R&D system, and the shortage of sufficient R&D funding.

The next step was to construct a mathematical model of the South African R&D system, populating it with the relevant variables and estimating the parameters governing the relationships among those variables.

Data to support the model was collected from various sources, including R&D surveys conducted between 1977 and 2003. The parameters associated with the model's production functions were estimated through statistical techniques, and the model was subjected to rigorous testing.

The model was then realised by means of computer simulation to test a number of scenarios. These simulations reveal that shrinking R&D capacity and output are partly the result of increasing student-to-staff ratios, and that policy interventions aimed at significantly expanding and nurturing South Africa's R&D workforce are required if the country is to regain and improve its international position as knowledge creator.

Scenario tests also indicated that, should South Africa's R&D system be allowed to decay any further through insufficient investment, the cost of rebuilding capacity is likely to increase considerably.

Another conclusion from the study is that the deteriorating R&D capacity in the Higher Education sector can be arrested to a significant

degree by revisiting the current division of work of academics between research and teaching and the application of innovative techniques to the delivery of teaching.

The model offers a valuable tool for testing and comparing the probable consequences of various policy alternatives. As such, it can assist decision-makers in enhancing the effectiveness with which problem areas in the South African R&D system are addressed.

## Technological entrepreneurship in an emerging economic region

A substantial body of knowledge has amassed on entrepreneurship in the sales, services and technology-based business domains in the developed world. Research in this field has concentrated on issues such as personal attributes that distinguish successful entrepreneurs from unsuccessful ones, as well as environmental factors that influence the establishment and growth of new business ventures.

By contrast, relatively little is known about the entrepreneur or about new venture creation and business growth processes in developing countries. This dearth of knowledge is especially severe in the arena of technology-based entrepreneurship (in other words, enterprises that depend on technology for their products or operations).

Frans Lotz, a student of Prof Andre Buys, addressed this shortcoming through research for his PhD thesis entitled: *Technological entrepreneurship in an emerging economic region: A model developed from a multi-cultural provincial study*. In this study, he focused on a group of more than two hundred entrepreneurs at the helm of technology-based enterprises in the province of KwaZulu-Natal.

Over 25 000 data points were collected through questionnaires and subjected to statistical analysis. The study yielded a number of interesting findings. For instance, it was found that formal entrepreneurship training and education in the primary and secondary schooling system is virtually non-existent. Where such training does occur (primarily in tertiary institutions), it is regarded as poor or totally inadequate.

The study also revealed that environmental factors such as growing-up experiences and cultural heritage – including age when first introduced to entrepreneurship, prevailing social attitudes towards entrepreneurship and self-employment status of parents – contribute significantly to the “making” of technological entrepreneurs in emerging societies.

The study culminated in the development of a model that identifies the most prominent influences on technological entrepreneurship in an emerging economy. This model incorporates three categories of variables: technology-specific factors, start-up assistance factors and personal attributes of technological entrepreneur.

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## A finger on the pulse of South Africa's book publishing industry

In 2003, the Publishing Studies division of the Department of Information Science was approached by the Publishers' Association of South Africa (PASA) with the request that data be collected on the book publishing industry.

This request provided the impetus for a number of surveys: two “snapshot surveys” focusing on the years 2002 and 2003, and two more in-depth surveys for 2004 and 2005.

The participants in these surveys included a large number of publishing houses that are members of PASA. The data collected during the surveys were analysed in order to detect trends and patterns in a number of variables; these included turnover, production, authorship, employment and ownership profiles.

The results of each survey were captured in an annual report, thus providing a comprehensive overview of the contemporary book publishing industry in South Africa at that time.

These reports are used by PASA, the Print Industries Cluster Council and various government departments to monitor the growth and development of the book publishing industry.

In 2006, an additional report was compiled to reflect broad trends over the period 2002-2005. The report indicates that the Total Net Turnover of the book publishing industry during 2005 was just over two thousand million Rand; this represents an 18,25% growth between 2004 and 2005.

When this Total Net Turnover (in nominal terms) is compared with the Gross Domestic Product (GDP) Current, it is evident that the publishing industry, as a cultural industry, is making a relatively significant contribution to the economy of the country (0,139% in 2005).

The report also highlights several other interesting economic trends. Examples of such trends include the ratio between income generated by local versus imported products, as well as the ratio of income generated by the educational, academic and trade book sub-sectors.

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## Activity Theory in Anti-Retroviral Treatment

In 2003, the South African government commenced an Anti-Retroviral Treatment (ART) programme in selected clinics throughout the country. This programme places considerable strain on health staff, as treatment centres often have to contend with insufficient human resources and escalating numbers of patients requesting ART.

The pressure is further compounded by the fact that government and non-governmental organisations (NGOs) frequently request medical statistical data or demographic information from treatment centres – and this information is often not readily available.

An important step towards improving the level of service and addressing the lack of reliable information is the establishment of an appropriate Hospital Information System (HIS).

Such a system would contain data on patients' medical details, and would be able to produce quick and accurate clinical, demographic and medical statistical reports. It would therefore make a valuable contribution towards reducing the workload of staff at ART centres.

A shortcoming of many information systems is that they are not designed to be an integral part of the day-to-day work activities of the organisations in which they are to function.

Maria de Freitas and Dr Elaine Byrne of the Department of Informatics conducted a study aimed at finding ways of addressing this shortcoming. They investigated the use of Activity Theory – a theory that emerged from nineteenth century psychology, and that stresses the

importance of taking into account a person's interaction with the physical environment when attempting to understand his or her behaviour – to promote the adoption of a more holistic view during the design of information systems.

During their research, they used the Activity Analysis and Development (ActAD) model as an analytical tool for the design and development of an information system for an anti-retroviral treatment (ART) clinic.

This model succeeded in highlighting the challenges faced by ART centres with their current information systems, and also assisted in representing what users require from such a system. Their results confirmed the usefulness of Activity Theory as a tool for information systems development.

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## Iron oxyhydroxide precipitates

Research in hydrometallurgy continued to concentrate on chloride hydrometallurgy, solvent extraction, metal recovery from electronic waste materials, iron precipitation, and gold hydrometallurgy. The doctoral work of Johann Claassen focused on the removal of iron from zinc solutions by precipitation of the iron as oxyhydroxides.

It was found that close control of the neutralization step as well as seed recirculation were necessary to promote the growth rather than nucleation of new precipitates. However, it was found that the growth of the precipitates occurred mainly by agglomeration i.e. the cementing of particles into larger conglomerates.

Claassen identified and optimised the process conditions which most strongly affect precipitate quality, and thus liquid-solid separation.

## Cyanide from gold mining circuits

Cyanide is a dangerous, but useful reagent that is widely used in the extraction of gold from ores. It follows that the process residues will contain some residual cyanide that must be controlled to limit harmful interaction with the environment.

Nadia Lötter investigated and quantified the volatilisation of hydrogen cyanide from cyanide solutions and pulps in gold mining circuits as part of her master's research.

The combined measurement of mass transfer conditions with on-site measurements, provided a quantitative tool for the prediction of cyanide transfer and attenuation of the cyanide present in such process streams, and as such will be useful in safety and environmental studies.

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## Recrystallisation behaviour of low carbon hot rolled strip steels

It has been known for some time that the recrystallisation behaviour of low carbon hot rolled strip steel from the Mittal Steel Vanderbijlpark plant after cold rolling may differ significantly from the corresponding behaviour of nominally identical strip steel from the Saldanha plant.

The long-standing question of why this might be the case (a question that has been a cause of concern for customers) has finally been resolved through two research projects conducted within the Department of Materials Science and Metallurgical Engineering.

Although it had long been suspected that the difference between the two steels might be associated with differences in the size and distribution of AlN (Aluminium nitride) precipitates caused by discrepant nitrogen content (with Saldanha originally running at lower nitrogen contents than its counterpart), researchers had not been able to establish a direct link between these variables.

One project therefore focused on the austenite-to-ferrite transformation behaviour of the two sets of steels, while the other investigated the recrystallisation behaviour after cold work.

The results of these projects have proven that the link between recrystallisation behaviour and AlN is a very indirect one, and that the fundamental difference can be traced to the presence or absence of MnS in either steel.

It was shown that the AlN preferentially nucleates heterogeneously on the coarse MnS (if it is present) and thereby becomes ineffective in pinning the dislocations, grain boundaries or moving transformation fronts.

If the sulphur content of the steel is very low (as in the earlier Saldanha steel production) the AlN is forced to nucleate homogeneously within the grains and adopts a very fine size distribution.

Such fine particles are highly effective in pinning dislocations and boundaries, thereby making the steel somewhat difficult to recrystallise after cold work.

Based on the results of these studies, it was possible to identify appropriate solutions for the problem experienced at the Saldanha plant.

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## Carrying the weight of the platinum mining industry

Rockfalls continue to be the biggest cause of accidents that result in fatalities and injuries in underground mines in South Africa. An effective face support system to minimise rockfalls in rockfall-prone mines was developed during a project sponsored by the Safety In Mines Research Advisory Committee (SIMRAC).

A technology demonstrator roof support unit was developed and evaluated. It consists of two similar support units connected to each other via two crank mechanisms. Different concepts were developed and evaluated against the system specifications and it was then developed and tested on surface. The process included detail design, building and testing of components and sub-systems, design reviews and then the building and commissioning of the technology demonstrator.

The testing of the system was done in a 500-ton hydraulic press, in a mock-up stope and underground. A risk analysis, in which technical, logistical and economical aspects were assessed, was done to determine the critical areas.

## Hip arthritis

Owing to the crippling nature of arthritis, surgeons have been trying for well over a century to successfully treat this debilitating disease

particularly when attacking the hip joint.

Many different designs have been developed but they all revolve around a femoral stem, femoral head and acetabular component. Independent of the design, longevity of the implant remains a problem. The major cause of replacements, according to various hip registers, is due to aseptic loosening resulting from osteolysis.

This study performed a root cause failure analysis to determine the principal reason for mechanical failure on failed acetabular cups, retrieved during revision surgery, by making use of sound engineering failure analysis techniques.

The bearing couples varied between steel on UHMWPE and ceramic on UHMWPE. The information gained during this analysis brought to the fore that the principal mode of mechanical failure for acetabular cups is overheating of the UHMWPE. The overheating is mainly due to a lack of good and/or sufficient lubrication.

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## Shell buckling

Imperfections (undulations or bumps) in the geometry of cylindrical shells have a large influence on their buckling behaviour. In particular, it is well known that imperfect shells buckle at much lower applied loads than if they had a perfectly flat surface.

The manufacturing methods through which such shells are made always lead to some level of geometric imperfection. When designing structures that contain imperfect geometries – the impact-absorbing structural member hidden behind a motor vehicle's bumper, for instance – it is important to take the effect of such geometrical imperfections into account during the numerical simulation of the crush performance.

One way to model geometric imperfections is through the use of random fields, realised through spectral series expansions (also referred to as Karhunen-Loève expansions). For these expansions to be generated, however, some knowledge of the covariance function describing the imperfection amplitude and wavelength is required.

Prof Ken Craig of the Department of Mechanical and Aeronautical Engineering has conducted research in which the methodology as implemented into the dynamic simulation code LS-DYNA® was applied to the optimal design of thin-walled cylindrical shells with cut-outs to save mass.

Using Monte Carlo simulations within a Design of Experiments metamodeling framework through the use of the design optimisation software LS-OPT, the coefficient of variation of the peak force during collapse was minimised while constraining both the maximum average peak force and the average energy absorbed by this structure.

The result of this process is a robust, optimal design, which, although heavier than its counterpart not incorporating imperfections, minimises the effect of geometrical imperfections on the resulting design's performance.

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## Predicting the potential for highwall failure in surface mines

Rock failure is a source of risk for any mining operation. Consequently, the ability to predict such failure has attracted the attention of many researchers. Prof Matthew Handley and his colleagues at the Department of Mining Engineering have conducted research aimed at assessing the probability of a specific type of rock failure: highwall failure caused by a phenomenon known as the Block Thrust Failure Mechanism.

A highwall is a feature of a typical open pit mine: it is an angled cut into the ground that provides a free face for blasting purposes. Highwall failure occurs when the rock composing the highwall loses its structural integrity. This can happen in various ways: the rock composing the highwall could slide out, topple, or collapse under its own weight.

The Block Thrust Failure Mechanism represents yet another way in which a highwall could fail. This process is more complex than any of the three failure mechanisms mentioned above: it occurs when fracture processes lead to the formation of a wedge-shaped block in the rock behind the highwall.

The sharp end of this wedge is pointed downward, and runs parallel to the face of the highwall. Thus, if the wedge is pushed down by its own weight, the highwall face is thrust outwards into the pit.

During their research, Handley and his team studied three failures in an open pit coal mine in South Africa. Based on the results of these studies, they were able to develop a simple yet accurate technique for assessing the risk of highwall failure. Their technique represents a significant improvement over currently accepted methods, and therefore holds considerable promise in terms of more stable slope designs.

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*Pictured at a recent function to launch the Carbon Chair were (seated from left): Prof Dave Morgan, Chairholder; Mr Thabang Makubire, General Manager of the PBMR; and Dr Thabani Mhlongo, Deputy Chairholder; (standing from left): Mr Fanie Swanepoel, PBMR; Prof Anton Ströh, Dean, Natural and Agricultural Sciences; Prof Roelf Sandenbergh, Dean, Engineering, Built Environment and Information Technology; Mr Pieter Venter, PBMR; and Prof Walter Focke, Director of the Institute of Applied Materials.*



## Faculty of Health Sciences

### Message from the Dean

The year under review was exciting as well as challenging for the Faculty of Health Sciences. The majority of faculty members are clinicians who have to spend long hours treating patients and they are under pressure to increase their clinical service load. Despite these pressures, the research and research output of the faculty as a whole is increasing as is clear from the increase in Department of Education (DoE) subsidized publications for 2006, which is indeed remarkable.

The worldwide focus on the importance of infectious diseases creates unique opportunities for collaboration between various departments and schools in respect of research projects as diverse as Avian Flu and AIDS. Chronic diseases due to an unhealthy lifestyle, especially obesity and Diabetes Mellitus, currently viewed as a worldwide epidemic on the increase, also create research opportunities already utilized by the schools in the faculty.

The School of Medicine has two Medical Research Council units, both functioning well. Both units are particularly active and produce research and research publications of outstanding quality.

Much of this research contributes to improved medical service delivery to the people of South Africa. Various academics of the school also contributed significantly to international medical textbooks. The faculty, like the rest of the university is responsive to the needs of the country and the international community. A number of international congresses were presented at the faculty or are in the planning stage. This serves as international contact and collaboration of various departments.

The School of Healthcare Sciences is involved in a variety of innovative projects, for instance the school's participation in a national survey on the nutritional status of a segment of the population by using a World Health Organisation (WHO) evaluation tool.

The aim is eventually to assist the Community Development Committee in improving service delivery. This collaboration creates new research opportunities in the school. At the same time, there are also various longstanding research projects that continue.

The School of Health Systems and Public Health also continued with their research priorities, such as the influence of chemical exposure on health, public health management of communicable diseases and a multi-sectorial approach to alcohol and drug dependency. The school received substantial support from the National Institutes of Health in the United States of America (USA) to do research on the foetal-alcohol syndrome, an existing problem in South Africa, which has developed into an extensive national multi-disciplinary study.

The School of Dentistry is still focusing on the early diagnosis of oral cancer as well as the relationship between smoking and oral

health under the youth in Limpopo Province. The research on oral cancer is recognized internationally for its outstanding quality.

The Faculty of Health Sciences' vision is focused on making an important contribution to the improvement of the health of all South Africans in South Africa through the delivery of significant relevant research.

**Prof TJ Mariba**

## Unveiling the past through physical anthropology

A number of projects have been conducted by members of the Physical Anthropology research group of the Department of Anatomy that help to unravel mysteries of the distant and recent past.

### The Mapungubwe gold graves revisited

The discovery of the hilltop burial site at Mupungubwe in the Limpopo valley represents one of the most spectacular archaeological finds ever made in South Africa. First excavated in the 1930s, the site contains a number of graves that are thought to be the final resting place of the rulers of an ancient African trade kingdom.

The high status of the individuals buried in these graves is revealed by the fact that at least three of the graves contained a wealth of golden artefacts. Unfortunately, very little information is available today on the condition of the graves when they were first excavated.

This may be ascribed to a combination of factors, including the circumstances under which excavations were made. In order to unravel some of the site's mysteries, researchers in the group fine-combed the remaining information relating to the three gold burials.

On the basis of archival reports and previously unpublished photographs, they were able to piece together a body of evidence suggesting that at least one of the burials – the so-called "Gold Grave" – may in fact have been a secondary burial, similar to that of a male burial at Thulamela – a stone citadel in the northern part of the Kruger National Park.

Key pieces of evidence supporting this argument include the arrangement of the bones and the positioning of the gold objects found with the grave.

### In sickness or in health?

Toutswe is located about 200 kilometres to the west of Mapungubwe, in east central Botswana. During the Early Iron Age (AD 700 to AD 1300), this area was inhabited by mixed farmers.

Previous research – in particular, the results of palaeodemographic analysis – suggest that the Toutswe people were better off than the contemporary inhabitants of Mapungubwe, as well as those of K2 (a neighbouring site).

MSc student M Mosothwane has studied the bones and teeth of 84 individuals from ten sites at Toutswe. The study was aimed at garnering independent evidence pertaining to the general health of the Toutswe communities – a task that had not been attempted before.

The individuals whose remains were analysed during the study ranged from newborn to 75 years of age, and included both sexes. Their teeth and bones were analysed for osteological manifestations of diseases.

This analysis revealed the presence of diseases commonly found

in archaeological populations, such as osteoarthritis, spina bifida occulta, cribra orbitalia, porotic hyperostosis and enamel hypoplasias.

One possible case of diffuse idiopathic skeletal hyperostosis (a form of degenerative arthritis characterised by excessive bone growth along the sides of the vertebrae) was also found.

The frequency of lesions was found to be comparable or even lower than at other, similar sites (which include K2, Mapungubwe and sites elsewhere in southern Africa). These findings suggest that the people of Tautse did indeed live in fairly benign circumstances: they had relatively low levels of stress, and were not subjected to unduly high rates of infection.

Although members of the Physical Anthropology research group concentrate much of their efforts on elucidating the distant past, their research is also often concerned with matters closer to the present. As the following paragraphs show, forensic investigations form an important part of such research.

## Ante-mortem stature estimates in South Africans

Many people find it difficult to judge the height of another in metric terms, even if that person is well known to them. This presents an obstacle in cases where the remains of an unidentified individual have to be linked to a description of a missing person.

Although it is possible to estimate ante-mortem stature of an individual with reasonable accuracy through analysis of his or her skeletal remains, relatives of the missing person might not be able to describe that person's height with any greater accuracy than to say the person was "tall", "short" or "of medium height".

Prof Maryna Steyn of the Department of Anatomy and Jan Ryno Smith of Ergonomics Technologies conducted a study aimed at linking such informal estimates of height to precise measurements.

They compiled a dataset containing the statures of 2 052 Black, 483 Coloured and 880 White South Africans of both sexes, based on measurements that had been taken over a number of years. This dataset enabled them to determine the sex-specific distribution of statures for each population group.

With such a distribution in hand, it is a simple matter to determine the average height of each group, as well as the variability among individuals belonging to that group. It is also possible to determine how tall a person must be to fall in the tallest or shortest 25% of the population comprising that group.

On the basis of these findings, the researchers proposed a simple scheme for interpreting estimates of stature contained in forensic reports: they suggest that the upper 25% of the distribution of each group be regarded as "tall", the lower 25% as "short" and the middle 50% as "medium".

A comparison between the results of this study and previous reports on stature among South Africans yielded another interesting finding: there appears to be a weak positive secular trend – meaning that South Africans are gradually getting taller. The study did not attempt to identify the causes of this trend, but it may be related to improvements in nutrition.

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## Traditional South African anti-asthmatic remedies

Traditional herbal remedies have been used for many generations in various cultures to treat a broad spectrum of ailments. Examples include wild cannabis (*Leonotus leonorus*), *Euphorbia hirta*, *Withania somnifera* and *Urginea sanguinea*, which are frequently used by herbalists in Southern Africa to treat asthma.

Little is known about the physiological consequences of using such herbal remedies – although there is reason to believe that some of them might have deleterious effects that far outweigh their benefits.

One piece of evidence supporting this assertion is the fact that *Urginea sanguinea*, in addition to alleviating asthmatic symptoms, is also sometimes used to induce an abortion. A substance capable of causing such a severe reaction in the body is likely to possess a high level of cytotoxicity.

Under the leadership of Prof Resia Pretorius, the section of Histology and Cell Biology within the Department of Anatomy has conducted extensive research on the effects of traditional herbal asthmatic remedies on cellular structures.

The specific focus of their research – which is funded primarily by the NRF and has produced 89 publications since 2000 – is the impact of such remedies on the coagulation system and the nervous system.

The spectrum of methods employed in this research includes animal experiments. In a recent study, for instance, Pretorius and her team investigated the effects of the above-mentioned plants on brain development in growing chick embryos.

In 2006, the group successfully established a Balb/c mouse asthmatic model at the Onderstepoort animal facilities. *Euphorbia hirta* was tested successfully using this model. The relevance of these specially bred mice for their research resides in the fact that they can be made to display asthmatic symptoms through exposure to an allergen.

They therefore represent a living laboratory for investigating the effects of various anti-asthmatic substances. The research group also makes use of permanent and primary cell cultures, which allow them to study morphological changes in cells after exposure to a medicinal substance.

In addition to broadening scientific knowledge regarding the cellular effects of plant-based medicines, the group's research also offers tangible benefits for communities. In particular, it is aimed at raising awareness about the possible dangers of some traditional remedies and promoting the use of herbal medicines that do not have such cytotoxic properties.

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## Occupational lung diseases among platinum miners

Occupational lung diseases represent one of the most significant threats to the health and safety of miners. Examples of such diseases include pulmonary tuberculosis (pTB), chronic obstructive pulmonary disease (COPD) and silicosis.

Little information is available on occupational lung diseases among platinum miners. In order to address this shortcoming, Prof Brendan Girdler-Brown of the School of Health Systems and Public Health



conducted a study aimed at documenting existing knowledge about factors affecting the risk for occupational lung diseases among platinum group metal (PGM) miners.

This review of prior research was supplemented by two pieces of empirical research: an analysis of autopsy findings in a group of miners who died on a platinum mine, and a cross-sectional study of the burden of occupational lung diseases among current PGM miners in South Africa.

The results of the study, which was conducted during 2005 and 2006 with funding from the Safety in Mines Research Advisory Committee of the Department of Minerals and Energy, revealed that routinely monitored levels of air pollutants were well below the occupational exposure limits recommended for workers.

However, it was found that the methods specified by the Department of Minerals and Energy for monitoring such pollutants may result in under- or over-estimation of exposure levels.

The study also identified a need for improving the completeness and accuracy of record-keeping with regard to previous work histories. The importance of such information derives from the fact that the risk associated with various types of occupational lung diseases depends on the type of mine.

Silicosis, for instance, is more likely to occur among persons with current or previous gold mining exposure than among those who have only worked in platinum mines. The prevalence of pulmonary tuberculosis, on the other hand, was not found to differ between those with and without a previous gold-mining history.

## Monitoring exposure to crystalline silica dust

Crystalline silica dust is an important environmental hazard in the mining industry. If this dust is inhaled on a frequent basis, it can cause silicosis – an incurable, chronic lung disease. This danger provides a powerful incentive for the development of environmental monitoring tools capable of detecting the signs of silica dust exposure in people before it gives rise to the disease.

The quest for such tools is complicated by a number of factors. One possibility is that a test might fail to distinguish between individuals who already suffer from silicosis, but are no longer exposed to silica dust, and those who are currently exposed and are therefore at risk of developing the disease.

The outcome of a test might also be confounded by other factors that affect lung condition, such as smoking and HIV infection. A promising avenue for the development of a tool for detecting silica dust exposure is through the use of biomarkers – cellular products or constituents that indicate changes in an organism.

Previous research had identified a number of biomarkers that could potentially serve as indicators of silica dust exposure.

In a project funded by the Safety in Mines Research Advisory Committee and led by Professor Girdler-Brown of the University and Jill Murray of the University of the Witwatersrand, these biomarkers were measured in a group of 120 volunteers.

The members of this group differed along a number of dimensions, including current exposure to silica dust, diagnosis with respect to silicosis and HIV status. It was found that two of the biomarkers had significantly reduced levels in silica-exposed groups, but were unaffected by smoking, HIV status or the presence of clinical silicosis.

Further research is currently underway to develop a standardised monitoring protocol based on these biomarkers.

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## Evaluating the use of polyether impression materials in forensic dentistry

South Africa's high crime statistics have regularly featured in the news recently, with a very high incidence of murder, rape and child abuse. Research has indicated that as many as 28% of female rape victims are bitten during the course of the attack, and that biting is common during all violent crimes. (A full-length article appeared in the 2005 Research Report

Bite mark analysis can be instrumental in identifying the perpetrators of these violent crimes. Part of the recognised protocol for investigating such cases therefore involves taking impressions of the bite marks for macroscopic and microscopic analysis.

Since bite mark impressions form an integral link in the chain of evidence, it is vital that the materials used to take such impressions maintain their dimensional stability over time.

However, research conducted by Prof Herman Bernitz at the Department of Oral Pathology and Oral Biology has indicated that the impression material most commonly used in forensic dentistry does not meet this criterion.

When dentists are asked to take impressions of bite marks, they tend to use the material they already have in stock. The polyether impression material, Impregum is one of the most popular impressions materials used in dentistry, as it is highly suited to crown and bridgework.

This material is therefore also often used to take impressions of bite marks in skin – although the product was not designed with this primary use in mind.

Bernitz and his colleagues garnered clear evidence in the field and research laboratory that Impregum was unstable after coming in contact with skin: such impressions tend to alter their physical properties with time, becoming sticky and unusable as evidence.

The results of their study, which has generated a certain amount of controversy, led to the recommendation that Impregum should not be used in applications where the impression material will come into contact with skin, especially where such impressions will need to be stored for any length of time.

The recommendation is that it not be used in forensic cases to take impressions of skin for the purpose of collecting bite mark evidence.

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## Asthma in rural communities

Asthma and eczema are becoming more common among children worldwide. However, little research has been conducted to determine whether this trend is reflected in rural provinces in South Africa.

In order to address this gap in scientific knowledge, Dr Janine Wichmann and her colleagues at the School of Health Systems and Public Health have conducted a population-based study involving nearly seven thousand children living in a sixty-kilometre radius around

Polokwane in the Limpopo Province. The children represented two age groups: 6-7 and 13-14 year of age.

Data for the study were collected by means of questionnaires; these included items designed to determine whether or not a child had experienced symptoms of asthma, eczema or hay fever within the last twelve months.

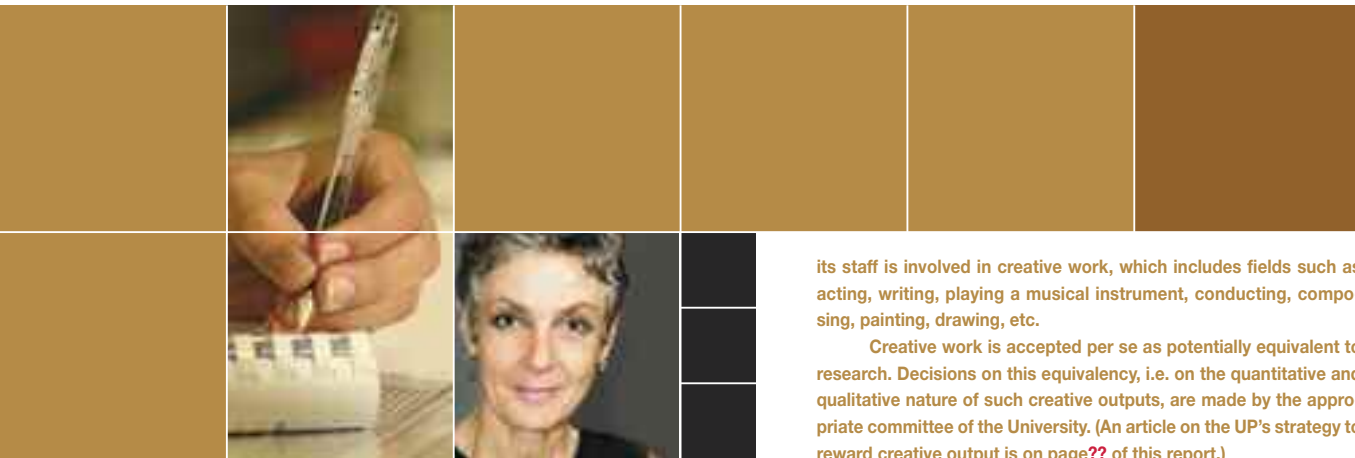
The questionnaires also elicited information on respondents' exposure to tobacco smoke, polluting fuels (such as smoke from wood or charcoal fires) and other environmental factors that might aggravate asthmatic symptoms.

The findings of the study included the surprising result that children living in households using a combination of clean and polluting fuels have a lower prevalence of asthma than children in households who rely exclusively on clean fuels.

This trend may be explained by the fact that households using only clean fuel tend to have higher socio-economic status than those who use polluting fuels as well.

The mystery remains, however, as to why the incidence of asthmatic symptoms increases with rising socio-economic status. It might be that asthma is under-diagnosed and over-diagnosed in lower and higher socio-economic status groups, respectively. Wichmann *et al.* also cite previous research suggesting that stress and other factors associated with a westernised (and usually more prosperous) lifestyle might increase children's susceptibility to asthma.

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## Faculty of Humanities

### Message from the Dean

The Faculty of Humanities acknowledges that teaching and research are indivisible, and that each must feed off the other. Therefore - and in line with the UP Strategic Plan - we expect all academic staff to engage in research activities, and to aim at achieving the research excellence that is expected of us by the University.

Our faculty aims to produce research that is both locally relevant and internationally competitive. This is also in line with the UP policy. In addition, we aim to produce research that goes beyond relevance to achieve impact, both at home and abroad.

Research is often a collaborative endeavour. The faculty acknowledges this, and encourages co-operation and collaboration both within the faculty itself and the UP community as a whole (i.e. across departmental and faculty boundaries), as well as with the wider scholarly community at home and abroad. We regard international collaboration not merely as a means of stimulating research, but also as a means of establishing broad benchmarks and a higher degree of competitiveness.

A new and fresh dimension in the faculty's vision of research is the decision to also place a high value on creative outputs. The Faculty of Humanities acknowledges that a substantial proportion of

its staff is involved in creative work, which includes fields such as acting, writing, playing a musical instrument, conducting, composing, painting, drawing, etc.

Creative work is accepted per se as potentially equivalent to research. Decisions on this equivalency, i.e. on the quantitative and qualitative nature of such creative outputs, are made by the appropriate committee of the University. (An article on the UP's strategy to reward creative output is on page?? of this report.)

Our faculty also believes that we have a responsibility to invest in future researchers. We attempt to increase the number of our postgraduate students, though with the emphasis on acquiring and maintaining quality, not mere quantity.

The faculty also guides younger, less experienced staff in developing their research. We organize research days to encourage, stimulate and promote research, and we give guidance to staff applying for the first time for an NRF rating. Research is going from strength to strength in our faculty.

**Prof ME Muller**

## Highlights

### Importance of volunteerism in SA sport

The values of commitment, mutual benefit, engagement, solidarity and free will are universal to mankind and form the cornerstones of volunteerism. Although sport as a social phenomenon in South Africa depends heavily on volunteers to deliver services to sport consumers, reality indicates problems regarding sustained commitment and retention of volunteers, which could impact negatively on the learning curves and standard of sport event management.

The aim of this study was therefore to measure the discrepancy

between the expected needs and the satisfied needs in terms of job content and job context (as determinants of job satisfaction) of volunteers in sports settings, which could serve as input for a sustainable human resource plan for South African sport volunteers.

Respondents in the study indicated that they were dissatisfied with their style of supervision, their expected administrative duties, the support system to manage their problems, the receiving of adequate information on policies, plans and procedures, their participation in decision making, the general organisational climate of the sport event they are volunteering services for, the recognition of their achievements and the furthering of their status as volunteers.

Based on her research findings, Prof Anneliese Goslin advises that event organizers and bidders for international events alike should strategically address the concerns of volunteers to improve the efficacy of events.

- Goslin's "valuable contribution to volunteerism in sport" was recognized by the International Olympic Committee in 2006. She also received the South African State President's Award for Sport for her role as a recreation administrator. Internationally, she received a Catalyst Award from the Global Centre for Social Change through Women's Leadership and Sport of Kennesaw State University in the United States. The award was handed to Goslin on 27 October 2006.

## Costs versus benefits of sports events

Sports events impact on the economic as well as the social context of residential populations in the proximity of sport venues. Social effects are, however, not as easily and objectively measured as economic effects. Success and failure of sports events are influenced by social perceptions of the event and sports event managers need to create a balance between economic and social effects in order to establish sustainability.

Two sport venues - Vodacom Loftus mega-sport stadium and LC de Villiers multi-sport venue - form part of the sport facility network of the Tshwane Metropolitan Council and are included in the proposed competition and practice profile of the 2010 World Soccer Cup Tournament.

The aim of this research project was to measure residents' perceptions of the social costs and benefits of sport events in the residential areas in the proximity of the two sport venues. Findings indicate that respondents are dissatisfied with the social costs to their quality of life and community resources. Residents adjacent to Loftus indicated a higher social cost index in comparison to those living near LC de Villiers.

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## Early Communication Interventions

The pandemic proportions of HIV/AIDS in South Africa, the challenges of developing contexts and the impact of this disease on infants and young children renders them the most vulnerable group requiring Early Communication Intervention (ECI). Many infected or orphaned infants and young children are placed in care centers.

A long-term research project comprising eight studies was initiated with the aim of developing a contextually relevant ECI service delivery model in South Africa that is accountable and sustainable.

Six studies were conducted on infants and young children with

HIV/AIDS in care centers in Gauteng as well as the centers' caregivers. A communication stimulation programme was also implemented.

Findings indicate that all the children experienced communication delays, and that their feeding was functional, but compromised by infections.

In addition, caregivers expressed a need for guidelines regarding communication stimulation. A training programme was held and received positively. Caregivers indicated that it led to improved caregiver/child interaction. Additional findings indicate that there is a great need for ECI services in care centers and thus validated the role of a speech-language therapist as a trainer at these centers.

In addition, the service delivery to infected or affected infants and young children by speech-language therapists in private practice nationally and in the public health sector in Gauteng was investigated. Results indicated that these children were included in case loads of all the hospital based therapists, but that those in private practice were minimally involved.

These findings prompted the launch of a community orientated project by private practitioners in Tshwane, aimed at training caregivers in centers to facilitate and support the language and communication development of young children affected by HIV/AIDS.

Based on the results of the project, guidelines were formulated for ECI with these infants, young children and their caregivers to counteract the negative impact of the disease.

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## Hearing screening for infants

In a follow-up study into the early identification of hearing loss in infants, Dr De Wet Swanepoel developed a Position Statement on Early Hearing Detection and Intervention for the country at the request of the Health Professions Council of South Africa (HPCSA).

This position statement has been reviewed by a panel of national and international experts and will serve as a guiding document for the implementation and management of early hearing loss detection and intervention systems in South Africa.

In addition, Swanepoel and Prof Suzanne Delpoit of the Department of Pediatrics at Kalafong Hospital are investigating the long-term incidence of various types of hearing loss presenting in high-risk infants from the Neonatal Intensive Care Unit.

This study is important because it is the first of its kind to be conducted in South Africa and aims to describe the many risk factors that are faced by these infants, such as prenatal HIV exposure and the effect it has on hearing loss in this group. Preliminary findings suggest a ten times higher incidence of hearing loss compared to healthy babies.

Apart from these research projects, Swanepoel also investigated an alternative, more cost-effective method to identify hearing loss; namely iridology. The study was the first to examine the possible use of this alternative and complementary healthcare method in which the iris of the eye is examined as a screening tool for hearing loss.

Results demonstrated a significant relationship between the analysis of the iris and actual hearing status, but the accuracy at this stage is not yet comparable to existing electrophysiological techniques. (A full-length article on Swanepoel's research appeared in the 2005 Research Report.)

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## Understanding speech motor control in AOS

Apraxia of Speech (AOS) is an acquired neurogenic speech motor planning disorder resulting from damage to the cortical motor areas of the brain. A characteristic symptom of AOS is overt attempts to self-correct speech. This research project was aimed at determining if speech monitoring and overt speech correction improves in a speaker with AOS during a period of speech intervention.

It was predicted that the number of self-corrections will decrease and the percentage of successful self-corrections will increase if speech improves during treatment. It was also predicted that the number of self-corrections as a percentage of the total number of errors would decrease during treatment.

A decrease in the percentage of self-corrections may indicate a shift from externally manifested (overt) self-correction based on response-produced feedback to error correction of upcoming speech errors based on internal feedback.

If internal predictive control improves, the percentage of overt self-correction may decline. Answers to these questions may contribute to a better understanding of speech motor control in AOS.

Results indicate that the number of incorrect productions of words and non-words and the number of self-corrections decreased during treatment. The percentage of successful self-corrections increased over time.

However, self-correction as a percentage of the total number of incorrect productions remained almost similar during treatment, which suggests that error prediction did not improve and that errors continued to occur inadvertently.

The results suggest that the process of internal predictive control is dysfunctional in speakers with AOS and that the loss of volitional control of speech should be addressed in a comprehensive definition of this disorder.

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## Molly Keane under the looking glass

Prof Andries Wessels of the Department of English contributed a chapter to the book *Molly Keane Centenary Essays* entitled "*Resolving history: negotiating the past in Molly Keane's Big House novels*". The collection has been hailed as an important contribution to Irish literary studies.

Keane was one of the most significant twentieth-century proponents of the Big House Novel genre, which traces the vicissitudes of the Anglo-Irish ruling class and its decline in modern Ireland. Keane's novels are overtly humorous, even though her comedy can be quite dark.

Twentieth-century Anglo-Irish novelists like Elizabeth Bowen, William Trevor and Keane used the Big House Novel to demonstrate how the Protestant Ascendancy, who dominated Ireland over centuries through the oppression of the native Irish, themselves became the victims of the paralyzing hold of this history of oppression.

Wessels found that Keane reveals her characters, who are faced with a choice between internal exile in the land of their birth and a harsh adjustment to the culture of the New Ireland, as courageous enough to "emigrate" psychologically from the Old to the New Ireland, resolving the claims of a glamorous but incapacitating history and embracing an unglamorous but self-determined present. Keane postulates divestment of a mythic past as a first prerequisite for the investment of a mature, energetic self.

Commenting on his findings, Keane scholar Vera Kreilkamp states that while Wessels "acknowledges that many of Keane's works operate within the tradition of Anglo-Irish decline, he notes a competing narrative of history in both early and late works [and] finds that Keane creates characters who negotiate with history, moving out of its 'debilitating shadow' of glamour to find 'a legitimate place in contemporary Ireland'".

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## Ethics of corporate governance

Corporate governance can be defined as management at the topmost level of corporations. As a "practice" it is fraught with its share of ethical challenges and dilemmas. A research project – which culminated in the publication of a book entitled: "*Global perspectives on ethics of corporate governance*" – explored and brought together perspectives from all continents on both the ethics of governance and the governance of ethics.

The book is divided into two sections – the first part deals with the ethical challenges and dilemmas facing corporate governance along with a detailed discussion of theoretical perspectives on the ethical dimension of corporate governance. The second part is devoted to an empirical survey of the relationship between business ethics and corporate governance in six different regions of the world, viz. Africa, Asia-Pacific, Japan, Europe, Latin America and North America. The second part was coordinated by Prof Deon Rossouw of the Department of Philosophy.

Findings indicate that corporate governance models around the world range from exclusive to inclusive. Exclusive models are premised upon agency theory that portrays managers as the agents of shareholders who are obligated to act in the best financial interest of the shareholders of the corporations.

Inclusive models on the other hand are premised upon stakeholder theory and conceive the corporation as a social institution, in which the corporate board and management must strike a balance between the interests of their various stakeholders e.g. shareholders, customers, employees, local communities and the environment.

These results contradict predictions by prominent scholars in the corporate governance field that a convergence towards shareholder orientated exclusive corporate governance regimes should occur.

Corporate governance practices in most European countries, Canada, Japan and more recent corporate governance reforms in Africa, Latin America and some Asia Pacific countries suggest that stakeholder orientated inclusive corporate governance regimes are either well established or on the incline.

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## Voting behavior of the youth

In the run-up to the South African local government elections in March 2006, much was made of service delivery as a crucial issue in the elections and was considered a threat to support for the African National Congress (ANC) in particular; a threat in general to the electoral process as a key aspect of democratic expression; and a threat to democracy in the long run with voters being disillusioned to the point of rejecting elections as being meaningless.

The aim of this research project, a pilot study conducted in conjunction with the Department of Sociology among students at the University, was to determine whether or not service delivery did indeed play a role in behavior of voters.

Findings indicated that although 53% of the respondents were registered as voters, only 23% voted in the local government elections. Male respondents tended to be more interested and involved in politics and recorded a higher voting percentage than their female counterparts. The highest voting percentage was among White Afrikaners (32%) and students from Mamelodi campus (30%).

Although only 30% of voters were "satisfied" with the services delivered by their local authorities, 70% indicated that things in South Africa had improved for them and their families over the past five years.

The researchers concluded that despite the low level of voter registration and voting among young people, they tend to become more involved in "ballot box" activities over time and remain largely optimistic about the country. To the extent that voters (youth and adults) are dissatisfied with the performance of the ruling party (the party of overwhelming choice), such dissatisfaction does not point to a shift to support opposition parties.

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## Dynamic assessment

The significant effect size generated by a meta-analysis undertaken by researchers in the Department of Psychology indicates that utilising a dynamic assessment as an alternative in the selection process of academically disadvantaged students is a viable option in selection tests, as opposed to utilising only static-based assessments.

The aim of this research project was two-fold: to determine the significance of the efficacy of dynamic assessment as a viable assessment strategy in South African studies in terms of increasing scores on post-test results and to compare and analyse two meta-analytic software programmes.

Meta-analysis is a powerful technique, which can aid in the determination of how effective individual studies are when cumulated. Synthesized study results may yield results contrary to individual study results. Seven studies were included in the final analysis.

Effect sizes of 0.3354 and 0.3481 were calculated, utilising two meta-analysis software programmes respectively. Although the results were significant, the small sample size limited the conclusions that could be drawn.

Limitations surrounding the use of the two packages and violations inherent in the analysis of the data were addressed. The researchers suggest that any future South African research designs conducted within the field of dynamic assessment should preferably be designed to accommodate future meta-analysis, since this technique is dependent on data that can be successfully utilised within such an analysis.

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## Domestic violence in SA

Violence towards women forms an integral aspect of the societal inequality and power differentials that still exist between genders in South Africa. The prevalence of domestic violence is increasing and is largely characterised by female "victims" and male "offenders". Restorative justice has been suggested as a possible method to deal with the effects and underlying causes of crime.

Restorative justice is a collaborative process that allows all concerned parties who have a stake in a specific offence to identify and address their obligations and the harm that was done, in order to form part of the healing process. Victim-Offender Conferencing (VOC) is one of the programmes in the process.

This research project was aimed at evaluating victims of domestic violence's response to VOC, its efficacy and whether it has any future use in the criminal justice system.

Research findings were mixed in terms of responses relating to the content and structure of the mediation process from the victims as to the utility of VOC. Most of the female victims found that VOC was helpful in that it offered some resolution to the domestic problem.

Dr Jean Triegaardt of the Department of Social Work and Criminology found that in some cases VOC served as a deterrent to fighting as well as a motivating factor to follow through with the agreement. However, many of the respondents reported that they were beaten again.

The study further indicated that the involvement of families and communities as support structures in the mediation process was perceived by victims as empowering, since a feature of domestic violence is that victims are often isolated from their families and friends.

The respondents further highlighted that the VOC process provided them with temporary relief and the opportunity for self-reflection. They also perceived the process as valuable, but sustainability was an issue due to a lack of follow-up. Most of the respondents continued to be battered. Those who were no longer battered indicated that VOC had been helpful in interrupting the cycle of violence.

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## Reflections of middle-class White people

The privileged position that White people have occupied in South Africa, as well as the normalcy attached to this, has been challenged and questioned with the changing political, social and economic landscape.

This research project examined the discourse of middle-class White residents in Johannesburg on the changes they observe in their neighbourhoods in the city.

Several studies have suggested a dynamic shifting from race towards class as an organizing principle within the South African society. It is argued that a need to rely on race as a basis for securing privileges has diminished as whites secure a middle-class position in society.

Findings suggest that the legacy of a racist past continues to shape the prevailing conceptual order. Although race-evasiveness is a characteristic of the discourse on change, the use of class and culture remains "racialist". Class and culture serve as a more acceptable, less contentious base for an exclusionary discourse.

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## AIDS-related stigma in a political context

Key government officials have sought to challenge the orthodox views of HIV/AIDS and to delay the implementation of a national anti-retroviral rollout programme since 2000.

The aim of this research project was to examine the presentation of AIDS-related stigma within the context of the South African government's position on HIV/AIDS. Government's position has been severely criticized in the media and elsewhere for contributing to an already widespread climate of AIDS stigmatization.

To shed more light on this relationship, Alain Vandormael of the Department of Sociology conducted a survey in a South African township and compared results to a similar survey conducted in 2004 shortly after anti-retroviral medications became available.

Results indicate a change in stigma levels over the period and that those respondents who endorsed "contentious" political views about HIV/AIDS were more likely to demonstrate a higher level of AIDS stigmatization than those respondents who accepted the orthodox view.

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## The status of African languages

The aim of this research study was to determine the degree to which African languages in South Africa have been developed into fully-fledged standard languages and thus are appropriate for use in high-function contexts such as tertiary academic institutions. If African languages are to fulfill their role in modern-day South Africa with its philosophy of pluralism, the development of fully-fledged standardized varieties is essential.

The findings indicate that although African languages have undergone standardization, they do not yet possess fully-fledged standard varieties, and can therefore not yet adequately function in educational contexts. The research is being continued with the support of the Pan South African Language Board and the co-operation of the National Language Bodies.

Prof Vic Webb also investigated language planning in higher institutions of learning. He focused on the exclusionary, discriminating and therefore unfair practice of using English as the main or only language of teaching and learning for students who are developing their English language proficiency, as well as the need for language planning to be based on reliable and valid information and the central role of clear and validated plans for language policy implementation.

The investigation revealed that only the University of Stellenbosch has researched the necessary comprehensive and validated sociolinguistic profile of the communities involved (e.g. students, administrative and academic university staff) for language planning and policy development.

South African universities also underestimate both the complexities of meaningful language planning and the role of factors such as market forces, imagining that the development of a language policy is sufficient for addressing the problems involved, and that this development can be adequately handled by the bureaucratic leadership of their institutions.

Furthermore, the major obstacles to effective language-political transformation in the higher education system are the attitudes and the views of the academic staff, and no South African university seems to take the development of African languages as languages of science seriously.

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## Faculty of Law

### Message from the Dean

During 2006 the Faculty of Law managed to further enhance its reputation as one of the premier law faculties in the country. Apart from hosting the most comprehensive and to date collection of legislation and law reports of countries in Africa, the faculty also boasts an increase in its number of rated researchers by the National Research Foundation (NRF).

Prof John Dugard – who will join the faculty's Centre for Human Rights early in 2007 - received an A-rating, while Prof Danny Bradlow – currently based at the Washington School of Law in the United States of America (USA) - received a B-rating. One of the main thrusts of the faculty in the future will be to increase the number of NRF rated staff.

The faculty houses three centers that focus on specific areas of research, namely the Centre for Human Rights, the Centre for Child Law and the Centre for Advanced Corporate and Insolvency Law.

In addition, staff members undertake research in a wide range of other areas of law, including constitutional law, environmental law, mercantile law, international law, gender studies, medical law, sports law, law of education and the law of succession, delict, damages and contract.

The faculty houses two accredited journals (*De Jure*, edited by Prof Hans Visser, and *African Human Rights Law Journal*, IBSS accredited, edited by Professors Frans Viljoen and Christof Heyns). Prof Chris Nagel is the editor of the *Journal of Contemporary Roman Dutch Law* (IBSS accredited and published on behalf of the Society Hugo de Groot). The faculty also publishes the African Human Rights Reports.

Accredited research outputs in journals amounted to 78. There is an increasing focus on publications in international and in particular ISI and IBSS accredited journals, and in respect of research of universal significance also on the translation of such research into other languages to reach a broader audience.

A total of nine books were authored or edited or contained chapters by staff members. Staff members presented papers at nine international conferences.

One of the events that had an impact on research in the faculty was the promulgation of the new National Credit Act 24 of 2005 that elicited nationwide response and interest. Three staff members, Prof Melanie Roestoff, Messrs Stefan Renke and Franciscus Haupt were involved in research on the effect of the new legislation on the economy and on banks, sellers, private individuals, etc and delivered papers on the subject. The research of a number of staff members was cited as authority by the South African courts.

A citation system is being developed by the faculty's Senior

Law Librarian, Shirley Schröder, to trace the impact of publications by South African legal academics. The impact of one of the faculty's leading publications, *Constitutional Law of South Africa*, edited by Stu Woolman has already been tracked, and it was found that this comprehensive reference work on the South African Constitution was cited more than double the number of times of its closest competition by local as well as overseas courts and academic writers.

The continental relevance of research by Faculty members is starting to expand. The Law of Africa Collection in the Oliver R Tambo Law Library of the Faculty of Law is now the most comprehensive and to date collection of legislation and law reports of the 53 countries of Africa.

This provides members of the faculty of Law with unique access to comparative legal research on more than a quarter of the countries of the world. Faculty members were and are involved in this context in research on the harmonization of the Law of Africa for the Pan African Parliament and others.

Prof CH Heyns

## Highlights

### Impact litigation to address the plight of adult survivors of child sexual abuse

Prof Trynie Davel, director of the University's Centre for Child Law, has investigated the plight of adult survivors of childhood sexual abuse in South Africa, and found that the law and legal processes potentially offer powerful tools for promoting the constitutionally enshrined fundamental rights of women and children.

Child sexual abuse has taken on horrific proportions in South Africa. In 2001, for instance, an estimated 58 children were raped daily in this country. This trend shows no sign of slacking, and has become a major social and judicial concern.

Our government has ratified numerous far-reaching international instruments aimed at protecting women's and children's rights, and we pride ourselves on a constitutional dispensation that safeguards human dignity. In reality, however, these rights fail to make a difference in the lives of thousands of South Africans.

While this is partly because of inadequate law enforcement, some blame must also be laid at the feet of the criminal justice system.

A case in point is the matter of *Van Zyl v Hoogenhout*. Esmé van Zyl is an adult survivor of childhood sexual abuse: between the ages of six and fourteen, she was repeatedly subjected to sexual abuse, sodomy and rape at the hands of her uncle. This ordeal culminated in pregnancy and an abortion in 1965.

More than thirty years later, Van Zyl instituted a claim for damages caused by the sexual assaults to which she had been subjected as a child. However, her case was dismissed by the High Court in view of the 1969 Prescription Act, which states that a claim for damages must be submitted within three years from the date on which the debt became due.

Her case was then taken to the Supreme Court of Appeal by the Women's Legal Centre in Cape Town. Their appeal raised the argument that the Prescription Act must be in accordance with the requirements of section 39(2) of the Constitution, which obliges courts to promote the

spirit, purport and objects of the Bill of Rights when interpreting legislation.

The appeal was successful: the order of the Court *quo* was set aside, and the plaintiff was awarded R200 000 for infringement upon her personality rights (general damages) and R133 300 for future medical costs (including psychotherapy, psychiatric evaluations and anti-depressant medication).

This case is an example of *impact litigation* – in other words, litigation that aims to address some deficiency in legislation by creating a precedent for future court cases. Davel asserts that impact litigation represents a powerful weapon for reforming society.

She also argues that, although the case of *Van Zyl v Hoogenhout* is a groundbreaking victory for women and children's rights in South Africa, more work remains to be done in terms of exploring avenues for the provision of appropriate compensation.

## Children's constitutional right to legal representation in civil proceedings

Davel and her colleagues at the Centre for Child Law have also conducted research aimed at establishing the ambit of section 28(1)(h) of the Constitution of South Africa.

This section of the Constitution states that a child has the right to legal representation in civil proceedings affecting him or her if substantial injustice would otherwise result. Furthermore, the legal practitioner has to be assigned to the child by the state at state expense.

Although this provision has been on the statute books for nearly a decade, its nature and content is still clouded with uncertainty. Some of the main issues that need to be addressed include the correct procedure for the assignment of a legal representative and the question of which body should make the assignment (for instance, whether it is the State Attorney or the Legal Aid Board).

The Centre for Child Law has taken on a number of cases aimed at establishing the content of children's constitutionally defined right to legal representation. In one case, the Centre approached the Legal Aid Board and the State Attorney on behalf of two sisters (aged twelve and thirteen) to request the assignment of a legal representative.

The State Attorney agreed to assign the senior counsel identified by the Centre. Although this application was successful, it unfortunately did not establish a viable model for the future, since the State Attorney – unlike the Legal Aid Board – is not readily accessible to the public.

The Centre subsequently had the opportunity to pursue the issue further. In the unreported case of *G v S*, it was asked to assist an eleven-year-old boy who had been placed by an order of the High Court in the custody of his father, but who wanted to live with his mother. In this instance the Legal Aid Board stepped in, and thus established an accessible route for the public at large.

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## Restorative justice and Child Justice

In her recently published LLD thesis, Dr Ann Skelton of the Centre for Child Law has explored the origins, theory and practice of Restorative justice in South Africa. Her study makes special reference to the relevance and implications of restorative justice to Child Justice.

Restorative justice is best understood by contrasting it with current standard criminal justice. Whereas the latter proceeds from the questions "Who has committed the crime? How should the state punish the offender?" the former gives pride of place to the questions "Who has been harmed? What are the needs of that person?"

A restorative justice process allows the victim to voluntarily come into contact with the offender, to challenge the offender and to explain his or her needs. This encounter is mediated by a skilled facilitator.

The outcome of the process is an agreement that the offender will put right the wrong directly to the victim. Skelton notes that restorative justice resonates powerfully with African traditional systems and the philosophy of *ubuntu*.

Skelton goes on to argue that child justice systems across the world have benefited from the restorative justice movement, as it has proved to be a counter-balance to a rising tide of popular punitiveness against young offenders.

This trend can also be discerned in South Africa: the Child Justice Bill has a strong restorative justice orientation – although this has been eroded somewhat by increased retributiveness arising from public fears about crime.

Skelton predicts that the value-base of restorative justice will be an important instrument for the future interpretation of the legislation and for the development of a restorative justice jurisprudence.

The influential nature of Skelton's work is evidenced by the fact that her thesis was cited in the judgement following a case that appeared before the Constitutional Court in 2006.

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## Child offenders and life imprisonment

Section 28(1)(g) of the Constitution of South Africa states that imprisonment of child offenders must always be a measure of last resort, and then for the shortest appropriate period of time.

Carina du Toit of the Centre for Child Law has conducted a study to determine how many persons currently serving a sentence of life imprisonment were below the age of 18 when they committed the offence. She also investigated the legality of such a sentence in light of the Constitution and international law.

During the research, interviews were conducted with 55 prisoners suspected to have been below the age of 18 when they committed the crime. Of these, 32 were found to have been. An analysis of South African sentencing practices revealed that legislation enacted in 1997 created a sentence of mandatory life imprisonment for certain serious violent crimes.

This minimum sentence legislation states that, although it does not apply to persons below the age of 16, a judge may impose it on a 16- or 17 year-old – provided that there are demonstrable reasons for doing so.

This legislation led to widespread confusion about whether minimum sentences automatically apply to children who were 16 or 17 when they committed the crime. The question was finally resolved in 2004 by the Supreme Court of Appeal, where it was decided that minimum sentences – specifically life imprisonment – do not automatically apply to children of 16 or 17.

Most of the persons interviewed during Du Toit's research were found to have been sentenced between 1997 (when minimum sentences



were introduced) and 2004. She concludes that these young people have been wrongfully sentenced to life imprisonment, and that it is in the interest of justice that their sentences be taken on appeal.

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## The impact of the Truth and Reconciliation Commission

The Truth and Reconciliation Commission was established in terms of the *Promotion of National Unity and Reconciliation Act*, No 34 of 1995; its purpose was to give voice to people who had been the victims of violence and human rights abuses during the apartheid era. Perpetrators of such crimes could also give testimony and request amnesty from prosecution. Prof Caroline Nicholson of the Department of Legal History, Comparative Law and Jurisprudence has studied the TRC from the perspective of Therapeutic Jurisprudence – an interdisciplinary approach to law that centres around the law's impact on the community in which it operates.

The aim of her research was to assess the position in South Africa today in light of the objectives set for the TRC at its inception, and also to assess the extent to which these objectives have been achieved.

The research took the form of a literature survey focused on the TRC process, the associated legal challenges and the recommendations made in the light of these challenges. The survey also included various works written about and in response to the TRC, as well as statements made by persons such as Archbishop Desmond Tutu and Yasmin Sooka.

Nicholson came to the conclusion that, although the TRC had generated an enormous amount of goodwill and hope at the time of its inception, South Africans are currently disillusioned by the lack of effect given to its recommendations.

Such disillusionment lends momentum to a drive to force those who were responsible for apartheid atrocities, and who failed to seek amnesty, to assume responsibility through prosecutions.

All in all, it appears that the TRC has failed to live up to its promise. The outcomes of this research were reported at two international conferences.

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## Matriculation subjects and symbols as predictors of success among LLB students

A disturbingly large proportion of LLB students leave the University without a degree. This trend may be partially explained by the fact that many students who enrol for the course do not have the requisite academic ability to cope with its demands.

The current entry requirements for the course are based on students' m-scores – aggregate scores reflecting the symbols attained during their matriculation examinations. Individuals with m-scores below 14 are not allowed into the course.

The high failure rate among LLB students suggests, however, that this criterion might not be stringent enough. Anton Kok of the Department of Legal History, Comparative Law and Jurisprudence conducted a study to assess the value of matriculation subjects and symbols as predictors of academic success among LLB students.

The study revealed that students with an m-score below 18 generally do not cope well with the demands of academic study. It was also found that a student's choice of matriculation subjects may be a better predictor of academic success than his or her m-score per se: students who have higher-grade Mathematics and Physical Science at matriculation outperform students who do not have these school subjects.

In fact, even students who achieved D- and E-symbols in Mathematics and Physical Science perform better than the average LLB student. This may be due to the fact that success in these two subjects serves as a proxy indicator of "intelligence", capacity for logical thinking or perhaps even reading ability.

On the basis of these findings, Kok recommends that LLB applicants with m-scores between 14 and 18 should at least be informed of their poor chance of success. He also suggests that marketing material and recruitment drives at high schools should point out the indirect practical utility of higher-grade Mathematics and Physical Science for law students, and that preference should be given to LLB applicants who take these subjects at higher-grade level in their final school year.

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## The National Credit Bill and over-indebtedness

Over-indebtedness – in other words, the inability of a consumer to satisfy the obligations of his or her credit agreements in a timely manner because of limited financial means or other obligations – is a growing problem in South Africa.

In view of this fact, the National Credit Bill was designed to establish legislation that protects consumer rights, promotes responsibility in the credit market, addresses imbalances in negotiating power between consumers and credit providers, and provides mechanisms for combating over-indebtedness.

Prof Melanie Roestoff and Stefan Renke of the Department of Mercantile Law conducted research aimed at evaluating the proposed measures in the National Credit Bill that are intended to combat over-indebtedness. An additional objective of their study was to determine the extent to which these measures comply with the general constitutional demands in terms of consumer protection.

Their findings indicate that the Bill does not do enough to bring South African legislation in line with measures in other jurisdictions. Corresponding measures in the USA, for instance, provide for programmes on personal money management for use in schools.

The legislation of that country also requires disclosure of the consequences of making only the minimum payment in respect of credit card (and other) debts. This requirement is intended to ensure that consumers are informed of the risks inherent in credit.

Roestoff and Renke point out that South African legislation does not contain similar provisions, and that much more needs to be done in terms of consumer education. Nevertheless, they conclude that

the new legislative initiatives are to be welcomed in that they seek, in the spirit of the Constitution, to codify certain basic consumer rights.

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## Intercountry adoption in South African law

Intercountry adoption has become a contentious issue worldwide, and has been the subject of research conducted by Anne Louw of the Department of Private Law. Louw points out that the intercountry adoption process is particularly perilous when foreigners apply to adopt children from countries that are not signatories to the Hague Convention on Intercountry Adoption – or when a country has become a member state to the Convention, but has not incorporated it into domestic law. South Africa falls in this second category.

In such cases, the Convention is unenforceable and the adoption procedure is not regulated by the international guidelines embodied in the Convention. In South Africa, the problem is exacerbated by the fact that foreigners may approach the High Court for guardianship and custody of a South African child with the aim of adopting the child in their country of origin.

Although not illegal, this alternative adoption route has raised concerns insofar as it removes the child from the protective ambit of the adoption procedure currently prescribed in terms of the Child Care Act 74 of 1983.

The South African courts have questioned the advisability of allowing a child who has not been orphaned to leave the country for the purpose of being adopted elsewhere, since intercountry adoption should only be considered as a last option.

Louw argues that the current uncertainty and vulnerability of children with regard to intercountry adoption will persist until the Children's Act 38 of 2005 comes into operation. This Act incorporates the Hague Convention into South African law; thus, it will effectively close the existing loopholes and provide a measure of protection for children who become the subject of intercountry adoption proceedings.

Until then, an application for guardianship by a non-citizen should, as now indicated by the High Court in *De Gree and Another v Webb and Another*, be channelled through the Children's Court and subjected to the same scrutiny as an intracountry adoption.

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## Faculty of Natural and Agricultural Sciences

### Message from the Dean

The Faculty of Natural and Agricultural Sciences has an exceptionally strong research ethos. This fact is substantiated by the increased focus on producing quality research publications in ISI accredited journals in order to ensure strong international participation. It is noticeable that over the past three years we ensured that almost 90% of all our articles were published in international journals. For the same period a definite upward trend in the number of DoE subsidised publication units was noticed, with an overall high of more than 300 units reached for 2006.

The faculty rates among the best science faculties in the

country. A significant number of our scientists are evaluated internationally and as a result, acknowledged through the National Research Foundation (NRF) by their peers as researchers of high international standing and in some cases as world leaders in their fields.

It is noteworthy to mention that Prof Clarke Scholtz from the Department of Zoology & Entomology received an A-rating and Prof Zander Myburg from the Department of Genetics a P-rating from the NRF.

Prof Rashid Hassan, Director of the Centre for Environmental Economics and Policy in Africa (CEEPA), was awarded the prestigious Kofi Anan Zayed International Prize for his contribution to the Millennium Ecosystem Assessment (MA) project, while our Director of the Forestry and Agricultural Biotechnology Institute (FABI), Prof Mike Wingfield received a Technology and Human Resources for Industry Programme (THRIP) excellence award for his valuable contributions in the category *Human Resource Development*.

Exciting new strategic initiatives took place during 2006, which is expected to have a significant impact on future research:

**School of Agricultural and Food Sciences:** Recent changing trends in agricultural and food markets locally and globally provides interesting and exciting new opportunities for researchers. A consumer with greater concerns over food safety, quality, nutrition and health attributes and reputation of food products resulted in interesting responses from food producers and food retailers,

resulted in fluctuating markets and greater demands on the operation of the “fork-to-farm” supply chain.

The departments are appropriately responding to these trends by improving laboratories and research facilities (i.e. further investment on the experimental farm such as the improvement in the dairy parlour, and the small stock section) to address these many research opportunities in a multidisciplinary fashion and mostly with international collaborators.

The Department of Food Science has initiated a strategic move to integrate food science, health and nutrition while nutrition and health aspects are also more and more becoming an integral part of the research activities of the Department of Animal Science, Consumer Science and Plant production and Soil Science. As an illustration of the strengthening of international networks on these themes January 2007 saw the launch of two European Union (EU) 6<sup>th</sup> framework research projects where Departments of this school are partners in the research consortia: “Quality improved pork chains” (Agricultural Economics) and “Innovative and healthful products” (Food Science).

The Animal Science department will focus on the nutrition, breeding and underlying physiological principles of domesticated and wild animals in a variety of production systems, as well as the quality of livestock products.

The world is also grasped in the new trend towards bio fuels. The Department of Plant Production and Soil Science has embarked on a concerted drive to forge links with crop producer organizations, with the aim to promote more effective and sustainable production practices. Scientific support for crop production systems is augmented by research on the biological rehabilitation of sites that have been disturbed by industrial activities, e.g. mining.

Here, the Department also has several projects related to finding suitable crops for this purpose while the Department of Agricultural Economics has economic models in place to assist the policy and economic decisions regarding the bio fuels policy in South Africa. Already the Presidential Working Group has recommended that this model be used in future for all economic analysis on aspects of the proposed bio fuels policy.

**School for Biological Sciences:** The University is recognised internationally for the significance of its water research. During the past decade more than forty highly qualified, internationally recognised researchers and their students in various faculties have completed many successful research projects related to water supply, sanitation and integrated water resource management, providing state-of-the-art technology to the water sector leading up to the establishment of the University Water Institute towards the end of 2006.

With its focus on research and training, the institute will build on strategic alliances that have been established with the CSIR (for research) and the Georgia Institute of Technology in Atlanta, USA (for internationally accredited postgraduate training).

The UP has contributed to postgraduate education linked to the South African forestry industry for many years. In this regard, MSc and PhD degrees have been conferred to scientists and managers working in forestry in specialised fields. These include amongst others, fields such as genetics, botany, plant pathology, entomology, chemical engineering and business management.

In 2006 the UP's offering in the Plant Sciences linked to forestry were expanded and a specialised MSc and PhD “Forest Sciences” option was introduced. A new postgraduate Medicinal Plant Science degree option will also be introduced in 2007.

It will be a multidisciplinary and collaborative research pro-

gramme incorporating Botany, Phytochemistry, Pharmacology and other disciplines concerned with safety and efficacy issues of commonly used and new phytomedicines. These initiatives form part of our strategy to increase student numbers on postgraduate level.

The Laboratory for Microscopy and Microanalysis acquired a confocal laser-scanning microscope in 2006. This instrument will be available to the scientific community and is the only one of its kind in the region. The Zeiss LSM 510 META is equipped with four lasers, which generate seven lines of laser light.

It, therefore, allows for more opportunities to exploit a greater variety of fluorescent molecules. Confocal laser scanning microscopy allows the researcher to visualize biological specimens in the alive or fixed state. It can therefore be applied to detect specific molecules and their interactions in cells at small concentrations and with a good signal-to-background ratio.

It has the further advantage that it produces optical sections by the in depth scanning of bulk samples. These optical sections can then be used to create 3-D and dynamic images of samples with the aid of sophisticated computer software.

**School of Mathematical Sciences:** The internationalisation of the school, which is one of its high priorities, reached a culminating point in 2006 with the research visit of Prof Laurent Lafforgue, Fields Medallist (Institut des Hautes Etudes Scientifiques, France). Lafforgue, whose visit was hosted by the Department of Mathematics and Applied Mathematics from 6 November to 2 December 2006, gave a motivational talk that was widely attended.

He also delivered a series of advanced lectures, which, thanks to the direct involvement of the French Embassy, are likely to have an impact on the school plan to embark on research and postgraduate study in new areas, which include aspects of Differential Geometry, Algebraic Topology and Number Theory.

In addition to this the school formalised an existing partnership with the Abdus Salam International Centre for Theoretical Physics (ICTP) in Italy by signing a Federation Arrangement according to which the ICTP will provide substantial financial support for young researchers from the Department of Mathematics and Applied Mathematics to visit the ICTP.

**School of Physical Sciences:** During this year the Chemistry and the Physics departments obtained substantial contracts from PBMR for the development of the fuel elements of the PBMR nuclear reactor. The pending fossil fuel energy crisis has made energy production via nuclear reactor an exciting option to consider.

The new regulations of the US Nuclear Regulatory Commission and the International Atomic Energy Commission in Vienna on new nuclear reactors require many new features to ensure safer reactors. The PBMR reactor belongs to this new generation of nuclear reactors.

Carbon is a key element in the PBMR reactor. Many tons of highly purified carbon is employed as neutron moderators in the reactor. In addition, the small PBMR fuel spheres also contain several layers of carbon. Thus research into the science of carbon is of paramount importance for the success of the PBMR reactor.

The Department of Science and Technology (DST) has awarded the University a Chair in Carbon Technology and Materials. The Chair was officially launched on 2 August 2006. The Chair is located in the Institute of Applied Materials, which resides jointly under the Faculty of Engineering, Built Environment and Information Technology and the Faculty of Natural and Agricultural Sciences.

It will be funded by the DST for five years to the amount of R2 million per annum. During 2006 two short courses on carbon

materials technology were presented with the help of Prof Harry Schobert of Penn State University and Prof Brian Rand and Dr Aidan Westwood from Leeds University.

Other relevant highlights, accomplishments and awards either follows this introduction or are mentioned under other sections of the report. The faculty will continue to focus on becoming international leaders in selected areas of expertise.

#### Prof A Ströh

## Highlights

### Economics of water management

The highlight among the research outputs in the Department of Agricultural Economics, Extension and Rural Development during 2006 was undoubtedly the two books published by the researchers in the environmental economics programme (CEEPA).

The first book by Glenn-Marie Lange and Rashid Hassan entitled: *The Economics of Water Management in Southern Africa: An Environmental Accounting Approach* (Edward Elgar) is based on the UN's handbook for environmental accounting and describes the implementation and policy application of water accounts in three African countries - Botswana, Namibia and South Africa. The book presents a valuable new tool for water management - water resource accounting - that significantly advances the economic analysis of water.

On the same theme of water management and governance Hassan was again the co-author with Sylvain Perret and Stefano Farolfi of a book entitled: *Water governance for sustainable development: Approaches and lessons from developing and transitional countries: Approaches, case studies and lessons for Africa* (Earthscan publishers).

This book explores the control and governance of water as critical issues of the 21<sup>st</sup> century. It shows that in recent years, water policies, institutions and governance have shifted from technical, quantitative, supply-driven, centrally controlled management to more demand-sensitive, qualitative, decentralized, participatory, integrated approaches.

The book examines these issues through case studies at national, river basin and local levels using accessible multidisciplinary approaches that integrate economics, institutional analysis, geography and policy analysis.

Ultimately this publication untangles and presents best practices for policy- and decision-makers, governments and regulators, NGOs and user groups, farmers, water supply companies and researchers, as well as pointing towards how good water governance structures can be developed and implemented for the benefit of all.

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### Goats – the highly efficient all-rounders

Animal Science has a longstanding research programme with goats. The goat was the first farm animal to be domesticated and is at present the most widely used farm animal in the world. In many species of livestock,

the need to produce a uniform product for consumers and at greater efficiency has reduced genetic variability to a few highly selected breeds.

This is different with goats. Genetic variability remains vast. This gives the advantage of being able to farm with goats in many challenging environments ranging from tropical to the sub-arctic. Africa has 20% of the world goat population, with thousands of small scale and nomadic farmers dependent on goats for their livelihood.

Goat breeds produce a highly palatable product and it has been found that goat breeds can be selected for meat quality. Carcass and meat quality for local and export markets are an important research focus in the department including work recently on Ethiopian goat breeds. Understanding their growth characteristics and combining these traits with feed from available local resources was the key to efficiently producing goat meat suitable for export from local Ethiopian breeds.

It was established further that in a resource-poor situation where grain is the staple food for humans, a grain-less diet could be used to produce meat with excellent palatability and nutritional value in a feedlot system. The fat quality was high in polyunsaturated fats with a favourable unsaturated to saturated fatty acid ratio.

The research on goats is continuing with the emphasis on nutrition for extensive production, nutrition for milk production and the raising of kids, meat quality of genotypes raised under different conditions, fertility, genetic markers for mohair quality and the effect of the interaction between physiology and dietary constituents on the physical properties of mohair.

The wide-ranging research programme is within South Africa's National Livestock Strategy and is supported financially by the National Department of Agriculture and a number of other institutions including Mohair South Africa, the NRF and THRIP.

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### Diagnosis and treatment of tuberculosis

The research programme focuses on the interaction of patient antibodies with antigens of lipid, carbohydrate and protein nature. In the field of tuberculosis, two significant breakthroughs were made by the group.

- One PhD student learned how to synthesize the waxy mycolic acids that encapsulate the tuberculosis causing mycobacterium in a stereochemical-controlled way at the University of Wales, Bangor. Together with co-workers from Bangor, they subsequently created several isomers that were tested positively for biological activity at University. This is the first demonstration ever of the chemical synthesis of an antigenic mycolic acid that paves the way for the elucidation of the role of these molecules in the pathogenesis of tuberculosis. It also prepares for an improved diagnosis of tuberculosis, based on the detection of antibodies to mycolic acids as surrogate markers for active TB. This approach has been patented internationally by UP and is currently being developed for the market.
- A second significant breakthrough was the discovery that mycolic acid folds to assume the structure of cholesterol. With the collaboration of the Department of Chemistry, one MSc student could brilliantly demonstrate that a cholesterol binding pharmaceutical could bind equally well to mycolic acid. The critical role that chole-

terol plays in the pathogenesis of tuberculosis is already well known, but this breakthrough for the first time indicates the role of mycolic acid in it. This discovery has great potential to be exploited in the development of new therapeutic approaches for the treatment of TB. By means of our collaboration with the University of Gent, one PhD student could demonstrate how mycolic acid prevents asthma in mice. This work was published in 2006.

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## Plant-pathogen interactions and bio informatics

Research into the molecular basis of plant-pathogen interactions has focused on the biochemical characterization of polygalacturonase inhibiting proteins (PGIP) from apple plants. PGIPs are cell-wall associated proteins that inhibit cell-wall degrading polygalacturonases (PG) produced by pathogenic fungi. PGIPs are widespread in dicot plants and often encoded by gene families, which makes it difficult to study PGIPs directly in host plants since different family members often co-purify.

In research carried out in collaboration with the ARC-Roodeplaat Vegetable and Ornamental Plant Institute and the University of Johannesburg, a particular *pgip* gene, apple *pgip 1*, was cloned and expressed in transgenic tobacco.

Purification of the apple PGIP1 without contamination from endogenous PGIPs was used to solve the problem of PGIP mixtures and prove that this protein inhibited PGs from pathogens of apple and lupin plants. This opens the possibility of using the apple PGIP1 in a genetic modification strategy for crop improvement.

The Microarray Platform Project at the African Centre for Gene Technologies (ACGT) Microarray Facility was supported by a grant from the Biotechnology Regional Innovation Centre, BioPAD. It was set up to increase human capacity in applying microarray technology in the BioPAD region by involving researchers and technical assistants at the University, University of Witwatersrand, and Inqaba Biotechnical Industries Pty (Ltd). A service pipeline is being developed to efficiently support small to large microarray projects in South Africa.

The microarray lab also presented a Crop Bioinformatics training workshop for African scientists on databases, internet resources and bioinformatics for crop improvement. It was funded by the Generation Challenge Programme (GCP) and attended by scientists from ten African countries. The co-presenter was Prof Jan Peter Nap from Wageningen University and Research, Netherlands.

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## Medicinal Plant Science

Several novel bioactive compounds have been isolated and identified from medicinal plants with anticancer, antityrosinase, antidiabetic and anti-plasmodium activity. Pharmaceutical companies in pre-clinical trials are currently testing the bioactive compounds from two of these plants with anti-hypoglycaemic and anti-herpes activity.

The best antituberculosis compound (7-methyljuglone) isolated from the medicinal plant, *Euclea natalensis*, was chemically synthesised and its mode of action investigated. The mode of action was found to be on the electron transfer process and proved to be a novel mechanism on tuberculosis; this has some exciting possibilities to design a potent antituberculosis drug with little toxicity.

An NRF/Royal Society grant was awarded for a tuberculosis project, which enabled students to conduct research at Queen's College, Belfast (UK). Compounds belonging to the naphthoquinone group have been shown to have inhibition on the mycothiol reductase enzyme of *Mycobacterium tuberculosis*, which indicates a novel mode of action for this group of compounds

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## Virtual electrochemical properties and activity of potential drugs in bone cancer treatment

The bone is one of the most preferential metastatic target sites for several cancers, including breast, prostate, and lung cancer because it possesses unique biological features that enable circulating cancer cells to home, survive and proliferate.

Radiopharmaceuticals, such as  $^{153}\text{Sm-EDTMP}$ , have produced satisfactory results in pain palliation therapy. Intravenous radioisotopes such as  $^{89}\text{Sr}$  and  $^{153}\text{Sm}$  have been used to treat bone cancer in radiation therapy. The mechanism by which these radioisotope-containing bisphosphonates (BPs) lessen the bone cancer pain is not yet known.

The main component of the bone is the hydroxyapatite (HA). The overall structure of any BP might be written as  $\text{H}_2\text{O}_3\text{P- (R1) C (R2)-PO}_3\text{H}_2$  with R1 being mostly OH-group. BPs show extremely high affinity toward HA due to the presence of the two groups,  $-\text{PO}_3\text{H}_2$ .

It is accepted that the bisphosphonates' ability to bind the bone and their anti-resorptive ability (or potency) depend on the nature of the groups attached to the central carbon atom. BPs containing a primary nitrogen atom in the R2 group (e.g. in 1-hydroxy-3-aminopropylidene diphosphonic acid, APD) are more potent than non-nitrogen bisphosphonates (e.g. 1-hydroxy-ethylene-diphosphonic acid (HEDP) where  $\text{R2} = -\text{CH}_3$ ).

We recently embarked on extensive studies of HEDP and APD by electroanalytical (solution equilibria), spectroscopic (interactions of BPs with HA(s) by Raman), and computational (modeling, MM and MD) techniques.

A newly developed concept of virtual thermodynamic potential, computed from non-equilibrium and dynamic polarographic data, was used to model the solution composition (prediction of metal complexes formed) and computing stability constants of identified species.

Results obtained by us in modeling and optimisation operations (involving virtual potentials) for the APD-Cd(II) and APD-Pb(II) systems are in good agreement with other data reported by us earlier for the HEDP-Cd(II) system where we used a "traditional" methodology. Also,

results generated from virtual potentials are in good agreement with Raman Spectroscopic studies. From results obtained we came to the conclusion that there is no evidence to support increased potency of APD by role the  $-\text{CH}_2-\text{CH}_2-\text{NH}_2$  chain might play in the complex formation with a central metal ion.

We claim that this chain is not involved in complex formation reactions at blood plasma pH (just above 7). This opens up a new chapter in interpretation of the role of the R2 group in the increase (or decrease) in activity (potency) of radiopharmaceuticals. Our intention is to computationally model the interactions between the bone (HA) and BPs in order to understand the variation in their potency as a function of the chemical structure of the R2 group.

Virtual potential might be seen as quite an unusual concept, but we are making it clear (by results generated) that without the use of it, it would be impossible to interpret experimental data rigorously. We hope that with time, the concept (theory) of virtual thermodynamic potential will find its place in academic textbooks, but more importantly, will be used daily by many scientists working in the field, and not only us.

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## Polymers and chemical product design

Long-life mosquito netting: Progress was made towards the development of a long-life polypropylene (PP) mosquito net that will conform to World Health Organization (WHO) specifications. Laboratory-scale development has been completed and the first pilot scale production of PP yarn was successfully produced in December 2006.

Urea-based moulding compounds for investment casting: New urea-based thermoplastic compounds have been developed for application in investment casting. The work was done by PhD student Hilary Rutto from Kenya.

He formulated new resin systems and optimized a polymer compounding process to prepare the urea-based moulding compounds. The effect of composition on the mechanical, thermal, surface and flow property values of the formulation were studied and this allowed the optimization of compound composition to meet the specifications required in industrial investment casting practice. The formulation and its manufacturing process are in the process of being industrialized.

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## Customer service in supermarkets in the spotlight

The project investigated the shortcomings in terms of the elements of customer service that could be addressed to improve the quality of service to customers of prominent supermarkets in Tshwane. Qualitative and quantitative surveys revealed significant differences in customers' judgement of service quality.

Dissatisfaction was mainly due to personnel related issues. In general, customers realise that the same products can be found at

different supermarkets, but are willing to inconvenience themselves and travel further to avoid being frustrated by poorly trained and incompetent personnel.

Interestingly, the supermarkets that were judged to be less satisfactory were those that spent the most on advertising during the previous year. The conclusion was that more effort and money should go into proper training of staff so that the store could benefit by "word of mouth" referrals by satisfied clients.

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## Body measurements

The way a garment fits, is key to whether or not a consumer will buy it. It also influences the consumer's perceptions about the workmanship or quality of the garment, its comfort and lifespan. In the clothing industry the only true competitive advantage is to keep existing customers happy. The costs associated with recruiting new customers are much higher.

Internationally it has been found that there is growing dissatisfaction – especially among women – about the fit of ready-to-wear clothing. It has also been found that few manufacturers take cognisance of the great variety of human shapes. However, body measurements and proportions are both essential inputs when a garment is designed.

In South Africa the problem is exasperated by the fact that very little is available in the public domain about the basis on which the local clothing industry incorporates body measurement data in their designs.

The aim of this study was to investigate and describe how the South African clothing industry incorporates body measurement data in their designs, to compare international and South African descriptions of body measurements needed by the clothing industry, and to describe the problems that the local clothing industry experiences with body measurements.

The research among clothing and footwear manufacturers and retailers revealed a number of problems being experienced with body measurements and their use. There are for example either no international descriptions available or no consensus as to how body measurements should be taken and there are no height measurements available for more than two thirds of the population.

The survey also established the knowledge base of body measurement descriptions, what the South African sizing system entails, how block patterns are generated and how fit-and-wear testing is done.

Recommendations include the establishment of a national standard for identifying reference points and the development of methods for measuring the body accurately. This should precede a survey of the morphology of the South African population.

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## Love and war

Why do certain males fight over mates whereas others prefer to mate peacefully side by side? In pollinating fig wasps the life history is such that brothers compete with one another for mating opportunities.

We found that most species mate peacefully, but as soon as the ratio of males to females become too high they will fight, even their own sibs, to increase their own reproductive output. This work illustrates the obvious: a shortage of resources and an excess of consumers will lead to a struggle for existence, which can be so powerful that it can even overrule the unity of the family. In modern society we tend to focus on producing more resources, but the reality of continued survival is a limitation on consumers.

In a related study we found that mothers, rather than the sons themselves, determine if the sons will develop into large fighters or Romeos. In this case, the mother has more information on the adversities her sons may face. This work shows that natural selection is extremely efficient at shaping life, not only is male development plastic, but even the quality of information is "considered" in developmental "decisions".

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## Cellulose Synthesis Toolbox of *Eucalyptus* trees revealed

Cellulose is a biopolymer produced by plants to strengthen their cell walls and together with other cell wall polymers it provides mechanical support for plant organs.

Large amounts of cellulose are synthesized in the woody stems of forest trees. This process consequently plays a major role in global carbon sequestration.

Cellulose-rich wood fibre harvested from fast-growing plantation trees constitutes a renewable source of raw materials for a variety of purposes including paper manufacturing and bioenergy production.

*Eucalyptus* tree species are the most widely planted hardwood trees in the world with approximately 18 million ha under cultivation in tropical and subtropical regions.

They have achieved this status through excellent productivity and superior wood properties sought after by the global pulp and paper industry.

Fast-growing eucalypt plantations can produce more than 50 m<sup>3</sup> of wood per hectare per year and in the process sequester more than 10 tons of carbon per hectare per year, much of it in the form of cellulose.

Despite its commercial importance and fundamental role in plant biology, the genetic regulation and detailed molecular biology of cellulose biosynthesis is still not completely understood. In fact, the molecular machinery involved has proven largely intractable to direct scientific investigation, since it involves a very large protein complex embedded in the plasma membranes of plant cells.

The Forest Molecular Genetics (FMG) Programme directed by Prof Zander Myburg in the Department of Genetics and Forestry and Agricultural Biotechnology Institute (FABI) focuses on the molecular genetics of wood formation in *Eucalyptus* trees. In 2005 and 2006, the FMG programme achieved a major breakthrough when MSc student Martin Ranik, isolated full-length copies of six cellulose synthase genes from actively growing tissues of a *Eucalyptus* tree.

Three of these genes were shown to encode the protein components that comprise the cellulose biosynthetic complex in woody tissues, while the three other genes were involved in cellulose biosynthesis in non-woody tissues such as young unfolding trees (work published in the journal *Tree Physiology*, Ranik and Myburg, 2006).

Access to the genes that encode the cellulose synthase proteins in wood fibre cells is now allowing Myburg and his students to study the genetic regulation of cellulose biosynthesis in these trees, as well as the molecular interactions that allow assembly and functionality of the cellulose biosynthetic machinery in trees. Their work has important implications for pulp and paper, as well as bioenergy production in fast-growing *Eucalyptus* plantations. This work is funded in part by the University, Mondi Business Paper South Africa, Sappi Forest Products, THRIP and the NRF.

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## Numerical weather prediction

Funding was received from the British High Commission in South Africa to implement a Numerical Weather Prediction (NWP) system for countries over equatorial Africa. Uganda, and in particular, the Uganda Department of Meteorology has been selected as a pilot for this initiative.

Achievements are that the project team managed to install a model and to produce daily forecasts of four days in advance on a routine basis for Uganda (15km x 15km resolution), Lake Victoria (8km x 8km resolution), South Africa (15km x 15km resolution) and the Eastern Highveld of South Africa (8km x 8km resolution).

The computer and networking for this is provided by the BEE company Tabia Endelevu Africa (TEAfrica: meaning "Environmental Development Africa" in Swahili). Through the project, TEAfrica and the University, also managed to do infrastructure development at the national weather forecasting office of Uganda at Entebbe.

A new nonhydrostatic atmospheric model has been developed based on an equation set not applied before in atmospheric modeling, and employs a novel split semi-Lagrangian numerical solution procedure.

The numerical scheme is stable at large advection time-steps and is formulated on a nonstaggered grid that makes it computationally highly efficient. The model has been used to study highly nonhydrostatic and nonlinear flow in a series of bubble convection experiments. It may be used in the future to study the characteristics of nonhydrostatic circulation over South Africa, such as severe thunderstorms and mountain waves.

Research in Namibia has focussed on rainfall and sediments. In the past seven years alone, Namibia has experienced three rainy seasons, 2000, 2004 and 2005/2006 with abnormally high precipitation. Research has focused particularly on the geomorphological implications of the rainstorms, the type, frequency, magnitude and overall intensity of flooding and the extent of damage.

Late Pleistocene to Holocene valley fill sediments from several catchments within the Escarpment region of southern Namibia (Huns River and tributaries, Boom River) were investigated and palaeoenvironmental scenarios were reconstructed with respect to the rainfall regime, runoff dynamics and depositional environments (fluvial, wetland, lacustrine).

Rich organic material findings from palaeosols provided series of radiocarbon dates which are presently being correlated with findings from neighbouring catchments.

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## Linear space of Hausdorff continuous functions

Hausdorff continuous (H-continuous) functions are special interval-valued functions, which are commonly used in practice, e.g. histograms, are such functions.

However, in order to avoid arithmetic operations with intervals, such functions are traditionally treated by means of corresponding semi-continuous functions, which are real-valued functions.

One difficulty in using H-continuous functions is that, if we add two H-continuous functions that have interval values at same argument using point-wise interval arithmetic, then we may obtain as a result an interval function, which is not H-continuous.

In this work the operation addition is defined in such a way that the set of H-continuous functions is closed under this operation. Moreover, the set of H-continuous functions is turned into a linear space. It is also proved that this space is the largest linear space of interval functions.

These results make H-continuous functions an attractive tool in real analysis and provides a bridge between real and interval analysis.

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## Non-commutative recurrence on locally compact groups

The notion of recurrence plays a central role in the study of dynamical systems (systems that evolve with time, movement of planets, the heart's beat, pendulums). It was discovered by Henri Poincare and states that a dynamical system having a finite amount of energy and confined to a finite spatial volume will always return to a position close to its initial state, if a sufficient amount of time elapses.

H. Furstenberg obtained recurrence results concerning weakly mixing and almost periodic measure preserving transformations. That result was later extended by Prof Anton Ströh and his collaborators to  $C^*$ -algebras.

The present work of Dr Richard de Beer, Dr Rocco Duvenhage and Stroh extend previous results on noncommutative recurrence in unital  $*$ -algebras over the integers, to the case of locally compact Hausdorff groups.

They derive a generalization of Khintchine's recurrence theorem, as well as a form of multiple recurrence. This is done using the mean ergodic theorem in Hilbert space, via the GNS construction.

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## A mathematical model in vibro-acoustics

The problem of noise control in aircrafts and submarines has given rise to the mathematical investigation of so-called structural acoustic models in which an acoustic medium (which may be a gas), interacts with an elastic medium (which may be a plate).

The composite dynamics of the structure is described by systems of partial differential equations, which model the dynamics of the gas and the plate. However each system of partial differential equations is augmented by additional terms, which describe the interaction between the two media.

An important addition to the existing literature is a model, recently developed by M. Grobbelaar-Van Dalsen, in which the dynamics of the elastic medium, here a plate, takes account, not only of the transverse deflections of the plate and rotational inertia effects, but also of transverse shear effects.

This yields an even more complex model, which contains two additional variables representing the shear angles of filaments of the plate. The model which uses the Reissner-Mindlin plate equations to describe the plate dynamics, is not only more accurate over the whole frequency range, at least as far as the vibrations of the elastic medium are concerned, but is also valid at high frequencies when the Euler-Bernoulli equation ceases to be valid.

The existence of unique solutions both for two- and three-dimensional linear and non-linear models is established. In the two-dimensional case, carefully chosen multipliers are shown to yield uniform stability of the energy associated with both linear and non-linear models under a physically feasible restriction on the geometry of the structural component, a Timoshenko beam in the two-dimensional case.

Only feedback controls at the walls of the acoustic medium, as well as at the edges of the beam, is required.

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## Non-standard finite difference methods for singular perturbation problems

Singularly perturbed differential equations, i.e. equations in which a small parameter is multiplied to the highest derivative, arise in various fields of science and engineering to model the physical phenomenon of boundary layers. Classical numerical methods are not reliable in the solution of such problems.

For the class of problems investigated in this paper, we design non-standard finite difference schemes, which converge uniformly with respect to the perturbation parameter and which replicate essential physical properties of the exact solutions.

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## Solutions of generalized second grade incompressible fluids

This work investigates the flow down an inclined plane of a non-Newtonian fluid (generalized second grade fluid type). Non-Newtonian fluids are those that do not obey the Newton's law of viscosity and have a wide range of industrial applications and examples include consumer goods such as plastics, paints, toothpaste, foodstuffs such as tomato sauce and biological fluids such as blood.

The simplest model for non-Newtonian fluids is the second grade Rivlin-Ericksen model for fluids with constant viscosity, which cannot be used to model fluids with shear dependent viscosity. Another popular model is the power law model where viscosity is proportional to a power of the velocity gradient and successfully models shear-thinning and shear thickening fluids.

The model we used in this study is one that combines the second grade and the power-law fluids. In the study both the exact and the numerical solutions of a fully developed flow of a generalized second grade fluid with power law temperature dependent viscosity are obtained. Closed form analytical solutions are possible only for the linear case of the governing equation. For the non-linear case only numerical solutions were possible.

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## Sylvester-Gallai theorems for complex numbers and quaternions

In 1835 Plücker wrote about a set of nine points in the complex plane with the property that every line through two of them contained a third point of the set.

In 1893 Sylvester asked whether such a set could be found in the real plane. Let us call a finite set  $S$  of points a Sylvester-Gallai (SG) configuration if the line through any two points in  $S$  contains a third point in  $S$ .

The question of Sylvester was again asked independently in 1933 by Paul Erdős and in the same year Gallai proved that an SG configuration in any real projective space is collinear, that is one-dimensional.

In the light of the 9-point SG configuration of Plücker in the complex plane, Serre asked in 1966 whether an SG configuration in a complex projective space must necessarily be coplanar. In 1986 it was proved by Kelly to be the case by using a deep inequality of Hirzebruch.

In this article we give an elementary proof of Kelly's result and extend it to show that an SG configuration in projective space over the quaternions must be contained in a three-dimensional flat.

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## Evolution and epidemiology of Lyssaviruses, including rabies virus

The African rabies-related viruses; *Lagos bat virus* (LBV), *Mokola virus* (MOKV) and *Duvenhage virus* remain among the most obscure in the Lyssavirus genus. We have succeeded with various recent isolations of MOKV and LBV from South Africa. Most recently we regularly isolated LBV from bats, but also isolated LBV for the first time from terrestrial wildlife and implicated LBV in rabies vaccine failures of dogs.

These findings re-emphasized our lack of understanding of the pathogenicity or epidemiology of lyssaviruses throughout Africa and renewed the interest in the rabies-related viruses in particular. Internationally, these aspects are closely linked to similar questions of other lyssaviruses – including the newly discovered viruses from Asia as well as the better known genotypes like the European and Australian bat lyssaviruses.

We also study the southern African mongoose rabies virus, and the origin of this unique variant of rabies virus in southern Africa. Our research explores: (1) Introduction of this virus from bats to small herpestid carnivores of southern Africa and (2) Introduction of terrestrial mongoose rabies into southern Africa before the global dissemination of cosmopolitan dog rabies.

Additionally, we have focused on the molecular epidemiology of the ongoing dog rabies epidemic in Kwazulu/Natal. For the first time we have obtained a picture of the viruses involved and their movement within and among the municipal areas of this province.

Our research indicated that, contrary to traditional belief, there have been multiple introductions of rabies virus into the province, with implication for the future control of rabies in this province and elsewhere in southern Africa. One of these introductions has been from a virus cycle associated with jackals.

Whereas the importance of dogs as rabies hosts throughout Africa is without question, the role of jackals as important hosts has to date been controversial.

## Lyssavirus vaccines

Oral vaccination of free-roaming dogs will be a major step in the struggle to control rabies in Africa. Despite the effective use of oral vaccines to vaccinate wildlife in Europe and Northern America, current oral vaccines (designed for wildlife) are not appropriate for application in sub-Saharan Africa.

The main problems are relative instability of some vaccines, or the potential danger of others, given the very high incidence of immunodeficiency in the resident human populations, primarily through the AIDS pandemic in the subcontinent. For various related reasons, the use of these classical pox recombinants has also been met with increasing resistance in the developed world.

In this regard, a replication-deficient recombinant poxvirus expressing the relevant antigens may provide not only an effective vaccine but also a safer alternative to the currently available recombinant oral vaccines.

Several such candidate vaccines (based on recombinant LSDV and MVA) have been constructed and evaluated in murine and canine laboratory models. In addition, several combined or cross-reactive vaccines – of specific benefit to laboratory diagnosticians worldwide and to high-risk groups in those areas where rabies-related lyssaviruses, have been constructed.

## Plant viruses

The primary research of the plant virology programme is directed at support of the South African Citrus Improvement Program (CIP) as well as the Wine Grape Certification scheme. Winetech, the wine industry research co-ordinating body, supports the grapevine research component financially, while Citrus Research International (CRI) funds the citrus component.

In both schemes virus control plays a central role, with citrus tristeza virus (CTV) being the most important virus in the citrus scheme, and Grapevine leafroll associated virus type 3 (GLRaV-3), the most important one for the wine grape scheme.

However, the differences in mode of transmission of these viruses require that the respective certification schemes employ different strategies for control of these viruses. As CTV is easily and rapidly transmissible by highly mobile aphid vectors, citrus material from which viruses have been eliminated are protected against CTV infection in the field through the pre-inoculation of planting material with mild CTV strains.

In contrast with this and because of the relative slow rate of spread of GLRaV-3, wine grape material is subjected to virus elimination techniques and then propagated under conditions to minimize re-infection.

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## UV Detection

GaN and ZnO are wide bandgap materials that can be used for UV detection. If used in spacecraft as UV detectors, these materials are exposed to a harsh radiation environment. We have compared the radiation-hardness of these two materials by irradiating them with MeV protons in our van de Graaff accelerator. Schottky barrier diodes were used as probes to study the electrical properties of the irradiated material.

The experiment revealed that ZnO is more than 100 times radiation harder than GaN. It would therefore last 100 times longer in space than a UV detector. The defects that govern this unusual radiation hardness are still under investigation.

Preliminary results have shown that some of them can only be observed two weeks after irradiation and that these anneal out when storing the irradiated ZnO at room temperature.

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## Improvement of propagation practices in *Protea cynaroides* (King Protea)

South Africa's national flower, the King Protea (*Protea cynaroides*), is an important cut flower for the floriculture industry. It is in high demand and fetches exceptionally high prices on the export markets. A major constraint for producers is that conventional propagation by seeds and stem cuttings is unreliable and slow.

With recent research conducted by the Department of Plant Production and Soil Science under the supervision of Professors Elsa du Toit and Charl Reinhardt, unique *in vitro* propagation protocols for *P. cynaroides* were developed using *in vitro* zygotic embryo culture, micrografting and somatic embryogenesis. Significant improvement in the rooting of cuttings was achieved through blanching. The relationship between starch and phenolic compound levels and rooting of cuttings was established. A final discovery was that the phenolic compound, 3,4-dihydroxybenzoic acid, plays a fundamental role in the rooting process of this difficult to root plant. Findings have contributed significantly to greater efficiency in the commercial production of King Proteas.

## Establishment of Bio-fuel focus area

Research into bio-fuels is being done in the Department of Plant Production and Soil Science, under the management of Prof Elsa du Toit. Contracts related to possibilities in the bio-fuels industry of South Africa have been delivered to the Department of Agriculture and the Department of Trade and Industry (dti).

A two-year feasibility study has been completed on *Jatropha curcas* as a potential biodiesel tree crop, in the Mafikeng area of South Africa. Plant propagation protocols for potential indigenous trees for the bio-diesel industry have also been done. Current research is aimed at the optimization of horticultural practices for potential bio-diesel tree crops in South Africa.

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## Stimulating potatoes to sprout is a critical step in seed certification

The University has successfully established a Potato Research Programme funded by Potatoes South Africa. The Department of Plant Production and Soil Science coordinates the programme that began in 2005 with seven projects involving scientific disciplines from Entomology, Plant Pathology, Consumer Science and Plant Production.

One project deals with the stimulation of sprout growth on fresh, dormant potato seed tubers, which is a critical step in timeous seed certification. The topic of tuber dormancy has been under investigation for almost a hundred years, but in spite of the mass of accumulated scientific information, it is still practically impossible to force a fresh tuber to sprout.

A promising procedure developed at the University utilizes a combination of gibberellins and cytokinins. Provided water is available to the developing sprouts, dormant tubers harvested from plants still growing can be induced to sprout within four days, with vigorous sprouts

present after 10 days when sprout growth slows down.

The next challenge is to find a way to sustain sprout growth and ensure plant establishment. Apart from hormonal checkpoints in the cell cycle of the buds, sprouting is probably also controlled by blockage of plasmodesmata with callose, thus prohibiting transport of stored assimilates and other resources to the developing sprouts.

The integrity of cell membranes of fresh tubers may be an additional factor limiting cell-to-cell transport. Application of oxidants yielded promising results in terminating tuber dormancy, possibly by breaking down of callose plugs and affecting membrane integrity.

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## The use of Coal Ash for land reclamation

In an integration of pasture, soil, environmental and weed sciences with an emphasis on environmental problems our Land Reclamation team has developed interesting applications of coal ash, an industrial by-product that can cause environmental problems.

The fine coal ash known as fly ash has been used to ameliorate soil and coal discard, by neutralization. Raising the soil or substrate pH in this way inherently creates a better environment for grass roots to develop, thus improving plant production. This helps to optimise post-mining land use, inter alia limiting the amount of heavy metals translocated by the plants or leached out of the newly reclaimed areas or by-product disposal sites.

Preliminary work has indicated that fly ash also has the ability to improve certain microbiological aspects important in soil health and plant production. Coal ash with a coarser texture has been used together with industrial biosolids to create a growth medium where various subtropical grasses and trees have been established in an effort to stabilize the surface of industrial by-product disposal sites. The approach it is anticipated will ultimately also use vegetation to curtail the movement of water through these disposal sites.

In related work, waste dumpsites, which contain large amounts of wood ash from campfires, were found to be invaded by certain invasive plant species. Indigenous grass species have now been identified that are adapted to the changed conditions.

They can be used to revegetate such sites, which increasingly occur in wildlife conservation areas. These findings were presented in various papers at the International Coal Ash Conference hosted by the South African Coal Ash Association last year.

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## Integrated rural development

Since 2003, Prof Nic Olivier and other members of the staff of the SADC Centre for Land-related, Regional and Development Law and Policy have been working with the Greater Giyani Local Municipality in developing and coordinating a Local Economic Development Strategy. The focus of the programme is to promote the sustainable utilisation of the abundant

natural resources within the municipal jurisdiction.

With the extensive support of the Greater Giyani Local Municipality, the Mopani District Municipality, the Office of the Premier in Limpopo Province, various other government departments and the Development Bank of Southern Africa, the programme rolled out three community driven natural resource projects whilst establishing the necessary governance structures. This model of local government development is expected to be rolled out in many other rural municipalities soon.

Whilst Prof Olivier and his staff are responsible for the overall coordination, monitoring and reporting as well as the establishment and maintenance of sound relations with the provincial and local spheres of government.

The CSIR component of the joint Sera Task Team on Sustainable Rural development is responsible for the implementation of the Mopani Worm Commercialisation project, which includes investigations on other Mopani worm products such as polony and instant soups. In addition, various other service providers are involved in bee-keeping and oyster mushroom cultivation projects. Giyani traditional community members are actively involved in all areas of these projects.

In the implementation of these projects UP Honours students and academic staff have been doing intensive research, the outcomes of which will be a number of further degrees as well as academic publications.

What makes these projects unique, is that they do not occur in isolation, but are embedded in the developmental planning of the local community whilst strengthening the governance structures; simultaneously the academic input forms the basis for both the conceptual framework and the coordination, providing a controlled environment for academic research.

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## Statistical analysis of grouped data

This research aims to provide a theoretical foundation for analysing grouped data, taking into account the underlying continuous nature of the variable(s). Statistical techniques have been developed and applied extensively for continuous data, but the analysis for grouped data has been somewhat neglected.

This creates numerous problems especially in the social and economic disciplines, where variables are grouped for various reasons. Due to a lack of appropriate statistical techniques to evaluate grouped data, researchers are often tempted to ignore the underlying continuous nature of the data and employ say the class midpoint values as an alternative. This leads to an oversimplification of the problem and valuable information in the data is being ignored.

In this work the analysis of grouped data is performed utilizing the maximum likelihood (ML) estimation procedure, developed by Matthews and Crowther. Three integrated areas are addressed. The objective is ultimately to provide a satisfactory fit that describes the data as effectively as possible, revealing the various trends.

Firstly, continuous distributions such as the exponential, normal, Weibull, log-logistic and Pareto distributions are fitted to a single frequency distribution. The constraints are formulated such that the cumulative relative frequencies equal the cumulative distribution curve at

the upper class boundaries.

A general method is proposed by formulating the vector of constraints in terms of a linear model. The second area concentrates on the analysis of generalised linear models where the response variable is presented in grouped format.

A cross classification of the independent variables leads to various so-called cells in a single-factor, two-factor or even multifactor design. Each cell contains a frequency distribution of the response variable.

A new approach, where a specified underlying continuous distribution for the grouped variable is fitted to each cell is introduced. Certain measures such as the average, median or even any other percentile of the fitted distributions are modeled to explain the influence of the independent variables on the response variable. A third contribution is the fit of a bivariate normal distribution to a two-way contingency table.

The estimation of the bivariate normal distribution reveals the complete underlying continuous structure between the two variables. The ML estimate of the correlation coefficient is used to great effect to describe the relationship between the variables.

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## Energade for birds

Nectar is much more than sugar water. We are studying nectar feeding in sunbirds and other passerine birds, and paying particular attention to non-sugar constituents of the nectar. Amino acids occur in some bird nectars at quite high concentrations (up to 100 mM), and while non-essential amino acids are the most abundant, all the essential amino acids are also present.

In the laboratory, sunbirds reject sugar solutions containing amino acids if the concentrations are too high. However, the nectars of sunbird flowers are energetically diluted and sunbirds must drink large volumes to meet their energy requirements, so their nitrogen intake will not be negligible.

Floral nectars also contain sodium and potassium ions, and we have recently found that the sodium is especially important for birds feeding on the most diluted nectars: otherwise their kidneys are unable to recover enough sodium from the enormous volumes of urine.

The large inflorescences of *Aloe marlothii*, which flowers on northern hillsides during dry winters, are visited by few sunbirds but by a multitude of other bird species, none of them specialised nectar feeders. For these birds the nectar is both a water and energy source and supplements other dietary components such as seeds.

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## Indian Mynas

Common (Indian) Mynas (*Acridotheres tristis*) have been introduced to many areas of the world outside of their native Asian range, either accidentally (e.g. escaped cage birds) or deliberately (e.g. for pest control).

The birds were first introduced to South Africa in 1902 and in the last century have expanded markedly northwards and eastwards and have now reached Botswana, Zimbabwe and Mozambique. In view of the possible negative effects that the Common Myna poses to indigenous avian communities, it is necessary to understand its position in urban and semi-natural avian communities, its distribution, and the factors that determine its distribution.

At the regional scale, there is no empirical information on the extent to which a relationship exists between the distribution range of this bird and human population density, degree of land transformation and location of protected areas.

In collaboration with Honours student Derick Peacock, we used fine scale satellite imagery and avian point count censuses to identify (1) land-cover variables that constitute prime myna habitat, and (2) bird species that could be threatened by the myna's presence.

The study found that mynas are strongly attracted to areas severely altered by urbanisation (e.g. city centre), where they potentially compete with a relatively species-poor avian community, many of which are also alien. Based on myna density estimates, there is a ratio of almost one myna to every two people inhabiting the City of Tshwane Metropolitan Municipality.

At the regional scale, Common Mynas were found more frequently than expected by chance in areas with greater human population numbers and land transformation values. With regard to the spatial arrangement of protected areas, the study showed that, although there is some overlap, the Common Myna distribution is not closely tied to the existing conservation network.

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## Faculty of Theology

### Message from the Dean

For the Faculty of Theology qualitative research remains one of the core building stones of its academic contribution to the scholarly community and to the South African society. To be nationally relevant in Church and Society and to be internationally competitive among highly ranked international universities are prime academic endeavours, which this faculty strives for.

A large number of research publications, some international books, SANPAD, NRF and THRIP awards as well as the increasing involvement of personnel in international academic projects and endeavours during 2006 have encouraged the faculty's dedication to be one of the leading research faculties at the University.

The influence and impact of theological research in South Africa and in the world can hardly be underestimated. As a multi-church faculty in cooperation with other faculties and universities worldwide this impact has been underscored by the high intensity of public interest and news coverage during 2006. A variety of themes have been addressed in the research endeavours this year: the authority of the Scripture, homosexuality, HIV/Aids, and the relationship between various religions are some examples.

Again, research in Old and New Testament Studies or related extra-biblical literature was focused on the Pentateuch, Psalms, Enoch, Septuagint, John, Christology and biblical ethics. Research in Systematic Theology and Christian Ethics concentrated on the interaction between rationality, spirituality and morality, the "ethics of responsibility" and the debate between Theology and the Natural Sciences.

Church History and Church Polity has focused attention on African Christianity, reconciliation and ecumenical responsibility. With regard to Practical Theology the emphasis fell, *inter alia*, on various aspects of sexuality, liturgy, preaching, hymnology, cremation, trauma counselling, narrative pastoral family therapy, HIV/Aids, and urban community development.

Focus areas in Science of Religion and Missiology included the importance of the Truth and Reconciliation process in South Africa and the role of various religions in this process. Black Economic Empowerment (BEE) is also one of their main focus areas.

Co-operation with a number of international institutions took place during 2006, including the Asbury Theological Seminary (USA), the Context Group (USA), Evangelical Theological Seminary Cairo (Egypt), the International Reformed Theological Institute, Von Humboldt-University (Berlin), the Universities of Bonn, Durham (Duke Divinity School), Essen, Bochum, Louvain, Marburg, McCormick Theological Seminary (Chicago, USA), Munich, Münster, Princeton Theological Seminary, St Petersburg, Utrecht, Vienna and the Free University of Amsterdam.

Research in the faculty is supported by courses in research methodology for especially graduate students. These students as well as professionals with post-graduate degrees are integrated in research projects of faculty members in collaboration with an extensive network of international research associates.

Two scholarly theological journals of the faculty, namely, *HTS Theological Studies* and *Verbum et Ecclesia* are internationally recognized and accredited journals. Their editorial boards include various international scholars.

Approximately 140 articles were published in national/international academic journals and books during 2006. Examples of international books include e.g. *Het Evangelie van Judas* (J van Oort), Ten Have: Netherlands; and *Identity, ethos, and ethics in the New Testament* (J G van der Watt), Walter de Gruyter: Berlin,

Factors that will impact on the research of the faculty in 2007 will be the accumulating involvement of post-graduate researchers from Church and Society, sustainable internationalisation, involvement of participating churches in Faculty activities, and relevant community projects like those on HIV/Aids, BEE, cremation, sexuality, the Septuagint and others.

International congresses on Homiletics, Pentateuch, Psalms and Hebrews have been held in 2006 and will be disseminated internationally in academic books during 2008. Centres of the faculty, like the Centre for Theology and Community (CTC), the Institute for Missiology and Ecumenical Research (IMER), the Centre for Continued Theological Training (CCTT) and the Reformed Theological College (RTC) have all stimulated research. The faculty accepts the challenge of maintaining a high standard of relevant research during 2007.

Prof CJA Vos

## Highlights

### My feet wish to sing

In this article the author takes a closer look at erotica using biblical poetry on the one hand and contemporary Afrikaans poetry on the other. By way of conveying some thoughts on texts in Song of Songs (along with other assorted scriptural texts) the ideas regarding sexuality encountered therein are made to converse with a careful selection of a number of Afrikaans poems to express in homiletical fashion something about the wonder and mystery of this greatest of Heaven's gifts bestowed upon the human condition - the divine spark.

The researcher uses a refrain in popular Afrikaans folk singer Laurika Rauch's song *My Tante Koba* (My Aunt Koba) to demonstrate contemporary erotica. Changing the song's refrain "*Maar my voete wil nou dans en my lippe wil nou sing*" (My feet want to dance and my lips wants to sing) to "My feet want to dance and my lips wants to kiss", he states that this reference is the essence of erotica.

To demonstrate erotica in a biblical context, he uses the story of Ruth and Naomi - her mother-in-law - in which the latter advises her as to how best to seduce Boaz. She tells her to wait until he is a bit drunk and has fallen asleep. Then "go in and uncover his feet and lay thee down; and he will tell thee what to do". According to the researcher, the uncovering of his feet has erotic undertones.

But what is erotica? According to the researcher, erotica can be described as a form of imaginative human sexuality. Man's libido is

essential to his erotic consciousness, but not definitive. In addition, it gives meaning and shape to man's aesthetical and religious actions. Sexuality is therefore an essential part of man's existence.

He adds that erotica finds form and understanding in language. He also stresses that a clear distinction should be made between erotica and pornography. The latter is a form of suppression and masking - a perversion that can also be described as the erotica of hate. He concludes by saying that erotica is a divine spark that allows love in its purist form to blossom.

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## Deuteronomy in Hebrews

The fact of Pentateuchal influence on the writers of the New Testament, and particularly their use of Deuteronomy, is widely accepted in scholarly circles today. Substantial evidence for this is found in the explicit quotations, references, allusions and broader motifs.

The presence of quotations from Deuteronomy reflects the attitude of the NT writers towards the Jewish law and customs, at a time when early Christianity was still positioning itself – sometimes alongside, other times in opposition to it. The role of the *Shema* and the Decalogue is obvious in this regard and it occurs in almost all of the NT books that quote from Deuteronomy.

Along with Romans, Mark, Matthew, and Luke-Acts, Hebrews is identified as one of the NT books that quoted the most from Deuteronomy. It also contains the quotations closest to the beginning and to the end of Deuteronomy.

But all of the (suggested) Deuteronomy quotations in Hebrews are short and fragmentary when compared to the same author's quotations from the Psalms and the Prophets.

This raises some questions: Did he quote from memory rather than from a written text? Did he know these phrases from the early Jewish or early Christian traditions? What role did the liturgical traditions play here? Should these brief Deuteronomic phrases be seen as conscious references or allusions, rather than explicit quotations, especially in the light of the absence of clear introductory formulae and in most cases, differences in wording?

Two features are also worth noting at the outset. Firstly, unlike the Psalm quotations (and Jeremiah), the texts are not quoted with reference to divine authority. In itself this conveys the attitude that the author of Hebrews had with regard to the Torah, and especially with regard to Deuteronomy.

Another interesting phenomenon is the fact that, except for Heb. 1:6 (and it is questionable whether it really belongs to the Deuteronomy quotations – see below), all of the quotations are to be found in the latter part of Hebrews, between Heb. 10:28 and Heb. 13:5.

A closer look at these nine identified "quotations" from Deuteronomy shows, however, that there are strictly speaking *only four explicit quotations*: Deut. 32:43 LXX (Ode 2) in Heb. 1:6; Deut. 32:35-36 in Heb. 10:30-31; Deut. 9:19 in Heb. 12:21, and Deut. 31:6 in Heb. 13:5.

At least four of the instances usually identified as quotations should rather be counted as *allusions* (all of them in Hebrews 12) and the remaining one as an intended reference. Furthermore, a number of these nine cases occur as quotations in early Christian literature, or, as in the case of the very last quotation listed above, by the Jewish writer, Philo (*Conf.* 166).

Of particular interest are those that occur in Romans, for the unknown author of Hebrews quotes from the context immediately preceding a quotation (Deut. 9:3 in Hebrews and Deut. 9:4 in Romans) and also alludes to the following context of a quotation that occurred in Romans (Deut. 29:17 in Hebrews and Deut. 29:3 in Romans).

There is little doubt that the author of Hebrews is in dialogue with Jewish-Hellenistic Christians. He reinterprets some key aspects of their Jewish religious background and heritage in the light of Jesus as the exalted Son of God.

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## African theology

In its beginning African theology was mostly reactive and apologetic, and consisted mainly of comparative studies. In the latter half of the twentieth century this religious studies framework was replaced by a theological framework: African theologians concentrated on liberation theology, and the first efforts to produce an inculturated African theology can be traced.

At the end of the twentieth century African theology became more assertive and proactive. During this period African theologians concentrated on the African context as subject for the interpretation of the Bible.

Three suggestions are made with regard to the future of African theology: Firstly, the argument that African theology should be different from and abandon anything that is Western needs some rethinking.

The researcher found that African theology does not need to be different, but needs to be contextual. The question should not be "what is different", but rather "is it contextual?" By contextual is meant a contextual critical reading of Scripture and the critical appropriation thereof, or, diversely, a theology that arises from the African context, in that context for that context.

African theology should be, like any other theology, purpose and context driven. Only then will it speak on behalf of the people for the people, and will it make a difference in society and church.

Secondly, African theology, if it wants to be Christian, should be Biblical. In the Bible the life (words and deeds) of Jesus Christ, as the Word, speaks of God as the Creator of new life. He is our Saviour from sin and from ourselves.

Finally African theology, if it wants to make a difference for Africans in Africa, should be a theology of protest. It should protest, on a Biblical basis, against everything in its context and social life that is not Biblical: Corruption, poverty, crime, not caring for the sick (especially those with HIV/Aids), nepotism, misuse of (political) power and the abuse of women, to name but a few.

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## A study of space in Daniel

In Daniel 1 the Babylonian court presented a challenge to Daniel and his compatriots to continue serving the Lord as they did in Jerusalem. In the liminal phase of preparation for service in the court they created a stra-

tegy to sustain their Judean identity.

The aim of this research project was to indicate how their scheme of eating their own food was not only created from the ideological space of what Soja calls "Thirdspace", but was also conceptualised in bodily terms as a theology of containment.

Space depicted in narratives, is never without ideological meaning. It is always part of the strategy followed by the narrator. Space contributes to the narrator/author's communication of his/her/their ideology. Space not only indicates physical areas, but also has ideological meaning for those who live in it. People extend their beliefs into everyday spatial reality.

The researcher found that at the back of Daniel's resistance to eat the king's food lies an in-out pattern. The body is a container. To eat from the king's table would mean to take food into his body that would disturb his containment.

Purity rules held up the boundaries of his mental space of holiness. Now he is confronted by a threatening power in the form of the king's order to eat his food. This food is an external harmful power that should be prevented from entrance into his body.

If consumed in his body, according to the logical transfer schema stated above, this food and what it represents will become part of him. This would break down his containment and make his world come apart. His own food will keep his containment intact and act as a measure against external powers entering his body and destroying his "Second- and Thirdspace" world.

His refusal is therefore based on the above mentioned image schema of protection. It is neither the physical substance of the food nor his physical body that is endangered here. It is his mental body and his idea world that is endangered and should be protected at any possible price.

In Daniel's physical resistance to consume the king's food a battle is depicted that actually takes place not only on material level but especially on ideological / theological level. Daniel refuses to take the material food into his physical body, but in terms of Prof Mark Johnson's seven image schemata this is a direct confrontation on metaphysical level where compulsive power is met with a counterforce.

Johnson – a Knight Professor of Liberal Arts and Sciences in the Department of Philosophy at the University of Oregon-developed a theory of image schema as the basic building blocks in cognitive linguistics for conceptual metaphor, as well as language and abstract reason, which was published in his 1987 book *The Body in The Mind*.

Daniel's refusal to literally take in the king's food and his proposal to rather eat different food of his own choice is the effort of an opposing power to divert the king's power in another direction.

Thanks to the favour and compassion God gave to Daniel in the sight of the Babylonian officials, a direct physical confrontation between Daniel and the king was averted. The confrontation is, however, diverted to the metaphysical level – which Daniel won!

The researcher identified a circular movement in the mental processes taking place here. The events experienced in physical "First-space" are projected onto a second level of symbolic meaning and a third level of ideological opinion.

The choice of the physical food Daniel wanted to eat and the opposition to edible food from the king's table were dictated from the overarching ideology in "Thirdspace" conceptualised in terms of containment ideas formed from basic bodily experiences of moving in and out.

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## Perspectives on erotism and sexuality in the ancient Near East

Sexuality and erotism form an integral part of life. Both these aspects mediate life-fulfilling experiences of love. As part of the creation reality, sexuality effects a positive power of life. Evidence from the ancient Near East, especially from Egypt, Canaan and Mesopotamia, confirms humankind's fascination for and participation in sexual behaviour.

In the sexual experience the borders of the "self" is transcended to participate in the warm love of the other. Whether the gods or humans are engaged in this act of heavenly ecstasy, it is evident that life's meaning is captured in this life enriching experience of power, vitality and joy.

With regard to specific research findings it evolves from ancient Near Eastern religious texts that: sexuality is a basic human need, which is part of the creation reality. It is a positive life force; sexuality entails more than a bodily need, while erotism is the cultivated and sublime sexuality, which involves sexuality on the intellectual and artistic spheres of life.

Sexuality and eroticism cover a variety of aspects in the ancient world and were known in- and outside the so-called marriage-relationship. This includes heterosexuality, homosexuality, prostitution, sodomy, transvestitism, nekrophily, zoophily and pederasty.

Some of these aspects were viewed differently in the various cultural milieus in various time periods. Divine myths about the gods Isis, Osirus, Seth and Horus in Egypt, Gilgamesh and Enkidu in Mesopotamia, or Asherah and Tammuz (Dumuzi) reflect a wide range of sexual motifs and behaviour.

Because sexuality expresses an urge for the body, the human body is viewed overwhelmingly positive in these cultures. A beautiful, clean and perfumed body of male and female was a call for the "holy" or the transcendent world of the gods.

Nevertheless, sexuality had a high value and esteem with regard to civilisation and culture. Sexual practices were therefore integrated in a spectrum of cultural activities among various ancient cultures. This means that the borders between love and sex was not always closely knitted.

Sex outside love relationships was well known. Examples of this are holy and profane prostitution, and partners who acted as men's consorts in the public domain. The question about sexual morality or immorality in antiquity cannot be determined or solved easily from a modern or post-modern perspective.

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## Perspectives in support of the narrative turn in pastoral care

In their research project, the researchers focussed on three perspectives, which have been supportive of the narrative turn in pastoral care:

- The hermeneutics of Ricoeur, social constructionism and the post-foundationalist approach to theology. According to Ricoeur, text is not only an oeuvre, but also encompasses social institutions, art and monuments. In a pastoral conversation the people in conversation are the text. The fusion of their horizons enriches all the conversational partners, including the therapist/pastor. If stories are the most

appropriate medium to achieve transformation, the researchers state that they have to conclude that (more) stories should be told in order to create an opening for people to change.

- In an effort to define social constructionism, which encompasses a whole spectrum of different viewpoints, distinction is made between between micro – for example discursive psychology - and macro social constructionism. Micro social constructionism focuses on the role of microstructures and the use of language in interaction. Therefore social constructionism prefers story telling to an argumentative discourse.
- Postfoundationalist Practical Theology should be seen as an approach within the broad paradigm of the hermeneutical approach. And yet, it moves beyond hermeneutics as a metaphor for Practical Theology. For instance, the hermeneutical approach as such does not provide a positioning in between the foundationalist and the nonfoundationalist approaches.

This way of thinking is always concrete, local, and contextual, but at the same time reaches beyond local contexts to transdisciplinary concerns. It is contextual, but at the same time in acknowledgement of the way in which our epistemologies are shaped by tradition.

The researchers found that the concept of *local wisdom* is vital for the pastoral conversation and a basic principle in the narrative approach. It corresponds with the idea of the not-knowing position taken by the narrative therapist. The assumption on which such a conversation is based is that the real expert knowledge about a person's life is situated with the person self.

The pastor does not attempt to provide the new or alternative narrative and therefore cannot lay claim to the "success" of the pastoral care, but she/he explicitly attributes it to the parties concerned. Here, humbleness is elevated to the status of a methodical principle. The task of the pastor is to facilitate a conversation where this *local wisdom* can be re-told and re-invented in order to construct a new preferred reality.

According to the researchers, it seems as if the hermeneutics of Ricoeur, social constructionism and the postfoundationalist approach to theology are all part of one family. These epistemological approaches support the narrative turn in pastoral care and conversation on several points. These can be formulated as guiding criteria for a pastoral conversation:

- Preference for stories instead of concepts and arguments
- Locally contextual
- Socially constructed stories and identities
- In dialogue with the tradition
- Exploring interdisciplinary meaning

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## Conceptualisations of evil in African Christian theology

Africa is a huge continent inhabited by a large number of nations and cultural groups. One of the salient features of this continent is the big variety in manifestations of its traditional religions. It is therefore more or less impossible to speak of African religion as a unitary system.

This not to say however, that there are no features, which these religions have in common. It would, to a certain extent, be possible to identify a number of common denominators that would enable one to

construct a basic theoretical structure that could be called African Traditional Religion, which manifests itself in concrete and contextual form in a large number of different situations.

The aim of this research project was to study the interaction between the conventional Christian tradition on the one hand and African Traditional Religion on the other hand with special reference to the conceptualisations of evil, which is obtained in each of them respectively.

In the conventional Christian tradition the notion of evil is sometimes conceptualised in the personal categories of Satan and demons. Many theologians, however, believe that these figures are not mentioned for their own sake but only as a reality that serves to emphasize the role of Christ in the salvation of mankind from its seemingly incurable tendency towards evil.

In African Traditional Religion the notion of evil is conceptualised in terms of the general African cosmological notion that the totality of reality consists of the interaction of forces or powers. Finding one's rightful place in the hierarchical network of powers between God, ancestors, chief, father, animals and plants means to be in possession of force. Evil is experienced as displacement within this network of forces and powers.

An important implication of such a monistic system is that both good and evil are seen as being caused by the same Supreme Being. This leads to the position that the Supreme Being is regarded as good when he does not involve himself in human affairs, remaining a distant and transcendent being. The religious awareness and cultic activity of traditional African believers therefore focus more on intermediary agencies like ancestor spirits, witches and sorcerers than on the Supreme Being.

A relevant question at this point refers to the issue of the extent to which it would be possible for present-day African Christians to deal with the notion of evil in their indigenous religious tradition in a manner that is in line with the overall Christian tradition. The researcher found that there is an increasing acceptance in African Christian theological circles of the traditional African framework of thought on the nature of evil and the mechanisms of dealing with it.

According to this approach the notion of salvation is not merely a matter of the forgiveness of sins as emphasized by the tradition of the Latin West but rather the idea of Christ conquering evil as emphasized by the Greek patristic tradition.

The researcher concludes that in this way African Christian theology contributes towards reconnecting the ecumenical church with a vital element of the Christian faith that played a dominant role in the first ten centuries of Christian history.

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## Racism as religion

In 1982 the Nederduitsch Hervormde Church (NHKA) terminated its membership of the World Alliance of Churches (WARC) after this Protestant ecumenical institution suspended the NHKA's membership until the denomination consciously and meaningfully renounced the justification of *Apartheid* as a theological heresy and confessed her guilt about it.

In October 2004, the 67<sup>th</sup> General Synod of the NHKA decided to mandate the Church's General Commission to reapply for membership. The WARC's Executive Committee responded by delegating officers to visit the NHKA's leadership in Pretoria to determine whether or not the



NHKA complied with the set conditions of Ottawa 1982 in light of social attainments in South Africa since political democracy in the country from 1994 onward.

Representatives of WARC visited members of the NHKA during June 2006. The aim of the visit was to determine the extent to which the NHKA in its actions and practices has fulfilled the conditions set by the 21<sup>st</sup> General Council. Since 1994, NHKA has made the following changes to its official policies:

- Black Christians are no longer excluded from Church services, especially Holy Communion;
- Concrete support in word and deed is given to those who suffer(ed) under the system of *Apartheid*; and
- Unequivocal synod resolutions are made which reject *Apartheid* and commit the Church to dismantling this system in both church and politics.

As moderator of the NHKA, the researcher was responsible for compiling evidence – based on extensive research – to convince representatives from WARC that NHKA has indeed met the requirements as stipulated in Ottawa in 1982.

His research indicated that the church in principle already agreed on the fact that *Apartheid* is a sin and that any attempts to justify it in accordance with the Bible is nothing less than a heresy.

In addition, the researcher investigated the notion of an ethnic church (volkskerk) and argues from a Barthian perspective of "Revelation Theology" versus "Natural Theology", which means that the concept of Church is to be understood primarily as a community of believers which is brought to completion by the Spirit of God and which therefore transcends all anthropological qualifications such as race.

Against this background, "racism as religion" is confessed to be idolatry and *Apartheid* a sin. Any attempt to justify racism theologically amounts therefore to heresy.

The researcher found that the notion of an ethnic church houses an intrinsic categorical impurity in the sense that it mixes two different *genera*. Church is to be based upon rebirth and not birth, grace and not nature.

If this does not happen, the revelation of God in Christ is "civilized" and "domesticated". Such a rest of humanism has to be abandoned out of a church order.

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## Faculty of Veterinary Science

### Message from the Dean

Early in 2006 the top management of the faculty met for a "bosberaad" where a new faculty plan was developed for the four years until 2009. Some of the important decisions related to its research effort were the following:

- To make postgraduate training one of the primary thrusts in the next 4 years.
- To make research another primary thrust, aiming to stimulate and focus research on unique problems, which will give us a leading edge.
- To review our research focus areas in order to achieve this objective.
- To strengthen the existing relationships with the Universities of Utrecht, Oslo and California (Davis) and to develop further collab-

orations, both national and international.

Success with the first objective is reflected by the fact that the number of postgraduate bursaries allocated during the year increased almost tenfold.

The faculty has identified the following five research niche areas (RNAs):

- **Molecular studies on infectious and parasitic diseases of animals** A research focus utilizing biotechnology for the development of improved diagnostic techniques and vaccines for animal diseases and for the study of their pathogenesis.
- **Phytomedicine and ethno-veterinary medicine** An established multidisciplinary and collaborative research programme focusing on the development of extracts from plants with antimicrobial or antiparasitic activity for use in animal production.
- **Wildlife and Environmental Health** An inclusive research focus with contributions from all five departments of the faculty, including studies on tuberculosis in buffalo, immune-contraception in elephants, theileriosis in roan and sable, toxicity of non-steroidal anti-inflammatories in vultures and endocrine disruptors in the environment.
- **Veterinary aspects of food safety and food security** An established research focus of the faculty, which includes, *inter alia*, programmes in veterinary public health, community development, epidemiology and risk assessment and poultry health.
- **Equine and companion animal health and welfare** A research focus on infectious and other diseases of horses and other companion animals with an important impact on trade and sports

medicine (racing industry) or on the welfare and management of these animals.

The first two are being supported within the NRF Institutional Research Development Programme, meaning that projects within these niche areas will qualify for support for a 5-year period from 2007-2011. For 2007 an allocation of R1 million has already been approved for six projects within them. The first of the niche areas is also being considered for a DST Research Chair.

Last but not least, the faculty hosted an accreditation visitation by the South African Veterinary Council (SAVC) during the year. The SAVC is the custodian of the veterinary and para-veterinary professions in South Africa and has the legal responsibility to ensure that training standards for registration are met.

The outcome of the visitation was positive although several constructive suggestions for improvements were made, *inter alia* greater exposure of undergraduate students to research activities. Implementation of this proposal should help solve the faculty's perennial problem of attracting more postgraduate students.

**Prof GE Swan**

## Highlights

### Saving endangered Asian Vultures

Veterinary use of the nonsteroidal anti-inflammatory (NSAID) drug diclofenac in South Asia has resulted in the collapse of populations of three vulture species of the genus *Gyps* to the most severe category of global extinction risk. Vultures are exposed to diclofenac when scavenging on livestock treated with the drug shortly before death.

Diclofenac causes kidney damage, increased serum uric acid concentrations, visceral gout and death. Concern about this issue led the Indian Government to announce its intention to ban the veterinary use of diclofenac by September 2005. Implementation of a ban was still in progress late in 2005 and to facilitate this, researchers at Onderstepoort's Paraclinical Sciences sought potential alternative NSAIDs by obtaining information from captive bird collections worldwide.

Researchers from the Royal Society for Protection of Birds in the United Kingdom (UK) found that the NSAID meloxicam had been administered to 35 captive *Gyps* vultures with no apparent ill effects. The researchers then undertook a phased programme of safety testing of meloxicam on the African white-backed vulture *Gyps africanus*, which they had previously established to be as susceptible to diclofenac poisoning as the endangered Asian *Gyps* vultures.

In addition, they estimated the likely maximum level of exposure (MLE) of wild vultures and dosed birds by gavage (oral administration) with increasing quantities of the drug until the likely MLE was exceeded in a sample of forty *Gyps africanus*.

Subsequently, six *Gyps africanus* were fed tissue from cattle which had been treated with a higher than standard veterinary course of meloxicam prior to death.

In the final phase, ten Asian vultures of two of the endangered species (*Gyps bengalensis* and *Gyps indicus*) were dosed with meloxicam by gavage; five of them at more than the likely MLE dosage. All meloxicam-treated birds survived all treatments and none suffered any obvious clinical effects. Serum uric acid concentrations remained within the normal limits throughout, and were significantly lower than those from birds treated with diclofenac in other studies.

The researchers concluded that meloxicam is of low toxicity to *Gyps* vultures and that its use in place of diclofenac would reduce vulture mortality substantially in the Indian subcontinent. Meloxicam is already available for veterinary use in India.

Swan was awarded the 2005 Sasol Vulture Conservation Award in recognition of his leadership role in this research project. He received the award in 2006.

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### Origin of elevated urea:creatinine ratio in canine babesiosis

Pigmented serum, usually due to free haemoglobin and/or bilirubin, is a common finding in dogs with babesiosis, resulting in interference with all biochemical tests that rely on photochemistry. This is particularly true of urea and creatinine determinations, complicating the diagnosis of acute renal failure, which is a serious complication of babesiosis.

A disproportionately raised serum urea concentration of unknown origin occurs in severely anaemic canine babesiosis patients and gives rise to an increased serum urea:creatinine ratio.

The assay for cystatin-C, an excellent measure of glomerular filtration rate is unaffected by free serum haemoglobin, and due to its different intrinsic origins free of influence by the metabolic derangements and organ pathology, other than renal disease, encountered in canine babesiosis. Serum cystatin-C was used to compare the concentrations of serum urea and serum creatinine in dogs with the severely anaemic form of canine babesiosis as well as a canine babesiosis-free reference group.

Mean serum urea and mean serum urea:creatinine ratio were significantly elevated in the babesiosis-infected group relative to the reference population in this study. Mean serum creatinine and mean serum cystatin-C were within the reference ranges.

Therefore an elevated urea:creatinine ratio in canine babesiosis in the presence of a normal serum creatinine concentration is considered to be caused by an elevated serum urea concentration and is most likely of non-renal origin.

Serum creatinine was therefore as specific a measure of renal function as serum cystatin-C in canine babesiosis in this study. The sensitivity of serum creatinine as a measure of renal function was not established by this study. Serum urea, however, proved to be of little use compared to serum cystatin-C and serum creatinine. Serum urea should therefore not be used to diagnose renal failure in canine babesiosis.

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### Canine babesiosis

The pathophysiology of canine babesiosis, a common and often fatal disease of dogs, has many similarities to human malaria. Research undertaken by the Department focused on the effect of experimental anaemia on body function and compared it to the pathophysiological processes of babesiosis and malaria anaemia.

In one study the haemodynamics of the left renal artery and interlobar artery were evaluated in beagles with severe acute, moderate chronic and mild chronic normovolaemic anaemia using Doppler ultrasound.

The researcher recorded the heart rate, peak systolic velocity (PSV), end diastolic velocity (EDV), time-averaged mean velocity (TMV), pulsatility index (PI) and resistive index (RI). He then compared these values in the dogs following the induction of anaemia to corresponding values in the same dogs prior to the induction of anaemia.

He found that the left renal artery's mean PSV, mean PI and mean RI were significantly higher and the mean EDV significantly lower in severe acute anaemia. Knowing these changes occur in acutely anaemic patients will prevent attributing these changes to other disease conditions and thus help to prevent misdiagnoses.

No significant change in mean values of the same parameters in moderate or mild chronic anaemia was found. In addition there was also no significant change in TA mean of the LRA or mean PI and mean RI of the ILA in any grade of anaemia implying that if changes occur in these parameters in moderately anaemic patients another cause must be found for the abnormal values.

The researcher also found that acute, severe normovolaemic anaemia significantly altered LRA Doppler parameters in resting dogs without influencing those of the ILA emphasizing the differences that occur in different kidney vessels.

## Diagnostic imaging of wild cats

The economic value of wild large cats in their natural habitat or in conservation breeding programmes is considerable, particularly if they are an endangered species such as the cheetah.

These large cats are occasionally presented to the Onderstepoort Veterinary Academic Hospital with clinical problems. Researchers in the department focused their research on determining the normal imaging anatomy of the animals in an effort to gain a greater understanding of the disease processes that affect these unique patients.

In one of the projects, researchers focussed on the cheetah abdomen using ultrasonography. They found that there were several differences when compared to the abdomen of domestic cats.

The cheetah's gall bladder is often bilobed with an enlarged tortuous common bile duct which in a domestic cat would be indicative of bile duct obstruction. The description of the normal ultrasonographic anatomy will allow the researchers to be able to better interpret the changes seen in the important diseases of captive cheetahs such as gastritis, glomerulosclerosis (chronic kidney disease) and hepatic veno-occlusive disease.

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## The curse of the tsetse fly

Trypanosomosis or Nagana which is transmitted by tsetse flies, remains a major constraint to livestock production in sub-Saharan Africa. The disease causes increased mortality rates and reproduction is also severely reduced. In an attempt to develop sustainable trypanosomosis control strategies, researchers in the department collaborated with the Institute of Tropical Medicine, Antwerp, Belgium, and the ARC-Onder-

stepoort Veterinary Institute. The research has resulted in a number of interesting findings.

Studies on the virulence and transmissibility of *Trypanosoma congolense* isolated in eastern Zambia revealed a high level of genetic diversity in the trypanosome population. This variability was reflected in different levels of pathogenicity and transmissibility by tsetse flies.

Studies on factors determining the susceptibility of tsetse flies to trypanosome infection showed that starvation significantly increased the flies' susceptibility. On the other hand, subsequent studies revealed that feeding tsetse flies a single blood meal containing a trypanocidal drug (isometamidium chloride) made treated flies resistant to infection with trypanosomes.

Field studies in KwaZulu-Natal showed the high prevalence of trypanosomal infection in cattle kept at the edge of Hluhluwe-iMfolozi Park. Field experiments determined the effectiveness of various control methods under the conditions prevailing in the province.

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## Theileriosis in Roan antelope: Investigating vaccination as a method of control

Theileriosis is the single most important fatal disease of Roan and Sable antelope, contributing to decreasing population numbers throughout South Africa. High mortalities are especially encountered among calves. Theileriosis is a tick-transmitted bloodborne protozoal disease.

Conventional methods of control failed to prevent the disease on game ranches throughout the country. Research into vaccination as a method of control has been conducted since 2002 on a game ranch in Malelane.

An in-depth article about this research project appeared in the 2004 Research Report. Since then, the following progress has been made:

- The tick vectors involved were identified. The main vector involved is the "red legged tick" (*Rhipicephalus evertsi evertsi*) with the "brown ear tick" (*R.appendiculatus*) playing a suspected secondary amplification role during theileriosis outbreaks;
- A tick derived stabilate was prepared by laboratory infection of ticks (*R. e. evertsi*) and processing to obtain an injectable infective material. This will be used as a live vaccine during the vaccination procedure, resulting in life long immunity;
- Successful inoculation, treatment and post vaccination challenge with infected ticks proving immunity; and
- Vaccination trials, under various management systems (intensive vs. semi-extensive conditions) showed that the stabilate can be used effectively in practise.

The researchers are currently testing the production of a similar vaccine for Sable antelope under field conditions.

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## Tick identification

Research into ticks continued being productive. Researchers in the department established that the bont-legged tick, previously known as *Hyalomma marginatum turanicum* in South Africa, was in fact *Hyalomma glabrum*. This is the only bont-legged tick that occurs exclusively in the southern hemisphere.

The geographic distributions of the six tick species that infest tortoises and other reptiles in South Africa were all mapped from collection data. The known distributions and ecological preferences of blue ticks of the subgenus *Boophilus* in Africa and Latin America were established.

It was established that, contrary to popular belief, not one of five burning regimens that were applied in the south of the Kruger National Park had an effect on the numbers of free-living ticks on the vegetation.

## Goats as alternative hosts of cattle ticks

The objective of this study was to compare the presence on goats and cattle of adult ticks that usually infest cattle. To this end ticks collected from sets of five goats were compared with those collected from sets of five cattle at 72 communal dip-tanks in the eastern region of the Eastern Cape Province.

The bont tick *Amblyomma hebraeum* was present on goats at 25 and on cattle at 39 dip-tanks, and a total of 61 goats and 138 cattle were infested. Adult blue ticks, *Rhipicephalus (Boophilus) microplus* were present on goats at 48 and on cattle at 69 dip-tanks, and a total of 113 goats and 242 cattle were infested.

Adult brown ear ticks, *Rhipicephalus appendiculatus* were pre-sent on goats at 70 and on cattle at 67 dip-tanks, and a total of 296 goats and 271 cattle were infested. Adult red-legged ticks, *Rhipicephalus evertsi evertsi* were present on goats and cattle at all 72 sampling localities, and a total of 334 goats and 316 cattle were infested.

These results underscore the necessity of including goats in any tick control programme designed for cattle at the same locality.

## The host status of African buffaloes

The objective of this study was to assess the host status of African buffaloes, *Syncerus caffer*, for the blue tick *Rhipicephalus (Boophilus) decoloratus*. This tick is a vector of babesiosis (redwater) in cattle. To this end the blue tick burdens of ten buffaloes examined in three north-eastern KwaZulu-Natal Province (KZN) nature reserves were compared with those of medium-sized to large antelope species in these reserves and in the southern Kruger National Park (KNP) in Mpumalanga Province.

The blue tick burdens of the buffaloes were considerably smaller than those of the antelopes in the KNP, but not those in the KZN reserves. The life-stage structure of the blue tick populations on the buffaloes, in which larvae predominated, was closer to that of this tick on blue wildebeest, *Connochaetes taurinus*, a tick-resistant animal, than to that on other antelopes.

A single buffalo examined in the KNP was not infested with blue ticks, whereas a giraffe, *Giraffa camelopardalis*, examined at the same locality and time, harboured a small number of ticks.

In a nature reserve in Mpumalanga Province adjacent to the KNP, two immobilized buffaloes, from which only adult ticks were collected, were not infested with blue ticks, whereas greater kudu, *Tragelaphus strepsiceros*, examined during the same time of year in the KNP harboured large numbers of adult ticks of this species.

African buffaloes would thus appear to be resistant to infestation with blue ticks, and this resistance is expressed as the prevention of the majority of tick larvae from developing to nymphs.

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## The reproductive biology of ratites

South Africa has a vibrant ostrich industry, which has made a major contribution to the economy. Recently, a second economically important ratite, the emu, has been introduced to South Africa. Emus are being reared in South Africa mainly for their subcutaneous fat, from which emu oil is extracted.

The extraction and processing of emu oil is a growing industry in South Africa. It is widely used to alleviate the symptoms of arthritis in humans. Although both ratites, the ostrich and emu have different breeding seasons. The ostrich is generally a long day breeder, while the emu breeds during short day lengths. A common feature of both is the low fertility rate in captivity.

Research has been conducted on the reproductive biology of both immature and mature female ostriches in order to provide basic information, which may then be used to elucidate the reasons for low fertility in these birds. The project has now been expanded to include the female emu.

Immunohistochemical studies on the distribution of intermediate filaments in the ovaries of the emu and ostrich have highlighted similarities and differences between the two. In both smooth muscle actin immunoreactive fibroblast-like cells were demonstrated in the theca externa of vitellogenic follicles.

These cells are most likely involved in the ovulatory process, as well as in the infolding of the follicular wall during atresia. In the ostrich smooth muscle actin and desmin immunoreactive fibroblast-like cells were prominent features of atretic vitellogenic follicles.

Although the stages of atresia in the emu appear similar to those of the ostrich, smooth muscle actin and desmin immunoreactive cells were not observed in the emu. Instead atretic follicles in the emu were characterized by the presence of numerous melanocytes, the function and significance of which is unclear at present.

Information gained from this project on the morphology and stages of degeneration of ovarian follicles in the ostrich and emu establishes a baseline for researchers investigating ovarian dysfunction in ratites.

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## Academic Support Services Education Innovation

### The state of research-based postgraduate education at the University

The Unit for Research and Development (University Education) was commissioned to do a survey on the current state of postgraduate education at the University. The information gained from this research will inform strategic decisions regarding the development and support of postgraduate education, and will also be used in preparation for the 2007 institutional audit by the Council for Higher Education (CHE).

The aim of the study was to do an institution-wide survey on the state of research-based postgraduate education at the University as seen by its senior postgraduate students (research-based Masters and Doctorate candidates).

The findings of the different phases were consistent and highlighted a number of key needs including:

- general information needs (programme, facilities, funding, access);
- key academic information services (electronic information resources, subjects specialist support, selection of reference material, loan periods);
- clarification of roles and responsibilities of role-players associated with the postgraduate episode;
- inclusion of postgraduate students into the research community;
- structured supervision and support (especially during proposal development and approval stage);
- the revisiting of current training and development programmes in research methodology skills, academic writing and editorial support;
- smaller postgraduate supervisor: student-ratios;
- improved connectivity for postgraduate students;
- acknowledgement of the personal circumstances of postgraduate students; and
- accommodation and parking arrangements for postgraduate students on campus.

The research highlighted a relationship between three key variables. Students that have not developed the ability to manage their time, as well as their personal circumstances and other responsibilities properly, find it difficult to focus on the selected research topic, which leads to either their not completing their studies in the prescribed time, or eventual withdrawal.

These students tend to transfer the responsibility to supervisors by demanding a more structured approach in supervision. Students' experiences of their postgraduate exposure are determined by two drivers, namely students' level of satisfaction with their postgraduate

experience, and their ability to cope with the collective realities associated with postgraduate studies.

A number of events/causes trigger four typical categories of persistence behaviour. These causes determine whether students withdraw, continue, complete and return to the UP to further their higher education. A model is proposed to explain these behavioural patterns.

### Guidelines for teaching and learning

The University adopted a strategic document which makes provision for key points of departure on teaching; assessment and curriculum design; as well as providing more specific guidelines to be borne in mind by faculties, departments and lecturers when planning these important functions.

As stated in its Strategic Plan, 2006 - 2010, the University is committed to the scholarship of teaching, recognising that the act of teaching involves more than the transmission of facts or the transfer of knowledge.

The guidelines acknowledge teaching as a deep intellectual engagement moving beyond formal instruction to setting a climate in which established knowledge is engaged, critical questioning is encouraged, and new knowledge forms are discovered and appreciated.

The scholarship of teaching recognises the symbiosis between teaching and research, emphasising that the best teaching draws on, and is informed by, the newest developments in research while it simultaneously extends and enriches knowledge, thereby raising new questions for advanced inquiry.

The scholarship of teaching recognises the diversity of learning styles, experiences and backgrounds represented within the student body, and responds in ways that accommodate such variation.

The scholarship of teaching works from the assumption that assessment is a vital instrument in improving teaching and learning through structured and regular feedback from and to students. Assessment therefore influences university teaching, and is crucial to building responsiveness in the ways teaching is conducted and learning supported at the University. (A full-length article on the Scholarship of teaching appears on page 54)

### Assessment Framework

Following the development work completed by a task team during 2005, the year under revision saw the refinement of these principles, the integration of internal and national regulations and policies, as well as the gradual inclusion of recommended "best practices" into the framework.

The framework was used as a foundation for the development of a formal assessment policy in collaboration with the Quality Assurance Unit. The purpose of the policy is to provide a vision for assessment and to align the strategic plan, institutional policy, regulations and guidelines on the assessment of student learning.

Other objectives of the policy are to:

- define the principles on which the UP bases its assessment practices;
- serve as a resource to provide information on current policy related to the assessment of student learning;
- inform and guide assessment practices at the UP;
- provide a framework according to which faculty assessment policy and practices can be organised and interpreted; and
- create an institutional awareness regarding the UP's responsibility

and accountability towards assessment of student learning.

The policy makes provision for 13 internationally accepted key principles of assessment. Faculties are responsible for ensuring that their policies and practices as well as the information contained in their year-books are aligned with this policy.

## Permanent undergraduate withdrawals

Student throughput (completion rates and drop-out) has become a national concern during recent years. The University maintains a database on this phenomena and has introduced a number of interventions, such as anti-semester courses and summer schools in order to enhance throughput.

In order to gain a better understanding of the reasons why students withdraw, an exit interview instrument was developed during 2004. The aim of the study was to assess the legitimacy of the withdrawal categories and to do a comparison between category choices on the cancellation letters and reasons identified during telephonic exit interviews done with 100 students.

A comparison between the results of the exit interviews and the data generated during actual cancellations using the agreed-upon institutional categories, revealed a discrepancy in some of the categories. The research revealed a "Big Five" set of reasons for withdrawal, namely academic reasons, study choice, financial reason, health reasons and dismissal.

Congruency between the actual reason for withdrawal (exit interviews) and institutional data volunteered by students on the cancellation letter will be enhanced when students are put through an exit interview, facilitated by a qualified interviewer.

## Feedback on the quality of undergraduate education

Research on the instrument used for undergraduate student feedback (contact and web education) came full circle with the implementation thereof during April 2006. The revised version:

- makes provision for statistically confirmed reliable information on teaching quality and assessment practices of individual lecturers;
- serves the objectives of quality assurance, performance management, and academic staff development, taking into consideration the lecturer's performance over a number of feedback episodes;
- A paper-based data capturing instrument, and a fully automated electronic manipulation and reporting facility; and
- The instrument was also activated on *Umfundi* (an electronic survey facility) to assess the potential of electronic data capturing and manipulation towards a fully automated system.

An instrument was developed to gain student feedback on the quality of programmes. Following permission from a renowned author in this area (Paul Ramsden: Course Experience Questionnaire), the instrument was adapted and contextualised for local use. The instrument was activated on *Umfundi* (an electronic survey facility) for use during external audits at institutional, faculty and departmental level.

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## Study Guide

Further to a decision taken by the Vice Principal's committee in June 2005, the Department for Education Innovation embarked on a survey of study guides at the UP and a review of the guidelines and criteria used to evaluate study guides.

**Phase 1** of the project comprised a survey of a representative sample of study guides. The survey was conducted by EI Education consultants, according to a generic set of core criteria. Feedback was provided to all deans and follow-up actions and interventions were negotiated between education consultants and faculties. These initiatives are currently underway and aim to facilitate the ongoing development and improvement of study guides.

**Phase 2** involved a review by an external panel, of the guidelines and criteria for the development and evaluation of study guides. The feedback from the external panel was consolidated and used by the education consultants to develop and adjust the guidelines and criteria accordingly. The improved guidelines and criteria will guide lecturers in the process of developing and upgrading their study guides.

A follow-up initiative planned for 2007 will include a survey among students as prime users of study guides, to determine their perception of the quality and usefulness of study guides in providing learning support. It is recommended that the UP-wide survey and review of study guides be repeated every three years in order to ascertain and monitor continuous development and improvement.

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## The Smart Podium

At present the majority of venues at the UP do not reflect best practice for teaching and learning. Lecturers are hampered in their teaching activities by audiovisual equipment that is not standardised, integrated, maintained and/or supported. Compared with international standards, even the allocated number of educational technology support staff does not measure up quantitatively.

Existing, and in particular, newly planned educational venues need to integrate technology in such a way that it is didactically, ergonomically and aesthetically conducive to being used seamlessly and with ease by the lecturer. As part of the strategy to equip venues with well-integrated educational technology, the concept of installing a "Smart Podium" in all priority classrooms was investigated.

The Smart Podium will play an essential role in making available and safely housing in one unit, all the equipment that a lecturer requires (e.g. networked PC, screen, keyboard, DVD player), as well as a control panel to operate the various items of equipment as well as sound and lighting.

A prototype was demonstrated to stakeholders during the latter part of 2006. During the demonstration, further developmental needs were identified, which was incorporated in the design. Four adapted prototypes will be developed and placed in the Chancellors building during 2007.

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## Teaching large classes

During 2006 a detailed needs analysis was undertaken by EI with the aim of identifying the problems lecturers experience when teaching large classes. Brainstorming sessions were facilitated in the Faculties of Humanities and Economic and Management Sciences. The most significant findings were as follows:

- A dire need was expressed for the optimisation of the learning environment, which includes upgrading of lecture halls and media for teaching;
- Although measures have been put into place by most departments to handle administrative tasks, these are not ideal as they are temporary and often costly;
- Timely and appropriate assessment of learning is a huge problem and continuous assessment is not possible. The reliability of the assessment is compromised with multiple assessors having to be employed;
- Teaching appears to be very unsatisfactory as discipline is a problem and relationship building is not possible. Synchronization of multiple lectures is problematic. Lecture halls are not suitable for active or collaborative learning;
- The workload is not distributed evenly in departments and this affects personal motivation. Lecturers do not find time to keep abreast in their field of study due to time constraints; and
- The value of well-designed study guides and the importance of additional learning material or opportunities, e.g. as is made possible with web-supported learning, are evident. Additional tutor support is seriously needed.

Problems associated with large classes are multifaceted and a holistic approach is needed. In the Faculty of Economic and Management Sciences follow-up induction sessions will be organized by the Department for EI. The aim is to facilitate discussions between heads of departments, school chairs and new lecturers in order to find solutions that will fit the needs of a specific department.

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## Academic Information Service

### South African Research Information Service

In 2004 and 2005 the Academic Information Service (AIS) participated in the South African Research Information Service Project, which was funded by the Ford Foundation. The aim of the project was primarily to identify ways in which access to information for all South African researchers could be improved.

During the course of the investigation it became clear that e-science/e-research was not getting coherent attention in South Africa and hence it was added to the agenda. The project concluded with a proposal for an e-Research Service for South Africa.

In 2006 AIS continued with these e-research initiatives, which resulted in a number of very successful contributions to the UP research environment including:

## UPSpace

The institutional research repository, known as UPSpace, was implemented. An institutional repository (IR) is an integrated online locus for collecting and preserving - in digital form - the intellectual output of an institution. In the case of a university this would include research articles, theses, dissertations and other digital objects generated by normal academic life.

The main objective of an IR is to enhance the visibility of the knowledge products created by an institution's members by providing easy open access. It also has the following additional advantages for :

- **The University's researchers:** Improved readership of their outputs leading to impact and research progress, persistent URLs for citations, dialogue with colleagues;
- **The University:** Complete and coherent record of scholarship, long term archiving and preservation, the ability to influence dissemination;
- **Researchers worldwide:** Access to material that was previously unavailable leading to better research; and
- **The country:** Better return on the investment in research.

The open source platform, DSpace, which was developed by an MIT-Hewlett Packard alliance was selected for the UP IR. It is widely used throughout the world and has a strong supportive user group. A campus wide team investigated the usability of the system, tested the system and developed specifications for the customization of the system to local needs.

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## UPSpace Collections

Although UPSpace is still in its infancy the following collections have taken shape during 2006:

**The Arnold Theiler collection** of photos and memorabilia of Sir Arnold Theiler (1867 - 1936), widely known as the founder of veterinary science in South Africa.

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**The Mapungubwe collection** of documents, photographs and pictures of artifacts in the Mapungubwe Museum. The museum contains original archaeological cultural material excavated from the Iron Age archaeological sites, Mapungubwe and K2. The University has been the custodian of this national heritage since its discovery in 1933.

This collection provides researchers and the general public access to these invaluable items. Special collections of rare and

valuable books, documents, manuscripts, maps and other material such as the *African Heritage Digital Collection* are included. Parts of this initiative were undertaken in co-operation with the Department of Architecture.

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The **Jonathan Jansen Collection**, featuring the research output, media columns, speeches and interviews of the dean of the Faculty of Education.

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## openUP

The collection of research articles produced by UP affiliates is also housed on UPspace and is called openUP to signify its strong relationship to the international open access movement. Open access underscores the philosophy that "the research literature, which is not written for profit but for the advancement of science and which is largely funded by public money, is a public good and should be accessible to everyone who has a need for the information."

One of the ways to realise this is for the research institution to actively influence the dissemination of its knowledge products. Since the copyright of research papers is generally signed over to publishers, copyright clearance, forms an important part of the work of the openUP office.

The aim of this initiative is to integrate this collection with the research information management system (RIMS), the UP research report, the collection of electronic theses and dissertations (UPeTD), research data and to provide different views of the collection.

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## Digitization

Sophisticated infrastructure is necessary to digitize the University's valuable old collections to preserve them for posterity and to make them available on UPspace. In 2006 three sophisticated scanners were acquired for scanning scarce and brittle material. The AIS is the first library in South Africa to buy the Digibook10000RGB scanner.

The scanner's cradle has been specifically designed to minimise handling and to protect brittle documents, particularly book spines, during the process. Its flat bed can accommodate big items such as maps up to A0 (32 times A4).

The DigiBook has a very powerful camera lens with the ability to zoom in on the minutest detail. It is capable of high output: normal colour scanning at 300dpi takes 28 seconds per page. Additionally a special microfiche/microfilm scanner as well as a dedicated slide scanner has been added to this environment positioning the AIS to make great strides in the coming years.

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## Google Scholar

In recent years AIS has been confronted by a new breed of client, the so called "net generation" who prefer Google to library searches, want quick answers and instant gratification at the end of no more than three clicks from a simple interface. This has been confirmed in client surveys such as LibQUAL+.

A solution to this problem has been forthcoming in the form of federated search engines which have the ability to do a global/meta/broadcast search of different collections simultaneously. Thus the library catalogue, e-journals, subscription databases, e-print collections, digital repositories and web pages can be searched at the same time and the results blended.

To further improve on this a link resolver can be added to the solution to connect the resultant references to available full text resources. A number of these products are available commercially.

A project was undertaken by AIS to evaluate these products as possible solutions to our local needs and to assemble the necessary information to produce a business case for the acquisition thereof and for guiding future plans. The libraries of the University of the Witwatersrand, University of South Africa (UNISA) and the Council for Scientific and Industrial Research (CSIR) indicated that they too are interested in a similar solution and were invited to participate in the evaluation.

Seven sessions were held and vendors were given the opportunity to demonstrate their products via the internet, a Q&A session was held via telephone conferencing and was followed by a hands-on session. An expert review checklist was used as evaluation instrument and followed up by online discussion via e-mail and a blog. Important criteria such as search functionality, search results, interface features, user access and vendor support were examined.

The result was that none of the commercial products fully met the expectations of the AIS. Therefore an interim solution was developed by combining the two free products Google Scholar (as a federated search engine) and ScholarSFX (as a link resolver). This unique local implementation provides an enriched version of the Google interface with live links to electronic resources to which the library has access. It is



available from the AIS web site. It has the following advantages:

- Single one-stop searching point;
- Time saving;
- Less training for students;
- Immediate access to full text via link resolver;
- Optimisation of expensive databases;
- Google-users are guided back to high quality library resources; and
- The library's presence is increased.

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## The future of research publishing in South Africa

In 2005 an investigation into the future of research publishing in South Africa was undertaken by the Academy of Science of South Africa (ASSAf). The very limited visibility of and impact of South Africa's researchers has been a constant source of concern for a long time.

The work of a task team assembled by the Academy under the leadership of Prof Wieland Gevers included a bibliometric assessment of SA research publications, a comprehensive analysis of SA research journals, a survey of editors' opinions and global e-research trends and was followed by conclusions and recommendations.

The findings were published in the *Report on a Strategic Approach to Research Publishing in South Africa*.

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## Virtual research environments

A solution should ultimately be found for the researcher's need for an integrated virtual research environment where all the current products and tools available to them will be combined with new capabilities such as digital curation of research data, described as "going beyond data archiving and digital preservation, to include the active management and appraisal of data over the life cycle of scholarly and scientific interest". (Conversation with Dr Peter Burnhill, Director, Digital Curation Centre, Edinburgh, UK, 2004).

The AIS and CSIR Information Services have formulated a project proposal: "Identifying the requirements of a specific VRE (virtual research environment) in a South African context" in order to create a conceptual model and develop a prototype VRE. A VRE can be defined as follows: a set of online tools and other network resources and technologies interoperating with each other to support or enhance the processes of a wide range of research practitioners within and across disciplinary and institutional boundaries.

A key characteristic of a VRE is that it facilitates collaboration among researchers and research teams providing them with more effective means of collaboratively collecting, manipulating and managing data, as well as collaborative knowledge creation.

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## International co-operation

Library staff who were involved in e-research initiatives attended national and international conferences, delivered ten papers and posters and visited key institutions such as the United Kingdom (UK) Digital Curation Centre in Edinburgh, and the libraries of the Universities of Illinois, Michigan, Glasgow and Strathclyde (Glasgow) to discuss issues of mutual concern, co-operation and to inform themselves of the latest trends and developments.

A particular highlight was the visit by Prof Tony Hey to the UP during the second half of 2006. Hey is a former Core Programme Director for UK eScience and chair of the JISC committee on eScience. He is currently the Corporate Vice President of the Technical Computing Microsoft Corporation, based in the United States of America (USA). He gave an open lecture on e-Research and Repositories and held discussions with members of the executive, Library Committee and top UP researchers.

## LibQUAL+™

In August 2005 the UP took part in the annual international LibQUAL+™ survey for the first time. LibQUAL+™ is a measuring instrument for libraries based on the SERVQUAL concept and developed at the Texas A&M University. The survey was done online and measured three dimensions of information support:

- Clients' command of their personal information space;
- Competency and attitude of staff; and
- The library as place.

AIS undertook the Afrikaans translation of LibQUAL+™ with support from the University of Stellenbosch Library Service and the Ferdinand Postma Library of the University of North West.

The basic information was analysed by LibQUAL and the free text comments by the AIS Quality Unit. The information is used to inform planning and to rectify identified problems. The 2005 results for postgraduate students revealed a number of serious problems for this very important sector of the University's researcher population.

The survey was therefore repeated in 2006 to measure the impact of changes such as the purchasing of additional bandwidth. The results have been shared with postgraduate students.

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