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CONTENT

MESSAGE
from the DEAN
2017 ANNUAL REPORT

2016 will be remembered as one of the worst years for tertiary education in South Africa due to student unrest – first the #RhodesMustFall, and then the #FeesMustFall movements. The timing of these movements placed tremendous pressure on university staff, especially within our faculty where many practical lectures were unfinished. To give our students a fighting chance to complete the year successfully, we had to think innovatively and plan carefully throughout the last part of the semester. A positive outcome was that staff moved to a more blended approach in the curriculum. It also alerted us about what is more relevant for industry. Unfortunately, the aftereffect of the unrest left students less well prepared for 2017 than they should have been (especially in the more mathematical courses), and it reflected in their results. We trust that similar incidents will not reoccur, as it affects the academic integrity and performance of our students.

The theme of our 2017 annual report is 'Academic Silos' – with silo being used as a metaphor and not an actual silo. According to the Oxford Dictionary, the literal meaning of silo is "a tower or pit on a farm used to store grain". The metaphorical meaning is: "A system, process, department, etc., that operates in isolation from others".

Picture a grain elevator – which is a collection of bins – where each bin could contain a unique product, and once a product is there, it remains. It should have no interaction with any other silo. The other silos can be emptied, shipped, or refilled with new products, without affecting the silo in question. In an organisation, there are people and groups that behave in the same manner: Their little slice of the world does not interact with the rest of the organisation. They make decisions without considering how they affect the rest of the business. Like grain silos, they have (and work to maintain) barriers around them. Typically, they are perceived as being less interested in the overall success of the organisation, and more occupied with maintaining their normal state.

The 'Silo Effect' in academia refers to professors who become so isolated within their own academic neighbourhood that they experience minimal interaction with colleagues and other departments. One unintended outcome of this siloed approach to research, is a duplication of effort. Such isolation results from the pressures of class preparation, grading, advising, committee work, service to the institution, continuing education, writing and publishing, participation in conventions, speaking engagements, additional teaching duties for other institutions, and community service. The rat race of the academic year can cause an academic to get into a routine or a 'zone' where every minute is scheduled and accounted for. Unfortunately, these packed schedules leave little time for significant social and professional interactions with colleagues, for example teatime gatherings and departmental functions. It is usually during these interactions (and sometimes robust discussions) that

new research ideas are born. How many academics are aware of what others in the department are busy with?

One key component that natural/agricultural scientist tend to ignore, is the integration with social science. It is time for us to interact with the social scientists much more, and to bring the human-factor component into our research.

Isolation from others can be detrimental to your professional development. We gain new knowledge and insights by interacting with colleagues in other fields, and even within our own field. Sharing ideas and experiences can also improve our teaching. People are not as effective or productive when they work alone as when they collaborate with others. To examine your own experience of the 'silo effect', reflect on these questions:

- How many different colleagues do you interact with each week?
- How many hours per week do you spend on interacting with colleagues? And how many hours do you spend working alone?
- Are you satisfied with the amount of interaction that you have with colleagues?
- How much interaction do you have with other departments in the faculty, and in other faculties?

Is it possible for academics to break through the silos to form relationship networks across departments and across faculties? With our intentional strategy, we want to break down the barriers between faculty members and encourage interaction that will help them improve their effectiveness as educators, while also meeting some of their personal needs.

- **Performance:** Unfortunately, most higher education institutions do not place value on teamwork among faculty members. Not much weight is placed on how well or how much a faculty member works with other faculty members during performance discussions. Each faculty member is only rated on his or her own individual performance in relation to those of others in the institution and outside the institution. We should reconsider a true measure of performance.
- **Competition:** During the year, we developed an integrated transformation plan that concentrates on breaking down the silos and encourages research across departments and faculties. We intend to introduce a competition for all academics, during which they can discuss their research within a few minutes. This should provide a platform for informing staff about what researchers in the various departments do, and what the faculty is busy with.
- **Equipment:** Supporting cutting-edge research is critical to the mission of universities. For this, we need state-of-the-art equipment that can be used across faculties. We started a programme during the year to determine the equipment needs, as well as discussions on how we will be able to afford it.

The current financial situation requires academics to rely more on finding their own funding by means of grants and interaction with industry. Therefore, it is necessary that we market relevant research required by industry. We cannot afford to continue doing research that is only of an academic nature; we must adapt to what industry requires from us. This implies that we will have to interact with the various disciplines of industry more regularly. Industry requirements change every year, and we must make sure that we remain relevant.

That said, we need real silos on the farm as well. We adopted a more hands-on training approach on the farm, necessitating the re-introduction of the dairy, a piggery, broiler unit, and intensive sheep unit. To make this viable, we must produce more of our own food; therefore, we rented the experimental Pannar farm in Bainsvlei where we intend to produce maize and lucerne for the farm's needs. We do need to fill the silos!

Staff and student achievements

Department of Physics:

Edward Lee won the best student/postdoctoral oral prize at the annual Physics conference. This prize is accompanied by a Young Scientist Award from the International Association of Advanced Materials. The department also won the runner-up student/ postdoctoral oral prize, the best postdoctoral poster prize, and the second runner-up student poster prize.

Prof Hendrik Swart received funding for the Research Chair in Solid State Luminescent and

Advanced Materials from SARChi for another five years.

Postgraduate students from the Department of Physics attended the *Suid-Afrikaanse Akademie vir Wetenskap*

en Kuns Studentesimposium 2017 hosted by the University of Pretoria. Our students did an incredible job in presenting their respective research projects in Afrikaans. Two students claimed first place in their respective sessions, and two were rewarded with the second place in their sessions.

Profs HC Swart, JJ Terblans, and two MSc students attended the 9th International Conference on Advanced Materials, ROCAM 2017, in Bucharest, Romania, from 11 to 14 July 2017, where Prof Swart gave an invited talk and the others presented their work at the conference.

Department of Plant Sciences:

Sadie Geldenhuys and Cornél Bender both received a UFS Merit Award for outstanding research support in 2017 during a function held by the Vice-Rector of Research, Prof Corli Witthuhn.

Dr Angie van Biljon was elected as president of Cereal Science and Technology South Africa (CST-SA).

Prof Maryke Labuschagne was re-elected as the South African representative to the American Association for Cereal Chemists.

Lisa-Ann Rothmann (PhD student in Plant Pathology) participated in the 3-Minute-Thesis competition and was the winner in the PhD category.

Department of Urban and Regional Planning:

Dr Thulisile Mphambukeli was invited to form part of the South African delegation of experts to attend the 2017 BRICS Academic Forum in Fuzhou, China.

Department of Geology:

The department received the Haughton Award for the year 2016 for the best Honours thesis.

Centre for Environmental Management:

Tshiamo Legoale, a master's student in the Centre for Environmental Management, was named the FameLab International Champion at the Cheltenham Science Festival in the UK on 8 July 2017. Her mini-dissertation research is on how to use wheat in the harvesting of leftover gold.

Dr Falko Buschke and his students attended the 14th Annual Kimberley Biodiversity Research Symposium held at the Sol Plaatje University in Kimberley.

Richard Williamson and Surina Esterhuyse from the Centre for Environmental Management attended the Biennial Groundwater Conference in Stellenbosch from 14 to 18 October 2017, where they presented papers.

Microbial, Biochemical and Food Biotechnology:

The Department of Biotechnology hosted a prestigious postgraduate research day in June 2017. Postdoctoral fellows from the department presented their research and progress on research projects. Several research projects were presented, with themes ranging from projects with commercialisation potential to cutting-edge fundamental research projects about disease control and bioremediation. The event was sponsored by a laboratory supplier company, Separations.

Saheed Sabiu, a PhD student in the Department of Biotechnology, received the prize as the first runner-up in the Science category of the annual National three-minute thesis competition, after being the overall winner out of 11 Kovsie students who took part in the regional competition.

Trudi O'Neill from the Department of Microbial, Biochemical and Food Biotechnology visited the Kumasi Centre for Collaborative Research at the Kwame Nkrumah University of Science and Technology (KCCR-KNUST) in Kumasi, Ghana, on 25 April 2017. The KCCR-KNUST hosts the secretariat for the African Research Network for Neglected Tropical Diseases (ARNTD), of which Dr O'Neill is the interim chair.

Institute for Groundwater Studies

Prof Abdon Atangana received the African Award of Applied Mathematics in Morocco during early November 2017.

Soil, Crop and Climate Sciences

Prof Cornie van Huyssteen and his students attended the National Wetlands Indaba, where they presented three papers. The indaba was held from 16 to 19 October 2017 at the Wild Coast Sun, near Port Edward.

Agricultural Economics

The Department of Agricultural Economics participated fully in ALFA 2017, held at the Afri-Dome, Parys, from 12 to 14 September 2017. Besides having a stall, the department was actively involved in the ALFA schools competition, which included 13 agricultural schools (roughly 120 learners) from across the country. Two trophies were sponsored by the department and were awarded during the closing function.

Frikkie Maré from the Department of Agricultural Economics and Dr Johan van Zyl from Economic and Management Sciences attended the 21st congress of the International Farm Management Association (IFMA) in Edinburgh, Scotland from 2 to 7 July 2017.

Animal, Wildlife and Grassland Sciences

Dr Francois Deacon from the Department of Animal, Wildlife and Grassland Sciences at the University of the Free State (UFS) led a multi-specialist research group of more than 30 people from 10 different countries to collect information about giraffes during October 2017.

Computer Science and Informatics

The Department of Computer Science and Informatics and the IT department at CUT co-presented the annual conference of the South African Institute of Computer Scientists and Information Technologists (SAICSIT). Prof Pieter Blignaut was elected as vice-president of SAICSIT for the period 2017-2019.

Sustainable Agriculture

The University of the Free State's Centre for Sustainable Agriculture was represented by JW Swanepoel at the International Food and Agribusiness Management Association's (IFAMA) Conference in Miami, Florida, from 17 to 21 June 2017. He is a PhD student in the centre and did his department proud by not only presenting results from his PhD in the academic track of the conference, but also by being part of an advanced case-study team representing South African universities, which won IFAMA's International Student Case Competition.

Quantity Surveying and Construction Management

Two UFS Quantity Surveying students received awards for academic excellence from the Association of South African Quantity Surveyors (ASAQS). Both awards consider academic excellence as well as leadership potential and are open to all institutions in South Africa that offer Quantity Surveying programmes.

Research performance:

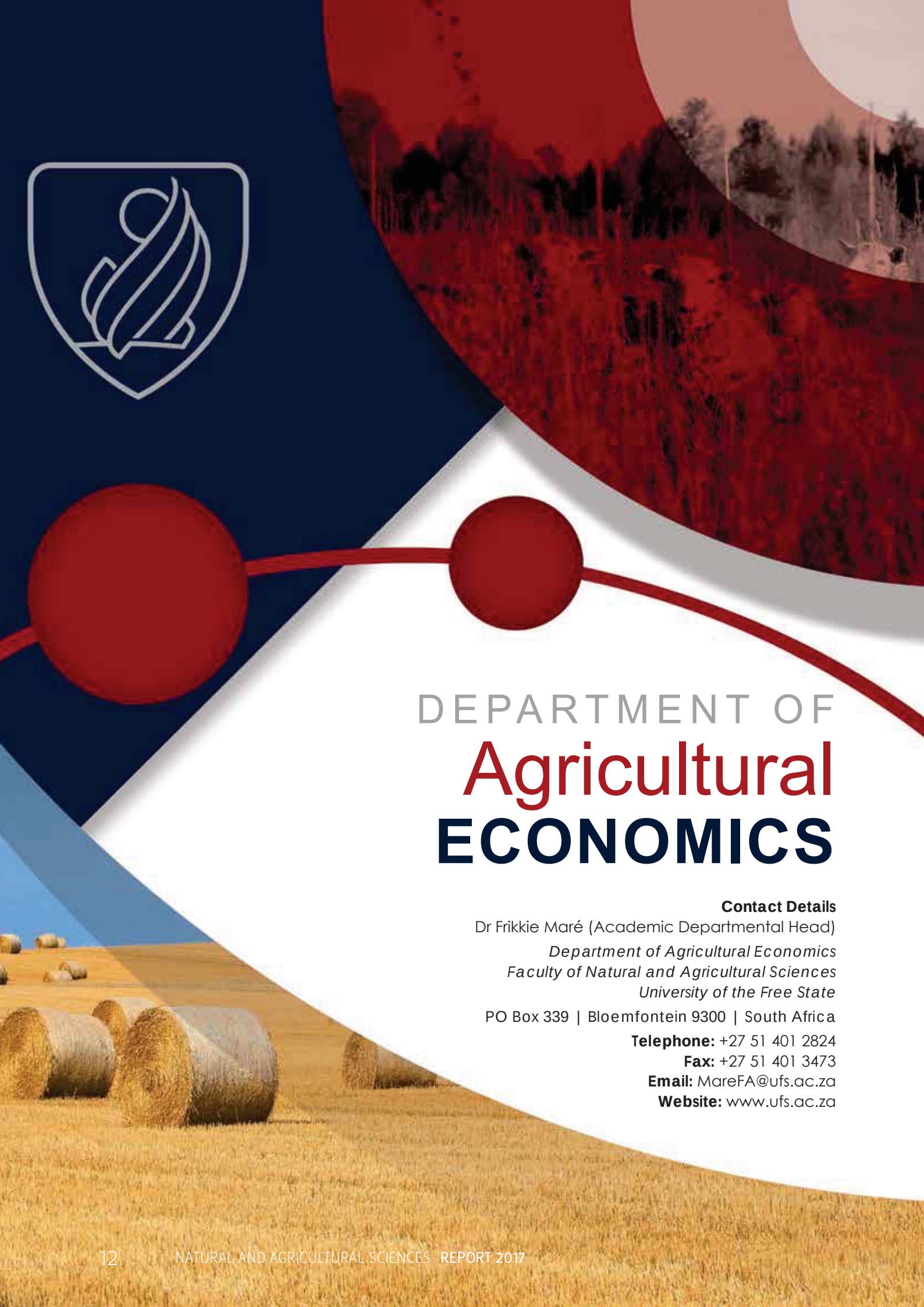
During the 2017 graduations, the Faculty of Natural and Agricultural Sciences conferred a large number of master's and PhD degrees, the most in many years. It is quite an achievement when compared to the rest of the university. Several staff members also improved their NRF ratings, with Prof Meyer retaining his B2 rating and Prof Andre Roodt improving to a B2.

During 2016, the following academic outputs were obtained by the faculty, with Prof Hendrik Swart from Physics and Prof Abdon Atangana from the Institute for Groundwater Studies again the top performers:

- 282 articles were published, which is a little less than in 2016. This comprises 39% of the total publication units of the university. Unfortunately, the larger workload at the beginning of the year (due to the fees must fall protest) resulted in less time for research during the summer break.
- Seven of the top 14 departments regarding publication outputs (above 15 units) reside in our faculty, with Physics the top performer again.

Well done to everybody who contributed to the academic footprint of the faculty and the university.

It is my pleasure as dean to present to you our 2017 Annual Report and extend my sincere gratitude to the staff and students for their selfless commitment to make this faculty and university great. I trust that 2018 will be just as fantastic an experience as 2017, and that we will improve even more on our academic activities. We owe it to ourselves. I want to conclude in a true silo way with the words of Pearl Zhu in *IT Innovation: Reinvent IT for the Digital Age*: "Silos build the wall in people's minds and tie the knots in their hearts."



DEPARTMENT OF
Agricultural ECONOMICS

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2017 Overview

During 2017, our staff and students actively contributed towards serving both the scientific and the broader agricultural community. In doing so, we expanded our academic and industry footprint in the field of Agricultural Economics and Management. We offer several modules within our three focus areas: Agricultural Economics with a scientific foundation (BSc Agricultural Economics), Agricultural Economics with a business focus (BAgric Agricultural Economics), and Agricultural Management (BAgric Agricultural Management).

2017 was a steady year and our department functioned without interference in our day-to-day operations. Dr Henry Jordaan remained Acting Academic Head of Department while the appointment process for the Academic Head of Department resumed, following Dr Flippie Cloete's resignation. Dr Cloete took up a position as CEO of Terratek, a division of Suidwes Landbou (Pty) Ltd. There were no other academic and support staff changes during 2017.

Our staff and students generated good research outputs, and students performed relatively well. We had a presence at three international conferences and two local conferences where our staff and students presented contributed papers. From our research outputs, 20 articles were published in peer-reviewed scientific journals, and three in an edited book. In addition to publishing scientific articles, we were involved in industry-related activities in the broader agricultural sector.

ACHIEVEMENTS

Staff Achievements

Pascalina Mohlotsane successfully completed an international e-learning training course on Water Footprint Assessment. The course was presented by the Water Footprint Network and the University of Twente (The Netherlands).

Student Achievements

Four research assistants, Nngadiseng Motaung, Takalani Tshibalo, Kwathiso Netshifhefhe, and Adetoso Adetoro, successfully completed an international e-learning training course on Water Footprint Assessment. The course was presented by the Water Footprint Network and the University of Twente (The Netherlands).

Activities

Two lecturers, PZ Mokhatla and Z Coka, were invited as guest speakers to the FEA (Female Entrepreneur Awards) finalist business support workshop at the

Aldam Holiday Resort near Ventersburg on 3 August 2017. Coka presented on strategic management and farming success, and Mokhatla spoke about farming success. He showed the farmers how to construct a business plan, highlighting the importance thereof.

We participated in the ALFA Livestock Expo 2017 at the Afri-Dome, Parys from 12 to 14 September 2017. In addition to our information stand, we sponsored and awarded two trophies in the ALFA schools competition

that included 13 agricultural schools (roughly 120 learners) from across the country.

Our unit in Livestock Economics hosted the second annual Veeplaas Intensive Sheep Farming School on the Bloemfontein Campus during April 2017. This school, presented in collaboration with Plaas Media and Mamre, was a sold-out event with 160 attendees.

WA Lombard presented a paper on stock theft at the first International Rural Crime Conference at the Royal Elephant Conference Centre in Centurion on 27 September 2017. Among the presenters were

three international speakers: Dr Joseph Donnermeyer (USA), Dr Elaine Barclay (Australia), and Emmanuel Bunei (Kenya).

Dr Henry Jordaan attended the 23rd International Commission on Irrigation and Drainage (ICID) Congress in Mexico City from 8 to 14 October 2017.

He presented a paper, 'Management Practices and the Water Footprint of Irrigated Sugarcane Production in South Africa', based on the research of his master's degree student, Adetoso Adetoro – who could not attend.

Dr AA Ogundeji presented a paper titled 'The Impact of Climate Change on Crop Water Use and Chill Unit Accumulation: A South African Case Study' at the Water Security and Climate Change Conference, in Cologne, Germany, from 18 to 21 September 2017. The conference was organised by the Institute for Technology and Resources Management in the Tropics and Subtropics.

During the Nampo Harvest Festival, students from our department attended the Nation in Conversation event outside Bothaville on 19 May 2017.

Frikkie Maré represented the Department of Agricultural Economics at the International Farm Management Association Congress (IFMA) in Edinburgh, Scotland

during July 2017, where we had three contributed papers. On the photo is David Human (Zoetis South Africa), Phillip Oosthuizen (Sernick and former student in the department), Dr Johan van Zyl (Centre for Development Support, UFS), and Maré (Department of Agricultural Economics, UFS).

RESEARCH

Our research endeavours centre around two broad themes: (i) water-related research funded by the WRC, and (ii) research on livestock economics, mainly funded by industry partners. Dr Henry Jordaan is leading two research projects on water-footprint assessment to inform sustainable water use for food and fibre production in South Africa. The first is more specifically concerned with the water footprints of selected field and forage crops, and the second with the water footprint of fuel and fibre crops. In addition, Dr Jordaan and Pascalina Mohlotsane are involved in a collaborative research project with, among others, scientists from Stellenbosch University, exploring the scope of using water-footprint assessment to inform sustainable water use in the production of table grapes and wine.

Prof Bennie Grové also leads two projects funded by the WRC. The first is concerned with the development of appropriate management approaches to reduce electricity costs, improve water-use productivity, and increase the profitability of irrigation farming in South Africa. The second is concerned with the development and application of a long-run hydro-economic risk simulation and optimisation-modelling framework to quantify the hydro-economic impact of water curtailments.

In a collaborative research project, Drs Janus Henning and Henry Jordaan work with scientists from the University of KwaZulu-Natal on a project for the WRC, exploring entrepreneurial development paths to facilitate the participation of rural youth in formal agricultural activities. Another research project for the WRC is led by Dr Nicolette Matthews and Prof Grové, with the aim of developing an integrated bio-physical and economic model to develop guidelines for water and salt stress management within a precision agriculture framework. Lastly on the water theme, Dr Abiodun Ogundeji works with Prof Andries Jordaan from DiMTEC on a project for the WRC, exploring farmers' coping and adaptation strategies to drought and other water-related risks in a changing climate.

Our Livestock Economics unit is involved in a variety of research projects related to the economics of livestock production in South Africa. Their research endeavours are mainly funded by Red Meat Research and Development South Africa (RMRD SA), the Red Meat Producers Organisation (RPO), and private agribusinesses. Research projects funded by RMRD SA include a project led by Walter van Niekerk on wildlife predation in South Africa to assess the economic impact of wildlife predation and the factors affecting wildlife predation in South Africa. Willem Lombard led two more projects funded by RMRD SA, the first concerning the economic impact of stock theft and the factors affecting stock theft in South Africa, and the second with eye-tracking technology to research red-meat marketing in South Africa. Maré continues research activities with the Sernick group on the economics of beef production. A feedlot experiment is conducted with 600 Bonsmara bulls to test the economic and meat-quality impacts of different growth hormones and beta agonists at different administered rates and dates.

In addition to the above research projects, two of our staff members were successful in applying for Thuthuka research funding. Dr Abiodun Ogundeji explores Household Resilience to Agricultural Drought in the Northern Cape Province of South Africa, focusing on the main factors that enable smallholder and emerging livestock farming households in the Northern Cape of South Africa to resist, absorb, accommodate, and recover from agricultural drought. The other Thuthuka

project is led by Dr Yonas Bahta, aiming to develop scenarios for future agricultural water management in South Africa to identify feasible alternative prospects for agricultural water management within the political, social, economic, and natural environment.

Because most of the research projects are multidisciplinary, academics from different departments are involved, such as the Departments of Soil, Crop and Climate Sciences; Animal, Wildlife and Grassland Sciences; Computer Science and Informatics; and the Centre for Development Support.

Community Service

We continued to present quarterly market-outlook workshops at Glen Agricultural College, attended by Free State Department of Agriculture and Rural Development staff, governmental extension officers, and smallholder farmers from the Free State.

Dr Strydom and Mr Van der Walt present South African Futures Exchange (SAFEX) courses, in collaboration with Grain SA, to banks, farmers, students, and other agricultural enterprises.

Dr Henning served on the judging panel of the Free State Young Farmer of the Year Award.

Postgraduate Students

A total of 22 postgraduate students were registered at master's and PhD level in the Department of Agricultural Economics for the year 2017. Of these, 15 were registered for master's studies and seven for PhD studies. Three of the master's students and three of the PhD students successfully completed their studies by the end of 2017.

STAFF MATTERS

Dr Henry Jordaan continued as Acting Academic Head of Department (ADH) during the process of appointing a permanent ADH for the department. Dr Flippie Cloete was appointed as ADH as from October 2017, but before he could take up the position he accepted a position as CEO of Terratek, a division of Suidwes Landbou (Pty) Ltd.

RESEARCH OUTPUTS

Research Articles

Bahta, YT, Strydom, DB, and Donkor, E. 2017. Microcredit and gender empowerment: policy implications for sustainable agricultural development in Eritrea. *Development in Practice* 27(1): 90-102.

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Boulay, AM, Bare, J, Benini, L, Berger, M, Lathuillière, MJ, Manzardo, A, Margni, M, Motoshita, M, Núñez, M, Pastor, AV, Ridoutt, B, Oki, T, Worbe, S, and Pfister, S. 2017. The WULCA consensus characterisation model for water scarcity footprints: Assessing impacts of water consumption based on available water remaining (AWARE). *International Journal of Life Cycle Assessment* 23: 368-378.

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on crop water use and chill unit accumulation. *South African Journal of Science* 113(7/8): 1 – 7.

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Ridoutt, BG, and Hodges, D. 2017. From ISO14046 to water footprint labelling: A case study of indicators applied to milk production in south-eastern Australia. *Science of The Total*

Environment 599: 14-19.

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Chapters in Books

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Mdungela, NM, Bahta, YT, Jordaan, AJ. 2017. Farmer's Choice of Drought Coping Strategies to Sustain Productivity in the Eastern Cape Province of South Africa. *Toward a Sustainable Agriculture: Farming Practices and Water Use. Series on Frontiers in Sustainability: Volume 1*. Jordaan, J, Bergman, MM. Basel, Switzerland. MDPI

Conference Contributions

Lombard, WA, Van Niekerk, HN, and Maré, FA. 2017. *Assessing the economic impact of livestock theft in the Eastern Cape province of South Africa*. Paper delivered at the 21st International Farm Management Congress "Future Farming Systems". Edinburgh, Scotland. 2–7 July.

Lombard, WA, Van Zyl, JH, and Stott, TR. 2017. *Increase feedlot profitability by differentiating between beef breeds*. Paper delivered at the 21st International Farm Management Congress "Future Farming Systems". Edinburgh, Scotland. 2-7 July.

Oosthuizen, PL, and Maré, FA. 2017. *Increase feedlot profitability by differentiating between beef breeds*. 21st International Farm Management Congress "Future Farming Systems". Paper delivered at the 21st International Farm Management Congress "Future Farming Systems". Edinburgh, Scotland. 2-7 July.

Van Rooyen, FM, Lombard, WA, Ogundeji, AA, and Van Niekerk, HN. 2017. *Factors contributing to cattle theft in the Eastern Cape Province: An application of Craggs test* (Poster presentation). AEASA Conference. The Elangeni Hotel, Durban. 19 to 21 September.

Lombard, WA, Van Niekerk, HN, Van Rooyen, FM, and Ogundeji, AA. 2017. *Factors affecting livestock theft in the three South African provinces bordering Lesotho* (submitted as a presentation), International Rural Crime Conference. Royal Elephant Lodge and Conference Centre, Centurion. 27 September.

Ncube, A, Bahta, YT, and Jordaan, AJ. 2017. *Analysis of African migrant women coping and adaption in South Africa: the human and social livelihood capitals approach*. The Disaster Management Institute of Southern Africa (DMISA) Conference. Coega Vulidlela Conference Centre, Port Elizabeth. 27-28 September.

Tshibalo, T, Bahta, YT, and Geyer, A. 2017. *Price Attributes of South African Merino Wool: A Hedonic Pricing model approach*. 55th Annual Conference of the Agricultural Economic Association of South Africa. The Elangeni Hotel, Durban. 19-21 September.

Owusu-Sekyere, E, and Jordaan, H. 2017. *Compensating welfare estimates for water and carbon footprint sustainability policy changes in South Africa*. Agricultural Economics Society Annual Conference. The Royal Dublin Society, Dublin, Ireland. 24-26 April.

Mohlotsane, P, Owusu-Sekyere, E, and Jordaan, H. 2017. *Water footprint assessment along the wheat-bread value chain towards the sustainable use of freshwater in South Africa*. European Geoscience Union (EGU) General Assembly. Vienna, Austria. 23-28 April.

Jordaan, H, Mare, F, Owusu-Sekyere, E, Scheepers, ME, Mohlotsane, P, and Nkhoua, P. 2017. *Water footprint assessment to inform sustainable food production in South Africa*. 6th World Sustainability Forum. Cape Town. 27-28 January.

Owusu-Sekyere, E, Mahlathi, YY, and Jordaan, H. 2017. *Assessment of Consumers' Stated Preferences for Water and Carbon Footprint Sustainability Information: Insights from the Gauteng Province of South Africa*. 6th World Sustainability Forum. Cape Town, South Africa. 27–28 January.

STAFF

Associated Professors: Prof Bennie Grové.

Affiliate Professors: Prof Max Bergman.

Senior Lecturers: Dr Henry Jordaan, Dr Nicky Matthews, Dr Abiodun Ogundeji, and Kobus van Staden.

Lecturers: Dr Frikkie Maré, Dr Janus Henning, WA Lombard, Petso Mokhatla, Walter van Niekerk, and Marcill Venter.

Junior Lecturers: Pascalina Mohlotsane and Zimbini Coka.

Researchers: Dr Yonas Bahta and Primrose Madende

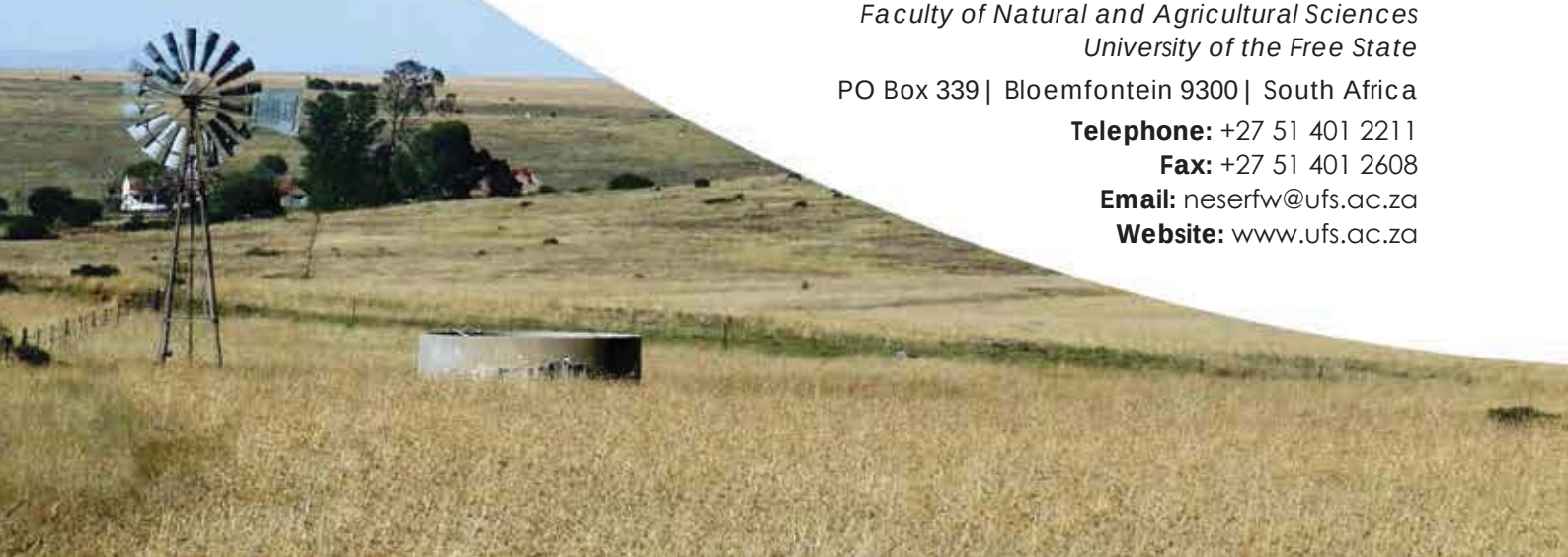
Research Assistants: Jano Bezuidenhout, Tosho Adetoro, Alex Botha, Enoch Owusu-Sekyere, André Ferreira, Fred Terblanche, Marx van Rooyen, Hanno Wessels, Violet Letseku, Nngadiseng Motaung, Khwathiso Netshifhefhe, Chéri-Lynn Steyn, Takalani Tshibalo.

Research Associates: Dr Brad Riddout and Dr Dirk Strydom

Officers: Chrizna van der Merwe and Ina Combrinck.

DEPARTMENT OF

Animal, Wildlife and Grassland Sciences



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2017 Overview

The Department of Animal, Wildlife, and Grassland Sciences celebrated the good inland rains during 2017 with farmers. We experienced lower maize and improved livestock prices in all species, as farmers started to rebuild flocks and herds after the prolonged drought. Because farmers retained female animals for breeding, less animals were available for slaughtering, resulting in a drastic meat-price increase for consumers.

The drought once again emphasised the importance of a proper veld management programme, as well as record-keeping of productive animals – something we have been advocating for a long time. Unfortunately, the Western Cape is still caught up in a severe drought, and we may only see possible relief in the winter of 2018.

An outbreak of avian influenza and the implementation of the AGOA agreement on imports of chicken meat from the USA had a severe impact on the profitability of poultry producers, with some reducing their production capacity. While the poultry industry remains one of the largest role players in agricultural job opportunities, these two factors could jeopardise the employment of thousands. It once again stresses the dangers of dumping goods and products on the fragile South African market, while our biosecurity protocols also need serious re-evaluation.

Dampening the good spirit of farmers after the rains, was the ruling party's adoption of the policy on land expropriation without compensation. The urgency of the matter sparked many discussions, while Organised Agriculture are actively involved in these discussions to ensure sustainable food production. However, it is important to realise that the redistribution of land to people without the proper training and financial backing, is doomed. We are actively involved in training emerging and communal farmers through short courses and a mentoring programme on our experimental farms.

Good news is that South Africa became a net exporter of meat in 2017. If it is possible to improve the management and fertility in the communal sector, exports could be even higher. However, this will only happen via proper training and mentorship of these farmers.

ACHIEVEMENTS

Staff Achievements

Dr Foch-Henri de Witt received his PhD during 2017 and Dr Francois Deacon was promoted to senior lecturer. The article 'Optimal geographical areas for milk production in Holstein cows on pastures: modelled for current and future climatic conditions' by Dr R Williams, Prof MM Scholtz, and Prof FWC Neser, published in the *South African Journal of Animal Science* (SAJAS), received the prize for best article published in this journal for 2016. It is the third time that Prof Neser received this award. He also received a prize for the most quoted article during the previous five years. Prof Japie van Wyk received an honorary member award and gold medal for service to the SASAS (South African Society for Animal Science) community.

Best *South African Journal of Animal Science* (SAJAS) article published 2017 – Prof FWC Neser

Most cited *South African Journal of Animal Science* (SAJAS) article during the past five years – Prof FWC Neser

Honorary member award and gold medal for service to SASAS community – Prof JB van Wyk

Student Achievements

The UFS team finished in fourth place during the student quiz held at the SASAS congress in Port Elizabeth, Eastern Cape, from 18 to 21 September 2017. Imke Stehn received the Kovsie Alumni Trust award for the best final-year BScAgric student, and Chéri-Lynn Steyn, a third-year student majoring in Animal Science and Agricultural Economics, was named Kovsie Dux for 2016/2017.

Chéri-Lynn Steyn – KOVSIE DUX student for 2016/2017, is a BScAgric Animal Science student

Activities

We are actively involved in both research and technology transfer in the Animal Science industry we serve. We presented lectures at several farmers' days in South Africa and Namibia and completed research trials sponsored by companies such as Voermol, Molatek, Nutri Feeds, Supreme Poultry, Sernick, and the Agricultural Research Council (ARC).

Prof Frikkie Neser is a judge for the Pick n Pay National Stud Farmer of the Year and the Pick n Pay award for the farmer who made the most progress in the last decade. He also attended and presented at the European Federation of Animal Science (EAAP) congress in Tallinn, Estonia.

Several staff members attended local and international congresses, including the SASAS congress held in Port Elizabeth, where we delivered 16 oral and poster presentations. Quite a few of our students and staff members also received awards at this congress (see Achievements).

Early in the morning, and some of the personnel from the department is heading for NAMPO 2017, outside Bothaville (Photo: Dr Beanelri Janecke)

Jossie van der Merwe sitting in the wheel of a Case tractor at the NAMPO show. (Photo: Dr Beanelri Janecke)

Giant cattle – the Chianina-Brahman cross at the NAMPO show. (Photo: Dr Beanelri Janecke)

WILD3764 field trip to Tussen-die-Riviere Nature Reserve from 13 to 15 October 2017

RESEARCH

Our research focuses on several broad topics, namely animal breeding, monogastric nutrition (pigs, poultry, hindgut fermenting herbivores, and wild carnivores) and ruminant nutrition (cattle, sheep, goats, and wild antelopes), animal physiology, grassland science, and wildlife science. Research topics are quite diverse and applicable to the current problems faced by farmers, producers, and wildlife ranchers.

Community Service

In 2017, the annual national Silage King competition, organised and owned by Plaas Media, took place from June to July. The University of the Free State was entrusted with the sampling of maize silage of contestants from all over South Africa. Two MScAgric students from the University of the Free State, Evan MacDonald and Kobie van der Walt, oversaw the correct sampling and logistics of the entire competition; in a space of three weeks they travelled 12 000 km while sampling a total of 77 bunkers.

Several community projects are still ongoing under the supervision of Prof HO de Waal. The first is the two Nguni Cattle projects (Northern Cape and Free State) in conjunction with the Industrial Development Corporation (IDC) and various provincial departments of agriculture that have been effective in the training of black farmers over the past ten years. This project involves more than 90 farmers and more than 1 000 head of registered Nguni cattle (cows and bulls). The recognition received was very positive.

The use of spineless cactus pear (*Opuntia ficus-indica*) as an important source of animal feed is also being investigated. More than 52 hectares of spineless cactus pear orchards have been established on 26 farms as an alternative feed source and to help resource-poor farmers.

A predator-management information centre was established in the department. The centre conducts research on the impact of predators (black-backed jackal and caracal) on the livestock industry in South Africa. This problem is estimated to cost the livestock industry in South Africa more than R2 000 million annually. All the livestock sectors are involved in this centre.

National and International Collaboration

Both national and international collaboration are important for any academic institution. Collaboration with the Agricultural Research Council (ARC) is of special importance. The two institutions (UFS and ARC) share several students and the ARC also funded some of the research conducted at the UFS.

Local collaborations were also extended to other organisations such as the universities of Pretoria, Fort Hare, and Stellenbosch, the Department of Agriculture (Glen, Elsenburg, and Grootfontein), the majority of breeding societies, Artificial Insemination (AI) stations, Breedplan SA, South African Studbook, and various poultry and feed companies.

Dr Foch-Henri de Witt and Ockert Einkamerer, in collaboration with the technical committee of the Animal Feed Manufacturers Association (AFMA), are involved in evaluating the nutritional quality of hominy chop as by-product of the maize-milling industry.

From the left: Evan MacDonald (UFS), Sello (Sparta Baby Beef – Marquard:
Winner of the sorghum silage category), and Ockert Einkamerer (Lecturer: Animal, Wildlife, and Grassland Sciences)

Internationally, we have projects running in collaboration with INRA in France and a memorandum of agreement were put in place between the UFS and AGROPARISTECH in Paris. Several international researchers, such as Dr Mike MacNeil and Dr Vincent Ducroq, are also actively involved in both teaching and research in this department.

Postgraduate Students

We have approximately 25 registered postgraduate students (MSc and PhD) in the different disciplines (Animal Nutrition, Animal Physiology, Animal Breeding, Grassland Science, and Wildlife Management) who are in various stages of progress. Our research is mostly driven by the postgraduate students and primarily focuses on applied research, as identified in collaboration with the relevant industries.

STAFF MATTERS

Dr HA O'Neill, Dr Alfredo Lepori, GC Josling, JW Paulse, and M van Niekerk were appointed and Dr AY Chulayo left the UFS to work at the Dohne Research station in Stutterheim. Three of our senior staff members, Prof HA Snyman, JB van Wyk, and HM Linde, retired at the end of 2017.

RESEARCH OUTPUTS

Research Articles

Bercovitch, FB, Berry, P, Dagg, A, Deacon, F, Doherty, J, Lee, D, Mineur, F, Muller, Z, Ogden, R, Seymour, R, Shorrocks, B, and Tutchings, A. 2017. How many species of giraffe are there? (CORRESPONDENCE). *Current Biology.* 27 (4): R136-R137.

Deacon, F, and Smit, GN. 2017. Spatial ecology and habitat use of giraffe (Giraffa camelopardalis) in South Africa. *Basic and Applied Ecology.* 21: 55-65.

Imbayarwo-Chikosi, V, Ducrocq, V, Banga, C, Halimani, T, Van Wyk, JB, Maiwashe, A, and Dzama, K. 2017. Estimation of genetic parameters for functional longevity in the South African Holstein cattle using a piecewise Weibull proportional hazards model. *Journal of Animal Breeding and Genetics* 134 (5): 364-372.

Joubert, D, Rust, A, Smit, GN, and Hoffman, M. 2017. Growth rates and mortality patterns of Acacia mellifera subsp. detinens in the semi-arid Highland Savanna, Namibia: Encroachment is not as rapid as previously believed. *Namibian Journal of Environment* 1: 1-5.

Macneil, M, Alexander, L, Kantanen, J, Ammosov, I, Ivanova, Z, Popov, R, Ozerov, M, Millbrooke, A, and Cronin, M. 2017. Potential emigration of Siberian cattle germplasm on Chirikof Island, Alaska. *Journal of Genetics* 96 (1): 47-51.

Macneil, M, Cardoso, F, and Hay, E. 2017. Genotype by environment interaction effects in genetic evaluation of preweaning gain for Line 1 Hereford cattle from Miles City, Montana. *Journal of Animal Science* 95: 3833-3838.

Macneil, M, Mokolobate, MC, Scholtz, MM, Jordaan, F, and Neser, FWC. 2017. Alternative approaches to evaluation of cow efficiency. *South African Journal of Animal Science* 47 (2): 118-123.

Macneil, M, Scholtz, MM, Theunissen, A, De Bruyn, J, and Neser, FWC. 2017. Crossbreeding in beef production: meta-analysis of breed means to estimate breed-specific effects on leather properties. *Animal Production Science* 57: 811-814.

Mapfumo, L, Muchenje, V, Mupangwa, J, and Scholtz, MM. 2017. Changes in biochemical proxy indicators for nutritional stress resilience from Boran and Nguni cows reared in dry arid rangeland. *Tropical Animal Health and Production* 49 (null) null: 1383-1392.

Mapholi, N, Maiwashe, A, Matika, O, Riggio, V, Banga, C, Macneil, M, Muchenje, V, Nephawe, K, and Dzama, K. 2017. Genetic parameters for tick counts across months for different tick species and anatomical locations in South African Nguni cattle. *Tropical Animal Health and Production* 49: 1201-1210.

Matebesi, PA, Cloete, S, Van Wyk, JB, and Olivier, J. 2017. Genetic parameters for ewe reproduction with objectively measured wool traits in Elsenburg Merino flock. *South African Journal of Animal Science* 47 (5): 712-722.

Ochsner, K, Macneil, M, Lewis, R, and Spangler, M. 2017. Economic selection index development for Beefmaster cattle II: General-purpose breeding objective. *Journal of Animal Science* 95: 1913-1920.

Ochsner, K, Macneil, M, Lewis, R, and Spangler, M. 2017. Economic selection index development for Beefmaster cattle I: Terminal breeding objective. *Journal of Animal Science* 95: 1063-1070.

Osthoff, G, Hugo, A, Madende, M, Deacon, F, and Nel, P. 2017. Milk composition of free-ranging red hartebeest, giraffe, Southern reedbuck and warthog and a phylogenetic comparison of the milk of African Artiodactyla. *Comparative Biochemistry and Physiology A-Molecular and Integrative Physiology* 204: 93-103.

Retallick, K, Bormann, J, Weaber, R, Macneil, M, Bradford, H, Freetly, H, Hales, K, Moser, D, Snelling, W, Thallman, R, and Kuehn, L. 2017. Genetic variance and covariance and breed differences for feed intake and average daily gain to improve feed efficiency in growing cattle. *Journal of Animal Science* 95: 1444-1450.

Swanepoel, P, Habig, J, Du Preez, CC, Snyman, HA, and Botha, P. 2017. Tillage effects, soil quality and production potential of kikuyu-ryegrass pastures in South Africa. *Grass and Forage Science* 72 (2) June: 308-321.

Webb, E, Visagie, P, Van der Westhuizen, J, Snyman, HA. 2017. Influence of bioregion and environmental

factors on the growth, size and reproduction of Bonsmara cows. *South African Journal of Animal Science* 47 (4): 542-552.

Chapters in Books

Greyling, JPC. 2017. Improving the reproductive efficiency of sheep. *Achieving sustainable production of sheep. 1st Ed*. Greyling, J (ed.). UK, Cambridge: Burleigh Dodds Science Publishing.

Conference Contributions

Cloete, S, Van Wyk, JB, and Olivier, J. 2017. *Genetic responses in component and composite reproduction traits in merino ewes divergently selected for number of lambs weaned*. Townsville, Queensland, 2-5 July.

Cloete, S, Van Wyk, JB, and Olivier, J. 2017. *The effect of divergent selection for a composite trait on genetic responses in components*. Tallinn, Estonia, 27 August–1 September.

De Wit, M, Fouche, HJ, De Waal, HO, Coetzer, GM, and Venter, SL. 2017. *Promoting the potential of spineless cactus pear (Opuntia ficus-indica) as a multi-use crop at the Oppermansgronde community in the Free State Province of South Africa.* International Congress on Cactus Pear and Cochineal, Coquimbo, Chile, 23-30 March.

De Witt, F, Muchenje, V, Fair, M, and Hugo, A. 2017. *The effect of dietary ω-type fatty acids on broiler production performance and fatty acid profile of breasts and thigh meat.* Congress of the South African Society of Animal Science, Port Elizabeth, South Africa, 18-21 September.

Deacon, F. 2017. *The fast-speed kinematics of wild giraffes, using video derived from an unmanned aerial vehicle*. New Orleans, USA, 5 January.

Ducrocq, V, Chavinskaia, L, Swaminathan, M, Pande A, Van Niekerk M, and Neser, FWC. 2017. *Development of genomic selection in dairy cattle in two emerging countries: South Africa and India*. 66th Ann. Meeting European Association Animal Production, Tallinn, Estonia, 28 August–1 September.

Hendriks, J, Scholtz, MM, and Neser, FWC. 2017. *Investigation into genetic parameters for feedlot traits of two cattle breeds in South Africa*. Proc. 50th SASAS, Port Elizabeth, South Africa, 18-22 September.

Janecke, BB. 2017. *Effect of the 2016 drought on vegetation structure and animal presence on the granite catena in Kruger National Park*. 15th Annual International Savanna Science Networking Meeting, Skukuza, South Africa, 12-16 March.

Maciel, S, Fair, MD, Scholtz, MM, and Neser, FWC. 2017. *Effects of environmental factors on reproductive performance of the Nguni cattle ecotypes in South Africa*. Proc. 50th SASAS, Port Elizabeth, South Africa, 18-22 September.

Magwaba, T, Van der Westhuizen, L, Grobler, JP, Bindeman, H, Du Plessis, C, Van Marle-Köster, E, and Neser, FWC. 2017. *Estimating the genetic variability of the Letelle sheep breed with the use of microsatellite markers*. 66th Ann. Meeting Europe Association Animal Production, Tallinn, Estonia, 28 August-1 September.

Makgahlela, ML, Neser, FWC, and Maiwashe, A. 2017. *Determining the optimal grouping strategy for multi-breed genomic evaluations*. Proc. 50th SASAS, Port Elizabeth, South Africa, 18-22 September.

Mdyogolo, S, Scholtz, MM, Neser, FWC, and Makgahlela, ML. 2017. *Testing the utility of imputation from low-density to high-density using Beagle, Impute and Fimpute: preliminary results*. Proc. 50th SASAS, Port Elizabeth, South Africa, 18-22 September.

Mokolobate, MC, Scholtz, MM, and Neser, FWC. 2017. *Investigating novelty traits to improve cow-calf efficiency in the South African Afrikaner, Angus and Charolais for climate smart production systems*. Proc. 50th SASAS, Port Elizabeth, South Africa, 18-22 September.

Ngayo, M, Fair, MD, Neser, FWC, Scholtz, MM, and Van Niekerk, M. 2017. *Factors affecting productive herd life in Nguni cows.* Proc. 50th SASAS, Port Elizabeth, South Africa, 18-22 September.

Pyoos, GM, Scholtz, MM, King, Z, De Lange, L, and Neser, FWC. 2017. *The effect of temperature on the feed intake and growth of beef cattle from different genotypes.* Proc. 50th SASAS, Port Elizabeth, South Africa, 18-22 September.

Reusch, C, Janecke, BB. 2017. *Activity patterns and diet of vervet monkeys at the Mogalakwena River Reserve.* SA Wildlife Management Association Conference, Worcester, South Africa, 10-14 September.

Scholtz, MM, Mokolobate, MC, Theunissen, A, Seshoka, M, Pyoos, GM, and Neser, FWC. 2017. *Sustainable livestock production in the era of climate change through targeted intervention*. 4th Global Science Conference on Climate Smart Agriculture, Johannesburg, South Africa, 27-30 November.

Smit, GN, De Klerk, J, and Schneider, M. 2017. *Platform presentation: an assessment of woody biomass as a sustainable energy source in a bush thickened area of Northern Namibia*. Grassland Society of Southern Africa, Mpumalanga-Limpopo Border, South Africa, 23-28 July.

Smit, GN, and Janse Van Rensburg, G. 2017. *Understanding the problem of bush encroachment in*

southern African savannas: lessons to be learnt from root studies. 14th Kimberley Biodiversity Research Symposium, Kimberley, South Africa, 25 October.

Strauss, A, De Waal, HO, and Avenant, NL. 2017. *The impact of predation on merino and dorper flocks in the central Free State, South Africa*. Provincial Research Colloquium, Bloemfontein, South Africa, 18-20 October.

Van der Westhuizen, L, Macneil, MD, Scholtz, MM, and Neser, FWC. 2017. *The identification of a genetic component contributing to wet carcass syndrome in sheep – preliminary results.* Proc. 50th SASAS, Port Elizabeth, South Africa, 18-22 September.

STAFF

Professors: Profs FWC Neser, GN Smit, HA Snyman, and JB van Wyk.

Senior Lecturers: Drs MD Fair and F Deacon.

Lecturers: Drs AY Chulayo, BB Janecke, HA O'Neill, PJ Malan, FH de Witt, and Messrs OB Einkamerer, MB Raito, M van Niekerk, and GC Josling.

Junior Lecturers: G Janse van Rensburg, J Barnard, and JW Paulse.

Affiliated Professors: Profs M MacNeil, A Maiwashe, TL Nedambale, V Ducrocq, M Makgahlela, and MM Scholtz.

Affiliated Researcher: L vd Westhuizen.

Post-Doc: Dr Alfredo Lepori.

Technician: JAM van der Merwe.

Chief Officer: WJ Combrinck.

Senior Officers: HMF Linde.

Senior Assistant Officer: Q Kruger.

Assistant Officers: NAK Green and CJ Williams.

Technical Assistants: Messrs NK Long and SA Rowles.

Messenger: MV Moses.

Cleaner: NM Mokoallo.

DEPARTMENT OF

Plant Sciences

(Bloemfontein and Qwaqwa Campus)

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2017 Overview

Our department consists of three divisions: Botany (both of the Bloemfontein and Qwaqwa campuses), Plant Breeding, and Plant Pathology, with expert staff in various fields of plant sciences. Botany on the Qwaqwa campus specialises mainly on ethnobotany and phytomedicine. We offer training and development that is responsive to local challenges, and through collaborations engage in research that is globally competitive. Industrial collaborations ensure sustainability and reaffirm the importance of plant sciences in research and industry. In 2017, we hosted international researchers from various European and American countries, and our staff and students visited countries in Africa, Europe, the United States of America (USA), and Asia. The quality and distinctness of our research are shown in the special awards, invitations, peer-reviewed publications, and qualifications conferred to students: thirteen honours, thirteen masters, and six doctoral degrees.

ACHIEVEMENTS

Staff Achievements

Prof Botma Visser was promoted to Associate Professor in Botany.

Dr Sandy-Lynn Steenhuisen received an Y1 rating from the National Research Foundation (NRF) for 2017-2021.

Dr Angie van Biljon was elected as President of Cereal Science and Technology South Africa during the bi-annual general meeting at the Southern African Grain Laboratory in Pretoria in August. The aim of this society is to advance cereal science and technology, both in the public sector and in the industry in Southern Africa.

Prof Maryke Labuschagne was re-elected as the South African representative in the American Association for Cereal Chemists International. She was also a keynote speaker at the 1st ICC (International Association for Cereal Science and Technology) Asia-Pacific Grains Conference (APGC), co-organised by the ICC and CCOA (Chinese Cereals and Oils Association) that took place in Xiamen, China, from 21 to 24 May 2017, attracting over 500 participants. Sponsored by the Royal Society, Prof Labuschagne attended the Commonwealth Science Conference at the Prime Minister's office in Singapore, organised by the Royal Society and the National Research Foundation, from 13 to 16 June 2017. It brought 450 scientists in different career stages from 40 different states together to celebrate excellence in science across the Commonwealth. The international AgriFoSe Programme (Agriculture for Food Security in Africa) contracted Prof Labuschagne for research in a collaborative project with the Swedish University of Agricultural Sciences; she was also elected to the scientific committees of two international conferences, the Global Sorghum Conference and the International Gluten Workshop.

Prof Botma Visser (Chairperson), Profs Zakkie Pretorius and Liezel Herselman, Dr Willem Boshoff, and Cornél Bender were elected as the local organising committee for the International Cereal Rusts and Powdery Mildews Conference (ICRPMC) to be held in Skukuza, South Africa, in 2018. Prof Visser also co-authored the article 'Detection of Polymyxa graminis, a vector of important soil borne viruses of wheat' (November/December edition of *Koringfokus/Wheat Focus*), which was nominated as the best value-adding contribution in the issue. [co-authors: Tarekegn Terefe (Agricultural Research Council-Small Grain (ARC-SG)), Goddy Prinsloo (ARC-SG), Gerhard Pietersen (University of Pretoria), Ronel Roberts and Wilhelm Botha (ARC-Plant Health and Protection)].

Prof Wijnand Swart was elected to the NuGrainSA Steering Committee during a meeting held at the North-West University in Potchefstroom in August 2017. The NuGrainSA consortium was initiated by the North-West Department of Agriculture and Rural Development and the North-West University in 2014, to alleviate food insecurity in Southern Africa by developing pseudograins such as amaranth, quinoa, and buckwheat.

Dr Lize Joubert completed a 21-month postdoctoral

research visit to the University of Cambridge.

Sadie Geldenhuys and Cornél Bender both received the University of the Free State (UFS) merit award for outstanding research support 2017 during a function held by the Vice-Rector of Research, Prof Corli Witthuhn.

Dr Rudo Ngara was an invited speaker at the Royal Society/NRF Research Capacity Strengthening in Africa: Learning from the Past, Building for the Future, event held at the NRF, Pretoria, 5-6 December 2017.

Student Achievements

Four of our postgraduate students attended the annual postgraduate symposium of the Department of Botany and Plant Biotechnology, University of Johannesburg. The students were Ansori Maré (PhD), Marlese Bester (MScAgric), Clausanne Esterhuizen (BScHons), and Dinè Pretorius (BScHons). Prof Botma Visser and Dr Andri van Aardt accompanied them to the two-day event. During the symposium, each student competed against peers from UJ, presenting a 10-minute paper on the research results of their respective degrees. All four students presented excellent papers (and received complements). Dinè Pretorius was awarded the prize for the best BSc Honours presentation, 'Evaluation of sunflower as a potential soil rehabilitation crop', supervised by Dr Gerhard Potgieter.

UFS delegates attending the postgraduate symposium of the Department of Botany and Plant Biotechnology at the University of Johannesburg, were (from the left) Dinè Pretorius, Andri van Aardt, Marlese Bester, Ansori Maré, Botma Visser, and Clausanne Esterhuizen.

Lisa Rothmann (PhD student in Plant Pathology) won the UFS 3-Minute Thesis competition in the PhD category with a presentation titled 'Using mathematical models to predict plant disease'. She was also an invited speaker at the Annual Symposium of the Soilborne Diseases Interest Group in Stellenbosch during September 2017, with a presentation titled 'Sclerotinia sclerotiorum disease epidemiology: A South African approach'. In close collaboration with Dr Marinda Visser from GrainSA, Lisa Rothmann initiated the South African Sclerotinia Research Network (SASRN). It is aimed at generating a virtual centre of excellence and expertise, highlighting the role South Africa can play in the *Sclerotinia* research arena internationally, and developing practical management strategies for diseases caused by *Sclerotinia* through a research consortium and network. Lisa Rothmann held the inaugural meeting of SASRN during September 2017 in Pretoria and was invited to present the South African perspective on Sclerotinia research at the 15th National Sclerotinia Initiative in Minneapolis, Minnesota, USA, from 18 to 20 January 2017. In addition, Rothmann was elected as chairperson of the student chapter of the Sorghum in the 21st Century Global Conference to be held in Cape Town during April 2018.

Marlese Bester was selected as one of two South Africans (from 1 200 South African applicants) to attend the 3rd Youth Ag Summit. The event was sponsored by Bayer CropScience and was held in Brussels, Belgium, in October 2017. Her essay was titled, 'The World's idea of ending poverty: realism versus idealism'. A total of 100 participants from 49 countries were present at this summit.

MSc student Schae-Lee Olckers, supervised by Prof Maryke Labuschagne, was seconded to spend a year (April 2017 to April 2018) at Michigan State University to work with Prof Perry Ng, an affiliated professor in Plant Breeding at the UFS.

RESEARCH

Botany: Plant physiology/biochemistry and molecular biology

Prof Botma Visser leads a research team working on phytopathogenic fungi. Many of the projects use microsatellites to fingerprint the different fungal populations in South Africa. Included are stem, leaf, and stripe rust of wheat, leaf rust of sunflower, and stem and crown rust of oats. The use of next-generation sequencing (NGS) to genotype these populations in future is currently being investigated. Two new research projects include an investigation into the genetic diversity within the Russian Wheat Aphid (RWA) population in South Africa, as well as the molecular identification of wheat viruses and their associated hosts from infected plants in KwaZulu-Natal.

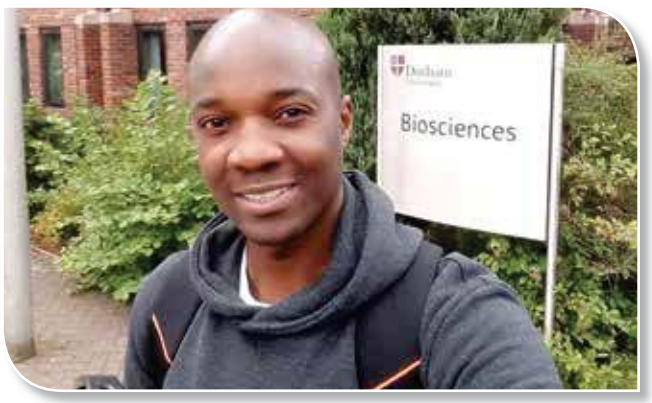
Dr Lintle Mohase and her research team focus on plant-defence mechanisms in wheat during insect (aphid) infestations. She collaborates with entomologists

from the UFS (Prof S vd M Louw) and the ARC-SG in Bethlehem (Dr A Jankielsohn). Her research concentrates on aphid distribution in wheat-producing regions of South Africa and Lesotho, the impact of aphid infestations on yield and quality, mechanisms of host resistance, as well as the effect of commercial plant activators on crop protection against the aphid *Duiraphis noxia*.

Dr Lintle Mohase and her two students (Pitso Masupha and Masasa Ntsibane) took a trip to the highlands of Lesotho in November 2017. They interacted with the subsistence farmers and studied their unique wheat-cropping systems in the environment characterised by high altitude and relatively cool summers, associated with frequent episodes of snow.

Dr Marieta Cawood's research focuses on extraction, identification, and utilisation of plant secondary metabolites in agricultural and medicinal fields. In collaboration with the ARC, the chemical composition and allelopathic influence of the underutilised crop, *Amaranthus cruentus*, is being investigated under abiotic stress conditions.

Dr Ngara and her PhD student, Tatenda Goche, undertook research visits to Dr Stephen Chivasa's laboratory at Durham University, United Kingdom (UK) for five weeks and three months, respectively. These visits were funded by Dr Ngara's Royal Society Newton Advanced Fellowship award for the period 2016-2019.



Tatenda Goche, a PhD student of Dr Ngara undertook a 3-month research visit to Durham University (United Kingdom) in August-October 2017.

Dr Gerhard Potgieter's research topics in the field of eco-physiology focus on hydroponic cultivation of plants and plant health. Hydroponics is used to investigate the bio-catalytic potential of natural compounds from different organisms. The bio-catalytic potential of the secondary metabolites from the symbiotic soil fungus *Trichoderma* is currently being evaluated on hydroponically-grown spinach plants under controlled nutrient stress conditions. Additionally, the rehabilitation of mine tailings using sunflower as a potential hyper-accumulator is also being evaluated. The pre-treatment of the 'toxic' tailings is imperative for successful rehabilitation. Control of soil pH, nutrient amendments, and changing the soil micro-environment using *Trichoderma* fungus treatments, are being evaluated. Chlorophyll-a fluorescence for photosynthetic capacity, chlorophyll concentration and Normalised Difference Vegetation Index (NDVI) imaging as base parameters of plant health is used to evaluate the above.

Eco-physiology excursion (2nd year students) held during the October break at the Amanzi Private Game Reserve in the Brandfort district, Free Sate. Students had the opportunity to study plant adaptations and physiological responses to environmental stress under field conditions.

Dr Ngara's research (Qwaqwa) focuses on understanding the molecular responses of sorghum plant systems to abiotic stresses. In 2017, Dr Ngara and her research group continued with the characterisation of sorghum proteomes in response to drought, salinity, and high-temperature stresses. These projects are funded by her NRF Competitive Support for Unrated Researchers (2015-2017), and the Royal Society (2016-1019) research grants.

Botany: Phytomedicine and ethnobotany

Dr Komoreng (Qwaqwa) is continuing with her research work on traditional medicinal plants used in the treatment of tuberculosis, elephantiasis, and ear, nose and throat (ENT) infections in South Africa. Her

research also focuses on indigenous medicinal plants that are used in the Eastern Free State for the treatment of various ailments. Dr Komoreng's research group screens medicinal plants for in vitro antimicrobial, anti-inflammatory, anti-oxidant, anthelmintic and antifilarial, and cytotoxic properties. The active compounds are isolated from plants showing good pharmacological activities without any toxic properties. The project is funded by the Thuthuka NRF Rating Track (2015-2017).

Dr Ashafa's (Qwaqwa) research centres around phytomedicine and phytopharmacology. It involves the determination of efficacy and pharmacological activities of medicinal plants for a number of disease conditions such as diabetes mellitus, cancer, cardiovascular diseases, liver diseases, ulcers, inflammation, infectious and non-infectious diseases, as well as isolating the bioactive compounds responsible for these pharmacological activities. Recently, he has expanded his research into parasitology, environmental microbiology, and bioinformatics.

Botany: Plant taxonomy and molecular systematics

The molecular systematics research group is headed by Dr Mariëtte Jackson. Her research focuses on the phylogenetic relationships between certain groups or genera, mostly within the family Asteraceae. A new field of research that uses fossil pollen from Prof Louis Scott's collection (Plant Sciences, UFS) in phylogenetic studies is being investigated. A master's student is optimising molecular techniques to acquire DNA sequences from fossil pollen.

Dr Lize Joubert's research focuses on combining taxonomic approaches with pollination biology, and flower evolution and development research to investigate various aspects of the diversity of South African flowering plants. Her research includes topics such as floral adaptation to pollinator shifts as a result of climate change and optimisation of floral characters in crops for higher pollination efficiency and improved yield. Dr Joubert also collaborates with Dr Andri van Aardt in developing species circumscriptions to link lineages of extant species to microfossils used in palaeo-vegetation reconstruction.

Botany: Palaeo-botany and ecology

Dr Andri van Aardt and Prof Louis Scott are currently investigating the long-term changing patterns in vegetation by studying both fossil and present-day plant material. Reconstruction of the climate and vegetation of the Quaternary in the central and western parts of the Free State and Northern Cape is an ongoing research project, where new material has been collected and is being processed. This includes material from Florisbad and the Wonderwerk Cave. The investigation of the leaf epidermis as a possible indicator for palaeo-environments at the Pretoria Salt Pan (Tswaing Crater) is in progress.

Dr Steenhuisen's research on the genetic diversity of Protea species that employ different pollinators is ongoing in collaboration with Prof Jeremy Midgley (University of Cape Town, UCT), Megan Smith (master's student, UCT), and Dr Rachel Prunier (Western Connecticut State University, WCSU, USA). In December 2017, Dr Steenhuisen, in collaboration with Dr Timotheus van der Niet and Ruth Cozien (University of KwaZulu-Natal, UKZN), discovered the first record of a lizard pollination system in Africa for a unique Afromontane plant species occurring in the Drakensberg Mountains. Research on plant associations in Afromontane grasslands is ongoing with master's student, Moralebona Gullit Maphatlalatse (UFS, Qwaqwa), and co-supervisors, Dr Erwin Sieben (UKZN) and Prof Timothy G O'Connor (South African Environmental Observation Network, SAEON).

Dr Steenhuisen attended the XIX International Botanical Congress (IBC 2017) in Shenzhen, China, from 23 to 29 July 2017 and delivered an oral presentation on her ongoing research into the pollination systems of Protea species, with a focus on mammal pollination systems, as part of a symposium on mammal pollination.

Dr Steenhuisen with other invited speakers for the symposium on "Pollination by non-flying mammals" at the XIX International Botanical Congress (IBC 2017) in Shenzhen, China, 23-29 July 2017.

Under the supervision of their lecturer, Dr Steenhuisen, the Vegetation Ecology third-year class spent two nights at the Weenen Game Reserve, as well as a day each at Sentinel Peak, Cathedral Peak, and Monontsha Wetland, learning about vegetation sampling techniques, plant adaptations, and species diversity in South African grassland, forest, and Savanna biomes.

Third year vegetation ecology students performing vegetation surveys on a slope below Sentinel Peak.

Third year vegetation ecology students and their lecturer, Dr Steenhuisen, enjoying a hike up to the base of Sentinel Peak (panorama of the Amphitheatre in the background).

Dr Steenhuisen and Dr Nacelle Collins from the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs conducted a field trip with Restoration Ecology Honours students to teach them about the restoration work conducted in Monontsha, Qwaqwa.

Dr Nacelle Collins explaining the importance of wetlands and restoration work in Monontsha to Restoration ecology Honours students and Dr Steenhuisen.

Plant Breeding: Molecular plant breeding

Prof Liezel Herselman's research continued to make progress towards the introgression of different rust resistance (stem, stripe, and leaf rust) as well as Fusarium head-blight (FHB) resistance genes into South African wheat cultivars. She presented this research as a poster during the 13th International Wheat Genetics Symposium held in Tulln, Austria during April 2017. One of her students from Uganda identified a possible new stem-rust resistance gene in South African winter wheat, while another student from Ethiopia is studying the genetics of stem-rust resistance in spring-wheat germplasm from Ethiopia. A postdoctoral fellow, Dr Ansori Maré, is applying conventional breeding, speed breeding, doubled haploids, and marker-assisted breeding to incorporate three stripe-rust resistance genes into doubled haploid lines that already contain eight rust and FHB-resistance genes. The wheat-resistance breeding programme thus applies marker-assisted backcrossing, fungal gene-expression analyses, phenotypic evaluations in the greenhouse and field, production of doubled haploid plants, and biochemical screening to develop pre-breeding lines. New promising lines are continuously being developed and identified for use in other breeding programmes.

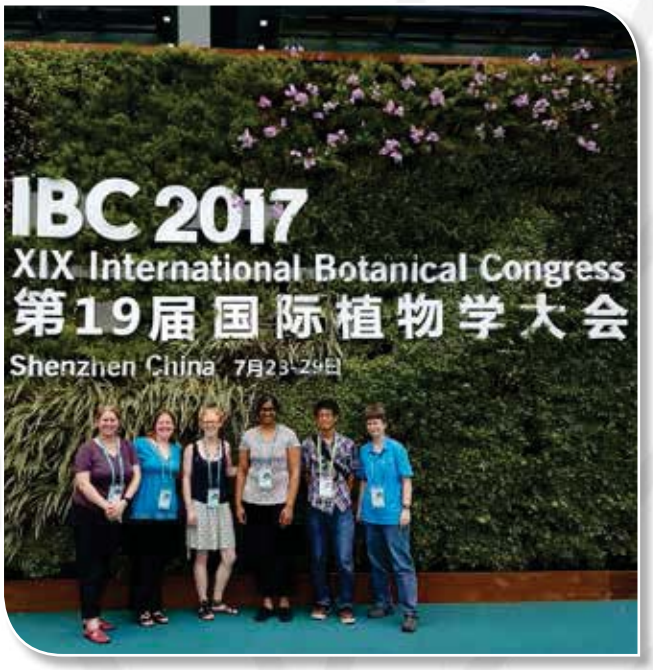
Prof Liezel Herselman, Nthabiseng Mashamba (MSc student in Plant Breeding), Prof Maryke Labuschagne, Dr Renée Prins (Research Associate), Dr Willem Boshoff, and Barend Wentzel (PhD student in Plant Breeding) attended the 13th International Wheat Genetics Symposium in Tulln, Austria. More than 520 participants from 45 countries attended the symposium. The Department of Plant Sciences presented six posters.

Dr Adré Minnaar-Ontong's research on the genetic variation of *Sclerotinia sclerotiorum* populations from different hosts in South Africa concludes at the end of 2018. This project is funded by the National Research Foundation's (NRF) Thuthuka fund. Outcomes of the project thus far have contributed towards a new research project which includes the development of a breeding programme for resistance to *Sclerotinia* diseases in economically important oil crops and other hosts. South African sunflower and soybean cultivars will be evaluated for resistance to *Sclerotinia* diseases to promote the improvement of disease-control strategies. Her research also includes the genetic analysis of soybean resistance to *Fusarium virguliforme*. This

project aims to evaluate commercial soybean cultivars for resistance and to improve management strategies for disease control. Dr Minnaar-Ontong collaborates with Dr Rouxléne van der Merwe on breeding for resistance to pod dehiscence in a vegetable-type soybean (in collaboration with the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences).

Plant Breeding: Conventional breeding

Dr Rouxléne van der Merwe continued her research on the newly initiated breeding programme of edamame (soybeans for human consumption), in collaboration with Dr M Smit of the Edamame Development Programme (EDP) in Durban and the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences. Her project involves stability analysis of edamame (*Glycine max L.)* introductions under South African production conditions, selection for drought-stress tolerance, improved yield and yield stability, and breeding for resistance to pod dehiscence in a vegetable-type soybean. Her projects are funded by the NRF Thuthuka fund, the Durban City Council, and the KwaZulu-Natal Government. Dr Van der Merwe visited the Northeast Institute of Geography and Agroecology in Harbin, China during July. During this visit she obtained laboratory training as part of a collaborative project on edamame breeding for South African conditions.



Dr Rouxléne van der Merwe visited the Northeast Institute of Geography and Agroecology in Harbin, China. During this visit she obtained training in the laboratory as part of a collaborative project on edamame (vegetable-type soybean) breeding for South Africa. The photo features Professors Qiuying Zhang, Tongqi Sun, and Hongjia Liu during a field trial visit in Suihua city.

Plant Breeding: Wheat-quality and crop-nutritional value research

The team of Prof Maryke Labuschagne (South African Research Chairs Initiative (SARChI) Chair: Disease resistance and quality of field crops), Dr Angie van Biljon, and a postdoctoral fellow, Dr Brigitta Töth, made significant progress in 2017 by analysing wheat proteins, looking specifically at the effect of low nitrogen, low phosphorous, and a combination of the two on protein through size exclusion and reverse-phase high-performance liquid chromatography. They also analysed maize proteins under abiotic stress conditions such as low nitrogen content and drought. A study on the proteomics of maize grain proteins under stress conditions was done in collaboration with the Stockholm University in Sweden. The genetic enhancement of iron and especially zinc in maize remains an important research focus; the research is done in collaboration with the International Maize and Wheat Improvement Centre (CIMMYT) in Zimbabwe and the ARC in South Africa. The research on the increase of provitamin A in staple crops such as maize, cassava, and plantain continued in collaboration with HarvestPlus international, and fieldwork was carried out in Ghana, Zimbabwe, and Nigeria.

Dr Ntjapa Lebaka works on the nutritional improvement of indigenous grain legume crops, currently focusing on Bambara groundnuts and cowpea. The study focuses on the evaluation of Bambara groundnuts and cowpeas for adaptation in selected South African environments, as well as evaluation of nutritional quality (protein, lipids, iron, and zinc content).

Plant Pathology: Cereal rust diseases

In collaboration with Chinese scientists, research in transferring rust resistance from a related grass species to wheat was expanded by Prof Zakkie Pretorius and Dr Willem Boshoff. They had a good field season and research consisted of the screening of commercial South African wheat cultivars and lines for rust resistance; data from these trials are annually included in the national wheat production guidelines of ARC-SG. Fieldwork was extended to include the evaluation of rye and oats cultivars for their rust reaction. Research was initiated to optimise the expression of stripe-rust adult plant resistance sources under greenhouse conditions. Good progress was made with projects on studying pathogenic variability in rust pathogens of barley, oats, and rye.

Dr Willem Boshoff visited researchers at the Chinese Academy of Sciences during the first week of April 2017 to discuss progress and future collaboration on wheat-stem rust research. Discussions were also held with Prof Xueyong Zhang at the Chinese Academy of Agricultural Sciences. Dr Boshoff toured the long-term gene-bank facility at the academy – currently with 420 000 accessions.

Prof Zakkie Pretorius was invited to the Institute of Genetics and Developmental Biology at the Chinese Academy of Sciences (CAS) in Beijing. He is involved in a joint project with CAS to utilise disease-resistant genes transferred from the grass Thinopyrum ponticum to bread wheat. He also visited the wheat research group at the Chinese Academy of Agricultural Sciences in Beijing, as well as field plots in Zhangjiakou, Hebei province.

Plant Pathology: Soil microbial ecology

The soil and microbial ecology group, led by Prof Wijnand Swart, focuses on monitoring the rhizosphere microbiome as a bio-indicator of plant health. Students study various annual and perennial crops, although research focuses on underutilised crops such as Bambara groundnut, cowpea, and various pseudo-grains such as quinoa and amaranth. The genetic and functional diversity of the rhizosphere microbiome of diseased plants are compared with that of healthy plants using various advanced biochemical and molecular tools at their disposal. Key biotic and abiotic factors in the plant's environment that influence plant health are identified and manipulated in order to directly or indirectly prevent disease or promote crop health. Research is primarily funded by the Ekhaga Foundation in Sweden, the ARC of South Africa, and the Strategic Research Fund of the UFS.

Plant Pathology: Mycology

Dr Gert Marais leads the mycology group that focuses on the biodiversity of fungi and their role in plant health, as well as their economic importance. A five-year contract was signed in 2017 between the UFS and the South African Pecan Nut Producers Association (SAPPA) to study pecan diseases and their impact in South Africa. The Pecan Health Research Group was established at the UFS, consisting of seven postgraduate projects that include plant pathologists and physiologists. Research is conducted in the six major pecan-producing areas in South Africa. Funding was also obtained from the Technology Innovation Agency (TIA) for the launch of this group and aid in the first year of research. Additional TIA funding was obtained to establish a production facility for the production of a plant growth-promoting stimulant that enhances root development, flowering, and fruiting in citrus and other plants.

Pecan Health Research Group taking samples of diseased pecan trees in Modimolle.

Plant Pathology: Epidemiology

The field-crops epidemiology programme is led by Prof Neal McLaren. Collaborative programmes with the Norman Borlaug Institute for International Agriculture and Texas A and M AgriLife Research that focus on the root health of sorghum, optimum utilisation of resources in rotation systems, and the adaptation of sorghum germplasm to local environmental and production conditions and disease resistance, was finalised during a visit in January 2017 to Texas AgriLife in Corpus Christi (Dr Jamie Foster – Principal Investigator (PI), rotation systems) and Lubbock (Dr G Peterson – PI, sorghum breeding). One MSc and two PhD studies are in their final stages, using data sourced from this collaboration.

The legume rotation programme initiated during the Texas A and M AgriLife collaboration, was extended to include a greater diversity of environmental and edaphic variables. This was funded by the ARC Collaborative Consortium: Broadening the Food Base Programme, in collaboration with Dr Maryke Craven at the ARC-Grain Crops Institute (ARC-GCI) in Potchefstroom. This research forms the basis of an MSc study to be finalised in 2018 and is associated with the ARC-Professional Development Programme.

Research support from the Sorghum Trust continued during 2017. Research focused on grain colonisation by grain-mould pathogens and mycotoxigenic *Fusarium* spp., risk-prediction modelling, and the identification and quantification of intervention technologies. A parallel study includes prediction modelling and intervention technology optimisation for sorghum leaf blight, a growing local production constraint. A prediction-modelling study aimed at risk analysis of *Sclerotinia* stem and head rot of soybean and sunflower was funded by the Sasol Trust. The Sasol Trust also funded a study into the optimisation of inoculation and field screening techniques for *Sclerotina* stem rot of soybean and head rot of sunflower and the quantification of genotype x environment interactions based on multi-environment responses. A Sasol Trust bursary also supported an MSc student related to the study.

Community Service

Dr Lize Joubert volunteered at the Cambridge Festival of Plants, Cambridge University Sciences Festival, and various events at the Cambridge University Botanic Garden during 2017. All these events are aimed at engaging the public in science and giving all members of the public (children to pensioners) an opportunity to interact with scientists and rare or interesting specimens.

Dr Andri van Aardt gave two talks at the Botanical Society of South Africa's Free State branch; one in March titled 'Know your shrubs', and the other in August titled 'What can plant fossils tell us about climate'.

Dr Mariette Jackson presented a talk at the Botanical Society of South Africa's Free State branch with the title 'Classification of plants using DNA as a tool'.

Prof Liezel Herselman acts as an evaluator for new projects submitted to the Winter Cereal Trust for funding.

National and International Collaboration

Prof Maryke Labuschagne officially collaborated with CIMMYT (International Maize and Wheat Improvement Centre) in Zimbabwe and Kenya on nutritional value of maize, as well as with Michigan State University and the Swedish University of Agricultural Sciences on wheat and maize quality. She and Dr Angie van Biljon are also involved in a collaborative project with HarvestPlus and the International Institute of Tropical Agriculture in Nigeria on provitamin A in plantain.

Prof Liezel Herselman collaborates with researchers from the Pannar Seed Company, CenGen, and the ARC-SG.

Dr Adre Minnaar-Ontong collaborates with Dr Rouxléne van der Merwe on breeding for resistance to pod dehiscence in a vegetable-type soybean (in collaboration with the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences).

Dr Rouxlene van der Merwe continued collaboration with the EDP. UFS collaboration with the EDP includes germplasm maintenance of introduced varieties, base-seed multiplication, research and training of students, pre-breeding and new cultivar development for South African growing conditions.

Dr Lintle Mohase continued her collaborative research with entomologists from the UFS (Prof S vd M Louw), and the ARC-SGI in Bethlehem (Dr Jankielsohn) on the distribution of the Russian wheat aphid (*Diuraphis noxia*) and the impact of commercial plant activators on wheat performance during aphid infestations.

Dr Lize Joubert collaborates with Prof Steve Johnson from the University of KwaZulu-Natal (UKZN) on pollination biology research in the family Apocynaceae; Dr Pieter Bester from the South African National Biodiversity Institute (SANBI) on systematics and evolutionary research of Nemesia, a genus endemic to Southern Africa and of significant horticultural and conservational importance; and Prof Beverley Glover from the University of Cambridge on floral evolution and development research.

Dr Adri van Aardt collaborates with Dr Frank Neumann from the UKZN and the University of Bremen on an international project on ocean cores from the Indian Ocean (Regional Archives for Integrated Investigations, RAiN), and with a PhD student, Juan Ochando Tomas, from the Faculty of Biology at the University of Murcia, Spain.

Prof Wijnand Swart collaborated closely with researchers from the ARC-Vegetable and Ornamental Plants Institute and the Durban University of Technology (DUT) on the cultivation of underutilised crops within the context of a Collaborative Consortium with Prof Swart as the PI. All participating researchers in the

consortium met at the UFS for two days in March to present and discuss their research results. Prof Swart also collaborated with Prof Pedro Crous, Director of the Westerdijk Fungal Biodiversity Institute in the Netherlands on fungal systematics and barcoding.

Participating researchers from the University of the Free State, the Durban University of Technology, and the Agricultural Research Council at the seminar of the ARC-DUT-UFS Collaborative Consortium for Broadening the Food Base.

Prof Wijnand Swart's research project on ecosystem services in organic fruit orchards funded by the Ekhaga Foundation in Sweden and in collaboration with Prof Klaus Birkhofer from Lund University in Sweden, Dr Regina Lindborg from Stockholm University, and researchers from the Department of Conservation Ecology and Entomology at Stellenbosch University culminated in a workshop at Stellenbosch University during October 2017 where results were presented and discussed.

Prof Neal McLaren and his students collaborated with the Pannar Seed Company in the evaluation of inoculation techniques for *Sclerotinia* stem and head rot of soybean and sunflower respectively, and inoculum production. This collaboration also included field screening of sorghum for risk analysis due to leaf blight and disease prediction. Collaboration with the ARC-GCI in Potchefstroom (Prof Bradley Flett, Drs Belinda Janse van Rensburg, and Maryke Craven) focused on root rot and leaf blight of maize and sorghum and weather modelling of cob rots and concomitant mycotoxins of maize. A new collaboration was initiated with AgriSeed (Dr Derick van Staden) on optimising screening methods for *Sclerotinia* stem rot of soybean. Prof McLaren also collaborated with the Department of Plant Pathology at Stellenbosch University. A course was presented on the application of statistics in the analysis and interpretation of field data related to disease assessment. This course was also presented to Plant Pathology students at the University of Pretoria.

Prof Neal McLaren and his postgraduate students collaborated with Texas A and M AgriLife Research on two projects, namely the Cowpea Focus Group: Improved Cowpea Varieties, and Pulse Legume-based Cropping Systems to Reduce Biotic and Abiotic Stress in Sub-Saharan Africa; and the Sorghum Focus Group: Sorghum Production and End-Use Product Development for Increased Food Security. Prof McLaren and Lisa Rothmann visited the PIs in January 2017. These collaborations also form the basis of Lisa Rothmann and Danelle van Heerden's PhD studies, with contributions to the PhD studies of Michael Chung and Anette Allemann in Prof Wijnand Swart's lab.

Dr Willem Boshoff and Prof Zakkie Pretorius conducted research projects in collaboration with CenGen, ARC-SG, Sensako, the Pannar Seed Company, the Central University of Technology, and Stellenbosch University. They also conducted research projects in collaboration with the Chinese Academy of Sciences (Beijing), the University of Minnesota (UM), and the Agricultural Research Service of the United States Department of Agriculture (ARS-USDA), and the University of Sydney (Australia).

Dr Gert Marais collaborates with SAPPA and the Forestry and Agricultural Biotechnology Institute (FABI) (Profs Bernard Slippers and Wilhelm de Beer) to study diseases in the pecan industry in South Africa. He also worked with Prof Karen Jacobs (Stellenbosch University), studying mycotoxins in abalone feed and co-presented a Mycology module for Honours students at the UFS. Dr Marais, in collaboration with TIA, the UFS, and Carbon Fertilizer Technologies (Pty) Ltd, is developing a plant-growth enhancer, which is in the commercialisation phase.

Dr Ngara collaborates with Dr Stephen Chivasa (Durham University, United Kingdom) and Dr Nemera Shargie (Agricultural Research Council-Grain Crops Institute, ARC-GCI, Potchefstroom).

Dr Komoreng collaborates with Profs Oriel Thekisoe and Rialet Pieters (North-West University), Prof Roger Coopoosamy (Mangosuthu University of Technology), Dr Buyisile Mayekiso (University of Fort Hare), and Meshack Mofokeng (ARC-Vegetable and Ornamental Plants, ARC-VOPI).

Dr Steenhuisen collaborates with Prof Jeremy Midgley and Megan Smith (UCT), Dr Rachel Prunier (Western State Connecticut University, USA), Dr Timotheus van der Niet, Ruth Cozien, Dr Erwin Sieben, Prof Steven Johnson, and Dr Adam Shuttleworth – all from UKZN, and Prof Timothy G O'Connor (SAEON) and Yolanda-Chirango-Hall (Stellenbosch University).

Dr Ashafa collaborates with Dr K Devaki (Karpagam Academy of Higher Education, India), Prof FA Gonzalez (Centro de Investigacion Biomedical del Noreste, Instituto Mexicano del Seguro Social, Mexico), Prof Gerda Fouché (Council for Scientific and Industrial Research [CSIR]), and Prof Jerry Shai (Tshwane University of Technology).

STAFF MATTERS

Dr Willem Boshoff was appointed as Senior Lecturer in Plant Pathology, and Dr Andri van Aardt was appointed as Lecturer in Botany. Prof Zakkie Pretorius took early retirement at the end of October 2017, and Marguerite Westcott resigned in June 2017.

In 2017, our Qwaqwa campus appointed Dr Sandy-Lynn Steenhuisen as a Senior Lecturer, and Dipuo Mosea as an Academic Facilitator for the Bachelor of Science (BSc) Extended Programme.

OTHER

Dr Frank Neumann, a German geologist who specialises in palynology, Quaternary and Neogene paleoecology, and palaeobotany, joined Prof Louis Scott's team in June 2017. His regional focuses are Southern Africa, the Near East, and Middle Europe. Until the beginning of 2017, he worked as an assistant professor at the University of Münster and then accepted a two-year postdoctoral position starting in June 2017, in the frame of the RAiN2 (Regional Archives for Integrated iNvestigations) Project. This interdisciplinary project represents a collaboration between researchers at UKZN and the Centre for Marine Environmental Sciences (MARUM, University of Bremen, Germany).

Dr Steenhuisen supervised a master's graduate from the University of Cape Town, Yolanda Chirango, who graduated in April 2017. Her study focused on the pollination ecology of Cape milkweeds (Asclepiadoideae). The student was co-supervised by Prof Jeremy Midgley (UCT), and Dr Adam Shuttleworth (UKZN).

RESEARCH OUTPUTS

Research Articles

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Allemann, I, Cawood, ME, and Allemann, J. 2017. *Amaranthus cruentus L.:* phytochemical characterisation and phytotoxic activity. Paper delivered at the 43rd Annual conference of the South African Association of Botanists (SAAB) – Protecting biodiversity through sustainability, Lagoon Beach Hotel, Western Cape, South Africa, 8-11 January.

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Sabiu, S, O'Neill, FH, and Ashafa, AOT. 2017. Kinetics of ***α***-amylase and ***α***-glucosidase inhibitory potential of *Zea mays* Linnaeus (Poaceae), *Stigma maydis* aqueous extract: An *in vitro* assessment. Paper delivered at the Society for Medicinal Plants and Economic Development, Birchwood Hotel and OR Tambo Conference Centre, Johannesburg, South Africa, 27-30 August.

Sabiu, S, O'Neill, FH, and Ashafa AOT. 2017. Kinetics of ***α***-amylase and ***α***-glucosidase inhibitory potential of *Zea mays* Linnaeus (Poaceae), *Stigma maydis* aqueous extract: An *in vitro* assessment. Poster delivered at the 65th Annual Conference of the Society for Medicinal Plant and Natural Product Research (GA), Basel, Switzerland, 3-7 September.

Scott, L, Gil-Romera, G, Brook, GA, and Marais, E. 2017. Holocene vegetation change recorded in Late Quaternary faecal deposits of the Namib Desert and boundary region. Poster presented at the Past Global Changes Open Science Meeting (PAGES OSM), Zaragoza, Spain, 9-13 May.

Scott, L, Manzano Rodriguez, S, Carr, AS, Bateman, M, Cordova, C, and Carrión, JS. 2017. A 13 ka pollen and isotope record from alluvial deposits in a Fynbos–Succulent Karoo ecotone near Uniondale, Western Cape, South Africa. Poster presentation published in the Proceedings of the 21st Biennial Conference of the South African Society of Quaternary Research, Johannesburg, *Palaeontologia Africana* 52: 35-37.

Steenhuisen, S-L. 2017. When flowers smell cheesy: An investigation into functional floral traits of African and Australian mammal-pollinated proteas (Proteaceae).

Paper delivered at a symposium on Pollination by Non-flying Mammals at the XIX International Botanical Congress (IBC 2017), Shenzhen, China, 23-29 July.

Terefe, TG, Visser, B, and Pretorius, ZA. 2017 Diversity within the population of *Puccinia graminis* f. sp. *tritici* detected on wheat and triticale in South Africa. Poster presented at the 50th Congress of the Southern African Society for Plant Pathology, Champagne Sports Resort, Drakensberg, 15-19 January.

Tiwani, T, Pieters, R, Mabena, JM, Mayekiso, B, Thekisoe, MMO, and Komoreng, LV. 2017. Antimicrobial, anthelminthic activity and cytotoxicity of medicinal plants used in the treatment of lymphatic filariasis in the Eastern Cape, South Africa. Paper delivered at the Indigenous Plant Use Forum, University of Pretoria, Pretoria, South Africa, 9-12 July.

Van Aardt, AC, Scott, L, and Du Preez, PJ. 2017. Western Free State vegetation ecology: From past to present. Paper presentation at the 43rd Annual Conference of the South African Association of Botanists, University of Cape Town, Cape Town, South Africa. *South African Journal of Botany* 109: 372.

Van Biljon, A, Wentzel, B, Onsando, J, Moloi, J, and Labuschagne, MT. 2017. Quantification of the high molecular weight glutenin subunits in South African hard red wheat cultivars using reversed phase - high performance liquid chromatography. Poster presented at the 13th International Wheat Genetics Symposium, Tulln, Austria, 23-28 April.

Venter, SL, Fouche, HJ, De Wit, M, Mavengahama, S, Coetzer, G, Swart, WJ, and Amonsou, EO. 2017. Fostering partnerships on broadening the food base: Cactus Pear, and Underutilised crop with unlimited potential; The South African Perspective. Paper presented at the IX International Congress on Cactus Pear and Cochineal. Coquimbo, Chile, 26-30 March.

Visser, B, Park, RF, and Pretorius, ZA. 2017. Microsatellite analysis confirms a historical intercontinental movement of *Puccinia graminis* f. sp. *tritici* from southern Africa to Australia. Paper delivered at the 50th Congress of the Southern African Society for Plant Pathology, Champagne Sports Resort, Drakensberg, 15-19 January.

Wentzel, B, Labuschagne, MT, Van Biljon, A, Booyse, M, and Miles, C. 2017. The contribution of non-prolamins (albumin and globulin) to dough properties in South African hard red wheat cultivars. Poster presented at the 13th International Wheat Genetics Symposium, Tulln, Austria, 23-28 April.

Wessels, E, Prins, R, Boshoff, WHP, and Pretorius, ZA. 2017. Mapping the stem rust resistance gene that failed to "Ug99" in wheat cv. Matlabas. Paper presented at the 50th Congress of the Southern African Society for Plant Pathology, Champagne Sports Resort, Drakensberg, 15-19 January.

Zhang, J, Hewitt, T, Zhang, P, Pretorius, ZA, Park, R, Upadhyaya, N, Schippenkoetter, W, Dundas, I, McIntosh, R, Mago, R, Periyannan, S, Wulff, B, Steuernagel, B, Kong, X, Hoxha, S, and Lagudah, E. 2017. Molecular organization of wheat stem rust resistance locus *Sr26* introgressed from *Thinopyrum ponticum*. Poster presented at the 13th International Wheat Genetics Symposium, Tulln, Austria, 23-28 April.

STAFF

Professors: Profs MT Labuschagne, NW McLaren, ZA Pretorius, and WJ Swart.

Associate Professors: Profs B Visser, and L Herselman.

Affiliated Professor: Profs PW Crous, and PKW Ng.

Affiliated Associate Professor: Prof M Zhou.

Senior Lecturers: Drs AOT Ashafa, WHP Boshoff, LV Komoreng, N Lebaka, GJ Marais, GP Potgieter, S-L Steenhuisen and A van Biljon.

Affiliated Senior Lecturer: Dr S Ramburan.

Lecturers: Drs ME Cawood, M Jackson, L Joubert, A Minnaar-Ontong, L Mohase, R Ngara, AC van Aardt, R van der Merwe, and TR Pitso.

Junior Lecturer: M Westcott (resigned in June).

Academic Facilitator: D Mosea.

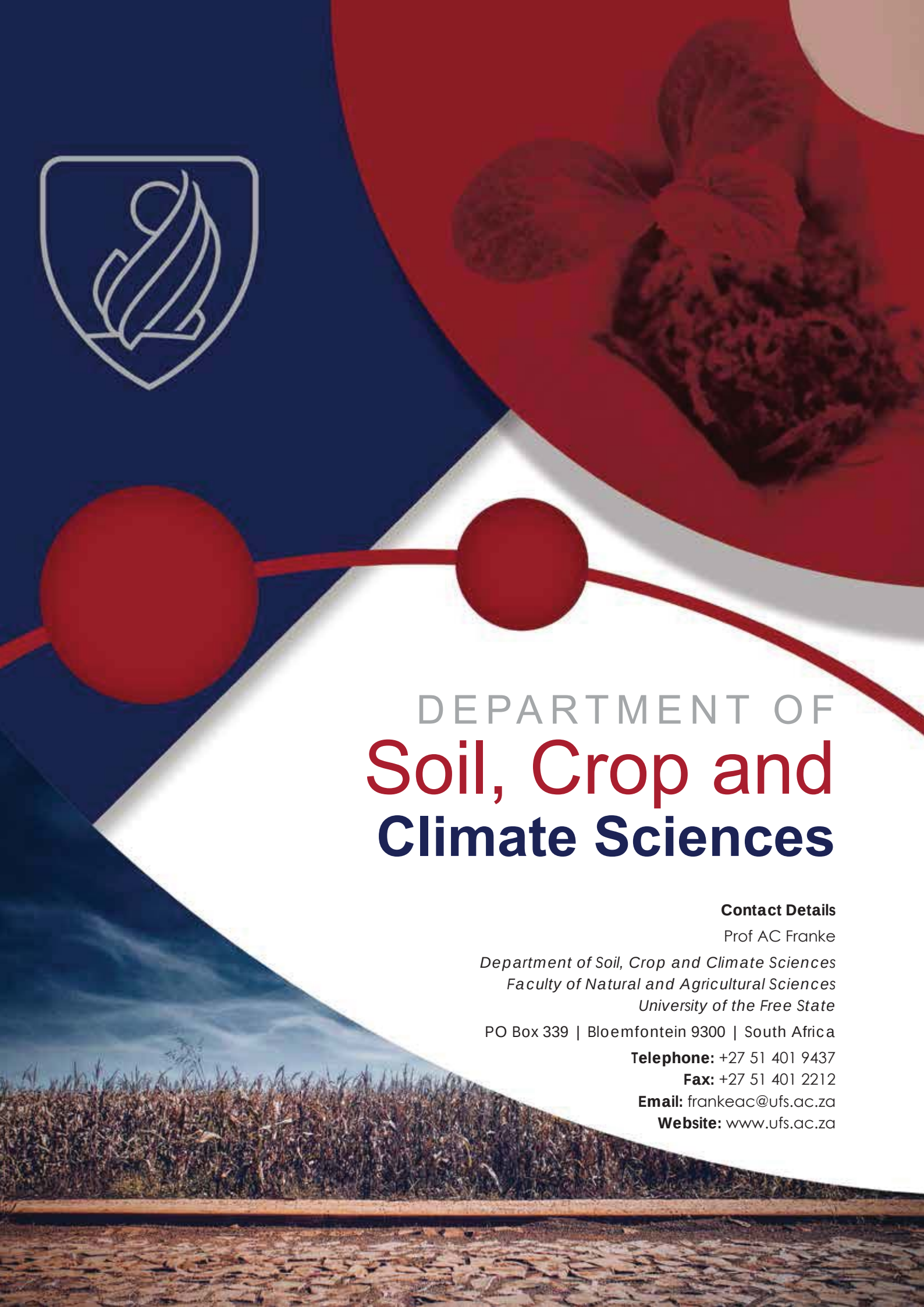
Senior Research Fellow: Prof L Scott.

Research Fellows: Profs PJ du Preez, R Moffet, JHT Venter, Drs R Prins, L Rossouw, and A Venter.

Technical and Support Staff: CM Bender, DR Coetzee, NH Dlamini, NS Macwili, PJ Mojau, LHA Molale, NP Mzizi, S Geldenhuys, N Janse van Rensburg, C Steyn, Z van der Linde, M Pienaar, D Jansen, and HP Pretorius.

Postdoctoral Fellows: Drs Janet Adefuye, Mohammed Elhassan, Marcelo Sandoval-Denis, Brigitta Toth, S Adebayo, FO Balogun, CP Palanisamy and R Selvarajan

Research Assistants: MC Bester, LA Coetzee, R Labuschagne, A Maré, GJ Maree, E Semu, N Theron, D van Heerden, WC Heppel, GM Oosthuizen, and FS Pelser.



DEPARTMENT OF

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2017 Overview

The Department of Soil, Crop, and Climate Sciences specialises in the disciplines of Agrometeorology, Agronomy, and Soil Science; contributing to the agricultural programme of the Faculty of Natural and Agricultural Sciences of the UFS. In addition to undergraduate and postgraduate teaching in the four disciplines, we also contribute to teaching in the centres for Sustainable Agriculture, Rural Development and Extension; Environmental Management; Disaster Management; and the Department of Quantity Surveying and Construction Management at the UFS.

ACHIEVEMENTS

Staff Achievements

Dr Ceronio was elected as the President of the South African Society of Crop Production; Dr Allemann was elected President and Ingrid Allemann as secretary of the Southern African Weed Science Society. Our staff presented five papers and were involved with eight student presentations at the Combined Congress of the South African Society of Crop Production, Soil Science Society of South Africa, Southern African Weed Science Society, and Southern African Society for Horticultural Sciences. Dr Allemann won the CropLife award for the best presentation in weed science with a paper titled 'Evaluation of mesotrione as a pre-emergence herbicide to control volunteer potatoes'.

Dr Makhosazana Aghoghovwia received her PhD in Soil Science from Stellenbosch University with her PhD dissertation 'Effect of different biochars on inorganic nitrogen availability.'

Neo Mathinya received the 2nd prize for oral presentations by a master's student from Cereal Science and Technology-SA (CST-SA) at the New Voices Symposium in Pretoria.

Student Achievements

BJM Bornman was awarded the Gold Medal from the South African Society of Crop Production for achieving an average of above 75% in the final year of the BScAgric degree. Tlomatsana received a medal from the Soil Science Society of South Africa for the final-year student in Soil Science with the best sustainable performance over all study years with an average of at least 70%.

Special Achievements

Potatoes SA produced a booklet on Volunteer potatoes, which is a compendium of papers on the control of volunteer potatoes written by Dr J Allemann and I Allemann.

Activities

Dr Allemann presented a paper on the 'Evaluation of alternative systemic herbicides for volunteer potato control' at the Potatoes SA Research Symposium held at Club Mykanos.

RESEARCH

Research to find a suitable systemic herbicide for the control of volunteer potatoes continued during the year, while a project into tissue culturing and DNA fingerprinting of pecans showed some promising results. Although the contract of the postdoc from Italy ended in 2017, the project continues. Research into cactus pear is also continuing, with huge success on tissue culturing and the establishment of a gene bank of 60 cultivars on West Campus. Natural product screening to identify plants producing potential fungicides, pharmaceuticals, insecticides, and herbicides continued during the year, and produced some encouraging results. Management guidelines for technology transfer to decrease salinization of irrigated land with precision agriculture continues, as well as various factors affecting sunflower emergence, such as herbicides, temperatures, and fertilisation practices.

In 2017, Prof Franke obtained two new research grants. Both grants built upon earlier work on resource-use efficiencies of land, water, and nutrients in potato-based systems in South Africa. Potatoes South Africa approved a three-year grant for detailed measurements of resource-use efficiencies among potato farmers in North-West (Vryburg) using flowmeters, lysimeters, eddy-covariance systems, and crop modelling. The project was extended to the Western Cape (the Sandveld) through a grant from Yara Fertilizer. Nozi Radebe is closely involved in the implementation of the fieldwork for these projects.

Dr Weldemichael Tesfuhuney secured a Water Research Commission (WRC)-funded project for

the ‘Uptake of knowledge, technology and practices for improving water productivity in rain-fed cropping systems’. A major component of this project entails a case study which focuses on smallholder farmers in Thaba Nchu. Funding for a second, related research project, namely ‘Cropping-systems, Climate-risk and Community-engagement Innovations in semi-arid areas of South Africa’, was also obtained from the National Research Foundation (NRF) and will focus on rain-fed cropping systems in semi-arid regions across three provinces (Free State, Limpopo, and Eastern Cape). The overall goal of this project is to increase agricultural productivity by intensifying cropping systems using intercropping and conservation agriculture techniques to promote nutrition security and improve natural resource management, thus reducing poverty and hunger in the semi-arid target areas.

Another research project focuses on determining the crop evapotranspiration of underutilised crops such as the super-grain cereal Teff (*Eragrostis tef*), pseudo-cereal Quinoa (*Chenopodium quinoa*), and other essential mint family Chia seeds (*Salvia hispanica*). For this, field trials were done on the experimental farm in Kenilworth. This study aims to promote alternative/underutilised crops with high nutritional values and enhance suitability to marginal production environments.

Dr Weldemichael Tesfuhuney with Teff at Kenilwoth

Charles Tharaga secured funding through the Thuthuka PHD-Track grant for his PhD studies. The grant also covers the cost of two students, one on master’s level and one on honours level. The grant will run from 2018 till 2020, with the possibility of extending it to postdoctoral level from 2021 to 2024.

Prof Chris du Preez and Dr Johan Barnard were members of a team who completed a WRC report titled ‘Risk based, site-specific irrigation water quality guidelines’ on request for the Department of Water and Sanitation. The 1996 South African Water Quality Guidelines is one of the most widely-used tools in water quality management. However, these guidelines are now viewed as significantly out of date. The new guidelines were thus envisaged to be different in a number of fundamental ways. Firstly, they are risk-based. Secondly, they allow for much greater site-specificity. Thirdly, they are made available primarily as a software-based decision-support system.

Prof Du Preez and Dr Elmarie Kotzé completed a German Research Foundation subproject titled ‘Vulnerability and resilience of soils under different rangeland use’ under the umbrella project titled ‘Resilience, collapse and reorganisation in social ecological systems of East and South Africa’s savannah’. The mentioned subproject was done in collaboration with Prof Wulf Amelung and Alexandra Sandhage-Hofmann from Bonn University. Several peer-reviewed papers were already published, and more are in the pipeline. This research manifested in an invitation to Chris du Preez for a review paper ‘Changes in soil organic matter content and quality in South African arable land’ and to Elmarie Kotzé for a review paper ‘Rangeland management and soil quality in South Africa’ in *Advances in Soil Science: Soil Degradation in Africa*. The editor of this book is Rattan Lal, a world-renowned soil scientist with about 700 peer-reviewed papers.

Prof Leon van Rensburg’s research group consists of Dr Johan Barnard, Dr Sabelo Mavimbela, Dr Zaid Bello, Frans Joseph (Department of Agriculture, Free State), Prof Rianto van Antwerpen (SASRI), Ashiel Jumman (SASRI), Dr Pieter van Heerden (PICWAT), Dr Willem de Clercq (Stellenbosch University), and a number of master’s and doctoral students.

Dr Sabello leads the research on the hydro-physical properties of selected ecotopes at the Kolomela iron mine near Postmasburg, aiming to provide answers on how rainfall is partitioned between runoff, drainage, evaporation, transpiration, and deep drainage, since farmers are complaining that the dewatering of the mine impact negatively on the groundwater supply and hence on their farming activities.

Dr Bello focuses on the water footprint of beer, a project sponsored by the Winter Cereal Trust and SAB Miller. This project focuses on the irrigation scheduling of barley and consist of glasshouse and field studies.

The main findings of the research were captured in the SWAMP model by Dr Barnard.

The rest of the team members focus on the ongoing Water Research Commission-funded project, viz. 'Management guidelines for technology transfer to reduce salinization of irrigated land with precision agriculture water and salinity management of irrigated crops'. In this project, water and salt distribution in the irrigation water and soils are spatially monitored over two cropping seasons under ten centre pivots located in four provinces.

Dr Johan van Tol finalised a multi-disciplinary Water Research Commission project which aimed to capture the potential impacts of the Mzimvubu Water Project (MWP) on agricultural, environmental, and socio-economic aspects. The study was conducted near Tsolo in the Eastern Cape in collaboration with the University of Fort Hare and Rhodes University. Three master's students and one doctoral student worked on various soil-related topics associated with the MWP. Dr Van Tol also leads another project in the same area, focusing on the mapping of erosion-sensitive areas. This project is funded by the Department of Environmental Affairs (DEA) under the National Resource Management Programme (NRM) and will be completed early in 2018. Two MSc students are involved in this project.

Dr Johan van Tol and two master's students (Tshiamo Setsipane and Matthew Chauke) finalised a research project funded by the DST and managed by the Institute for Commercial Forestry Research (ICFR). Dr Van Tol and T Setsipane focus on the hydropedological interpretation of soils to determine the site productivity of various forestry species. M Chauke, together with Dr George van Zijl (Digital Soils Africa), focus on extrapolating point findings to large areas, using digital soil mapping approaches. Dr Van Tol also obtained a certificate in Environmental Law (with distinction) from the University of Pretoria.

National and International Collaboration

We undertook research projects for, among others, Agraforum, the WRC, Pecan SA, Potatoes SA, and Yara Fertilizer. A collaborative workshop on cactus pear research was held with the ARC.

In February, Prof Franke visited Wageningen University in the Netherlands to discuss ongoing collaboration in the field of legume and farming systems research, and to attend the graduation of a PhD student he jointly supervised with their Plant Production Systems group. In October, Prof Franke visited the 18th WaterNet symposium in Swakopmund, Namibia, and gave a presentation on the nexus between water, energy, and land use efficiency in potato production in South Africa.

Dr Tesfuhuney accompanied several students to the annual South African Society for Atmospheric Sciences (SASAS) conference in Polokwane, Limpopo, during September. Two posters were presented. He also attended the American Geophysical Union (AGU) meeting in New Orleans in December, where he presented a paper during the climate change session.

Mr Tharaga made use of two international mobility grants in 2017. The first visit in May was funded by the university's Postgraduate School and Rectorate Research to the East Malling Research Institute and University of Reading in the United Kingdom. The aim of the visit was to learn more about the techniques used in relation to irrigation scheduling for commercial farmers in the area. The second visit was in June to the Neon Data Center in Denver, Colorado (USA) to attend one week of training on using different software packages for analysing evapotranspiration and other climatic variables from remote sensing.

STAFF MATTERS

In 2017, Dr Linus Franke was promoted from Senior Lecturer to Associate Professor. Later during the same year, he was appointed as the Academic Head of the Department, taking over from Prof CC du Preez, who will retire by the end of 2018.

RESEARCH OUTPUTS

Research Articles

Allemann, I, Cawood, ME, and Allemann, J. 2017. Influence of altered temperatures on alleopathic properties of *Amaranthus cruentus L. Acta Agriculturae Slovenica* 109 (2): 465-471.

Bah, S, Van der Merwe, R, and Labuschagne, MT. 2017. Estimation of outcrossing rates in intraspecific (Oryza sativa) and interspecific (Oryza sativa x Oryza glaberrima) rice under field conditions using agro-morphological markers. *Euphytica* 213: 81-1-81-12.

Barnard, JH, Van Rensburg, LD, Bennie, ATP, and Du Preez, CC. 2017. Water and salt balances of two shallow groundwater cropping systems using subjective and objective irrigation scheduling. *Water SA* 43 (4): 581-594.

Bello, ZA, and Walker, S. 2017. Evaluating AquaCrop model for simulating production of amaranthus (Amaranthus cruentus) a leafy vegetable, under irrigation and rainfed conditions. *Agricultural and Forest Meteorology* 247: 300-310.

Bello, Z., Van Rensburg, LD, and Dlamini, PE. 2017.

Response of Glasshouse Grown Malt Barley Yield to Water Stress. *Agronomy Journal* 109 (3): 1-13.

Bezerra, J, Marcelo, MP, Paiva, L, Silva, G, Groenewald, J, Crous, PW, and Souza-Motta, C. 2017. New endophytic Toxicocladosporium species from cacti in Brazil, and description of Neocladosporium gen. nov. *IMA Fungus* 8: 77-97.

Coetzee, PE, Ceronio, GM, and Du Preez, CC. 2017. Effect of phosphorus and nitrogen sources on essential nutrient concentration and uptake by maize (Zea mays L.) during early growth and development. *South African Journal of Plant and Soil* 34 (1): 55-64.

Debele, T, Du Preez, CC, and Ceronio, GM. 2017. Economic Evaluation of Tillage Systems and Nitrogen Fertilization for Maize Production in Western Ethiopia. *International Journal of Research in Agricultural Sciences* 4 (4): 2348-3997.

Debele, T, Du Preez, CC, and Ceronio, GM. 2017. Economic Evaluation of Nitrogen Efficient Maize Genotypes in Western Ethiopia. *International Journal of Agriculture Innovations and Research* 6: 217-221.

Debele, T, Du Preez, CC, and Ceronio, GM. 2017. Effect of Tillage Systems and Residue Management on Penetrometer Resistance of Nitisols under Maize Production in Western Ethiopia. *Ethiopia Journal of Applied Science and Technology* 8: 10-18.

Dingaan, M, Dingaan, MNV, Tsubo, M, Walker, S, and Newby, T. 2017. Soil chemical properties and plant species diversity along a rainfall gradient in semi-arid grassland of South Africa. *Plant Ecology and Evolution* 150 (1): 35-44.

Dlamini, PE, Ukoh Haka, IB, Van Rensburg, LD, and Du Preez, CC. 2017. Reduction of evaporation from bare soil using plastic and gravel mulches and assessment of gravel mulch for partitioning evapotranspiration under irrigated canola. *Soil Research* 55: 222-233.

Ezui, K, Franke, AC, Ahiabor, B, Tetteh, F, Sogbedji, J, Janssen, B, Mando, A, and Giller, K. 2017. Understanding cassava yield response to soil and fertilizer nutrient supply in West Africa. *Plant and Soil* 420: 331-347.

Ezui, K, Franke, AC, Leffelaar, P, Mando, A, Van Heerwaarden, J, Sanabria, J, Sogbedji, J, and Giller, K. 2017. Water and radiation use efficiencies explain the effect of potassium on the productivity of cassava. *European Journal of Agronomy* 83: 28-39.

Franke, AC. 2017. A potato model intercomparison across varying climates and productivity levels. *Global Change Biology* 23 (3): 1258-1281.

Jordaan, M, Coetzer, GM, and Allemann, J. 2017. Potential of Adelaide, Cradock and Middelburg, South Africa, for out-of-season onion production using different planting materials and planting dates. *South African Journal of Plant and Soil* 34 (1): 1-8.

Kermah, M, Franke, AC, Adjei-Nsiah, S, Ahiabor, B, Abaidoo, R, and Giller, K. 2017. Maize-grain legume intercropping for enhanced resource use efficiency and crop productivity in the Guinea savanna of northern Ghana. *Field Crops Research* 213: 38-50.

Kotze, E, Sandhage-Hofmann, A, Amelung, W, Oomen, R, and Du Preez, CC. 2017. Soil microbial communities in different rangeland management systems of a sandy savanna and clayey grassland ecosystem, South Africa. *Nutrient cycling in agroecosystems* 107: 227–245.

Makuvaro, V, Walker, S, Munodawafa, A, Chagonda, I, Masere, P, Murewi, C, and Mubaya, C. 2017. Constraints to crop production and adaptation strategies of Smallholder farmers in semi-arid central and western Zimbabwe. *African Crop Science Journal* 25: 221-235.

Matikiti, A, Allemann, J, Kujeke, G, Gasura, E, Masekesa, T, and Chabata, I. 2017. Nutritional composition of cocoyam (Colocasia esculenta) grown in manicaland province of Zimbabwe. *Asian Journal of Agriculture and Rural Development* 7: 48-55.

Mengistu, AG, Van Rensburg, LD, and Mavimbela, SSW. 2017. The effect of soil water and temperature on thermal properties of two soils developed from aeolian sands in South Africa. *Catena* 158: 184-193.

Parwada, C, and Van Tol, JJ. 2017. Litter quality effects on soil stability and erodibility of selected South African soils. *Global Advanced Research* 6: 181-187.

Parwada, C, and Van Tol, JJ., 2017. Stability of Soil Organic Matter and Soil Loss Dynamics under Short-term Soil Moisture Change Regimes. *Agrotechnology* 6: 1-8.

Swanepoel, P, Habig, J, Du Preez, CC, Snyman, HA, and Botha, P. 2017. Tillage effects, soil quality and production potential of kikuyu-ryegrass pastures in South Africa. *Grass and Forage Science* 72 (2): 308-321.

Tfwala, CM, Van Rensburg, LD, Schall, R, Mosia, MS, and Dlamini, PE. 2017. Precipitation intensity-duration-frequency curves and their uncertainties for Ghaap plateau. *Climate Risk Management* 16: 1-9.

Toffolo, M, Brink, JS, Van Huyssteen, CW, and Berna, F. 2017. A microstratigraphic re-evaluation of the

Florisbad spring site, Free State Province, South Africa: Formation processes and paleoenvironment. *Geoarchaeology-An International Journal* 32: 456-478.

Van Antwerpen, R, Miles, N, and Mthimkhulu, S. 2017. Mass and composition of ash remaining in the field following burning of sugarcane at harvest. *Proc. S. Afri. Sug Technol Ass* 90: 104-112.

Van Tol, JJ, and Parwada, C. 2017. Soil properties influencing erodibility of soils in the Ntabelanga area, Eastern Cape Province, South Africa. *Acta Agriculturae Scandinavica - Section B Soil and Plant Science* 67 (1): 67-76.

Van Vugt, D, Franke, AC, and Giller, K. 2017. Participatory research to close the soybean yield gap on smallholder farms in Malawi. *Experimental Agriculture,* 53 (3): 396-415.

Von Sperber, C, Stallforth, R, Du Preez, CC, and Amelung, W. 2017. Changes in soil phosphorus pools during prolonged arable cropping in semiarid grasslands. *European Journal of Soil Science* 68: 462-471.

Conference Contributions

Allemann, I, Cawood, ME, and Allemann, J. 2017. Allelopathy: Protocol to test Amaranthus cruentus L. on lettuce seedlings. Combined Congress 2017 - Poster, Klein Kariba.

Allemann, I, Cawood, ME, and Allemann, J. 2017. Amaranthus cruentus l phytochemical characterization and phytotoxic activity (Oral). 43rd Annual conference of SAAB, Cape Town, South Africa.

Allemann, I, Cawood, ME, and Allemann, J. 2017. Effect of temperature stressed Amaranthus cruentus L. residues and extracts on pepper germination and seedling growth. Combined Congress 2017, Klein Kariba.

Allemann, J. 2017. Evaluation of alternative systemic herbicides for volunteer potato control. PSA research symposium, Club Mykanos.

Allemann, J. 2017. Evaluation of mesotrione as a pre-emergence herbicide to control volunteer potatoes. (CropLife trophy for Best Paper in the field of weed science- SAWSS). Combined Congress 2017, Klein Kariba.

Allemann, J, Peni, ES, Maleka, MF, and De Vos, A. 2017. Oral - Chloroplast phylogenomics in cactus pear (Opuntia ficus-indica). Chloroplast phylogenomics in cactus pear, Klein Kariba.

Casales, FG, Coetzer, GM, and Van der Watt, E. 2017. Breaking seed dormancy, improving germination and seedling growth in pecan [(Carya illinoensis (Wangenh.) K Koch]. Combined Congress, Klein Kariba.

Coetzer, GM, and Fouche, HJ. 2017. Genotype x environmental interactions of cactus pear (Opuntia Ficus-Indica) in the semi-arid regions of South Africa: fruit production. IX International Congress on Cactus Pear and Cochineal, Chile.

Coetzer, GM, De Witt, M, Fouche, HJ, and Venter, S. 2017. Climatic influences on fruit yield, quality and sensory traits: a five-year evaluation. IX International Congress on Cactus Pear and Cochineal, Chile.

De Wit, M, Coetzer, GM, Fouche, HJ, and Venter, SL. 2017. Climatic influences on fruit quality and sensory traits of cactus pear (O. ficus-indica): a five-year evaluation. Coquimbo, Chile.

De Wit, M, Du Toit, A, Fouche, HJ, Hugo, A, and Venter, SL. 2017. Screening of cladodes from 42 South African spineless cactus pear cultivars for morphology, mucilage yield and mucilage viscosity. International Congress on Cactus Pear and Cochineal, Coquimbo, Chile.

De Wit, M, Du Toit, A, Fouche, HJ, Venter, SL, and Hugo, A. 2017. Relationship between cladode morphology and mucilage traits from different cactus pear cultivars for human food applications. Biennial International Congress of the South African Association of Food Science and Technology, Cape Town, South Africa.

De Wit, M, Fouche, HJ, De Waal, HO, Coetzer, GM, and Venter, SL. 2017. Promoting the potential of spineless cactus pear (Opuntia ficus-indica) as a multi-use crop at the Oppermansgronde community in the Free State Province of South Africa. International Congress on Cactus Pear and Cochineal, Coquimbo, Chile.

Du Toit, A, De Wit, M, Fouche, HJ, Hugo, A, and Venter, SL. 2017. The effect of dietary omega-3 supplementation of pigs on the technological quality, oxidative stability and sensory properties of pork back bacon. International Congress on Cactus Pear and Cochineal, Coquimbo, Chile.

Du Toit, A, De Wit, M, Fouche, HJ, Hugo, A, and Venter, SL. 2017. Determination of the functional properties of freeze-dried cactus pear mucilage powder from cladodes of four South African cultivars. International Congress on Cactus Pear and Cochineal, Coquimbo, Chile.

Fouche, HJ, and Coetzer, GM. 2017. Genotype x

environmental interactions of cactus pear (Opuntia ficus-indica) in the semi-arid regions of South Africa: cladode production. IX International Congress on Cactus Pear and Cochineal, Chile.

Fouche, HJ, Coetzer, GM, De Witt, M, Mavengahama, S, and Venter, SL. 2017. Cactus pear's potential to sustain livestock production in drought-stricken areas: a case study of Oppermans community in the Free State province of South Africa. IX International Congress on Cactus Pear and Cochineal, Chile.

Franke, AC, Steyn, J, Van der Waals, J, and Haverkort, A. 2017. The nexus between water, energy and land use efficiencies in potato production in South Africa. WaterNet Symposium, Swakopmund, Namibia.

Franke, AC, Van den Brand, G, Vanlauwe, B, and Giller, K. 2017. Sustainable intensification through rotations with grain legumes in sub-saharan Africa: a review. Bela-Bela.

Gqalaqha, Z, Van Huyssteen, CW, and Grundling, A. 2017. Identifying wetland soil properties that are conducive to the development of Rift Valley Fever. Port Edward, National Wetland Indaba.

Jaola, KP, and Van Huyssteen, CW. 2017. Glasshouse pot-trial to determine optimal degree of water saturation for wetland vegetation. National Wetland Indaba, Port Edward.

Jordaan, M, Coetzer, GM, and Allemann, J. 2017. Determining planting date of short day onion cultivars for the production of out of season onions at Adelaide (Eastern Cape, South Africa) using different planting dates. Combined Congress 2017 - Poster, Klein Kariba.

Jordaan, M, Coetzer, GM, and Allemann, J. 2017. Determining planting date of short day onion cultivars for the production of out of season onions at Adelaide (Eastern Cape, South Africa), using different planting dates. Combined Congress, Klein Kariba.

Le Roux, PAL., Van Tol, JJ, and Tinnefeld, M. 2017. Hydropedological interpretation of arid soilscapes, South Africa. European Geosciences Union, General Assembly, Vienna, Austria.

Lorentz, S, Van Tol, JJ, and Le Roux, PAL. 2017. Using Hydropedology Surveys to Guide Process Based Hydrological Modelling in South Africa. IAHS Scientific Assembly, Port Elizabeth.

Lorentz, S, Van Tol, JJ, Le Roux, PAL. 2017. Water and Solute Flux Simulation Using Hydropedology Survey Data in South African Catchments. European Geosciences Union, General Assembly, Vienna, Austria.

Mathinya, VN, Barnard, JH, and Van Rensburg, LD. 2017. Salinity effects on grain yield and quality of malt barley grown on irrigated shallow groundwater table soils. Paper delivered at the 2nd New Voices Symposium hosted by Cereal Science and Technology-SA (CST-SA), Pretoria, South Africa.

Maleka, MF, De Vos, A, and Coetzer, GM. 2017. Exploring DNA methylation in the cactus pear (Opuntia ficus-indica) genome. African Combined Congress, Bela-Bela, South Africa.

Masvodza, DR, Coetzer, GM, and Van der Watt, E. 2017. Sterilization of Potato Explants for In Vitro Propagation. World Academy of science, engineering and technology conference, Bangkok.

Mokgakala, K, De Vos, A, Coetzer, GM, and Maleka, MF. 2017. Exploring DNA methylation in the cactus pear (Opuntia ficus-indica) genome. African Combined Congress, Bela-Bela, South Africa.

Mokgakala, K, De Vos, A, Coetzer, GM, and Maleka, MF. 2017. Exploring DNA methylation in the cactus pear (Opuntia ficus-indicia) genome. Combined Congress, Klein Kariba.

Peni, ES, Coetzer, GM, Maleka, MF, and De Vos, A. 2017. Chloroplast phylogenomics in cactus pear (Opuntia ficus-indica). Combined congress, Klein Kariba.

Peni, ES, De Vos, A, Coetzer, GM, and Maleka, MF. 2017. Chloroplast phylogenomics in cactus pear (Opuntia ficus-indica). African Combined Congress, Bela-Bela, South Africa.

Phohlo, MP, Kotze, E, and Du Preez, CC. 2017. Influence of management practices on soil organic matter indicators under kikuyu, ryegrass and clover pasture mixtures. International Congress on Organic Farming, London, United Kingdom.

Phohlo, MP, Kotze, E, and Du Preez, CC. 2017. Influence of management practices on soil organic matter indicators under kikuyu, ryegrass and clover pasture mixtures on dairy farms in the Tsitsikamma region. Combined Congress 2017 of Soil Science Society of South Africa, South African Society of Crop Production, South African Society of Horticulture and South African Weed Science Society, Bela-Bela.

Sakumona, M, Allemann, J, and Van der Watt, E. 2017. Physiological responses of winter wheat cultivars under two ecotopes. Combined Congress 2017, Klein Kariba.

Sandhage-Hofmann, A, Loffler, J, and Du Preez, CC. 2017. The impact of management systems on bush

encroachment and soil properties in savannas of South Africa. Annual Conference on Tropical and Subtropical Agricultural and Natural Resource Management, Bonn, Germany.

Sandhage-Hofmann, A, Loffler, J, Du Preez, CC, Kotze, E, Weijers, S, Wundram, D, Zacharias, M, and Amelung, W. 2017. Rangeland degradation in savannas of South Africa: spatial patterns of soil and vegetation. European Geosciences Union General Assembly 2017. Vienna, Austria.

Stolk, A, and Van Huyssteen, CW. 2017. Quantitative differentiation between prismacutanic B, G, soft plinthic B, and E horizons, to aid wetland delineation. National Wetland Indaba, Port Edward.

Swanepoel, PA, Van der Laan, M, Weepener, H, Du Preez, CC, Annandale, J. 2017. Quantifying soil organic matter loss due to cultivation in southern Africa. Combined Congress of the Soil Science Society of South Africa, South African Society of Crop Production, South African Society of Horticulture Sciences and Southern African Weed Science Society, Bela-Bela.

Van der Watt, E, Pretorius, J, and Allemann, J. 2017. A preliminary study: impact of bio-stimulants on wheat under herbicide stress. Combined Congress 2017, Klein Kariba.

Van Huyssteen, CW. 2017. Glasshouse pot-trial to determine optimal degree of water saturation for wetland vegetation. Port Edward.

Van Rensburg, LD, Barnard, JH, and Steenekamp, D. 2017. Inferring salt and water distribution in an irrigated crop field using electromagnetic induction techniques. Paper delivered at the 3rd Global Summit on Plant Science, Rome, Italy.

Van Tol, JJ, and Lorentz, S. 2017. Understanding groundwater/surface-water interactions through hydro-pedological interpretations of soil distribution patterns. IAHS Scientific Assembly, Port Elizabeth.

Van Tol, JJ. 2017. Hydropedology: Linking groundwater and surface water. Combined Congress, Klein Kariba.

Van Tol, JJ, Lorentz, S, and Le Roux, PAL. 2017. Examples of hydropedological applications. 14th International Water Association Specialist Conference, Skukuza, Kruger National Park.

Venter, S, Fouche, H, De Wit, M, Mavengahama, S, Coetzer, GM, Swart, WJ, and Amonsou, E. 2017. The effect of fostering partnerships on broadening the food base: the role of cactus pear, an underutilised crop with unlimited potential, the South African perspective. 9th International Congress on Cactus Pear and Cochineal, and the General Meeting of the FAO-ICARDA International Cooperation Network on Cactus Pear and cochineal (CACTUSNET), Coquimbo, Chile.

STAFF

Professors: Profs CC du Preez, CW van Huyssteen, and LD van Rensburg.

Associate Professors: AC Franke.

Senior Lecturers: Drs J Allemann, JH Barnard, GM Ceronio, GM Coetzer, E Kotzé, E van der Watt, and JJ van Tol.

Lecturers: Dr WA Tesfuhuney, MP Aghoghovwia, L de Wet, Messrs AS Steyn, JC Dlamini, and PC Tharaga.

Junior Lecturers: VN Mathinya.

Affiliate Professors: Profs JC Pretorius, M Savage, and S Walker.

Affiliate Associate Professors: Prof R van Antwerpen.

Senior Officer: Professional Services: L Henning and TO Khitsane.

Officer: Professional Services: N Radebe.

Senior Assistant Officers: A Moffat, R Etzebeth, and GC van Heerden.

Technical Assistants: TDD Mavuya, TE Moeti, TG Mokoena, and EC Nthoba.

Building Sciences

DEPARTMENT OF

Architecture

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2017 Overview

The 2017 academic year presented many challenges, especially the exhaustive work in preparation of the external validation for the professional programmes. However, it was once again a productive year with many rewards. The SACAP/ CAA (South African Council for the Architectural Profession, Commonwealth Association of Architects) external validation of the Architectural Learning Site in April 2017 was a success. This validation process happens every four to five years, with several aspects being evaluated, ranging from curriculum content to staff performance. The department once again received unconditional validation and will continue to develop the highest standards of architectural education in line with the panel recommendations.

We hosted the 29th Sophia Gray Memorial lecture, with the firm Elphick Proome Architects (EPA) presenting their lecture 'Evolution' in the Kopanong Auditorium. The lecture was well attended and enjoyed by professionals and students. This lecture also serves as a CPD (continuing professional development) event and benefits our profession while also educating students. The accompanying exhibition was hosted at the Oliewenhuis Art Museum.

Validation Exhibition

Validation exhibtion (photos by JA Noble)

ACHIEVEMENTS

Student Achievements

MArch (professional) student, Su-Elna Bester, received the Free State Corobrik Student of the Year Award for her master's dissertation: 'The M.CAC / Multi-Cultural Centre of Dubai'. She described her design as a centre that is home to all different cultures and communities and will represent the Free State at national level in 2018.

The second prize went to Wim Boshoff for his Cinematic Art Centre in Bloemfontein, and the third prize was presented to Jani Schreuder who designed a Dual Education Centre for Women and Infants in Pretoria. An additional prize for the best use of clay masonry was awarded to Jacques Steyn for his design of an Urban Recycling Centre in Bloemfontein.

Students also performed well during the 10th Carl and Emily Fuchs Foundation Prestige Prize in Architecture competition that was hosted in the department. The top graduate students from eight national Architectural Learning Sites are adjudicated on their undergraduate portfolios, their full academic record, and a 24-hour En Loge project. The three winners were Madeli Beyers (UFS), Diana Kuhn

Su-Elna Bester (photo courtesy of Corobrik)

(UCT), and Benjamin Kollenberg (Wits). Each of the three top students received a bursary of R50 000. This year, the En Loge project was conceptualised by the department, investigating the forgotten voices in science, and the magical realism stories of the Free State landscape and the cosmos. The project was presented at the Boyden Observatory and Science Education Centre.

Our postgraduate class competed in additional competitions, and BArch Honours students Madeli Beyers and Megan van Aarde's portfolios were selected as part of the five finalists in the Boogertman + Partners SADC architecture competition.

Megan Van Aarde (right) and Madeli Beyers (far left) at the Boogertman awards (photo MM bitzer)

Stephan Diederiks and Margaux Loubser from Kovsies (photo by PG Bison)

The third-year BArch students also took up the challenge and competed in the PG Bison design competition; three of our students' designs were selected as part of the top 10 finalists. Stephan Diederiks and his lecturers, Zack Wessels and Kobus du Preez, received the award for best design and the opportunity to travel to Milan, Italy, in 2018. The second prize was awarded to Margaux Loubser.

Activities

Our second-year BArch students toured to Kimberley where they assisted Dr Gerhard Bosman with research on earth-constructed houses. The students visited Kimberley from 9 to 11 June on their annual design tour, with the new Sol Plaatje University campus buildings as one of the tour sites. Students spent most of their time conducting a household survey at the Soul City housing project to investigate the acceptability of RDP housing constructed over the past twelve years.

The honours students toured to Johannesburg to prepare them for their first-semester design projects, visiting several art spaces, including Nirox, Arts-on Main in Maboneng, and spaces in Newtown.

Jan Ras and Kobus du Preez organised the events around the August architecture activities at the UFS and assisted with the exhibition of Elphick Proome Architects' presentation during the annual Sophia Gray memorial lecture.

During the Free State Arts Festival, we hosted our annual Winter School for Grade 11 and 12 learners who are considering a career in architecture. They experienced a taste of the BArch course to help them decide if they want to pursue this qualification at the UFS.

Sophia Gray exhibiton - Elphick Proome

RESEARCH

Our staff attended local and international conferences and published several accredited articles.

Dr Gerhard Bosman travelled to the Himalayas in Northern India where he attended a workshop on earth-construction techniques.

Dr Auret started working on a book, supported by Routledge Publishers, based on his PhD level research on Norberg-Schulz and Heidegger.

Prof Jonathan Noble has also engaged with a book on the work of architect Peter Rich, while supervising the PhD in Architecture with Design academic programme. Both he and Kobus du Preez presented papers at the 11th annual SAJAH conference in Cape Town on 10 and 11 August. The conference investigated the theme 'craft.object.people'.

Community Service

Hein Raubenheimer and Dr Gerhard Bosman continued with the project: Construction of an experimental private dwelling in Phase 9, Mangaung. Students from across the different programmes were enthusiastic about their involvement on site.

The workshop in the Earth Unit is also up and running in our building, and students can apply their knowledge practically and experiment with materials. These experiments are also applied practically at the experimental dwelling project.

The Earth Unit continued with its responsibilities as a UNESCO Earth Architecture member, serving in the scientific committees of international conferences hosted by UNESCO partners.

Programme director, Jako Olivier, took the initiative to launch a bursary fund for deserving Architecture students. This fund was launched along with the 29th Sophia Gray Memorial lecture, offering a breakfast for alumni and friends of the department.

National and International Collaboration

Dr Hendrik Auret serves on the Permit Committee and Kobus du Preez on the Council of the Free State Provincial Heritage Resources Agency (FSPHRA).

Dr Gerhard Bosman serves on the Municipal aesthetic committee for Mangaung Metro. He also serves as UNESCO Chair: Earthen architecture, construction and sustainable development, and heads the Earth Unit.

Wanda Verster continues to work with Uppsala University contacts in Sweden to promote possible collaboration. She also chaired the Sweden-South African University Forum academic advice committee for the cities in the 21st century group as part of the planning for the 2018 event. Furthermore, from August 2017, she serves on the editorial advisory board of *Architecture SA*: the journal for the South African Institute of Architects.

There is an ongoing collaboration between the Departments of Architecture, Art History, and Image Studies, as well as the Department of Quantity Surveying.

Postgraduate Students

We are building on the success of three PhD graduates in 2015, with a strong cohort of postgraduate students in the higher degree programmes. PhD candidate, Yolanda van der Vyver, presented at the 11th annual SAJAH conference, and Wanda Verster published on her ongoing research.

We have registered a new higher degree programme which is open for enrolment in 2018, offering a unique opportunity for design professionals to earn a PhD in Architecture with Design, using their practice expertise. Largely founded on a similar programme initiated by RMIT in Australia, the UFS is the first African university to host a programme of this nature. Prof Jonathan Noble laid the academic foundations for the new PhD with specialisation in Design. The module 'Thesis in Architecture with Design' (ARCD9100), which serves this new PhD study plan, was approved via the relevant university committees. We are excited to start this new and innovative doctoral programme in 2018.

STAFF MATTERS

Valentino Moutzouris, a practicing architect with Cube Architects, was appointed as a contract lecturer in CAD drawing techniques, transferring his technical skills to second-year BArch students.

We also welcomed Prof Jonathan Noble, an NRF-rated researcher, lecturer, and SAIA Merit Award winner, to Bloemfontein. He is involved in the BArchHons programme in Design (DESN6800), Design and Research Methods (RMET6822), higher degree programmes, and most notably the new PhD in Architecture with Design.

RESEARCH OUTPUTS

Research Articles

Atkins, C. 2017. Transforming the architecture of death: monument vs. Anti-monument. *South African Journal of Art History* 32(1): 35-56.

Bosman, G. 2017. Ownership and care in culturally significant architecture: Three case studies. *Acta Structilia.* 24(1): 1-26.

Du Preez, JL. 2017. To have a roof over one's head. *South African Journal of Art History.* 33(1): 26-37.

Noble, JA. 2017. Like a Fish in Water: the smooth hybrids of Jackson Hlungwani. *South African Journal of Art History.* 32(2): 120-131.

Peters, WH. 2017. Competitions, politics and the production of modern architecture: Jack Barnett's Free State oeuvre. *South African Journal of Art History.* 32(1): 1-16.

Van der Vyver, Y. 2017. Crafting urban space with Pretoria's Church Square as an example. *South African Journal of Art History.* 32(2): 190-211.

Verster, W, Bysell, L, and Magnusson, A. 2017. Post-apartheid reconciliation through buildings: A comparison between two South African museums. *Tidskrift för ABM: Uppsala University*. 2(2): 39-60.

Chapters in Books

Noble, JA. 2017. What is a design thesis? *10 years 100 projects: Architecture in a Democratic South Africa*. Joubert, O. [ed]. Bell Roberts: Cape Town. pp.12-14.

Olivier, JI. 2017. Introduction: University of the Free State. *10 years 100 projects: Architecture in a Democratic South Africa*. Joubert, O. [ed]. Bell Roberts: Cape Town. pp.12-14.

STAFF

Academic Head of Department: HB Pretorius.

Professors: Prof JA Noble.

Senior Lecturers: JL du Preez, MM Bitzer, A Wagener, Dr G Bosman.

Lecturers: JH Nel, JW Ras, H Raubenheimer, ZG Wessels.

Junior Lecturers: JI Olivier, DPG van der Merwe.

Contract Lecturers: K Salzmann-McDonald, V Moutzouris, J Mitchell, J Deetlefts.

Affiliate Associate Professors: Prof JD Smit.

Research Associates: MY le Roux.

Research Fellow: Prof emer. WH Peters.

Postdoc: Dr HA Auret.

Secretary: Y Pretorius.

Assistant Officer, professional services: W Verster.

Assistant Officer: LT Kewsa, Z Bronkhorst.

Messenger: TJ Mohatlane.

DEPARTMENT OF

Quantity Surveying

and Construction Management

Contact Details

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2017 Overview

The past year progressed very well, although our hands were full dealing with the aftereffects of the #FeesMustFall student protests of 2016. The year was not without challenges, but there were also several achievements and highlights. We focused on improving the overall programme offerings and means of delivery to ensure that students get value for money. The department also received two programme accreditation visits from the South African Council for Project and Construction Management Professions (SACPCMP) and the South African Council for the Property Valuers Profession (SACPVP), whose positive outcomes were the major achievements for the year.

ACHIEVEMENTS

Staff Achievements

Prof Kahilu Kajimo-Shakantu, with her master's degree student, Bonisile Ngxito, won the Best Paper Award at the Association of Schools of Construction of Southern Africa's (ASOCSA) 11th Built Environment Conference in Durban.

Prof K Kajimo-Shakantu (Best Paper Award recipient)

Pierre Oosthuizen was voted as the Best Lecturer for 2017 in the category Student Engagement and Learning in the Faculty of Natural and Agricultural Sciences, as announced on 16 February 2018.

Prof K Kajimo-Shakantu (left) and Pierre Oosthuizen (right: Best Lecturer recipient)

Prof Kajimo-Shakantu was elected Chairperson of the Heads Forum of the Association of Schools of Construction of Southern Africa (ASOCSA) at the 11th Built Environment Conference. He also served as an accreditation panel member for the South African Council for Project and Construction Management Professions (SACPCMP).

Seven staff members attended the 11th Built Environment conference held in Durban from 6 to 8 August 2017. They were: Prof K Kajimo-Shakantu, M-M Els, T Bremer, P Oosthuizen, H du Plessis, C Ferreira, and N Xhala.

From the left: JC de Lange (former UFS student), P Oosthuizen, H du Plessis, C Ferreira, T Bremer, M-M Els, and Prof K Kajimo-Shakantu

Cameron Ferreira and Hendri du Plessis were both awarded MSc Quantity Surveying degrees.

Student Achievements

G Bothma, a third-year student, was the recipient of the Association of South African Quantity Surveyors (ASAQS) Future Leaders award (2017). J Thatcher, an honours student, was runner-up for the ASAQS Gold Medal Award (2017).

C Ferreira (UFS lecturer), J Thatcher (ASAQS Future Leaders award recipient), Dr S Ramabodu (UFS part-time lecturer), G Bothma (runner-up for the ASAQS Gold Medal Award), P Oosthuizen (UFS lecturer).

Special Achievements

The South African Council for Project and Construction Management Professions (SACPCMP) granted the department full accreditation for five years from Jan 2018 to Dec 2022 in respect of three programmes: BSc Construction Management, BScHons Construction Management, and the Master of Land and Property Development Management Programme. The South African Council for the Property Valuers Profession (SACPVP) granted conditional accreditation for the Master of Land and Property Development Management Programme. Both councils were pleased with the department and highlighted several commendations regarding the institution, department, and programmes offered.

Activities

Site visits for students

During the year, students undertook several site visits to provide them with exposure to construction-related activities aimed at enhancing their classroom learning experiences.

Winter school

Our first 'Winter school', giving students more practical exposure opportunities through invited industry and academic guests, took place in June. Some of the activities included computer-aided training, site visits, and manufacturers' demonstration of various building material.

Quantity Surveying and Construction Management 3rd-year site visit

Formal Student Event

In association with the department, the student representatives hosted a formal event at the UFS Centenary Hall. We also hosted a breakfast function for the Honours class of 2017 at the Oliewenhuis Art Museum, where we gave students personalised hard hats.

RESEARCH

Community Service

Our staff and students embarked on a community service project at the Wonderland Pre-Primary School in May 2017. This initiative gave our students an opportunity to learn new things and apply existing skills acquired during studying. Activities included painting and making items for children to play with, thereby contributing to early-childhood education and development.

Quantity Surveying and Construction Management students at the Wonderland Pre-Primary School

Postgraduate Students

Ten (10) students completed the Master of Land and Property Development Management programme and will graduate in June 2018. One student completed a PhD in Construction Management and will also graduate in June 2018.

STAFF MATTERS

Four new staff members joined our department, comprising three lecturers: C Ferreira, TL van Schalkwyk, and AH Deacon; and one support staff member: TH Mogorosi. We also bid three lecturers farewell who resigned: Drs T Froise and B Zulch, and K Tshwane, as well as one support staff member: G Mosala.

RESEARCH OUTPUTS

Research Articles

Peer-reviewed Journal Articles (DoE-accredited)

Xhala, NC, Nemec, J, and Kajimo-Shakantu, K. 2017. Public Private Partnership Projects: The Solution to Limited Public Finance for Public Infrastructure Investments. *African Journal of Public Affairs* 9(7): 66-78.

Peer-reviewed Journal Articles (Non-DoE-accredited)

Xhala, NC, Nemec, J, and Kajimo-Shakantu, K. 2017. The Breadth of Success and Failure Factors with PPPs Implementation. *European Financial and Accounting Journal* 12(2): 5-16.

Chapters in Books

Du Preez, OCR. 2017. Court-connected mediation in South Africa. *Court-Connected Construction Mediation Practice: A Comparative International Review, (Eds.).* Agapiou, A and Ilter, DA. Abingdon, England.

Conference Contributions

Vukela, R, Kajimo-Shakantu, K, and Xhala, NC. 2017. *Improving Construction Project Performance in the South African Public Sector*. Paper delivered at the 11th Built Environment Conference – Association of Schools of Construction of Southern Africa, 6-8 August 2017, Durban, South Africa, pp. 439-506.

Du Plessis, HB, and Oosthuizen, PM. 2017. *Building Contracts, a method to manage construction processes: A South African perspective.* Paper delivered at the 11th Built Environment Conference – Association of Schools of Construction of Southern Africa, 6-8 August 2017, Durban, South Africa, pp. 225-238.

Oosthuizen, PM. 2017. *Multilingualism in a Monolingual South African Built Environment*. Paper delivered at the 11th Built Environment Conference – Association of Schools of Construction of Southern Africa, 6-8 August 2017, Durban, South Africa, pp. 99-111.

Greyling, C, and Kajimo-Shakantu, K. 2017. *Industry perceptions on cost implications of going green in sustainable human settlements*. Paper delivered at the 11th Built Environment Conference – Association of Schools of Construction of Southern Africa, 6-8 August 2017, Durban, South Africa, pp.668-680.

Ngxito, B, and Kajimo-Shakantu, K. 2017. *Perceptions and experiences regarding the use of alternative building technologies in school infrastructure in the Eastern Cape Province*. Paper delivered at the 11th Built Environment Conference – Association of Schools of Construction of Southern Africa, 6-8 August 2017, Durban, South Africa, pp.112-123.

Bremer, T, De Lange, JC, Froise, T, and Els, M. 2017. *The Glass is always greener on the other side: A Case Study between two residential projects*. Paper delivered at the 11th Built Environment Conference – Association of Schools of Construction of Southern Africa, 6-8 August 2017, Durban, South Africa, pp.731-742.

Bremer, T, Knobel, L, and Els, M. 2017. *Feasibility of active design.* Paper delivered at the 11th Built Environment Conference – Association of Schools of Construction of Southern Africa, 6-8 August 2017, Durban, South Africa, pp.380-387.

STAFF

Head of Department: Prof K Kajimo-Shakantu.

Senior Lecturer: Dr B Zulch.

Lecturers: Dr T Froise, PM Oosthuizen, M-M Els, T Bremer, E Jacobs, TL van Schalkwyk, AH Deacon.

Junior Lecturers: H du Plessis, R Seedat, C Ferreira, K Tshwane.

Research Assistant: N Xhala.

Secretary: E van der Walt.

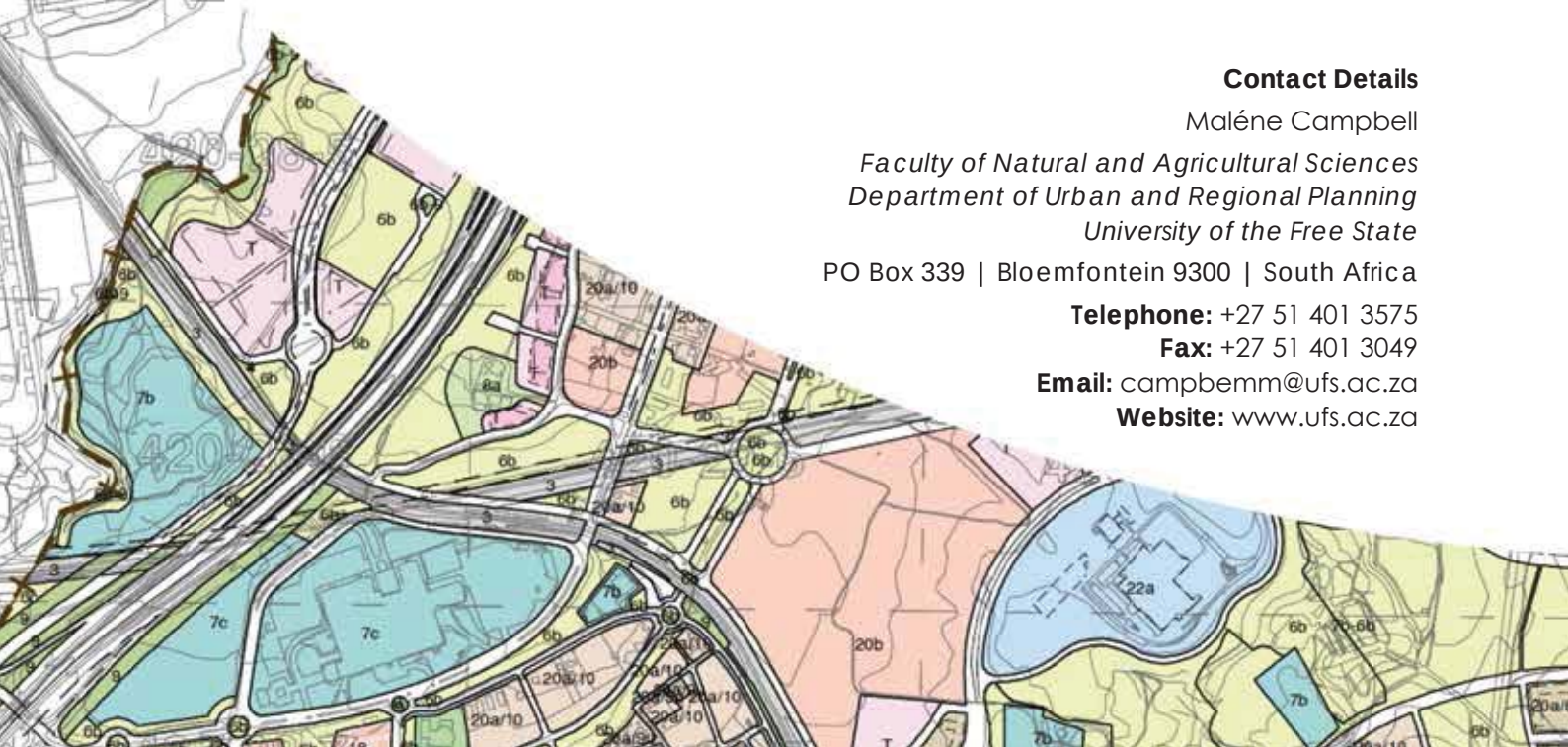
Officer, Professional Services: M Roux, TH Mogorosi.

Senior Assistant Officer: M Sepheka, G Mosala, O Litheko.

Typist Clerk: S Olivier.

DEPARTMENT OF

Urban and Regional Planning



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2017 Overview

The Department of Urban and Regional Planning excelled in 2017 in the areas of funding and strengthening international collaborations. The National Institute for the Humanities and Social Sciences allocated R300 000 to Thulisile Mphambukeli's research team for hosting a BRICS cluster workshop – a project of which Kgosi Mocwagae is also a collaborator. The World Academy of Sciences (TWAS) and the Deutsche Forschungsgemeinschaft (DFG) awarded Dr Mphambukeli a TWAS-DFG Cooperation Visit to the University of Konstanz at the end of 2017.

Stuart Denoon-Stevens is the primary investigator (PI) of the 10 million GBR South African Planning Education Research (SAPER) project. This project is jointly funded by the Economic and Social Research Council (ESRC) in the United Kingdom (UK) and the National Research Foundation in South Africa's (NRF) Newton call for collaborative research on higher education in South Africa. The PI from the University of Birmingham in the UK is Dr Lauren Andres. This research draws upon the hypothesis that an increased focus on the Global South in teaching and training will create more socially inclusive outcomes. Developing a critical and reflective understanding of post-colonial Planning of education in South Africa, and more widely in Africa, is crucial to establishing the importance of the Planning discipline in considering appropriate tools and policy to address and alleviate poverty. Prof Verna Nel is also collaborating on the project.

Stuart Denoon-Stevens successfully secured a National Research Foundation (NRF) Thuthuka grant for his three-year PhD research on 'Towards the development of an algorithmic approach to informal settlement upgrading in South African cities'.

The South African Cities Network (SACN) contacted all six of our lecturers for a report on intermediate cities. Our research had three broad aims: (1) to describe the nature of spatial changes in the case-study areas and to identify the mechanisms that tend to influence this change; (2) to evaluate the quality and ability of SDFs as a policy mechanism to create change; (3) to assess whether intermediate cities require a differentiated approach to spatial planning (Are intermediate cities different?). Eleven case studies were completed: Drakenstein, King Sabata Dalindyebo, Lephalale, Matjhabeng, Mbombela, Mahikeng, Msunduzi, Polokwane, Rustenburg, Sol Plaatje, and Stellenbosch.

The following staff members researched the following case studies:

Msunduzi – Dr Thullisile Mphambukeli
Mbombela – Dr Maléne Campbell
Mahikeng – Prof Verna Nel
Matjhabeng – Stuart Denoon-Stevens
Sol Plaatje – Thomas Stewart
Lephalale – Kgosi Mocwagae

ACHIEVEMENTS

Staff Achievements

Prof Sijekula Mbanga, the Chair for Education in Human Settlements Development, invited Thomas Stewart to give a presentation and participate in the intervarsity human settlements student colloquium and induction session in East London from 19 to 21 May 2017. The Nelson Mandela Metropolitan University hosted the intervarsity on Human Settlements Student Colloquium and Induction Session that was convened with the support of the Department of

Human Settlements. Students and lecturers from the Minnesota State University in the United States of America attended the session aimed at creating a platform for students in Human Settlement studies in South Africa (new academic programmes) in order to collectively and critically reflect on key issues affecting the human settlements sector in South Africa, and at the same time expose them to the manner in which such issues manifest themselves in practice.

Thomas Stewart was also invited to join the Human Settlements Sub-Group of the Land Cover Community of Practice. The main purpose of this subgroup is to bring relevant stakeholders with an interest in Human Settlements (HS) together to address gaps, challenges, utilise existing opportunities, and encourage collaboration and sharing of data between the stakeholders. This Land Cover CoP – HS subgroup will collaborate in advocating for data sharing, knowledge development, shared learning, and efforts to improve the efficient use of limited human and financial resources required for the sustainable HS development. This will ensure that settlements are allocated in areas with access to services, infrastructure, economic opportunities, and suitable land (away from disaster-prone areas).

Student Achievements

PhD student, Mischka Jacobus, went to Yekaterinburg in Russia during September 2017, where she was selected as a Young Planning Professional (YPP) as part of the International Society of City and Regional Planners (ISOCARP) Society. She was one of 13 young planners who took part in a nine-day workshop where they designed conceptual layouts for a neighbourhood in Yekaterinburg, Sverdlovsk, Russia. This workshop joined the School of Chief Architect (SCA), where they also collaborated with architects from Russia.

Mischka Jacobus in Portland Oregon, USA where she presented a paper on her Master's mini-dissertation research entitled 'Encouraging inclusive communities through zoning reform' at the 53rd International Society of City and Regional Planners (ISOCARP)/ Oregon Chapter of the American Planning Association (OAPA) Smart Communities Conference in Portland in the United States of America (USA)

Mischka Jacobus also presented a paper on her master's degree mini-dissertation research titled 'Encouraging inclusive communities through zoning reform' at the 53rd International Society of City and Regional Planners (ISOCARP)/ Oregon Chapter of the American Planning Association (OAPA) Smart Communities Conference in Portland in the United States of America (USA). Afterwards, she was notified that her paper was selected for publication and that it would be published in the upcoming conference proceedings.

Master's degrees were conferred upon 21 students, while honours degrees were conferred upon 24 students.

Special Achievements

Kgosi Mocwagae received the National Research Foundation (NRF) and the Department of Science and Technology (DST) NRF–FRF Sabbatical Grant. NRF–FRF Sabbatical grants are made according to the strategic objectives of the NRF–FRF Sabbatical Grant-funding instrument, the Ministerial directives on equity targets, and the available budget.

Kgosi Mocwagae delivered a presentation in Bloemfontein at the provincial Spatial Planning and Land Use Management (SPLUM) forum on water management in Qwa Qwa. From left to right Anastasia Hanana and Danie Schoeman alumni of our department and employees at the Department of Rural Development and Land Reform (DRDLR) with Mocwagae

Activities

The second African Urban Planning Conference was held in Lisbon, Portugal on 7 and 8 September 2017. It was hosted by the Institute of Geography and Spatial Planning (IGOT), University of Lisbon, and the International Planning History Society. Prof Verna Nel and a doctoral student, Martin Lewis (who is also

the CEO of the South African Council for Planners - SACPLAN), submitted two abstracts and consequently presented two papers. The first was on the Standards and Competencies process undertaken by SACPLAN, and the second the resilience of the Urban and Regional Planning profession over the past century. Both papers were well received, and Martin Lewis and Prof Nel were asked to chair parallel sessions, which were a success. Their attendance at the conference was funded by the South African Planning Education Research project (SAPER), the NRF, and ESRC.

Stuart Denoon-Stevens presented a paper 'Law and the New Urban Agenda' on the topic of embedding normative concerns into planning law, during the 4th Annual International and Comparative Urban Law Conference at the University of Cape Town (UCT) in July. He also presented at the Centre for Regional and Urban Innovation and Statistical Exploration (CRUISE)-Statistics South Africa Urban and Regional Science Conference 2017, on the potential of decision-making support tools for the assessment of land development applications of low-income settlements in South Africa.

RESEARCH

The Faculty of Natural and Agricultural Sciences, together with the Deputy Vice-Chancellor's Interdisciplinary Research Grant, funded mining-town research on eMalahleni. Research partners in this project are the University of Pretoria, the North-West University, the UFS Centre for Development Support, and the Department of Economics. Investigators from the department are Dr Maléne Campbell (grant holder), Stuart Denoon-Stevens (Primary Investigator), Prof Verna Nel, and Thomas Stuart. Routledge accepted a book proposal on the eMalahleni research.

Community Service

Dr Thulisile Mphambukeli and Kgosi Mocwagae accompanied the master's degree students on a field trip with the aim of determining the viability of a development axis along the N8 road between Bloemfontein and Maseru. The exercise commenced with an educational tour of the Mangaung townships in Bloemfontein, and to the earmarked central location of the Airport Development Node. Students were then introduced to the economic and social complexities of Botshabelo and Thaba 'Nchu, with the trip ending in Lesotho. The first stop was at the Maseru City Council, where the Chief Town Planner, Palesa Lekau, an alumnus of the Department of Town and Regional Planning, UFS, addressed the students. Before returning to Bloemfontein, they visited industrial and residential areas in the city. Officials of the Mangaung Metropolitan Municipality and consulting town planners were invited to attend presentations of the students' findings and proposals. The students gained first-hand experience on how to engage with communities and municipal officials. They were enabled by knowledge of regional development and assessed local economic development opportunities along the N8-corridor between Mangaung and Maseru.

Planning enhances opportunities for people, strives towards justice of space, and addresses economic resilience. Town planners must join local insights with their professional techniques in a collective attempt to improve place qualities. Dr Maléne Campbell instructed the 23 students registered for the Applied Urban Planning Project (URUP7906) in 2017, to identify interventions that could improve the lives of the residents of Nketoana Local Municipality, which includes the towns of Arlington/Leratswana, Lindley/Ntha, Petrus Steyn/Mamafubedu, and Reitz/Petsana. The students formed five groups. The first four groups each focused on one of the following four towns in Nketoana: Reitz, Arlington, Lindley, and Petrus Steyn, while the fifth group combined the draft Spatial Development Frameworks (SDFs) of those four groups into one SDF for Nketoana.

Issues as well as a joint vision were identified during consultation sessions with the local role players. Elma Barker, a town planner at the Free State CoGTA (Cooperative Governance and Traditional Affairs), introduced the students to the town planners at Nketoana Local Municipality, while Eddie Scott, Adjunct Director at FS CoGTA, evaluated the students' SDF for Nketoana. Interviews were conducted with the Town Planner, Setjhaba Nhlapo, the IDP Manager, Stephanie Venter, and other officials at Nketoana, as well as residents and business owners. A draft SDF for each town, as well as a combined SDF for the local municipality, were presented to a CoGTA official on our campus, and will be discussed with the Nketoana office-bearers. Reciprocal knowledge-sharing between the students and the community empowered both parties.

National and International Collaboration

The department hosted Dr Suzanne Speak from the University of Newcastle, who has visited us annually since 2015. We are grateful to the Postgraduate School for covering Dr Speak's travel costs. She presented various research workshops to our master's and PhD students, as well as a workshop on Research Supervision for the Postgraduate School.

Postgraduate Students

The South African Planning Institute's Planning Africa conference accepted the abstracts of the following five students to be presented at the bi-annual conference

in Cape Town: Thabo Khookhoo, Munette Lombaard, Grace Maanda, Nicholas Muleya, and Carolyn Reynolds.

STAFF MATTERS

Three of our six permanent teaching staff members were promoted in 2017. Dr Thulisile Mphambukeli was promoted to Senior Lecturer, and Stuart Denoon-Stevens and Kgosi Mocwagae were promoted to Lecturer.

Abongile Mgwele, who holds a master's degree in Urban and Regional Planning, joined the department as Senior Assistant Officer when Antoinette Nel left to take up a position with consulting planners.

RESEARCH OUTPUTS

Research Articles

Barnes, AP, and Nel, VJ. 2017. Putting Spatial Resilience into Practice. *Urban Forum*. 28(2):219-232.

Campbell, M, Nel, V, and Mphambukeli, T. 2017. The governance and spatial planning challenges of a thriving economy based on non-renewable resources within a local government under Administration: the case of Witbank, South Africa. *Land Use Policy Journal.* 62: 223-231.

Rapelang, T, Nel, V, and Stewart, T. 2017. Exercising the right to access adequate housing in Joe Morolong Local Municipality, Rural South Africa. *Journal of Housing and the Built Environment*: 1-20.

Conference Contributions

Denoon-Stevens, SP. 2017. *The use of decision-making support tools for the assessment of land development applications of low-income settlements in South Africa: an exploration of their potential.* Paper delivered at the 3rd Biannual Centre for Regional and Urban Innovation and Statistical Exploration (CRUISE) Urban and Regional Science Conference, at Stellenbosch, South Africa.

Denoon-Stevens, SP. 2017. *Translating normative concerns into law: an exploration within the field of land development regulation.* Paper delivered at the 4th Annual International and Comparative Urban Law Conference on Law and the New Urban Agenda, Cape Town, South Africa.

Jacobus, M, Denoon-Stevens, SP, and Nel, V. 2017. *Encouraging Inclusive Communities Through Zoning Reform: The case of Upper Ashbury, Bloemfontein.* Paper delivered at the 53rd International Society of City and Regional Planners (ISOCARP)/ Oregon Chapter of the American Planning Association (OAPA) Congress, Portland, USA.

Contract research: published reports

Campbell, M. 2017. Mbombela. In Marais, L and Du Plessis, D (Eds). *Spatial*

Transformation: Are Intermediate Cities Different? Johannesburg: South African Cities

Network, 32-34. Available from www.sacities.net.

Denoon-Stevens, S. 2017. Matjhabeng. In Marais, L and Du Plessis, D (Eds*). Spatial*

Transformation: Are Intermediate Cities Different? Johannesburg: South African Cities

Network, 22-24. Available from www.sacities.net.

Denoon-Stevens, SP and Nel, V. 2017. Proactive upzoning of land in TOD developments to promote urban regeneration in South African cities. In South African Cities Network, The *Urban Land Papers Series Volume 2*: A transit-orientated development lens: 41-53.

Denoon-Stevens, SP, Charman, A, Tonkin, C, and Demeestére, R. 2017. Post-apartheid spatial inequality: obstacles of land use management on township micro-enterprise formalization. Sustainable Livelihoods Foundation: online.

Mocwagae, K. 2017. Lephalale. In Marais, L and Du Plessis, D (Eds). *Spatial*

Transformation: Are Intermediate Cities Different? Johannesburg: South African Cities

Network, 26-28. Available from www.sacities.net.

Mphambukeli, T. 2017. Msunduzi. In Marais, L and Du Plessis, D (Eds*). Spatial*

Transformation: Are Intermediate Cities Different? Johannesburg: South African Cities

Network, 34-36. Available from www.sacities.net.

Nel, V. 2017. Mahikeng. In Marais, L and Du Plessis, D (Eds). *Spatial*

Transformation: Are Intermediate Cities Different? Johannesburg: South African Cities

Network, 28-30. Available from www.sacities.net.

Stewart, T. 2017. Sol Plaatje. In Marais, L and Du Plessis, D (Eds). *Spatial*

Transformation: Are Intermediate Cities Different? Johannesburg: South African Cities

Network, 40-42. Available from www.sacities.net.

STAFF

Professors: Prof VJ Nel.

Senior Lecturers: Dr MM Campbell, Dr TN Mphambukeli.

Lecturers: SP Denoon-Stevens, KS Mocwagae, T Stewart.

Researchers/Research assistants: G Ceretti, A Duma, RNP Khabe, AM Khumalo, P Mokonyama, T Raphuting, Q Tshazi.

Research Associates: Dr I Chariza, Dr YM Mashalaba, Dr SE Speak, Prof JJ Steÿn.

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DEPARTMENT OF
Chemistry

(Bloemfontein, Qwaqwa, and South Campuses)

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2017 Overview

The Department of Chemistry continued to focus on the strategic priorities of the UFS and that of the Faculty of Natural and Agricultural Sciences; the department operates on all three UFS campuses. The South Campus concentrates on the extended BSc programme, as well as the University Preparation Programme, with a total of 435 students. The Qwaqwa Campus caters for 230 local residential students and specialises in Polymer Science research. The Bloemfontein Campus teaches approximately 950 undergraduate students and conducts research in all four classic divisions of Chemistry: Analytical, Inorganic, Organic, and Physical Chemistry.

The postgraduate component on the Bloemfontein Campus comprises 24 honours, 25 MSc, and 15 PhD students, as well as 15 postdoctoral associates from Germany, the Netherlands, Nigeria, Sudan, Cameroon, and Zimbabwe. The commitment and enthusiasm of our staff are underscored by remarks from an external review report at the end of 2017: "The department excels at undergraduate teaching. The current curriculum is comparable to that of other major institutions in South Africa and certainly meets international standards. There is a good articulation of modules at different levels and undergraduate students report an excellent experience."

At the Bloemfontein Campus, we have four divisions, i.e. Inorganic Chemistry, Organic/Process Chemistry, Analytical Chemistry, and Physical Chemistry. The management committee of the department consists of Profs Walter Purcell (Departmental Chairperson), André Roodt, Ben Bezuidenhoudt, Karel von Eschwege, and Dr Ernie Langner, while Khotso Mpitso is the Subject Head for the Qwaqwa Campus.

Our undergraduate students on the Bloemfontein Campus (± 600 1st years, 100 2nd years, and 50 3rd years) are trained in theoretical and practical aspects of all four classical Chemistry divisions (Analytical, Inorganic, Physical, and Organic). Magda Meyburgh and Jeanette Mmope organise, prepare, and control practicals for approximately 800 students, including students who access the mainstream programmes from the University Preparation and Extended programmes on the South Campus. Our 24 honours students are lectured in all four Chemistry divisions.

Dr Charlene Marais and Rina Meintjes, assisted by four full-time (5/8) and five part-time facilitators, manage the teaching of Chemistry on the South Campus. They also manage the Chemistry first-year teaching activities on the Qwaqwa Campus (90 students), as well as the Chemistry enrolment and courses at FET colleges such as the Goldfields FET College in Welkom (12 students) and the Flavius Mareka FET College in Sasolburg (12 students). A total of 266 students were enrolled in the first-year Chemistry modules for the BSc Extended Programme on the South Campus, while 55 were enrolled in the UPP programme, which is designed to prepare students with low Admission Point (AP) scores for acceptance/enrolment into mainstream courses at the Bloemfontein Campus.

Teaching on the Qwaqwa Campus involves theoretical and practical aspects of all four classic Chemistry divisions from the first to the third year (± 72 1st years, 70 2nd years, and 60 3rd years). The honours course had an enrolment of eight students, which involved the teaching of subjects applicable to Polymer Science.

Our research productivity is demonstrated by the 2017 research outputs of 62 research articles published (all campuses) in national and international accredited journals, and 36 local and international conference presentations. We gratefully acknowledge the continued contribution and support of our staff, the Dean's Office, the faculty, and UFS senior management.

ACHIEVEMENTS

Staff Achievements

Prof J Conradie received a long-service certificate for her 30 years of service. Dr Marietjie Schutte-Smith was nominated by the students in the category Best Lecturer for the #FBIAwards#NAS# award that was run on social media, Blackboard, and the UFS website. She received the award for the Best Lecturer: Student Engagement and Learning at the annual awards ceremony. Dr Alice Brink was invited to present two seminar lectures at the Universities of Manchester (UK) and Oxford (UK) during July 2017. She was also nominated by the UFS Research office for the NRF 2017 Emerging Researcher Award.

Dr M Schutte-Smith (second from right) receiving the prize for the 'Best Lecturer: Student Engagement and Learning' from Prof D Vermeulen. Also in the photo are P Oosthuizen (co-winner), Ms L-A Frasenburg (Faculty Manager), and E Oosthuizen (Teaching and Learning Manager)

Student Achievements

E Chiyindiko from the Division of Physical Chemistry won the '3-minute thesis competition' at the University of the Free State, Bloemfontein, on 25 Aug 2017.

PhD students M Sebitlo and M Govender gave conference lectures in Paris, France, and CC Joubert gave a poster presentation in Amsterdam, the Netherlands. Govender also conducted research in the Polymer Institute at Ghent University. MSc student PJ Swarts conducted research in the Polymer Institute of the Bulgarian Academy of Sciences.

The Roodt Group's students performed excellently: Three PhD students, Tom DV Kama, Pennie Mokolokolo, and Orbett Alexander, were invited to give an oral presentation at the 24th Congress and General Assembly of the International Union of Crystallography in Hyderabad, India, during 2017. They conducted research at the University of Zurich (April 2017) and worked in a radiopharmaceutical laboratory under the supervision of Prof Roger Alberto. This falls within the Bilateral Swiss-South Africa Joint Research Programme (SSAJRP) agreement between the Roodt Research Group and the University of Zurich. During April 2017, the three students and Prof Roodt also conducted research at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France, in collaboration with Dr Katarzyna Jarzembska and Dr Radoslaw Kaminski from the University of Warsaw, Poland.

At the annual faculty prize-giving ceremony, the following students received prizes as best student in the different categories: G Swart (best 2nd year), D Maier (Merck prize for best 3rd year), L Parrott (best honours), JBM-L Smit (PETlabs prize for best MSc thesis), Dr MR Sebitlo (Bruker prize for PhD thesis), and Dr C-W Tsai (Joe Leipoldt prize as best postgraduate student in Chemistry).

Dr C-W Tsai receiving the Joe Leipoldt prize from Prof Purcell for the best post-graduate student in Chemistry at the annual faculty prize-giving ceremony

Activities

Dr Anke Wilhelm received eight weeks of intensive training under the supervision of Prof Matthias Hamburger at the University of Basel, Switzerland, on the zebrafish larval locomotive bioassay, which was recently validated and published by Prof Hamburger's group. Drs Bonnet and Wilhelm are in the process of establishing a similar zebrafish toxicity and activity testing centre for South African botanicals, which show the potential to be developed into possible lead compounds against diseases of the central nervous system (CNS) such as epilepsy, mood disorder, anxiety, and insomnia. They visited the fish facility of Prof Victor Wepener at North-West University in Potchefstroom in August 2017 to collect further information.

Prof Deon Visser continued the research collaboration with Dr Fabio Zobi from the University of Fribourg, Switzerland, Prof Demetrius Papadopoulus from Athens, Greece, as well as Dr Gregory Smith from the

Dr A Wilhelm harvesting zebrafish eggs in the Fish facility at the University of Basel, Switzerland

University of Cape Town. As part of the collaboration with UCT, Prof Visser was a co-supervisor for an MSc student, who obtained her degree with distinction.

Dr Linette Twigge, manager of the Nuclear Magnetic Resonance facility, assisted more than 20 postgraduate students from the different research groups with delicate and advanced multi-nuclear NMR experiments.

Prof André Roodt (one plenary, and six invited lectures) presented lectures at international conferences and venues in Slovenia, Tunisia, India, and South Africa. During 2017, he hosted Prof Claude Lecomte (University of Nancy, France), Prof Vadim Boyarskiy (Saint Petersburg State University, Russia), Prof Ingrid Dijkgraaf (Maastricht University, the Netherlands), and Prof Roger Alberto (University of Zurich, Switzerland) at the UFS, where they presented lectures and had intensive discussions with students. Dr J Venter presented a lecture at the 22nd EuCheMS International Conference on Organometallic Chemistry, Amsterdam, the Netherlands.

Dr Alice Brink, manager of the X-ray Crystallographic facility in the Department of Chemistry, presented the 'Crystallographic Solving and Refinement Workshop' to our staff and postgraduate students during March and August 2017. She also negotiates and manages the international databases (CCDC and ICSD) which allow any UFS student from the Bloemfontein and South Campuses access to the WebCSD. Dr Brink was a Research Visitor to the School of Chemistry at the University of Manchester, UK, and collaborated with Prof John Helliwell and Dr Louise Natrajan (June 2017). She hosted Prof Elspeth Garman (University of Oxford, UK) at the UFS during March 2017. Prof Garman presented lectures and tutorials to postgraduate Chemistry and Biochemistry students, and mentored PSP scholars. Dr Brink also presented a lecture at the 67th Annual Meeting of the American Crystallography Association in New Orleans, USA.

Some of our staff members acted as external reviewers for different international Chemistry journals and for the NRF, and served on faculty and UFS committees, while others made their contributions as external examiners for several universities at undergraduate and postgraduate levels and represented the UFS on international research councils.

Prof Conradie introduced the Nobel laureate, prof Michael Levitt (from the Department of Structural Biology, Stanford Medical School), during his public lecture on the birth and future of the multiscale modelling

Prof J Conradie (left) with Nobel laureate, Prof Michael Levitt (from the Department of Structural Biology, Stanford Medical School), Profs F Petersen (Rector) and C Witthuhn (Vice-Rector: Research)

of macromolecules at the UFS on 14 November 2017. She co-organised his visit to the University of the Free State from 14 to 15 November 2017. Prof Conradie was invited to visit the Department of Molecular Electrochemistry at the Heyrovský Institute of Physical Chemistry, Prague, and the University of Chemistry and Technology, Prague. She presented a lecture at the Heyrovský Institute of Physical Chemistry, resulting in the establishment of a new collaboration with this institution.

Prof Swart visited Syngaschem BV at Differ, Technical University, Eindhoven, in the Netherlands, to further existing collaboration in the field of heterogeneous catalysis. He also visited and presented a lecture to the research group of Prof Henry Lang (Chemnitz University of Technology in Germany, on metal carboxylates and electrochemistry) to further existing collaboration in the fields of electrochemistry, metallocenes, and phthalocyanines.

Dr Langner was involved in an interdisciplinary research project with Dr Richard Harris (Physics) on the Synthesis and Computational modelling of selected Metal Organic Framework (MOF) materials with applications in catalysis, drug delivery, and water purification. In 2017, this project was extended to include the enhancing of CO2 adsorption of ZIF-8.

Prof Purcell presented a lecture at the European Metallurgical Conference (EMC) held in Leipzig, Germany, and made a poster contribution at the 22nd EuCheMS International Conference on Organometallic Chemistry in Amsterdam, the Netherlands. He also visited Dr Sanja Potgieter-Vermaak at the Manchester Metropolitan University in the United Kingdom.

Dr J Venter and Prof W Purcell in Amsterdam during the 22nd EuCheMS International Conference on Organometallic Chemistry

RESEARCH

Community Service and Marketing

The Safety Committee of the department is chaired by Prof Ben Bezuidenhoudt, with the following group of representatives: Dr Johan Venter (Inorganic), Dr Eleanor Müller (Physical Chemistry), Dr Marianne Conradie-Bekker (Analytical), and Rudi Swart (Organic).

Prof Karel von Eschwege responded extensively to several private-sector requests on especially sustainable energy. He also acted as reviewer for several journal publications and external PhD theses.

Dr Johan Venter serves as the programme director of Physical and Chemical Sciences in the faculty, on the Timetable Committee, and sets the annual test timetable for the faculty.

Dr Truidie Venter acted as a judge at the regional Eskom Science Expo for Young Scientists held in Bloemfontein.

Dr Alice Brink is a reviewer for the journals *Acta Crystallographica C* and *Journal of Coordination Chemistry*.

Prof Roodt acted as reviewer for the NRF in evaluating other researchers and students; he also served as member of the Editorial Board of the *Journal of Coordination Chemistry,* acting as reviewer for publications in this journal, as well as other journals such as *Inorganic Chemistry*, *Crystal Growth and Design*, *Crystal Engineering Communications*, *Dalton Transactions*, *Organometallics*, *Journal of Organometallic Chemistry*, *Inorganica Chimica Acta,* and *Polyhedron*.

Professor Conradie acted as the Physical Chemistry Editor for the *South African Journal of Chemistry*. She also acted as a reviewer for the NRF in evaluating the quality of the research-funding applications and rating applications of other researchers and students, as well as reviewer for publications in *Inorganica Chimica Acta*, *Journal of Molecular Structure*, *Chemistry Open* (ACS), *Dalton (*RSC*)*, *Journal of Organometallic Chemistry*, *Journal of Inorganic and Organometallic Polymers and Materials*, *Organometallics* (ACS), *Physical Chemistry Chemical Physics* (RSC) and *South African Journal of Chemistry*.

Dr Langner was a member of the Ethics Committee for the Faculty of Natural and Agricultural Sciences. He also acted as a reviewer for the NRF (National Research Foundation).

Dr Erasmus acted as a reviewer for the NRF in evaluating the quality of research-funding applications and rating applications of other researchers and students. She was also a reviewer for the *Journal of Electroanalytical Chemistry* and the *Journal of Physical Chemistry and Biophysics*.

Professor Swarts acted as a reviewer for the NRF in evaluating the quality of the research-funding applications and rating applications of other researchers and students. He also acted as reviewer for publications in *Organometallics*, *Inorganic Chemistry*, *Inorganica Chimica Acta*, *Polyhedron,* and *Journal of Coordination Chemistry*.

Professor Swarts also conducted a faculty survey of research-equipment stock and compiled a large equipment plan for the Faculty of Natural and Agricultural Sciences.

Ina du Plessis organised and managed all our marketing activities at the Kovsies Open Day event held on campus.

National and International collaborations

The Purcell Group has research collaborations with Dr Johann Nel from NECSA; Prof Herman Potgieter from the School of Chemical and Metallurgical Engineering, Wits; and Dr Sanja Potgieter-Vermaak from the Manchester Metropolitan University, UK.

Prof Karel von Eschwege has ongoing collaborations

with the University of Pretoria and Stellenbosch University. The latter is a multi-disciplinary research project with the Laser Research Institute in their Department of Physics, studying electronic transitions and transfers, as well as fast isomerisations of light-sensitive molecular assemblies, in real time. Together with the former, highly ordered single-molecule thin films of photo-sensitive materials are grown for potential application in energy transfer and/or photo-catalytic reactions.

The Bezuidenhoudt Group collaborates with Chemical Process Technologies in Pretoria, Wildlife Pharmaceuticals in Nelspruit, and with PETLabs Pharmaceuticals on the synthesis of compounds with medical applications.

Drs Bonnet and Wilhelm collaborate with staff at the University of Basel (Prof Matthias Hamburger) and the University of Vienna (Profs Judith Rollinger and Prof Stefan Herring) on phytochemical projects. They also collaborate with the Wattle Industry (Pietermaritzburg) on projects to characterise different bark-extraction processes and Mannich reactions of tannins.

The Roodt Group's research on medical aspects of pharmaceutical model compounds in collaboration with Prof Roger Alberto (University of Zurich, Switzerland), Dr Marija Zbačnik (University of Zagreb, Croatia), Dr Gerdus Kemp (PETLaboratories, SA), and Prof Ted E Kroon (Physics, University of the Free State, SA), continued during 2017. A preliminary South African patent on multi-nuclear theranostic model agents was granted in December 2017. Similarly, the group's collaboration on model homogeneous catalysts continued with funding from Profs Vadim Kukushkin and Vadim Boyarskiy from the Saint Petersburg State University in Russia, Dr Esna du Plessis (SASOL), and the ESRF (Grenoble, France). Research on metal beneficiation with Dr Johann Nel from NECSA (South African Nuclear Energy Corporation) under the Advanced Metals Initiative (AMI) programme, and on environmental chemistry, i.e., hydrogen generation and carbon dioxide utilisation in collaboration with Prof Roger Alberto (University of Zurich, Switzerland), proceeded very well. PhD students, Alexander Mikherdov (St Petersburg, Russia), Angelo Frei, and Daniel Hernandez (both from the University of Zurich, Switzerland) visited the Roodt group to do advanced kinetic measurements on collaborative projects.

Dr Brink collaborated with Prof John Helliwell from the University of Manchester, UK. Additional collaborators involved in the research project include Dr Louise Natrajan (University of Manchester, UK), Dr Simon Tanley (University of Manchester, UK), Dr Colin Levy (Manchester Institute of Biotechnology, UK), and Prof Dirk Opperman (Department of Biochemistry, University of the Free State, SA). A collaboration with the Department of Pharmacology at the University of Pretoria and the University of Missouri (USA) is being established in association with Dr Truidie Venter.

Drs Truidie Venter and Alice Brink attended the 67th Annual Meeting of the American Crystallographic Society in New Orleans, USA, where they both presented lectures and attended workshops. This meeting led to a collaboration with Prof Nikolay Gerasimchuk from Missouri State University, Springfield, USA, regarding conductivity studies in transition metal complexes.

Professor Conradie collaborated with Prof M Landman, Prof P van Rooyen, and Dr F Malan from the University of Pretoria, Dr Gurthwin Bosman of the Laser Research Institute, Department of Physics, Stellenbosch University, and Dr CGCE van Sittert from the North-West University. She also collaborated

Drs Truidie Venter and Alice Brink at the 67th Annual Meeting of the American Crystallographic Association in New Orleans, USA

with Prof Abhik Ghosh and Dr Katherin Hopmann (Department of Chemistry and Centre for Theoretical and Computational Chemistry, University of Tromsø, Norway), Prof Irena Hoskovcová (University of Chemistry and Technology, Prague, Czech Republic), Prof Penny Brothers (University of Auckland, New Zealand), Prof JH Potgieter (Wits and Manchester Metropolitan University, Manchester, UK), and Prof Todd C Harrop (University of Georgia, Athens, Georgia).

Professor Swarts collaborated with Prof Mike Cook (University of East Anglia, Norwich, England on phthalocyanines), Prof Manuel Aquino (St Francis Xavier University, Antigonish, Canada on

metal carboxylates), Prof Henry Lang (Chemnitz University of Technology, Chemnitz, Germany, on metal carboxylates and electrochemistry), and Prof Hans Niemantsverdriet of Syngaschem BV at Differ, Technical University, Eindhoven, the Netherlands (heterogeneous catalysis), and Prof M Landman of the University of Pretoria (crystallography).

Dr Langner collaborated with Dr Valeska Ting (Department of Chemical Engineering, University of Bath, UK) and Dr Jenwei Ren (CSIR, Pretoria).

Dr Erasmus collaborated with Prof M Landman and Prof P van Rooyen from the University of Pretoria, and Prof JW Niemantsverdriet (Syngaschem, SynCat@ Beijing, Eindhoven, the Netherlands).

Postgraduate Students

The following students received their PhD degrees: Drs CC Joubert, M Sebitlo, FH Peens, C-W Tsai, R Gostynski, DG Masangoako (Physical Chemistry), Dr A-L Manicum (Inorganic Chemistry), GN Mnguni, T Pieterse (Organic Chemistry).

The following students received their MSc degrees: E van Rensburg (Organic Chemistry), A Crause, SJ Gerber, JP Swarts (Physical Chemistry), LL Ntoi, AQ Vilikazi (Analytical Chemistry), VP Raleaooa, TN Taoana (Inorganic Chemistry).

STAFF MATTERS

Prof Deon Visser was promoted from Associate Professor to Professor, and Dr E Erasmus was promoted to Associate Professor at the end of 2017. Dr Anke Wilhelm was promoted to Senior Lecturer.

Prof BCB Bezuidenhoudt retired at the end of 2017. Callie Laubscher retired as Financial Officer at the end 2017 and Rehana Wales was appointed in the position. Dr Amanda-Lee Manicum resigned as lecturer in Inorganic Chemistry at the end of May 2017 and accepted a new lecturing position at the Tshwane University of Technology in Pretoria.

RESEARCH OUTPUTS

Analytical Chemistry has Prof Karel von Eschwege (C3-rated) as Division Head, Prof Walter Purcell (C3-rated), Dr Rebotsamang Shago, Dr Nete Motlalepula, and Professional officer, Dr Marianne Conradie (Y2-rated and UFS Prestige Scholar). The division was supported by one PhD and six MSc students, and two postdoctoral associates. Two MSc students graduated in this period. The division was involved in eight publications in national and international journals, attended three conferences, and made six oral and poster contributions.

The group focuses on several analytical and inorganic projects. The former concerns the dissolution, quantification, and method validation of a number of inorganic and ore samples such as zircon, tantalite, and ilmenite to establish methods of accurately quantifying the different elements therein. These projects are conducted in collaboration with the South African Nuclear Energy Corporation's (NECSA) Advanced Metals Initiative (AMI).

Different advanced analytical techniques are employed, such as microwave and acid dissolution procedures, while inductively coupled plasma (both optical emission (ICP-OES) and mass spectroscopy (ICP-MS), graphite furnace atomic absorption spectroscopy (GFAAS), and infrared and UV/visible (UV/vis) spectroscopy were used for the identification and quantification of the different elements – with ISO 17025 criteria as benchmark. Other techniques such as X-ray diffraction and X-ray fluorescence (XRD, XRF), differential scanning calorimetry (DSC), and thermal gravimetric analysis (TGA) are also utilised. Elements which are currently investigated are niobium, tantalum, zirconium, hafnium, all the platinum-group elements (PGE), rare earth elements, as well as lithium beneficiation. Numerous samples were analysed for private individuals, as well as for local and national companies.

The group also focuses on different inorganic chemistry projects, such as kinetic and structural studies of organometallic complexes of Ir(I) and Rh(I) oxidative addition reactions, Re(V) and Os(VI) cyano complexes, as well as some Co and Cr aqueous chemistry. All of these studies utilised XRD, infrared spectroscopy (IR), UV/vis, nuclear magnetic resonance (NMR), and computational methods.

In yet another thrust, the group is involved in the investigation of chemical reactions that exhibits multiple chromisms in different transition metal complexes, with potential applications in a variety of sensors and molecular switching devices. Techniques such as ultra-fast femtosecond pulsed laser, UV/visible, IR, NMR, cyclic-voltammetry, single-molecule Langmuir-Blodgett thin films, quantum computational Chemistry (ADF (Amsterdam density functional) and Gaussian), and X-ray crystallography are employed. The Analytical section was responsible for the element analyses of other groups in the departments of Chemistry, Geology, Physics, and Microbiology.

The **Inorganic Chemistry** division consists of two separate research groups which are independently headed by Prof André Roodt (B2-rated) and Prof Deon Visser (C2-rated), respectively.

The research in the **Roodt Group** continued successfully, supported by grants under the prestigious Swiss-South Africa Joint Research Programme (SSAJRP: 2017-2020), NRF-rated researcher programme, and from SASOL. Drs Johan Venter, Alice Brink (Thuthuka grant holder), Marietjie Schutte-Smith, and Amanda-Lee Manicum (Thuthuka grant holder)

were the other senior members within the group. Research is further supported by Dr Truidie Venter (Thuthuka grant holder) as chief officer, professional services. The group had three postdoctoral associates, nine MSc and 11 PhD students, of whom one PhD and two MSc students graduated during 2017. Both Dr Brink and Dr Schutte-Smith are UFS Prestige Scholars. The Roodt group was involved in 20 publications and one preliminary patent, while group members attended numerous conferences and made 17 oral and poster contributions during the year.

This group focuses on Coordination Chemistry and the integrated investigation of 'reaction mechanisms through the use of crystallography, spectroscopy, computational chemistry, and reaction kinetics'. Four sub-research thrusts probe applications to medicine (radiopharmaceutical and chemotherapeutical), industrial reactions/homogeneous catalysis/applied process chemistry, the development of metal beneficiation technology, and coordination chemistry in the environment.

Prof Visser's research focuses on the application of organometallic complexes in photoluminescence studies, particularly in the fight against cancer and in the development of organic light-emission devices (OLEDs). Techniques used include X-ray crystallography, NMR, chemical kinetics and photoluminescence, and cell fluorescence spectroscopy. He published five articles in 2017 and delivered one PhD student.

The **Organic Chemistry** division is headed by Prof Ben Bezuidenhoudt (C3-rated), with Drs Susan Bonnet, Anke Wilhelm (Thuthuka grant holder and UFS Prestige Scholar), and Linette Twigge (0.4 SLE) as lecturing staff, and Rudi Swart as Professional Officer. The groups were involved in six papers (Phytochem group) in international Chemistry literature, while (Processchem 4) six MSc and (Processchem 3) six PhD students were studying towards higher degrees. Two students from Processchem (one MSc and one PhD) graduated during 2017. Two postdocs were also enhancing their skills in Organic Chemistry in the Phytochemistry group. Dr Johannes van Tonder is employed by PETLabs Pharmaceuticals but has been seconded to the UFS as a lecturer until the end of May 2018.

The **Organic Chemistry** division consists of two distinct research directions, i.e. the Phytochemistry group (Drs Bonnet and Wilhelm) that focuses on the isolation and synthesis of natural products and compounds with therapeutic potential, and the Process Chemistry group (Prof Bezuidenhoudt) that investigates new methodologies for the synthesis of organic compounds with the emphasis on catalyst development and evaluation for industrial processes.

The **Physical Chemistry** division is divided into four distinct and separate research groups which are independently supervised by Profs Jannie Swarts (C1-rated) and Jeanet Conradie (C1-rated), Drs Ernie Langner, Eleanor Müller (Y2-rated), and Lizette Erasmus (Y2-rated), and supported by Ina du Plessis as Professional Officer.

Profs Swarts and Conradie both held two NRF-research grants (Rated Researcher and Competitive Rated Researcher). Dr Müller held a Thuthuka grant from the NRF. The Swarts and Langner groups were funded by research grants from Syngaschem BV. Dr Erasmus was also funded by Sasol and Dr Müller had Sasol equipment funding. Postgraduate students in this division include eight MSc and 11 PhD students, as well as five postdoctoral associates. The division was involved with 36 publications in high-impact journals, attended 10 conferences, and made 25 oral and poster contributions.

The **Swarts Group** focuses on synthetic and physical chemistry aspects of multinuclear metallocenes, and concentrates on porphyrin and phthalocyanine compounds bearing metallocene substituents such as titanocene, zirconocene, ferrocene, ruthenocene, and osmocene derivatives, especially in association with late transition metals; electrochemical, kinetic, and thermal analyses of these complexes; medicinal aspects of these complexes; and industrial studies on carboxylato complexes and heterogeneous catalysis of systems supported on two-dimensional matrices in collaboration with Sasol.

The research in the **Conradie Group** focuses on the characterisation of transition metal complexes and intermediates by synthetic and computational chemistry. Transition metal porphyrin and related compounds, O,O'-chelated titanium complexes, beta-diketonato-carbonyl complexes of rhodium(I) and rhodium(III), and dithizonato compounds of transition metal complexes are currently also being investigated.

The **Erasmus Group**, on the other hand, focuses on heterogeneous catalysis of especially model catalysts on flat surfaces and materials characterisation with XPS techniques, while the **Langner Group** studies metal-organic frameworks (MOFs), especially for catalysis, gas adsorption, and desorption studies, and the thermal analysis thereof; and **Dr Müller's** research concentrates on Polymer Chemistry, anti-cancer research, and Organometallic Chemistry.

Polymer Science on the Qwaqwa Campus has Prof Riaan Luyt (C1-rated) as principal research leader. Other researchers involved are Dr JP Mofokeng, Dr NF Molefe, and Dr MV Mngomezulu. This group was mainly involved in investigating the morphology and properties of polymer blends, composites, and nanocomposites. The group consisted of four PhD students, eight master's and nine honours students, and was involved

in six publications and two conference presentations in international journals. Currently, Drs NF Molefe, Dr JP Mofokeng, and Dr MV Mngomezulu are the main researchers on different topics of Polymer Science.

Research Articles

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Roodt, A. 2017. *Integrated approach using Chemical Crystallography and Spectroscopy for solving difficult Chemical Reaction Mechanisms* (lecture). Sixth Tunisian Crystallographic Meeting -TCM6; Djerba, Tunisia. 1-5 November.

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Venter, JA, and Drost, RM. 2017. *Forty years later – can we still learn from Tolman? Structural and reactivity studies on Rh complexes* (poster). EuCheMS International Conference on Organometallic Chemistry XXII, Amsterdam, The Netherlands. 9-13 July.

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Patents

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STAFF

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Lecturers: Dr RF Shago, Dr L Twigge (NMR Manager),

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Secretary: AS van Rooyen.

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Facilitators: T Kama, D Marake, T Chiweshe, M Mbongo, P van Heerden, T Molatedi, B van Tonder, C de Klerk, M du Plessis, J Botha, and Z Venter.

Prof J Swarts, Prof M Swart (Institut de Quimica Computacional I Catálisi, Univ Girona, Spain) and PhD student, Pieter Swarts, at the 26th Conference on Coordination and Bioinorganic Chemistry, Smolenice, Slovakia.

Preparing to use supercritical carbon dioxide for extraction are Dr E Botha, H Khasemene, Prof A Roodt, Dr M Schutte-Smith, and M Motente

Dr MR Sebitlo giving a lecture at the Phosphorus, Boron and Silicon Conference in Paris, France

Chemistry's own soccer team wearing their new kits

The 'Mexicans', winners of the department's annual 'potjiekos' competition, enjoying themselves

DEPARTMENT OF

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2017 Overview

The Department of Computer Science and Informatics delivers highly trained information technologists with technical skills in programming, system design, and analysis, as well as in database and network management. Our programmes and learning content are revised on a continuous basis to keep abreast with new developments in technology and industry.

We offer two degrees, namely BSc (IT) and BCIS. The first allows students to combine their CS education with studies in Mathematics, Mathematical Statistics, Physics or Chemistry. Our specialised BCIS degree (Bachelor's in Computer Information Systems) educates students in the application and management, as well as development, of information technology in the business and managerial environment. We receive positive feedback from graduates, as they do not find it difficult to be employed, and employers continuously contact us seeking graduates from our department.

On honours level, we offer courses in human-computer interaction, information and forensic security, advanced courses in programming, development for cell phones and other mobile devices, data warehousing and business intelligence, analysis and development of algorithms, and artificial intelligence. Some of our modules are specifically tailored to fit the needs of industry, such as the SAS Programming module and the course in management of Oracle databases.

We have modern facilities and undergraduate laboratories with cutting-edge equipment. Our highly qualified staff have exceptional abilities and we pride ourselves in the personal attention that we offer our students. The department boasts a modern usability laboratory and we regard ourselves as the country's leading research unit in eye tracking. We also specialise in educational technology, sentiment analysis, and natural user interfaces such as brain-computer interfaces, touch pads, virtual reality, and gestures. We have a sophisticated cluster system that is used for student training and complex research problems.

The Department of Computer Science and Informatics, Qwaqwa Campus, implemented a postgraduate degree programme in 2016 to commence in 2017. The programme started in 2017 with an enrolment of six students – five honours and one master's.

Over the past years, the department has shown a gradual growth in the number of undergraduate students. In 2016, we had 54 first-year students, increasing to 86 students in 2017. With the establishment of postgraduate programmes that aimed to attract local teachers from around Qwaqwa, the number of postgraduates will consequently increase research output.

ACHIEVEMENTS

Staff Achievements

Conferences

Wynand Nel and Dr Andries Burger authored a paper titled: 'Proving cybercriminals' possession of stolen credit card details on compromised POS devices', which was presented at the 12th International Conference on Cyber Warfare and Security. The conference was co-hosted by the Wright State University and the Centre for Cyberspace Research, Air Force Institute of Technology in Dayton, Ohio, USA, in March 2017.

Dr Eduan Kotzé visited the Computational Linguistics and Psycholinguistics (CLiPS) Research Centre associated with the Department of Linguistics in the Faculty of Arts at the University of Antwerp from 13 November until 27 November 2017. The goal of the research visit was to investigate cooperation on

sentiment analysis and subjectivity detection, gain an understanding into the Pattern software system, and explore possible future research collaboration activities. Currently, the Department of Computer Science and Informatics, together with the Unit for Language Facilitation and Empowerment, are informally collaborating with CLiPS in a study of pragmatic and discourse linguistics aspects of hate speech that would inform the design of computational models and/or methodologies.

Dr Eduan Kotzé in front of the 'Het Steen' castle in Antwerp, Belgium

Annual SAICSIT Conference

The department, in collaboration with the Department of Information Technology at the Central University of Technology, hosted the annual conference of the South African Institute of Computer Scientists and Information Technologists (SAICSIT). Prof Pieter Blignaut was elected as Vice-President of SAICSIT. Rouxan Fouché presented a talk titled 'Head Mouse: Generalisability of research focused on the disabled to able bodied users'. Dr Pieter Potgieter, a former PhD student of the department, presented a talk on how eye trackers can be used to assess the application of divisibility rules when learners have to divide a multi-digit dividend by a single digit divisor.

Dr Ruth Wario was awarded the prize for the 2nd best contributed research paper at the UFS annual Teaching and Learning Awards ceremony. Petra van Merwe, our Assistant Officer, was promoted to Senior Assistant Officer. Staff members presented at both local and international conferences.

Dr Ruth Wario received an Excellence in Teaching and Learning Research award from the UFS Centre for Teaching and Learning (CTL)

Student Achievements

Student Cluster competition

The CHPC Student Cluster Competition exposes undergraduate students at South African universities to the high-performance computing (HPC) industry. It takes place during the CHPC's National Conference each year and is open to all second-year students in an IT-related degree. Students are given a budget of around R200 000 and are required to design, build, and benchmark a cluster computer. The team with the best performing cluster is then selected to represent South Africa at the International Student Cluster Competition in Germany. The department entered two teams, one of which was chosen to participate in the national meeting. To prepare the students for the competition, a workshop was presented by Albert van Eck from ICT Services and Jean-Pierre du Plessis, a staff member in the department. During this workshop, the students were taught a number of Linux server and networking fundamentals and were exposed to the installation and configuration of cluster and scientific computing software.

Jean-Pierre du Plessis with a student team at the finals of the National Cluster Competition

Hackathon for students

In a programming challenge (hackathon) for students, the students were required to write a code to control the movement of a small, virtual mining robot that collects minerals scattered around a map. The students' mining robots then competed against each other, and the top three were chosen as winners.

Daniël Wium (left) and Jean-Pierre du Plessis (right) with winners of the student hackathon competition

Deep-Learning Indaba

Daniël Wium (staff), Jean-Pierre du Plessis (staff), and Christiaan du Plooy (student) attended the first ever Deep Learning Indaba, held at the University of the Witwatersrand. The Indaba focused on developing machine learning in Africa and consisted of five days filled with lectures on different types of machine-learning techniques, as well as practical hands-on experience involving the programming aspects of machine learning. The indaba was presented by researchers from a variety of international institutions, including Google DeepMind, Amazon, and Facebook, as well as various other universities. Christiaan du Plooy also presented a poster titled 'Applying Named Entity Recognition to the Dictionary of Southern African Place Names' at the Indaba.

Activities

Upgrading of facilities

Several changes were made to our facilities on the South Campus. A waiting area was constructed outside the computer laboratories, and a new reception office as well as an office for technical assistance was constructed. On the Bloemfontein Campus, the floor tiles of the Sasol lab were replaced and a new entrance to the lab, as well as a new office for the technical assistant, were built. The CSIL administrative assistant's office was also moved to the Sasol lab in order to provide a one-stop service centre for students. New, high-resolution data projectors as well as several large computer screens were installed to ensure that students can follow explanations from anywhere in the laboratory.

New student waiting area in front of the computer laboratories on the South Campus

Students working in the renovated Sasol laboratory

Amazing Race

All staff members in the department took part in an Amazing Race event as part of a team-building exercise. The three teams had to decipher clues to get to the next event, where several team members had to perform a specific task. Activities included riding go-karts, doing latté art at Royal Roastery, as well as decorating cupcakes at the Food and Beverage Institute. We also enjoyed a fun-filled Casual Day 2017, playing putt-putt and having a hamburger braai afterwards.

Staff members of the blue team with the cupcakes that they decorated

We held an open day on our Qwaqwa Campus in 2017 where students from various schools were motivated and informed about the importance of a knowledge-based industry in local communities and the benefits associated with it. The new mobility lab was designed and constructed on the department floor. It is a modern learning space perfectly suited for lecturing and group work. It has state-of-the-art laptops, wireless Internet access, and a high-resolution 3D projector. The lab will be further enhanced with mobile devices in 2017 to serve as the department's flagship mobility laboratory.

We initiated a collaboration research project with the Central University of Technology (CUT) under the leadership of Dr Ruth Wario (UFS, Qwaqwa Campus) and Professor Masinde (CUT). The project was jointly funded by the two institutions and an amount of R50 000 was awarded. The project aims to tackle climate-change challenges, using ICT and indigenous environmental knowledge from both Qwaqwa and Bloemfontein.

Open-day showcase

RESEARCH

Brain-Computer Interaction

The Department of Computer Science and Informatics were able to obtain the latest in brain-computer interface (BCI) technology, the SmartBCI, with financial aid from both the faculty and the department. This SmartBCI is being used in research undertaken by Dr Lizette de Wet and the postdoc fellow in the department, Dr Silas Verkijika.

A BCI is a computer-based device that is used to acquire, analyse, and translate brain signals into new kinds of outputs. The SmartBCI, a non-evasive, commercially available BCI, is a high-resolution electroencephalography (EEG)-based BCI that has particularly been designed for practical research applications. The non-invasive nature of the device enables it to capture EEG signals from the scalp, using neuro-electrodes.

BCI devices are widely used as physiological measuring tools to monitor the cognitive and affective states of individuals. The EEG signals are captured in real-time and can be used for a variety of applications. Some of the common applications of BCIs include neuro-rehabilitation, education and self-regulation, human-computer interaction, information security, neuro-

Dr Silas Verkijika, a postdoctoral research fellow in the department, attaches the BCI to a participant's head

marketing, games/entertainment, neuro-ergonomics, smart environments and medicine (e.g. diagnosis and neuro-rehabilitation).

Presently, the SmartBCI is being used in the Department of Computer Science and Informatics for research in human-computer interaction (HCI), although there are possibilities for numerous interdisciplinary research studies. An ongoing study by Drs Silas Verkijika and Lizette de Wet focuses on evaluating the role of emotions in users' interaction with mobile applications.

Sentiment analysis

Ian van der Linde is enrolled for a Magister Scientiae in Computer Science and Informatics at the University of the Free State. The aim of his study is to provide a comparative benchmark between four sentiment-analysis (SA) techniques in a computer-cluster environment, using social media as big data source. The sentiment-analysis techniques that will be compared are: pure lexicon-based, Naïve Bayes, a

feed-forward artificial neural network, and a linear support vector machine (SVM). All of the experiments conducted in this study use real-world big data streamed from Twitter®, processed by the computer cluster. His supervisor is Dr Eduan Kotzé.

Eye tracking in classrooms

Dr Pieter Potgieter completed his PhD study under the supervision of Prof Pieter Blignaut. He used eye tracking to determine whether learners look at the correct digits to determine if a multi-digit dividend is divisible by a single-digit divisor.

Learners of Sentraal High School in one of the department's computer laboratories that are equipped with eye trackers

Community Service

Service Learning

Second-year Computer Science students enrolled for a community-based module in which members of the community are trained in the use of MS Word.

Tlholohelo Nkalai (right), a staff member, with a member of the community who received a certificate for attending the computer-literacy classes that are presented as part of our service-learning module

Tswellang

The department maintains a three-year-rolling upgrade plan in its computer laboratories to ensure that our students have access to the latest and best technology. Computers that are replaced are donated to schools who can put it to good use. In 2017, we donated 50 computers to Tswellang Special School. We are also involved in a continuous maintenance project to maintain the computers.

Python project

The UFS Python Project is an initiative of the Department of Computer Science and Informatics that teaches programmatic thinking skills to school learners. During 2017, learners participated in two national competitions, namely the Talent Search and the Programming Olympiad. Our learners performed exceptionally well in both competitions.

Daniël Wium, a staff member, with some of the learners who received Talent Search certificates

We entered a total of 36 learners and students for the Talent Search competition organised by the Institute of IT Professionals South Africa. We achieved 13 Gold certificates (top 7% nationwide), four Silver certificates (next 14% nationwide) and nine Bronze certificates (next 29% nationwide). Our top performer was Albert Dreyer, who scored 100% for the Senior (Grade 10 and 11) section.

Fourteen learners entered the first round of the national Programming Olympiad. Albert Dreyer top-scored with 100%. Four learners qualified for the second round by obtaining 60% or better in round 1. In the second round, Sean Stott achieved 100%. After the organising

Daniël Wium from the department, and Sean Stott with his certificate at the Programming Olympiad awards ceremony

committee evaluated his code, Sean was chosen as one of thirteen finalists. He was the first learner from the Free State since 2013 to be invited to the finals, and the first ever to participate under the name of the UFS Python project.

We offer RIS242 on our Qwaqwa Campus, a semester course with eight credits, as a service-learning community service. The objective of the course is to uplift the lifestyle of elderly and young people in the Qwaqwa community by showing and teaching them how to use computers and work with basic MS Office applications. This course is optional for UFS students, with about seven to ten students from our department choosing to do so annually. During the UFS showcase day, an event comprising exhibits from different companies and parties, the 2017 RIS242 students exhibited the services we offer to the community.

RESEARCH OUTPUTS

Research Articles

Ahishakiye, E, Opiyo, E, Taremwa, D, and **Wario, R.** 2017. Comparative Analysis of Open source Business Intelligence tools for Crime Data Analytics. *International Journal of latest Research in Engineering and Technology* 3(4): 58-63.

Ahishakiye, E, Opiyo, E, **Wario, R,** and Niyonzima, I. 2017. A Performance Analysis of Business Intelligence Techniques on Crime Prediction. *International Journal of Computer and Information Technology* 6(2): 84-90

Blignaut, PJ. 2017. Development of a gaze-controlled support system for a person in an advanced stage of multi-sclerosis: a case study. *Universal Access in the Information Society* 16(4): 1003-1016.

Blignaut, PJ. 2017. Using smooth pursuit calibration for difficult-to-calibrate participants. *Journal of Eye Movement Research* 10(4): 1-14.

Kotze, JE. 2017. Augmenting a Data Warehousing Curriculum with Emerging Big Data Technologies. *Communications in Computer and Information Science* SACLA 2017, CCIS730: 128-143.

Kotze, JE. 2017. A survey of Data Scientists in South Africa. *Communications in Computer and Information Science* SACLA 2017, CCIS730: 175-191.

Musumba, G, and **Wario, R. 2017.** Partner Performance evaluation problem for construction projects. *Journal of applied sciences, engineering and technology for development.* 2(1): 1-29

Nel, E. 2017. Students as collaborators in creating meaningful learning experiences in technologically-enhanced classrooms: An engaged scholarship approach. *British Journal of Educational Technology* 48(5): 1131-1142.

Senekal, BA, and Kotze, JE. 2017. Die statistiese eienskappe van geskrewe Afrikaans in 'n komplekse netwerk. *LitNet Akademies* 14(1): 27-59.

Swanepoel, EH, Beyers, C, and **De Wet, L.** 2017. Exploring judgement and internal bias of life orientation teachers in sexuality teaching. *Journal for Transdisciplinary Research in South Africa* 13(1): 1-12.

Verkijika, SF, and De Wet, L. 2017. Determining the accessibility of e-Government websites in Sub-Saharan Africa against WCAG 2.0 standard. *International Journal of Electronic Government Research* 13(1): 52-69.

Chapters in Books

Miller-Naude, CL, Naude, JA, **Beelders, TR,** and Bergh, L. 2017. Visual grammar: An eye-tracking perspective on cognitive complexity in Biblical Hebrew pronunciation. *Le-ma'an Ziony Essays in honor of Ziony Zevit*. FE Greenspahn and GA Gendsburg (eds). Oregon, United States of America, Wipf and Stock Publishers.

Conference Contributions

Fouche, RC. 2017. *Head Mouse: Generalisability of research focused on the disabled to able bodied users.* South African Institute of Computer Scientists and Information Technologists (SAICSIT) Conference, Thaba 'Nchu, South Africa.

Lombard, WA, Van Zyl, JH, and **Beelders, TR**. 2017. *Consumer preference with regard to red meat: an Eye-tracker case study.* 21st International Farm Management Congress "Future Farming Systems", Edinburgh, Scotland.

Macharia, P, Muiriri, P, Kumar, P, **Ngari, B, and Wario, RD**. 2017. *The feasibility of using an Android-based infant fingerprint biometrics system for treatment follow-up.* IST-Africa 2017 Conference, Windhoek, Namibia.

Musumba, G, Kanyi, P, Nyongesa, H, and **Wario, R.** 2017. *Techniques for evaluation and selection of partners for construction projects*. Pan African Conference on Science, Computing and Telecommunication (PACT), July.

Nel, W, and Burger, AJ. 2017. *Proving cybercriminals' possession of stolen credit card details on compromised POS devices*. 12th International Conference on Cyber Warfare and Security, Dayton, United States of America.

Irerii, B, and **Wario, R**. 2017. *An assessment of predictors of learner's attention and their influence to learner's engagement and learning outcomes in mobile learning classroom*. IST-Africa 2017 Conference 978-1- 905824-56, IEEE. ISI accredited.

Potgieter, PH, and Blignaut, PJ. 2017. *Using eye-tracking to assess the application of divisibility rules*

when dividing a multi-digit dividend by a single digit divisor. South African Institute of Computer Scientists and Information Technologists (SAICSIT), Thaba 'Nchu, South Africa.

Papers and Posters

Bergh, L and **Beelders, TR**. 2017. *Eye-tracking studies concerning print media in South Africa* (paper). 5th Annual Book History Seminar, Pretoria, South Africa.

Blignaut, PJ. 2017. *Real-time visualisation of student attention in a computer laboratory* (poster). European Conference on Eye Movements 2017, Wuppertal, Germany.

Du Plooy, DC, Kotze, JE, and Du Plessis, JL. 2017. *Applying named entity recognition on the Dictionary of Southern African Place Names* (poster). Deep Learning Indaba, Johannesburg, South Africa.

Holmqvist, K, Zemblys, R, **Beelders, T,** and Niehorster, D. 2017**.** *Magnitude and variability in eye-tracking data* (paper). European Conference on Eye Movement 2017, Wuppertal, Germany.

Huber, M, and **Wium, DJ.** 2017. *Where do we look? Eye-tracking in petrology* (paper). 9th Annual Meeting of the Igneous and Metamorphic Studies Group, Johannesburg, South Africa.

Janse van Rensburg, E, Oberholzer, M**,** and **Blignaut, PJ.** 2017. *OT Eye: A tool to guide intervention and monitor progress during occupational therapy* (poster). European Conference on Eye Movements 2017, Wuppertal, Germany.

Loth, CR, **Lilokoe, G, and Du Plessis, JL**. 2017. *Using technology to raise awareness about place names as cultural heritage* (paper). International Symposium on Place Names, Windhoek, Namibia.

Mase, B. 2017. *Using educational videos to improve knowledge retention in computer programming* (paper). National Conference on Distance Education and Open Learning, Bloemfontein, South Africa.

Musumba, GW, Kanyi, P, Nyongesa, HO, and **Wario, RD.** 2017. *Techniques for evaluation and selection of partners for construction projects* (paper). Paper delivered at the Pan African Conference on Science, Computing and Telecommunications 2017, Nairobi, Kenia.

Potgieter, PH, and Blignaut, PJ. 2017. *A tool to assist teachers to determine if learners apply the divisibility rule correctly* (poster). European Conference on Eye Movements 2017, Wuppertal, Germany.

Van der Westhuizen, R, and Blignaut, PJ. 2017. *Using eye-tracking to provide dynamic assistance on the reading skills of beginner readers on desktop or mobile devices* (poster). European Conference on Eye Movements 2017, Wuppertal, Germany.

Magazine Article

Lombard, WA, Van Zyl, JH, and Beelders, TR. 2017. Alle oë is op rooivleisverbruikers en hul voorkeure. *Veeplaas* 8(10): 10-11.

STAFF

Professor: PJ Blignaut.

Associate Professor: TR Stott.

Adjunct Professor: E Nel.

Senior Lecturers: L de Wet, JE Kotzé, Dr R Wario.

Lecturers: RW Brown, AJ Burger, JL du Plessis, R Fouché, WSJ Marais, W Nel, TS Nkalai, DJ Wium, G Dollman, B Mase, A Musa, F Radebe.

Junior Lecturers: MA Thakaso, T Lesesa, B Sebastian.

Senior Officer: S Opperman.

Senior Assistant Officers: C Cilliers, W du Toit, V van der Bank.

Technical Assistant: M Makhanya.

Assistant Officers: C Afrika, S de Klerk, MS Mocwana, M Mahakoe, P van der Merwe.

DEPARTMENT OF
Consumer Sciences

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2017 Overview

The Department of Consumer Science seeks to equip our undergraduate students with the knowledge to identify and understand the needs of individuals and families regarding food, clothing, and housing, and the skills to help them fulfil these needs with available resources.

We also strive to motivate and lead postgraduate students to undertake research projects to strengthen the scientific basis from which the consumer can benefit in the fields of clothing, textiles, and food. Regular revision of modules and module content is necessary to keep the qualification relevant.

We offer a three-year B Consumer Science degree, a four-year BSc Home Economics (Foods) degree, a BScHons Home Economics, an MSc Home Economics, and a PhD degree.

ACHIEVEMENTS

Student Achievements

Malessa Louw won the Free State Women's Agricultural Union Award for the best student in 2017. She also won the Beth Erlank prize for the best student in Clothing.

Activities

Prof Hester Steyn attended the IFHE Annual leadership meeting in Sligo, Ireland. The theme of the conference was 'Sustainable and Healthy Lifestyles: Policy, Pedagogy and Practice'. They worked on a detailed activity plan to strengthen our global network, promoting Home Economics and Home Economics Education to support families, individuals, and communities in order to meet their multi-faceted challenges.

Prof Hester Steyn delivered the keynote address at the 2017 IFHE Africa Regional Conference in Uyo, Nigeria, on '*Developing Skills for Improved Social and Economic Conditions of Families and Global Communities: Home Economics Future Direction'.*

We hosted and managed the Consumer Studies Olympiad for Grade 11 and 12 learners.

RESEARCH

Food Security

'Ensuring sustainable Food Security through the reduction of food waste': On average, South African consumers waste approximately 24 kg of food per week. This results in an estimated R505 million food waste annually. Of the 112 municipalities in our country, only two report food waste figures. The greater scope of the projects in this category aims to determine how much and what type of food is wasted, as well as the perceptions, attitudes, and behaviour of consumers towards food waste. South Africa is a culturally rich and diverse country, therefore each proposed solution given as a result of the research, is culture- and location-specific. Similar studies are conducted in Lesotho, where rural and urban areas are being compared.

'Evaluating policies and developing intervention programmes to improve food insecurity and vulnerability': A pilot study in Swaziland is currently underway to investigate the level of food insecurity and vulnerability of households. Furthermore, policies are evaluated to determine whether it is realistically helping the household become less food insecure. Possible loopholes will be identified to aid in developing intervention programmes or solutions in assisting the household to gain a food-secure status.

'Determining the link between food insecurity and malnutrition and identifying possible areas of concern to policy makers': Many (approximately 14 million) South Africans are malnourished. Understanding the link between food insecurity and malnourishment and identifying possible causing factors, might assist policy makers. This will have a positive effect on communities, because there are strong suggestions that raising food security might decrease malnourishment figures.

Recycling

Barriers and pitfalls preventing eateries and bars from recycling. Barriers preventing recycling services from motivating eateries and bars to recycle. Starting a recycling initiative in Central South Africa and possibly collaborating with government.

Recycling behaviour and barriers of apparel (clothing articles) in Bloemfontein. Uncovering possibilities and informing the public.

Green consumerism. Buying behaviour and barriers preventing consumers from purchasing 'green' products.

Overall, we have established that consumers in Bloemfontein and central South Africa lack information and knowledge about the consequences of their wasteful behaviour; collaboration with possible services

and government as well as the municipality might lead to more sustainable behaviour.

Edible insects

Consumers must become more aware of the negative environmental impact of the meat industry, advocating the need to find other alternatives in order to not exploit all the natural resources. The research project's focus is on the use of edible insects as an alternative source of protein. Positive sensory experiences play a necessary role in the process of learning to accept a food but are inadequate when unusual and culturally-inappropriate foods are involved – as curious tasting does not imply acceptance. Efforts must be made to introduce unusual novel foods, such as insects, to consumers. An understanding of consumer expectations regarding the consumption of edible insects must also be considered.

The aim of this research is to find acceptable sensory ways of using crickets and mealworms as protein alternatives and as sources of sustainable protein, which will reduce economic costs with less environmental impact. The development of various products through the use of insect protein will test the willingness of consumers to utilise insect protein and also test the taste to see if it is compromised in any manner. Results will indicate if the use of insects as a healthy, sustainable, and affordable source of protein will be acceptable to consumers.

Community Service

Our Community Development final-year students were involved in community service at Kopano disability centre. As a class, our aim was to teach participants new skills that will help them generate income for themselves after the intervention. We helped them to work on various tasks: the colour wheel, flower brooches, painting canvases, and making blankets.

In the first task, participants were introduced to the colour wheel to help them make correct colour-combination choices going forward. During the second, participants learnt how to make fabric flowers. We also encouraged them to use their creativity by painting canvases and decorating photo frames. The last task involved making blankets. We helped them to sew words such as "believe, happy, and picnic" on plain grey blankets. The participants enjoyed each task.

One of the major challenges we faced was a language barrier because most of the participants could only speak Sesotho, while others were hearing-impaired. However, the practical nature of this intervention helped us to overcome most communication barriers.

At the end of the project the class hosted a small function for the participants – cooking and serving soup

Students working residents at Kopano Disabillities Centre

Residents of the disabillities Centre received a certificate after completing the workshops presented by the students

and presenting each participant with a certificate to thank them for their enthusiasm and participation. Their faces radiated happiness on receipt of the certificates and we were overwhelmed by their gratitude and joy at our relatively small gesture.

Our students bought some of the products, and the rest remained at the centre for APD (Association for People with Disabilities) to sell it. All funds generated, as well as student donations, was given to the centre to help them with their daily needs.

RESEARCH OUTPUTS

Research Articles

Van der Merwe, I, Steyn, HJH, Hugo, CJ, and Schall, R. 2017. The physical fibre properties of *Gonometa Postica* after degumming the cocoons with different methods. *Journal of Family Ecology and Consumer Sciences* 45.

Seiphetlheng, K, Steyn, HJH, and Schall, R. 2017. Anolyte as an alternative bleach for stained cotton fabrics. *Journal of Family Ecology and Consumer Sciences* 2.

Pheto-Moeti, B, Riekert, DM, and Pelser, AJ. 2017. Perceptions of *seshoeshoe* fabric, naming and meanings of motifs on fabric. *Journal of Family Ecology and Consumer Sciences* 2.

Conference Contributions

Du Toit, A, De Witt, M, Fouché, HJ, Hugo, A, and Venter, SL. 2017. *Rheological characterization of cactus pear mucilage for application in nutraceutical food products.* IX International Congress On Cactus Pear And Cochineal, Chile.

Du Toit, A, De Witt, M, and Fouché, HJ. 2017. *Determination of the functional properties of cactus pear mucilage from cladodes of four South African cultivars.* IX International Congress On Cactus Pear And Cochineal, Chile.

Du Toit, A, De Witt, M, Taljaart, M, and Bothma, C. 2017. *The application of cactus pear mucilage in health-promoting mayonnaise products.* South African Association for Food Science & Technology (SAAFoST), 22nd Biennial International Congress and Exhibition, Cape Town.

STAFF

Associate Professor: Prof HJH Steyn.

Lecturers: Dr JF Vermaas, Dr I van der Merwe, and Dr N Cronjé.

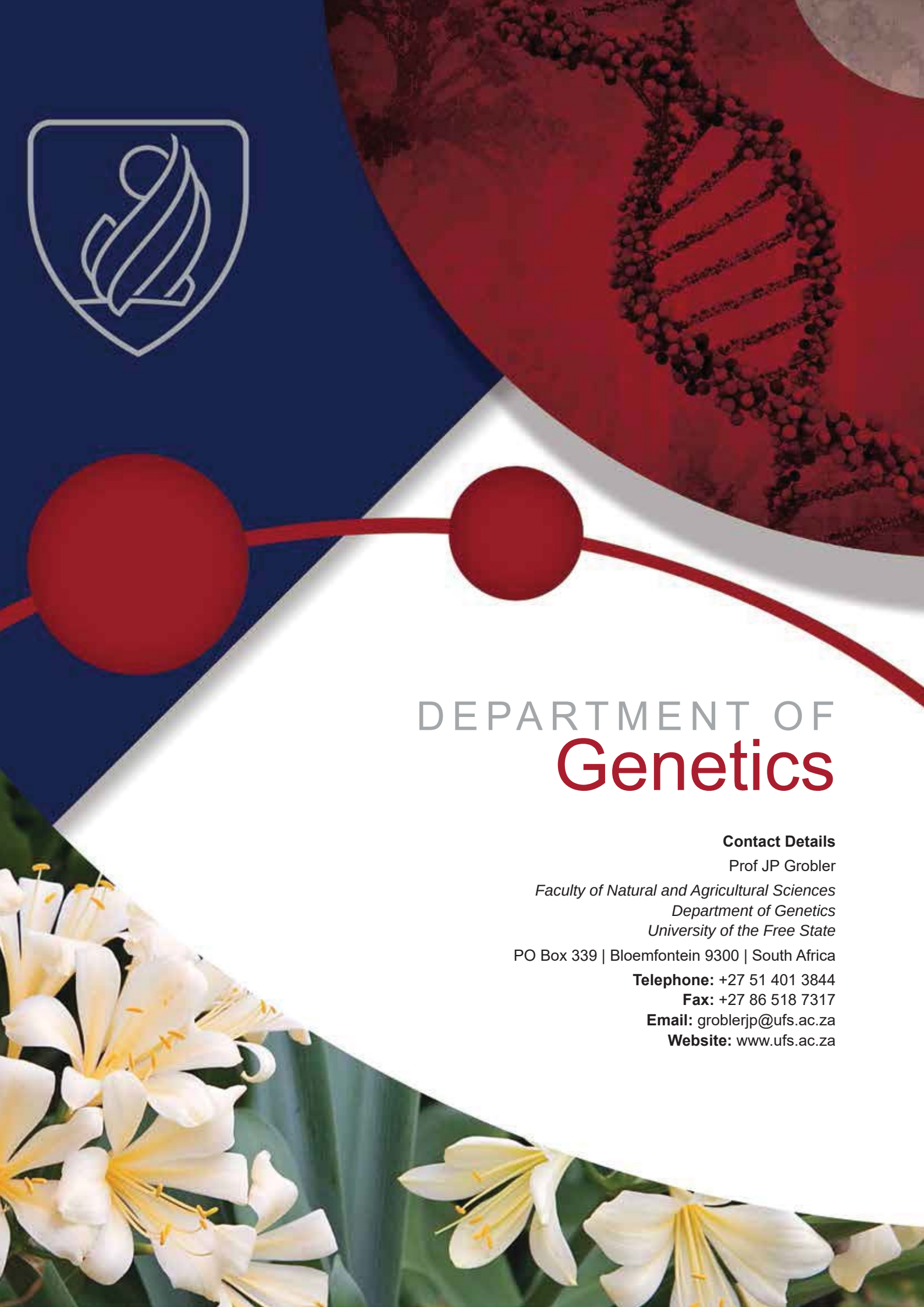
Junior Lecturers: PZ Swart, N Tinta, and JS van Zyl.

Part-time Contract Lecturers: Dr A du Toit and F van Tonder.

Senior Officer: Professional Services: D Jacobs.

Officer: Professional Services: C Denner.

Senior Assistant Officer: W van der Walt.



DEPARTMENT OF
Genetics

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2017 Overview

During 2017, several staff members in the Department of Genetics presented invited lectures at scientific meetings, internationally and within South Africa. Most other staff members also participated in scientific meetings. The expertise of several staff members was recognised by participation in leadership roles in national professional organisations.

Activities in our seven established research programmes continued, with new (for 2017) developments including the arrival of a new genetic analyser and the launch of a new research focus in zebrafish genetics. Collaboration was evident in visits from USA and UK scientists, as well as many local collaborations. The value of collaborations and the contribution of affiliated staff were also demonstrated by our outputs. Overall, we produced 18 papers in accredited journals in 2017, with a total of 44 conference contributions. Finally, to better serve our mandate in preparing undergraduate students for a career in Genetics, we launched a new module with a very strong applied component, covering practicalities encountered in the professional field.

ACHIEVEMENTS

Staff Achievements

Prof Paul Grobler delivered a keynote address at the annual meeting of the Australasian Wildlife Management Society (AWMS) in Katoomba, near Sydney, Australia. He spoke about the genetic issues that affect wildlife management in South Africa. Professor Grobler also commenced his second term as President of the Southern African Wildlife Management Association. Dr Gerda Marx was re-elected as an executive member of the Society for Endocrinology, Metabolism, and Diabetes of South Africa (SEMDSA). Dr Marx was also elected to serve as member of the academic programme organising committee for the International Conference of Endocrinology (ICE) to be hosted in Cape Town in December 2018. Furthermore, she was awarded a fully paid travel award to attend the 2017 European Association for the Study of Diabetes (EASD) Conference held in Lisbon, Portugal from 11 to 15 September. The conference was attended by 15 000 delegates from around the world.

Above: Dr. G. Marx (UFS) and Dr. A. Pillay (University of KZN) at the European Association for the study of Diabetes (EASD) conference venue in Lisbon, Portugal.
Right: Dr G Marx at the Belém Tower, constructed in 1515, one of the many famous landmarks in Lisbon.

Dr Karen Ehlers was invited as a keynote speaker to the 6th African Society of Forensic Medicine (ASFM) Congress, to address the topic of DNA forensics in South Africa. She also continued her term on the National Forensic Oversight and Ethics Board; with Frank Maleka serving on the council of the South African Genetics Society. Prof Antoinette Kotzé was invited to attend and participate in the Forensic Alliance Against Wildlife Crime (FAaWC) harmonisation workshop in the Hague, the Netherlands. Prof Desire Dalton was invited by the Natural History Museum, Vienna, Austria as a plenary speaker at the 3rd Annual meeting on Conservation Genetics.

Teaching and learning

We introduced a new module, 'Genetics in practice' (study code GENE3764). This is a specialisation module where third-year students will be exposed to applied aspects and recent advances in Genetics. The module is specifically aimed at exposing students to very recent advances but also practical considerations in their field, and covers diverse topics ranging from the fundamentals of Good Clinical Practice (GCP) and Good Clinical Laboratory Practice (GCLP) to regulations covering the use of animal and plant genetic resources for commercial purposes (Bioprospecting), and ethical requirements associated with genetic material. Established modules were also continuously improved, with particularly the newer modules in Forensic Science being developed to provide new levels of training in Forensic sciences.

RESEARCH

General

Research capacity in the department was significantly enhanced with the arrival of an ABI 3500 Genetic Analyser. We thank the Directorate of Research Development and the Dean of the Faculty of Natural and Agricultural Sciences for making this possible. In addition, the sequencer will provide services to the rest of the university community involved in molecular genetic research. Three of our staff members attended a three-day training course on the use and maintenance of the equipment.

We also launched a formal Departmental Research Committee in 2017. The mandate of the committee is to provide support for the AHD in formulating and implementing a departmental research strategy, promoting a strong research culture, and fostering research. At a practical level, the research committee will handle the submission and approval of project proposals for postgraduate students, monitor our progress against peers, support early-career researchers, make sure ethical and legal (permitting) requirements are adhered to, explore funding opportunities, manage our CRF allocation, facilitate mentorship opportunities, ensure that we use research seminars optimally, and formulate a strategy for research-equipment.

We conduct research and training under seven broad themes: Behavioural Genetics, Conservation and Population Genetics, Forensic Genetics, Forensic Science, Human Genetics, Molecular Systematics, and Plant Molecular Genetics and Genomics.

Behavioural Genetics

Zurika Murray continued to research the complexities of the monoamine neurotransmitters' involvement in modulating normal and abnormal human behaviour. The normal behaviour include problem solving and anxiety response in simulated stress environments, whereas the abnormal behaviour focuses on juvenile delinquency (studied in collaboration with specific schools).

Conservation and Population Genetics

Prof Paul Grobler continued with several projects in the field of conservation genetics, with a focus on hybridisation involving wildebeest, and the phylogeography of several species, with a strong focus on vervet monkeys (with Prof Trudy Turner as collaborator). He also studies the genetic effects of intensive and selective breeding of unusual phenotypes in ungulates. Dr Riël Coetzer is also involved in the studies involving vervet monkeys and ungulates. He initiated additional research work in this area, with a focus on the link between selection, geographic variation, and fitness. Hesmari Bindeman investigated patterns of differentiation and co-evolution between the caterpillar *Imbrasia belina* and the tree it feeds on – *Colophospermum mopane*. Prof Grobler and Bindeman are also involved in studies regarding farm-animal genetic resources, including the Boerperd, Letelle sheep, and Nguni sheep (with Dr Karen Ehlers also involved in the latter study).

Two affiliated staff members from the National Zoological Gardens (NZG), Profs Antoinette Kotzé and Desire Dalton, are engaged in a wide range of studies in the field of conservation genetics. Projects with a UFS link include work on African pangolins, vultures, white-winged flufftail (birds), and zebra.

Forensic Genetics

Letecia Wessels and Lucinda van der Westhuizen (MSc student) continued their work on the analysis of differential gene expression to establish a more accurate post-mortem interval during forensic investigations. The focus of the research is on *Chrysomya albiceps* pupae, as very little morphological changes occur during this developmental stage. This research project was presented at both the 4th National Forensic Services Conference and the 6th Annual Conference of the African Society of Forensic Medicine in 2017. Mthe Manqana presented results from his MSc study regarding the collection of human touch DNA from rhino skin at the 4th Forensic Services Conference in Pretoria.

Dr Karen Ehlers and her students continued various projects in the fields of Forensic Genetics, with a strong emphasis on Y-chromosome markers, wildlife crime, and molecular phenotypic.

Forensic Science

Dr Sonja Brink has a strong emphasis on Forensic Entomology. Zeenat Raffie specialises in toxicology and is currently studying the use of liquid chromatography mass spectrometry (LC-MS) analysis of the peptide human chorionic gonadotropin (hCG). The third member of the Forensic Science team –Tinus Viljoen – focuses on the chemical aspects of this field.

Human Genetics

Dr G Marx continued her research on diabetes predictive markers and has expanded the research scope to diabetes as comorbidity for patients on highly active antiretroviral treatment (HAART). Sue-Rica Schneider is investigating genetic susceptibility towards psychiatric disorders. She also collaborates with a private fertility clinic to research the genetic contribution towards idiopathic male infertility.

Molecular Systematics

Dr Gryzenhout is developing her research programme in the biosystematics of fungi and developing capacity at the UFS in molecular biosystematics. She is involved in developing molecular techniques, such as the use of next-generation sequencing, to detect and identify fungi from environmental samples such as soils, agricultural crops, and indigenous plants. She is also engaged with collaborations to aid identifying and surveying fungi of importance to humans from plants and the environment, using classical morphology and DNA sequence comparisons. She also embarked on developing the only fully-fledged research programme on the biosystematics of larger fungi, such as mushrooms, in South Africa.

Plant Molecular Genetics and Genomics

Frank Maleka is engaged in research on the genetics of flower pigmentation in *Clivia* plants. He previously used a next-generation sequencing (NGS) platform (Illumina) to sequence the flower transcriptome of *Clivia miniata*. He is currently validating the expression of a few select pigmentation genes as well as analysing the molecular evolution of such genes in *Clivia*. Maleka is also collaborating with the Department of Soil, Climate and Crop Sciences, UFS, on research involving the use of an NGS approach to determine the genetic basis between low and high biomass yielding cultivars in cactus pear.

Zebrafish as a model organism

Several members of staff – Prof Paul Grobler, Dr Riël Coetzer, Sue-Rica Schneider, and Zurika Murray – launched a new research focus on zebrafish. This venture is based on the use of zebrafish as an animal model for human disorders, the relationships between bottlenecks and fitness, and aspects of behavioural genetics.

Community Service

Dr Gerda Marx is part of a team of researchers that received a substantial grant from the Free State Department of Health to investigate the state of cardiovascular and metabolic health of newly diagnosed HIV patients in the Free State. The grant makes provision for the baseline and follow-up testing of 1 000 participants on antiretroviral treatment (ART) in the Free State, to determine co-morbidities associated with HIV-ART. Dr Marieka Gryzenhout continues to closely engage with citizen scientists around South Africa to aid them in identifying fungi, while they contribute to her research programme. She is also active in online citizen initiatives with the Animal Demography Unit at the University of Cape Town.

National and International Collaboration

Prof Paul Grobler continued his collaboration with Prof Trudy Turner from the University of Wisconsin-Milwaukee, who is also an affiliated Professor at the UFS. This collaboration yielded a paper in the journal *Nature Genetics* in 2017, following an extensive international collaborative project that also involved researchers from several other universities in the USA, as well as Austria, China, and the United Kingdom. In July 2017, she visited the UFS and collected samples from vervet monkey populations in KwaZulu-Natal. Locally, the Conservation Genetics team continued their strong collaboration with Profs Antoinette Kotzé and Desire Dalton from the National Zoological Gardens. Prof Kotzé attended and participated in the first IUCN Conservation Genetics Specialist Group workshop held in Antwerp, Belgium. She also visited Prof Fred Allendorf at the University of Montana, USA, to strengthen collaborations.

Prof Cristian Capelli from the Department of Zoology, University of Oxford, Tutorial Fellow in Human Sciences, St Hugh's College, visited the department from 28 to 29 March and gave a presentation regarding his research programme in human evolution.

Lt Col Anton Lucassen from the SAPS Forensic Division has been associated with the Department of Genetics for several years as an affiliated lecturer. In 2017, he provided training to the department's Honours students on the statistical approaches used at the SAPS forensic laboratories. Warrant Officer Theo Viljoen from the Local Criminal Record Centre of the SAPS also provided training to postgraduate students on the topic of crime-scene investigation.

Dr Marieka Gryzenhout collaborates strongly with the Biosystematics division of the Agricultural Research Council regarding research on a number of fungi. She also engages with the activities of the Animal Demography Unit at UCT.

The Forensic Science group is actively involved with several collaborations, including the South African Doping Control Laboratory (SADoCoL), the South African Police Services (SAPS), and the Departments of Anatomy and Chemistry on campus.

Postgraduate Students

Lucy Kemp completed her PhD on the phylogeography of the ground hornbill as part of a collaboration that also involved the National Zoological Gardens and the Tshwane University of Technology. Two MSc students – Adri Barnard and Polo Mokoma – were awarded their degrees in Forensic Entomology and Forensic Genetics respectively.

STAFF MATTERS

Prof Paul Grobler was officially appointed as the Academic Head of Department in June, after acting in the position for some time. Tinus Viljoen spent some time on sabbatical leave to complete his PhD. Five other staff members are also engaged in PhD studies. Unfortunately, we had to say goodbye to Dr Ellen Mwenesongole, who accepted a position in Botswana, but will retain a link with the department as affiliated Senior Lecturer. As replacement for Dr Mwenesongole, we welcomed Dr Sonja Brink to our ranks. Dr Brink is a forensic entomologist who is already contributing substantially to the Forensic Sciences programme. Zeenat Raffie also joined the Forensic Science team. Tanya Cornwell and Akhelethu Sithole left the department during 2017 to explore other career options.

RESEARCH OUTPUTS

Research Articles

Ahmed, SS, Abdel-Rahman, SM, Grobler, JP, and Kotzé, A. 2017. Allelic diversity of DQA2 exon 2 gene in Egyptian goat populations. *Indian Journal of Animal Research*. DOI:10.18805/ijar.v0iOF.7660

Ahmed, S, Grobler, JP, Madisha, T, and Kotzé, A. 2017. Mitochondrial D-loop sequences reveal a mixture of endemism and immigration in Egyptian goat populations. *Mitochondrial DNA* 28(5): 711–716.

Barasa, JE, Mdyogolo, S, Abila, R, Grobler, JP, Skilton, RA, Bindeman, H, Njahira, MN, Chemoiwa, EJ, Dangasuk, OG, Kaunda-Arara, B, and Verheyen, E. 2017. Genetic diversity and population structure of the African catfish, *Clarias gariepinus* (Burchell 1822) in Kenya: implication for conservation and aquaculture. *Belgian Journal of Zoology* 147(2): 105–127.

Dalton, DL, Smit-Robinson, HA, Vermaak, E, Jarvis E, and Kotzé, A. 2017. Is there genetic connectivity among the critically endangered White-winged Flufftail (*Sarothrura ayresi*) populations from South Africa and Ethiopia? *African Journal of Ecology*. DOI: 10.1111/aje.12414.

Du Plessis, M, Dalton, DL, Smit-Robinson, HA, and Kotzé, A. 2017. Next generation sequencing yields the mitochondrial genome of the critically endangered *Sarothrura ayresi* (white-winged flufftail). *Mitochondrial DNA* 2(1): 236–237.

Du Toit, Z, Du Plessis, M, Dalton, DL, Jansen, R, Grobler, JP, and Kotzé, A. 2017. Mitochondrial genomes of African pangolins and insights into evolutionary patterns and phylogeny of the family Manidae. *BMC Genomics* 18:746.

Gryzenhout, M, Fouché, HJ, and Swart, WJ. 2017. First report of a serious cladode disease of *Opuntia ficus-indica* (prickly pear) in South Africa caused by *Bisifusarium lunatum*. *Plant Disease* 101: 2148.

Grobler, JP, Hayter, KN, Labuschagne, C, Nel, EJ and Coetzer, WG. 2017. The genetic status of naturally occurring black-nosed impala from northern South Africa. *Mammalian Biology* 82: 27–33.

Jami, F, Gryzenhout, M, Wingfield, MJ, and Slippers, B. 2017. Diversity of tree-infecting Botryosphaeriales on native and non-native trees in South Africa and Namibia. *Australasian Plant Pathology* 46: 529–545.

Labuschagne, C, Dalton, DL, Grobler, JP, and Kotzé, A. 2017. SNP discovery and characterisation in White Rhino (*Ceratotherium simum*) with application to parentage assignment. *Genetics and Molecular Biology* 40(1): 84–92.

Luther, I, Jakop, U, Lueders, I, Tordiffe, A, Franz, C, Schiller, J, Kotzé, A, and Müller, K. 2017. Semen cryopreservation and radical reduction capacity of seminal fluid in captive African lion (*Panthera leo*). *Theriogenology* 89: 295–304.

Mafunda, PS, Maree, L, Kotzé, A, and Van der Horst, G. 2017. Sperm structure and sperm motility of the African and Rockhopper penguins with special reference to multiple axonemes of the flagellum. *Theriogenology* 99: 1–9.

Moodley, Y, Russo, I-SM, Dalton, DL, Kotzé, A, Muya, S, Haubensak, P, Bálint, B, Munimanda, GK, Deimel, C, Setzer, A, Dicks, K, Herzig-Straschil, B, Kalthoff, DC, Siegismund, HR, Robovský, J, O'Donoghue, P, and Bruford, MW. 2017. Extinctions, genetic erosion and conservation options for the black rhinoceros (*Diceros bicornis*). *Scientific Reports* 7:41417.

Mwale, M, Dalton, DL, Jansen, R, De Bruyn, M, Pietersen, D, Mokgokong, PS, and Kotzé, A. 2017. Forensic application of DNA barcoding for identification of illegally traded African pangolin scales. *Genome* 60: 272–284.

Svardal, H, Jasinska, AJ, Apetrei, C, Coppola, G, Huang, Y, Schmitt, CA, Jacquelin, B, Müller-Trutwin, M, Weinstock, G, Grobler, JP, Wilson, R, Turner, TR, Warren, WC, Freimer, NB, and Nordborg, M. 2017. Ancient hybridization and strong adaptation to viruses across African vervet monkey populations. *Nature Genetics* 49(12): 1705-1713.

Turner, TR. 2017. Preface 2017 Yearbook. *American Journal of Physical Anthropology* 162: 3.

Van Wyk, A, Dalton, DL, Hoban, S, Bruford, M, Russo, I-SM, Birss, C, Grobler, JP, Janse van Vuuren, B, and Kotzé, A. 2017. Quantitative evaluation of hybridization and the impact on biodiversity conservation. *Ecology and Evolution* 7(1): 320–330.

Woogeng, IN, Coetzer, WG, Etchu, KA, Ndamukong, KJN, and Grobler, JP. 2017. Current patterns of genetic diversity in indigenous and introduced species of land snails in Cameroon reflect isolation by distance, limited founder size and known evolutionary relationships. *Mitochondrial DNA Part B* 2: 375-380.

Chapters in Books

Schmidt-Küntzel, A, Dalton, DL, Menotti-Raymond, M, Fabiano, E, Charruau, P, Johnson, WE, Sommer, S, Marker, L, Kotzé, A, and O'Brien, SJ. 2017. Conservation genetics of the cheetah: Genetic history and implications for conservation. In *Biodiversity of the World: Conservation from Genes to Landscapes*, Nyhus, PJ (Ed.), Elsevier Academic Press, London, UK.

Schwartz, KR, Gusset, M, Crosier, AE, Versteege, L, Eyre, S, Tiffin, A, and Kotzé, A. 2017. The role of zoos in cheetah conservation: Integrating *ex situ* and *in situ* conservation action. In *Biodiversity of the World: Conservation from Genes to Landscapes*, Nyhus, PJ (Ed.), Elsevier Academic Press, London, UK.

Turner, TR. 2017. Savannah primates. In *International Encyclopedia of Primatology*, Fuentes, A (Ed.), Wiley, New York, USA.

Published Conference Proceedings

De Bruyn, M, and Mwale, M. 2017. *DNA barcoding as a forensic tool against wildlife crime in southern Africa.* Scientific abstracts from the 7th International Barcode of Life Conference / Résumés scientifiques du 7e Conférence international. Genome 60(11): 925-926.

Kgaditse, MM, Mwale, M, and Kotzé, A. 2017. *A DNA barcoding reference database for priority southern African snakes.* Scientific abstracts from the 7th International Barcode of Life Conference / Résumés scientifiques du 7e Conférence international. Genome 60(11): 953.

Mwale M, De Bruyn M, and Kotzé, A. 2017. *DNA barcoding and wildlife forensic investigations: The South African experience.* Scientific abstracts from the 7th International Barcode of Life Conference / Résumés scientifiques du 7e Conférence international. Genome 60(11): 977.

Conference Contributions

Adams, J, Van der Merwe, NC, Schneider, S-R, Buccamaza, I, and Imyanitov, EN. 2017. *Mutations in Bloom's syndrome: Do they contribute to familial breast cancer risk in South Africans?* South African Society of Human Genetics Conference, Durban, South Africa.

Adams, J, Schneider, S-R, Imyanitov, E, and Van der Merwe, NC. 2017. *The effect of heterozygous BLM mutations on breast cancer risk in South Africa*. Faculty of Health Sciences forum, University of the Free State, Bloemfontein, South Africa.

Bailey, B, Tonjock, RK, Cason, E, and Gryzenhout, M. 2017. *Root endophyte communities from sodic and non-sodic soils in a catena ecosystem of the Kruger*

National Park, South Africa. XXIth Congress of the Association for the Taxonomic Study of the Flora of Tropical Africa (AETFAT), Nairobi, Kenya.

Coetzer, WG, and Grobler, JP. 2017. *Immune linked genetic variation among different springbok (Antidorcas marsupialis) colour morphs*. Annual Symposium of the Southern African Wildlife Management Association, Rawsonville, South Africa.

Dalton, DL, and Kotze, A. 2017. *Genetic species integrity DNA sampling and chain of custody.* GEO WILD – Game species Symposium, Rhodes University, Grahamstown, South Africa.

Dalton, DL, and Kotzé, A. 2017. *Molecular assessment of African Penguin (Spheniscus demersus) populations in captivity (ex-situ populations).* Pan-African Association of Zoos and Aquaria (PAAZA), Idle Winds Lodge, Fourways, South Africa.

Diseko, LG and Marx, G. 2017. *Screening for the presence of single nucleotide polymorphisms associated with Type 2 Diabetes Mellitus* (poster). 2017 bi-annual Human Genetics of South Africa (HGSA) conference, Durban, South Africa.

Du Plessis, M, Mwale, M, Suleman, E, Mitchell, E, Dalton, DL, and Kotzé, A. 2017. *Toward next generation biodiversity research.* Joint Forum Biodiversity Information Management and Foundational Biodiversity Information Programme, Salt Rock Hotel and Beach Resort, Durban, South Africa.

Ehlers, K. 2017. DNA *Forensics in South Africa.* 6th African Society of Forensic Medicine (ASFM) Congress, Bloemfontein, South Africa.

Ehlers, K and Wessels, L. 2017. *UFS: Forensic Sciences Programme.* 4th National Forensic Services Conference, Pretoria, South Africa.

Grobler, JP. 2017. *Sustainable wildlife management: striking a balance? An overview of some genetic issues in wildlife management in SA.* Annual meeting of the Australasian Wildlife Management Society (AWMS), Katoomba, Australia.

Gryzenhout, M. 2017. 2017. *DNA approaches to aid the deficit in fungal biodiversity and conservation in Africa.* Joint congress of the European Council for Conservation of Fungi, International Society for Fungal Conservation and Macedonian Mycological Society, Ohrid, Macedonia.

Gryzenhout, M and Jacobs, A. 2017. *Roadside Fusarium species from South Africa* (poster). Joint congress of the European Council for Conservation of Fungi, International Society for Fungal Conservation and Macedonian Mycological Society, Ohrid, Macedonia.

Gryzenhout, M. 2017. *Deformation-type diseases of two native trees in South Africa.* Centre for Tree Health Biotechnology Symposium, University of Pretoria, Pretoria, South Africa.

Gryzenhout, M. 2017. *Phytobiomes of under-utilized crops.* Agricultural Research Council / University of the Free State / Durban University of Technology Collaborative Consortium on Under-utilized Crops, University of Free State, Bloemfontein, South Africa.

Gryzenhout, M. 2017. *The untapped biodiversity of Fusarium in Africa.* XXIth Congress of Congress of the Association for the Taxonomic Study of the Flora of Tropical Africa (AETFAT), Nairobi, Kenya.

Gryzenhout, M, Achilonu, C, and Cornwall, T. 2017. *A high diversity of Fusarium species from two native plant species in a semi-arid environment*. XXIth Congress of Congress of the Association for the Taxonomic Study of the Flora of Tropical Africa (AETFAT), Nairobi, Kenya.

Gryzenhout, M, Bailey, B, Kloppers, A, Cason, E, and Tonjock, RK. 2017. *Root endophyte communities differ between sodic and non-sodic soils in a catena ecosystem of the Kruger National Park, South Africa* (poster). 7th International Barcode of Life Conference, Kruger National Park.

Gryzenhout, M, Goldman, G, Tonjock, R, Loftie-Eaton, M, and Underhill, L. 2017. *MushroomMap: a tool to create demographic data for fungi.* XXIth Congress of Congress of the Association for the Taxonomic Study of the Flora of Tropical Africa (AETFAT), Nairobi, Kenya.

Gryzenhout, M, Tonjock, RK, Mkize, T, Kloppers, A, and Jacobs-Venter, R. 2017. *Using DNA barcodes to predict biodiversity priorities of macrofungi in South Africa.* 7th International Barcode of Life Conference, Kruger National Park, South Africa.

Kotzé, A. 2017. *Genes mirror geographic origin in southern African wildlife.* International Wildlife Forensics Symposium, Meeting of the Society for Wildlife Forensic Science, Edinburgh, UK.

Kotzé, A. 2017. *Sungazers*. National Biodiversity Investigators Forum, Black Mountain Hotel, Qwaqwa, South Africa.

Kotzé, A and Dalton, DL. 2017. *Species integrity approach via multidisciplinary angles.* Small Antelope Symposium, Rietvlei Nature Reserve, Pretoria, South Africa.

Labuschagne, K, Coetzer, W, and Kotzé, A. 2017. *The NZG Biobank Information and Information Systems: Analysis and improvement.* Joint Forum Biodiversity Information Management and Foundational Biodiversity Information Programme, Salt Rock Hotel and Beach Resort, Durban, South Africa.

Labuschagne, K, Dalton, DL, and Kotzé, A. 2017. *Forensically speaking: The value of Biobanks.* Southern African Wildlife Management Association Conference (SAWMA), Goudini Spa, Paarl, South Africa.

Marx, G. 2017. *What we know about the genetics of Diabetes* (lecture). Faculty of Health Sciences Research Forum, UFS, Bloemfontein, South Africa.

Mokgakala, K, Allen, A, Coetzer G, and Maleka, MF.

2017. *Exploring DNA methylation in the cactus pear (Opuntia ficus-indica) genome.* African Combined Congress, Klein Kariba, Bela Bela, South Africa.

Mokgokong, PS, Dalton, DL, Linden, B, Wimberger, K, Nupen, LJ, Tordiffe, ASW, Taylor, PJ, Madisha, MT, Jansen, R, and Kotzé, A. 2017. New insights into Samango monkey speciation in South Africa. 11th International Conference on Behaviour, Physiology and Genetics of Wildlife, Berlin, Germany.

Mqeku, M, Cason, E, Tonjock, RK, and Gryzenhout, M. 2017. *The fungal phytobiome of Searsia lancea (karee) trees with Karee Malformation Disease in South Africa* (poster). 7th International Barcode of Life Conference, Kruger National Park, South Africa.

Mwale, M, De Bruyn, M, Labuschagne, K, and Kotzé, A. 2017. *The status of wildlife forensic science at the NZG.* Southern African Wildlife Management Association Conference (SAWMA), Goudini Spa, Paarl, South Africa.

Nienaber, E and Marx, G. 2017. *Screening black South African females with Type 2 Diabetes Mellitus for mutations in the Peroxisome Proliferator Activated Receptor gamma gene* (poster). 2017 National Society of Endocrinology Metabolism and Diabetes of South Africa conference (SEMDSA), Johannesburg, South Africa.

Parusnath S, Dalton, DL, Kotzé, A, and Alexander, GJ. 2017. *Conservation genetics of the sungazer (Smaug giganteus).* 13th Herpetological Association of Africa Conference, Hluhluwe, South Africa.

Peni, ES., Allen, A, Coetzer, G, and Maleka, MF. 2017. *Chloroplast phylogenomics in cactus pear (Opuntia ficus-indica).* African Combined Congress, Klein Kariba, Bela Bela, South Africa.

Peta, K and Marx, G. 2017. *Mutation detection in the Endoglin gene in a family affected with hereditary haemorrhagic telangiectasia (HHT)* (poster). 2017 national bi-annual Human Genetics of South Africa (HGSA) conference, Durban, South Africa.

Radebe, T, Suleman, E, Heyne, H, Jansen, R, and Kotzé, A. 2017. *Morphological and molecular identification of ectoparasites associated with three African Pangolin species.* Southern African Wildlife Management Association Conference (SAWMA), Goudini Spa, Paarl, South Africa.

Spies, JJ and Spies, P. 2017. *Clivia taxonomy revisited, using DNA barcode regions.* II International Symposium on Ornamentals, Stellenbosch, South Africa.

Tonjock, RK, Errol Cason, E, and Gryzenhout, M. 2017. *Seed mycobiomes of six sorghum varieties using Next Generation Sequencing.* XXIth Congress of Congress of the Association for the Taxonomic Study of the Flora of Tropical Africa (AETFAT), Nairobi, Kenya.

Tonjock, RK, Carson, ED and Gryzenhout, M. 2017. *The mycobiome of cowpea (Vigna unguiculata) using environmental sequencing.* Joint congress of the European Council for Conservation of Fungi, International Society for Fungal Conservation and Macedonian Mycological Society, Ohrid, Macedonia.

Tonjock, RK, Cason, E, and Gryzenhout, M. 2017. *Comparisons of the mycobiome of five underutilized crop species in an intercropping system using Next Generation Sequencing.* 7th International Barcode of Life Conference, Kruger National Park, South Africa.

Van der Merwe, NC, Oosthuizen, J, Makhetha, MF, Adams, J, Dajee, BK, and Schneider S-R. 2017. *Contribution of PALB2 and BML mutations to familial breast cancer risk in BRCA1/2 negative South African Breast cancer patient detected using High-Resolution Melting Analysis.* 19th International Conference on Human Genetic Disorders and Disease.

Volschenk, C, Spies, P, and Spies, JJ. 2017. *Cytogenetic development in the genus Lachenalia.* II International Symposium on Ornamentals, Stellenbosch, South Africa.

Wessels, L, Ehlers, K, and Brink, S. 2017. *Gene Expression profiling in forensically important blow flies.* 4th Forensic Services Conference, Pretoria, South Africa.

Wessels, L. 2017. *Gene Expression profiling in forensically important blow flies.* 6th African Society of Forensic Medicine (ASFM) Congress, Bloemfontein, South Africa.

Whitehead, L, Swart, VR, and Gryzenhout, M. 2017. *DNA Barcoding of Aedes (Diptera: Culicidae) in the Free State Province, South Africa.* Congress of the Entomological Society of South Africa, Pretoria, South Africa.

STAFF

Professors: Prof JP Grobler.

Senior Lecturers: Dr K Ehlers, Dr M Gryzenhout, Dr G Marx.

Lecturers: Dr S Brink, H Bindeman, MF Maleka, Z Murray, S Schneider, JA Viljoen, L Wessels.

Junior Lecturers: Z Raffie.

Affiliate Professors: Prof A Kotze, Prof TE Turner.

Affiliate Senior Lecturers: Dr DL Dalton, Lt Col A Lucassen.

Research Associates: Prof JL Spies, Dr P Spies.

Research Fellows: Prof J Spies, Dr P Spies.

Senior Officer (Financial officer): B Henn.

Officer (Laboratory Technician): T Cornwell.

Senior Assistant Officer (Laboratory Technician): A Sithole.

Assistant officer: V Nuttall.

DEPARTMENT OF
Geography

(Bloemfontein, Qwaqwa, and South Campuses)

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2017 Overview

The Department of Geography had a busy 2017, with several student and research activities taking place. We attended various conferences to present research outputs.

The Department of Geography on the Qwaqwa Campus for the first time developed a strategic plan (2017-2021) in line with the University Strategic Plan. We continue to grow academically, in community engagement, and with research. Staff members also increasingly collaborate with other universities and institutions. We now have active and continued collaborations with colleagues at UKZN, SANSA, University of Limpopo, Wits University, ARC, University of Johannesburg, Walter Sisulu University, North-West University, University of Cape Town, and University of Tokyo, among others. Our students' average pass rate improved from 80% in 2016 to 85% in 2017. Similarly, the number of students enrolled in our flagship undergraduate degree programme (BSc Environmental Geography) increased. The first set of these BSc Environmental Geography students (six) graduated in May 2017. We also continued to increase our postgraduate output, with two PhD and two MSc students graduating in 2017. For the first time in years, one of our MSc students completed her degree with distinction; she will be graduating in May 2018.

ACHIEVEMENTS

Staff Achievements

Dr Le Roux attained an Y2 rating from the NRF.

Dr Adelabu was promoted to Senior Lecturer.

Student Achievements Qwaqwa Campus

Module code	No of students passed	Pass %	No of students failed	Fail %
GEOE1514	28	96,55	1	3,45
GEOG1514	290	88,69	37	11,31
GEOG2614	17	94,44	1	1,47
GEOG2634	67	98,53	1	1,47
GEOG3714	06	100		
GEOG3734	19	95	1	5
GEOG3754	3	100		
GISS2614	44	97,73	1	2,27
GEOT2614	6	100		
GEOT3714	7	100		
GEOE1624	24	85,71	4	14,29
GEOG1624	278	94,24	17	5,76
GEOG2644	16	100		
GEOG2624	75	98,68	1	1,32
GEOG3724	5	100		
GEOG 3744	15	78,95	4	21,05
GEOT 1624	23	53,49	20	46,51
GEOT 2624	4	100		
GEOT 3744	7	100		
GISS 2624	47	95,92	2	4,08
GISS 3724	4	100		

Activities

The Geomorphology Honours class, along with their lecturers and head of department, attended the biennial meeting of the Southern African Association of Geomorphologists in Manzini, Swaziland, from 25 to 28 July. It was preceded by a field excursion, tracking the Tugela River from source (Thendele, Royal Natal National Park, Drakensberg) to mouth (North Coast of KwaZulu-Natal). The excursion focused on various landscape and climate change issues that occur within the region.

From the left: Giovanni Theunissen, Lefa Morake, Elizabeth Rudolph, Lebo Senokoane, and Dr Jay le Roux at the SAAG conference in Manzini, Swaziland

RESEARCH

Liezel Rudolph's research focuses on dating the deglaciation of Marion Island. For this, rock samples were collected from the Island during the 74th Relief Expedition in April/May 2017, as part of a multi-institutional Geomorphology team. The annual expedition is funded by the SANAP-NRF: Sub-Antarctic Landscape-Climate Interactions (SLCi).

Fieldwork team on Marion, from the left: Sibusiso Sinuka (UFH, M74 Overwinterer), Profs Werner Nel (UFH) and David Hedding (UNISA), Elizabeth Rudolph (UFS), and Camilla Kotzé (M73 Overwinterer)

Dr Jay le Roux and PhD student, Ryan Anderson, collaborated with Prof David Hedding from Unisa and Dr Bennie van der Waal from Rhodes University to create 3D models of large gullies in the Tsitsa River Catchment in the Eastern Cape with drone technology. Not only is gullies a huge threat to infrastructure including roads, bridges, fences and lands, gullies feed massive amounts of sediment into river networks and silt up dams. Gullies also drain subsoil moisture, divert runoff from land to streams, and lowers water tables.

A gully in the Tsitsa Catchment, Eastern Cape

Community Service

We celebrated International Polar Week with the Association of Polar Early Career Scientists from 18 to 24 September. Guests from other university departments and external social clubs came during their lunch hours to listen to a range of talks on life and research at South Africa's stations in Antarctica and on Marion Island. The week ended with an exclusive screening of Ethan Steinman's Glacial Balance at the Naval Hill Planetarium.

National and International Collaboration

For an NRF/NSCF-funded project, Dr Jay le Roux collaborated with Prof David Hedding from Unisa, as well as Prof Gaojun Li and Dr Yang Chen from Nanjing University to create 3D models of a rare periglacial feature near Sani in Lesotho. The so-called block-stream consists of rocks that slowly 'flow' downslope due to water in summer and ice in winter that removes any sediment underneath it.

Dr SA Adelabu and Dr HM Hansen were part of the university representatives visiting Japan to establish collaborations between the UFS and some universities in Japan. As a result, we are excited about a potential collaboration between the University of Tokyo and the UFS in establishing a sustainable science hub with the Department of Geography taking a leading role.

Postgraduate Students Qwaqwa Campus

The number of PhD and master's student enrolments continued to increase from 2016 to 2017. We had 12 PhD enrolments for 2017, which is five more than the

Module code	No of students passed	Pass %	No of students failed	Fail %
GEOG 6814	6	100		
GEOG 6816	6	100		
GEOG 6836	6	100		
GEOG 6826	4	100		
GEOG 6846	2	50	2	50
GEOG 6824	5	83,33	1	16,67
GEOG 6808	3	60	2	40

seven we had the year before. Our master's degree numbers were also up by two, with a total of 12 registering in 2017. The Honours modules pass rate for 2016 is stated above:

STAFF MATTERS

Dr Massey was promoted to Senior Lecturer, and Ms Pretorius to Lecturer.

Alex Adjei's contract as stand-in for M Naidoo was renewed. N Sekhele is finalising her MSc degree. M Naidoo and P Mahasa's PhDs were progressing well.

RESEARCH OUTPUTS

Research Articles

Cloete, JS and Massey, RT. 2017. Seshego: an unexpected suburb. *South African Geographical Journal* 99(2): 152-165.

Gunter, A and Massey, RT. 2017. Renting Shacks: Tenancy in the informal housing sector of the Gauteng Province, South Africa. In: Środa-Murawska, S and Szymańska, D. editors, *Bulletin of Geography*. Socio-economic Series, No. 37, Toruń: Nicolaus Copernicus University, pp. 25-34.

Manatsa, D and Mukwada, G. 2017. A connection from stratospheric ozone to El Niño-Southern Oscillation. *Nature (Climate Science) Scientific Reports, 7.* Available: https://dx.doi.org/10.1038%2Fs41598-017-05111-8.

Manatsa, D, Mukwada, G, and Makaba, L. 2017. ENSO shifts and their link to Southern Africa surface air temperature in summer. *Theoretical and Applied Climatology*, pp.1-12. DOI 10.1007/s00704-017-2112-y

Massey, RT. 2017. The effect of informal settlement upgrading on women's social networks: Layout versus location. *Urban forum* 28: 205-217.

Mutana, S and **Mukwada, G**. (2017). An Exploratory Assessment of Significant Tourism Sustainability Indicators for a Montane-Based Route in the Drakensberg Mountains. DOI:10.3390/su9071202

Mukwada, G and Manatsa, D. 2017. *Acacia mearnsii* management in a South African national park: SWOT analysis using hot topics in biological invasion as a guide. *Journal of Mountain Science*. 14(1): 205-218.

Conference Contributions

Adelabu, SA. 2017. *Integration of Multispectral and ancillary data for mapping Seriphium plumosum in a mountainous terrain using ensemble algorithms*. Earth Observation (EO) Summit 2017 Montreal, Canada. 20-23 June.

Mahasa, PS, Palamuleni, LG, and Ruhiiga, TM. 2017. *Remote Sensing and Evapotranspiration Mapping: Implications for the Upper Orange River Basin, South Africa - Part 3*. International Conference on Environmental Science and Development (ICESD), Putrajaya, Malaysia. 4-5 May.

Mahasa, PS, Palamuleni, LG, and Ruhiiga, TM. 2017. *Irrigation Implications for the Upper Orange River through Remote Sensing and Evapotranspiration*. The 3rd International Conference on Water Resource and Environment (WRE 2017), Qingdao, China. 26-27 June.

Mahasa, PS, Palamuleni, LG, and Ruhiiga, TM. 2017. *Water Demand Management in the Upper Orange River Basin, South Africa*. International Conference on Disaster Risk Management for Sustainable Development (DRMSD 2017), Rochester Institute of Technology, Dubai (RIT, Dubai University). Dubai Silicon Oasis. 23-25 August.

Molaudzi, O and **Adelabu, SA**. 2017. *"Development of Fire Moisture Index for Fire Danger Assessment in a mountainous area using Remote Sensing.* Disaster Management Institute of Southern Africa (DMISA) Conference 2017, Port Elizabeth, South Africa. 27-28 September.

Mukwada, G. 2017. *Geospatial and temporal analysis of drought in a mountainous environment: The case of Lesotho*. 4th World Conference on Climate Change, Rome, Italy. 19-21 October.

Mukwada, G. 2017. *Spatiotemporal analysis of the impact of climate change on the state of vegetation cover in the Namahadi Catchment Area in South Africa.* 1st International Conference on Natural Hazards and Disaster Management, Osaka, Japan. 1-3 June.

Mukwada, G. 2017. *Spatiotemporal analysis of drought prone montane areas using gridded Standardized Precipitation Index (SPI) data: A case study of the Maluti Drakensberg Mountains of South Africa*. AfroMont-Mt Kilimanjaro Mountain Research Conference, Moshi, Tanzania. 22-26 February.

Mukwada, G and Makaba, L. 2017. *An assessment of the mountain farmer's perceptions and adaptation strategies towards climate change, a case study of subsistence farmers in Qwaqwa*. AfroMont-Mt Kilimanjaro Mountain Research Conference, Moshi, Tanzania. 22-26 February.

Okello, TW. 2017. *Interdisciplinary Research in Climate Change: The Case of Sub-Saharan Africa*. 3rd International Conference on Regional Challenges to Multidisciplinary Innovation (RCMI) at Nairobi, Kenya. 5-6 October. ISBN (978-969-9948-92-3)

Rudolph, EM, Hedding, DW, Nel, W. 2017.*Cosmogenic nuclide surface exposure dating: pitfalls and challenges for isolated fieldwork.* Southern African Association of Geomorphologists Manzini, Swaziland. 25-28 July.

Rudolph, EM, Hedding, DW, Nel, W. 2017. *The ice that capped the island: a review on Quaternary landscape evolution of Sub-Antarctic Marion Island.* 1st International Workshop on Antarctic permafrost, periglacial processes and soils (ANTPAS): from an expert group to a research program, Varese, Italy. 3-5 October.

Sekhele, NM. 2017. *Assessing environmental and socio-economic effects of livestock grazing in the Clarens Nature Reserve.* South African Geographers Student Conference University of Mpumalanga, South Africa. 18-22 June.

STAFF

Professors: Prof G Mukwada.

Senior Lecturers: Dr RT Massey, Dr CH Barker, Dr JJ le Roux, Dr T Okello, and Dr S Adelabu.

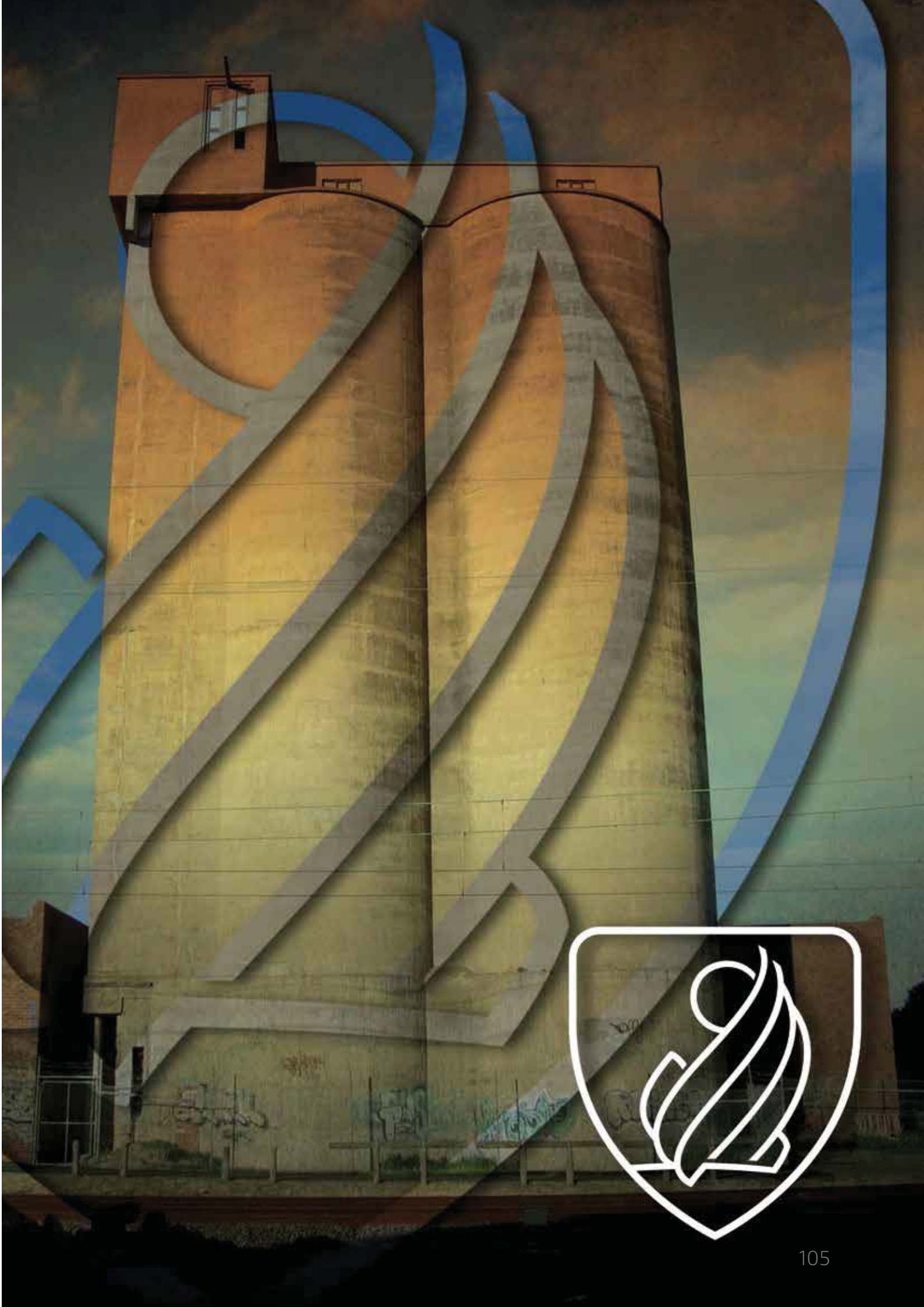
Lecturers: A Pretorius, TC Mehlomakhulu, ES Nkoee, EM Rudolph, E Kruger, A van der Walt, Dr M Hansen, P Mahasa, A Adjei, and M Naidoo.

Research Associates: Prof PJ Holmes and Prof J Boardman.

Junior Lecturers: N Sekhele.

Senior Officer, Professional Services: N van Dyk.

Officer, Professional Services: S Brits.



DEPARTMENT OF
Geology

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2017 Overview

During 2017, we awarded a total of 63 degrees, with 46 students receiving BSc degrees, 11 honours degrees, four MSc degrees, and two master's in Mineral Resource Management degrees. The department was responsible for the presentation of six undergraduate and three honours programmes, as well as the MSc (Mineral Resource Management) degree, and supervised the continued research of 15 students in Mineral Resource Management, 12 MSc candidates, and six PhD candidates over the course of the year.

ACHIEVEMENTS

Staff Achievements

The photo that won Dr Elizaveta Kovaleva the EGU photo contest

Dr Elizaveta Kovaleva won the European Geosciences Union (EGU) photo contest in Vienna with a photo titled 'Movement of the Ancient Sand'. In September, the International Mineralogical Association Commission on New Minerals, Nomenclature and Classification honoured Prof Marian Tredoux for her contributions to our understanding of the Bon Accord NiO body in the Barberton greenstone belt by naming a newly discovered mineral from the Bon Accord body 'tredouxite'. The new mineral has the formula $NiSb_2O_6$ and was proposed to the commission by an international group of scientists, including Prof Duncan Miller, affiliated Professor in our department. Dr Freddie Roelofse was elected to the Council of the Geological Society of South Africa; his visiting investigator appointment at the Department of Terrestrial Magnetism, Carnegie Institution for Science, was also extended until the end of 2018. Researchers in the department furthermore managed to secure R678 100 from the Iphakade Programme to support the research of postgraduate students in the department.

Student Achievements

We are proud of former honours student and current student in the Centre for Environmental Management, Tshiamo Legoale, who was announced the Famelab International Champion at the Cheltenham Science Festival held in the UK in June 2017, for her research on the use of wheat to harvest gold from mine dumps. The Geological Society of South Africa announced Photis Kalpakiotis, Prof Wayne Colliston's student, as the winner of the Haughton Award for the best honours thesis from a South African university in 2016, with a thesis titled 'The Mapping and Structural Analysis of the Putsies Migmatite'.

Activities

Arrangements for our Centenary Conference and Dinner, planned for April 2018, began in earnest during the year. The year also saw numerous field trips undertaken across the country. First-year students visited several sites around Bloemfontein to study sedimentary rocks and structures. They also

studied dolerite intrusions and the thermal effects that intrusive rocks have on the country rocks that they intrude. Second-year students undertook a series of visits to Austin's Post, southwest of Bloemfontein, to do mapping, and undertook a weeklong excursion to Barkly East where they were presented with additional opportunities to hone their geological fieldwork skills. Second-year students also visited a few landfill sites in and around Bloemfontein as part of their training in Environmental Geology. Third-year students undertook excursions to the Big Hole Museum in Kimberley to study the mining history of the town and the geology of kimberlites and diamonds, and to the Vredefort Dome to study the regional geology of the dome and the effects that regional and impact metamorphism had on the rocks exposed within the dome.

Third-year students posing for a group photo during their excursion to the Vredefort Dome

Honours students took part in various excursions and field trips. During a nine-day field trip to study the economic geology of the Kaapvaal Craton, they also visited a variety of working and defunct mines on the Bushveld Complex, the Barberton greenstone belt, and the Phalaborwa Complex.

Honours students during their Economic Geology field trip, taking notes while being instructed by Dr Matthew Huber on the geology of the Pilanesberg Complex

Honours students updating their field notebooks at the Scotia talc mine in the Barberton greenstone belt, which was visited as part of their Economic Geology field trip

Other shorter field trips were to the Northern Cape (Mineralogy), Jagersfontein (Geochemistry), the Council for Mineral Technology (Mintek) (Geochemistry), the Vanderkloof area (Sedimentology), and the Vredefort Dome (Structural Geology).

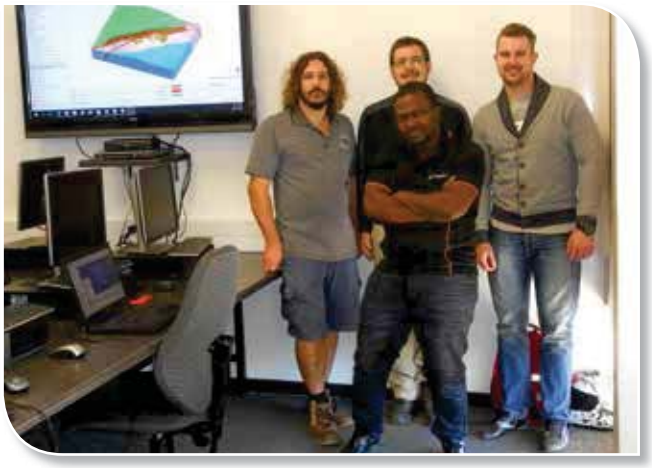
Staff members and students presented their work at several conferences, including the Igneous and Metamorphic Studies Group meeting hosted by the University of Johannesburg, the European Geosciences Union (EGU) General Assembly (Vienna, Austria), the Association of Southern African Professional Archaeologists (ASAPA) Conference hosted by the University of Pretoria, and the Goldschmidt Conference (Paris, France).

The following Kovsie GeoTalks were presented over the course of the year:

- 'Modern versus ancient controls on sedimentary systems – The present is not always the key to the past' presented by Prof Poppe de Boer, Utrecht University, the Netherlands.
- 'Chromitites and associated platinum-group elements in ophiolites: an overview' presented by Dr Federica Zaccarini, University of Leoben, Austria.
- 'Uralian-Alaskan complexes: a puzzling source of platinum' presented by Prof Giorgio Garuti, University of Leoben, Austria.
- 'Medical Geology – an interdisciplinary emerging field of science' presented by Prof Hassina Mouri, University of Johannesburg.
- 'The life of an exploration geologist' presented by Nathi Chabangu, RC Developments.
- 'Carbonates and carbonate melts in Earth's mantle' presented by Dr Igor Sharygin, VS Sobolev Institute of Geology and Mineralogy, Russia.

- ‘Research life at sea’ presented by Raimund Rentel.

During the year, we also hosted two short courses attended by staff and students. Stuart Bateman from Innov-X Systems showcased the latest developments in portable X-ray equipment, and Sizwe Nkehli presented an introductory Leapfrog course to staff and postgraduate students.



Some of the participants in the Leapfrog course that was presented in August

Jarlen Beukes, Prof Chris Gauert’s and Dr Freddie Roelofse’s PhD student, visited Dr Iain McDonald’s laboratory at Cardiff University, where she obtained platinum group-element data on samples from the Northern Limb of the Bushveld Complex. She received travel support from the National Research Foundation.

Additionally, we hosted delegations from the University of Venda and the East China University of Technology to explore collaborative possibilities in teaching and research.

The delegation from the East China University of Technology that visited our department in December to discuss aspects related to future collaboration in teaching and research

RESEARCH

Community Service

The department, in particular Rinae Makhadi, again hosted the Free State leg of the Minquiz National Science Competition on 18 May 2017. A total of 18 schools (mostly from the Free State) took part in the competition, each represented by three learners. The learners visited the Naval Hill Planetarium as part of the competition.

National and International Collaboration

Staff in the department actively collaborated with researchers at the following national and international academic and research institutions over the course of the year: University of Gothenburg (Sweden), University of Leoben (Austria), Cardiff University (UK), Department of Terrestrial Magnetism (Carnegie Institution for Science, USA), Deutsches GeoForschungsZentrum (Germany), University of Saskatchewan (Canada), Vanderbilt University (USA), University of Brasilia (Brazil), University of Montevideo (Uruguay), Johns Hopkins University (USA), University of Vienna (Austria), University of Liverpool (UK), Martin Luther University of Halle-Wittenberg (Germany), University of Manitoba (Canada), Ludwig Maximilian University of Munich (Germany), Vrije Universiteit Brussel (Belgium), the Czech Academy of Sciences (Czech Republic), Charles University (Czech Republic), Czech Geological Survey (Czech Republic), University of Johannesburg, University of the Western Cape, University of the Witwatersrand.

STAFF MATTERS

NRF intern, Susan Serfontein, who joined us in 2016, completed her internship early in 2017. She was, however, retained on contract basis for the second semester to help Adriaan Odendaal with lecturing responsibilities because he needed time to advance his PhD research. Dr Matthew Huber joined us as Senior Lecturer in Economic and Exploration Geology, following the completion of his postdoctoral research-fellow contract in mid-2017. Dr Elizaveta Kovaleva was retained as postdoctoral research fellow for a third year due to the excellent work that she conducted over the course of her initial two-year contract. Dr Hendrik Minnaar, previously from the Upington Regional Office of the Council for Geoscience, also joined us late-2017 as senior lecturer in Structural Geology. He was appointed as replacement for Prof Wayne Colliston, who retired as Associate Professor in Structural Geology in December 2017, after serving the department for 37 years. The year also saw Justine Magson promoted to Lecturer.

RESEARCH OUTPUTS

Research Articles

Adorno, RR, Do Carmo, DA, Germs, G, Walde, DHG, Denezine, M, Boggiani, PC, Sousa e Silva, SC, Vasconcelos, JR, Tobias, TC, Guimaraes, EM, Vieira, LC, Figueirdo, MF, Moraes, R, Caminha, SA, Suarez,

PAZ, Rodrigues, CV, Caixeta, GM, Pinho, D, Schneider, G, and Muyamba, R. 2017. *Cloudina lucianoi* (Beurlen and Sommer, 1957), Tamengo Formation, Ediacaran, Brazil: Taxonomy, analysis of stratigraphic distribution and biostratigraphy. *Precambrian Research* 301: 19-35.

Colliston, WP, Schoch, AE, and Cole, J. 2017. The Grenvillian Namaqua fold belt adjacent to the western Kaapvaal Craton: 2. Archaean Craton and supercontinent connections. *Precambrian Research* 300: 289-314.

Cornell, DH, Meintjes, PG, Van der Westhuizen, WA, and Frei, D. 2017. Microbeam U-Pb zircon dating of the Makwassie formation and underlying units in the Ventersdorp Supergroup of South Africa. *South African Journal of Geology* 120: 525-540.

Dixon, R, and Schouwstra, R. 2017. The role of forensic geology in the illicit precious metals trade. *Episodes* 40: 132-140.

Giebel, RJ, Gauert, CDK, Marks, MAW, Costin, G, and Markl, G. 2017. Multi-stage formation of REE minerals in Palabora Carbonatite Complex, South Africa. *American Mineralogist* 102: 1218-1233.

Huber, MS and Koeberl, C. 2017. Accretionary lapilli from the Sudbury impact event. *Meteoritics and Planetary Science* 52: 1257-1276.

Kovaleva, E, Austrheim, HO, and Klötzli, US. 2017. Interpretation of zircon coronae textures from metapelitic granulites of the Ivrea-Verbano Zone, northern Italy: two stage decomposition of Fe-Ti oxides. *Solid Earth* 8: 789-804.

Kovaleva, E, Harlov, D, and Klötzli, U. 2017. Complicated secondary textures in zircon record evolution of the host granitic rocks: Studies from Western Tauern Window and Otztal-Stubai Crystalline Complex (Eastern Alps, Western Austria). *Lithos* 284-285: 381-400.

Kovaleva, E and Klötzli, U. 2017. NanoSIMS study of seismically deformed zircon: Evidence of Y, Yb, Ce, and P redistribution and resetting of radiogenic Pb. *American Mineralogist* 102: 1311-1327.

Kovaleva, E, Klötzli, U, Habler, G, Huet, B, Guan, Y, and Rhede, D. 2017. The effect of crystal-plastic deformation on isotope and trace element distribution in zircon: Combined BSE, CL, EBSD, FEG-EMPS and NanoSIMS study. *Chemical Geology* 450: 183-198.

Rodler, AS, Frei, R, Gaucher, C, Korte, C, Rosing, SA, and Germs, GJB. 2017. Multiproxy isotope constraints on ocean compositional changes across the late Neoproterozoic Ghaub glaciation, Otavi Group, Namibia. *Precambrian Research* 298: 306-324.

Scheepers, R, O'Brien, R, and Schoch, AE. 2017. An occurrence of bavenite in the Cape Granite Suite, southwestern Cape Province, South Africa, and its implications on the formation of the host pegmatite. *South African Journal of Geology* 120: 223-230.

Schoch, AE and Scheepers, R. 2017. The Saldanha Bay Volcanic Complex: Clarifying the Cambrian geology of the Postberg-Saldanha area, West Coast, South Africa: Comment. *South African Journal of Geology* 120: 271-272.

Conference Contributions

Beukes, JJ, Roelofse, F, Gauert, CDK, Grobler, DF, and Brits, JAN. 2017. *The petrogenesis of the Turfspruit Cyclic Unit and its hangingwall and footwall lithologies at Turfspruit, Northern Limb, Bushveld Complex, South Africa.* Igneous and Metamorphic Studies Group Meeting, University of Johannesburg, Johannesburg, South Africa.

Huber, MS and Kovaleva, E. 2017. *Inhomogeneous distribution of clasts in the Daskop granophyre dyke, Vredefort impact structures, South Africa.* 48th Lunar and Planetary Science Conference, Houston, Texas.

Huber, MS, Roelofse, F, and Wium, D. 2017. *Where do we look? Eye tracking in petrology.* Igneous and Metamorphic Studies Group Meeting, University of Johannesburg, Johannesburg, South Africa.

Jacobson, L and Van der Westhuizen, WA. 2017. *Chemical characterisation of pottery from the Eiland Salt Works site: a preliminary study using XRD.* Association of Southern African Professional Archaeologists Conference, University of Pretoria, Pretoria, South Africa.

Jacobson, L and Van der Westhuizen, WA. 2017. *How representative of the total compositional profile of a ceramic is a single sherd? An empirical study using XRF.* Association of Southern African Professional Archaeologists Conference, University of Pretoria, Pretoria, South Africa.

Kovaleva, E and Huber, MS. 2017. *How lithology affects the development of pseudotachylitic breccia during large impact events.* Igneous and Metamorphic Studies Group Meeting, University of Johannesburg, Johannesburg, South Africa.

Kovaleva, E and Huber, MS. 2017. *Pseudotachylitic breccia in mafic and felsic rocks.* European Geosciences Union General Assembly, Vienna, Austria.

Kovaleva, E, Huber, MS, Somers, A, and Bateman, S. 2017. *The Daskop granophyre dyke: Inhomogeneous clast distribution and chemistry.* European Geosciences Union General Assembly, Vienna, Austria.

Kovaleva, E, Kusiak, MA, Wirth, R, Habler, G, and Klötzli, U. 2017. *Seismically deformed zircon: crystalline Pb nano-spheres and other enigmas.*

Conference on Accessory Minerals 2017, University of Vienna, Austria.

Rodler, AS, Frei, R, Korte, C, Gaucher, C, and Germs, GJB. 2017. *Early Cryogenian Cr isotope stratigraphy, Otavi Group, Namibia* (poster). Goldschmidt Conference, Paris, France.

STAFF

Professor: Prof WA van der Westhuizen.

Associate Professors: Profs WP Colliston, and M Tredoux.

Senior Lecturers: Drs M Huber, H Minnaar, and F Roelofse.

Lecturers: Dr RN Hansen, J Magson, and AI Odendaal.

Junior Lecturers: R Makhadi, T Mapholi, and R Rentel.

Affiliated Academic/Research Staff: Profs C Gauert, GJB Germs, DE Miller, R Scheepers, L Jacobson, RP Schouwstra, AE Schoch, Drs L Nel, H Praekelt, J Claassen, A Bisnath, H Prinsloo, JC Loock, PG Meintjes, M van der Merwe, Messrs AC Dunne, PJ Grobler, I Hunt, PG Laurens, PJ Viljoen, MJAR Vrijens, HCF Pretorius.

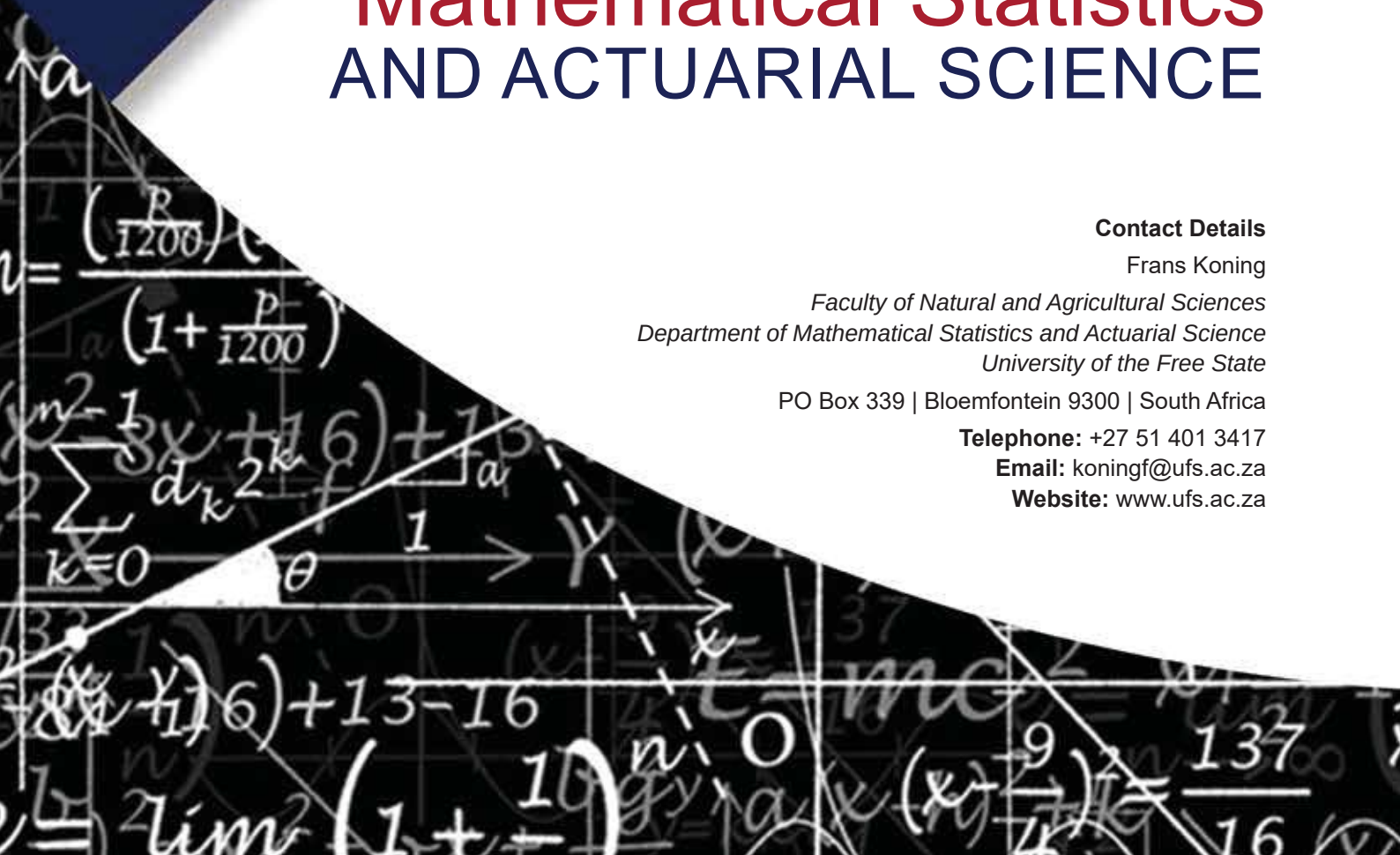
Postdoctoral Research Fellow: Dr E Kovaleva.

Secretary: PS Swart.

Administrative Officer: R Immelman and C van der Vyver.

Technical Support Staff: J Choane, A Felix, D Radikgomo, and Megan Purchase.

DEPARTMENT OF
Mathematical Statistics
AND ACTUARIAL SCIENCE



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2017 Overview

The year 2017 was a year filled with publications, conferences, and awards. Our department is proud to present the following report.

ACHIEVEMENTS

Student Achievements

Gaonyalelwe Maribe received the award for the best oral student presentation at the SASA conference in 2017.

Gaonyalelwe Maribe receiving the award for best speaker in the Young Statisticians Competition

Dr Nil Kamal Hazra (supervisor, prof Finkelstein) was awarded a prestigious Claude Leon Foundation Postdoctoral Fellowship for two years.

The Dean's Medal was won by one of our Actuarial Science students, Henrico Scheltema, as best BSc graduate in the Faculty of Natural and Agricultural Sciences.

Activities

The Department of Mathematical Statistics and Actuarial Science organised and hosted the 2017 conference of the South African Statistical Association. The conference featured roughly 300 delegates, including 140 speakers. International visitors delivered workshops covering hot topics such as Big Data and insurance, among others. Young researchers received training and mentorship from international experts. The conference was hosted at Ilanga Estate, who provided excellent catering. All conference functions were very popular with visitors.

The three days of presentations covered every area of statistics, from key theory, to fascinating applications, to statistics education. Industry experts also gave presentations.

The Young Statisticians Competition was won by our own Gao Maribe, who developed improved extreme value estimation for censored insurance applications.

We received praise for innovative changes to the conference that resulted in a pleasant experience.

Delegates listening to the words of the newly appointed Statistician-General and Head of Statistics South Africa, Risenga Maluleke

Prof Daan de Waal is presented with the SAS Thought Leader award for 2017

RESEARCH

- Robust Bayesian non-linear regression
- Assessment of subgroup effects in clinical trials
- Extreme value theory
- Paired comparisons
- Multiple imputations
- Longevity and mortality studies

National and International Collaboration

Ongoing collaboration with Prof Cha from Ewha Womans University (Korea) that resulted in five publications.

Ongoing collaboration with Dr Mahmoud Shafiee (Cranfield University, UK) on maintenance modelling which resulted in one publication.

New collaboration with Prof/Dr Levitin from the Israel Electric Corporation on structural reliability of complex systems resulted in eight publications.

Annual visits to the ITMO University and Elektropribor Institute (St. Petersburg, Russia) as a member of International Laboratory responsible for reliability and maintainability of large systems project.

Annual visit to the Max Planck Institute for Demographic Research (Germany) for research on applications of stochastic modelling to demography and population biology.

Collaboration between Dr A Verster and Prof J Beirlant from Leuven resulted in a published paper in 2017, with an additional paper accepted in 2017 (to be published in 2018).

Prof R Schall acted as a biostatistical consultant to the international contract research organisation IQVIA, the German pharmaceutical company, Medac (research collaboration with Prof Arne Ring), and the South African contract research organisation, ClinData.

Postgraduate Students

Peter Iiyambo obtained his PhD degree in Statistics with a thesis titled 'Fiducial Inference based on Order Statistics in Location-Scale and Log-Location-Scale Families'.

RESEARCH OUTPUTS

Research Articles

Beirlant, J, Schoutens, W, De Spiegeleer, J, Reynkens, T, and Herrmann, K. 2017. Hunting for Black Swans in the European Banking Sector Using Extreme Value Analysis. *Springer,* 189.

Beirlant, J, Kijko, A, Reynkens, T, and Einmahl, JHJ. 2017. Estimating the maximum possible earthquake magnitude using extreme value methodology: the Groningen case. *Springer,* Nat Hazards. https://doi.org/10.1007/s11069-017-3162-2.

Beirlant, J, Maribe, G, and Verster, A. 2017. Penalized bias reduction in extreme value estimation for censored Pareto-type data, and long-tailed insurance applications. *Insurance: Mathematics and Economics,* 78: 114-122.

Beirlant, J, Reynkens, T, Verbelen, R, and Antonio, K. 2017. Modelling censored losses using splicing: A global fit strategy with mixed Erlang and extreme value distributions. *Insurance: Mathematics and Economics,* 77: 65-77.

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STAFF

Distinguished Professor: Prof MS Finkelstein.

Professors: Profs JM van Zyl and R Schall.

Associate Professors: Profs Dhaene, A Ring, and J Beirlant.

Senior Lecturers: Dr SD Chikobvu, Dr L van der Merwe, Dr A Verster, Dr A Neethling (Units), FF Koning, and JM Blomerus.

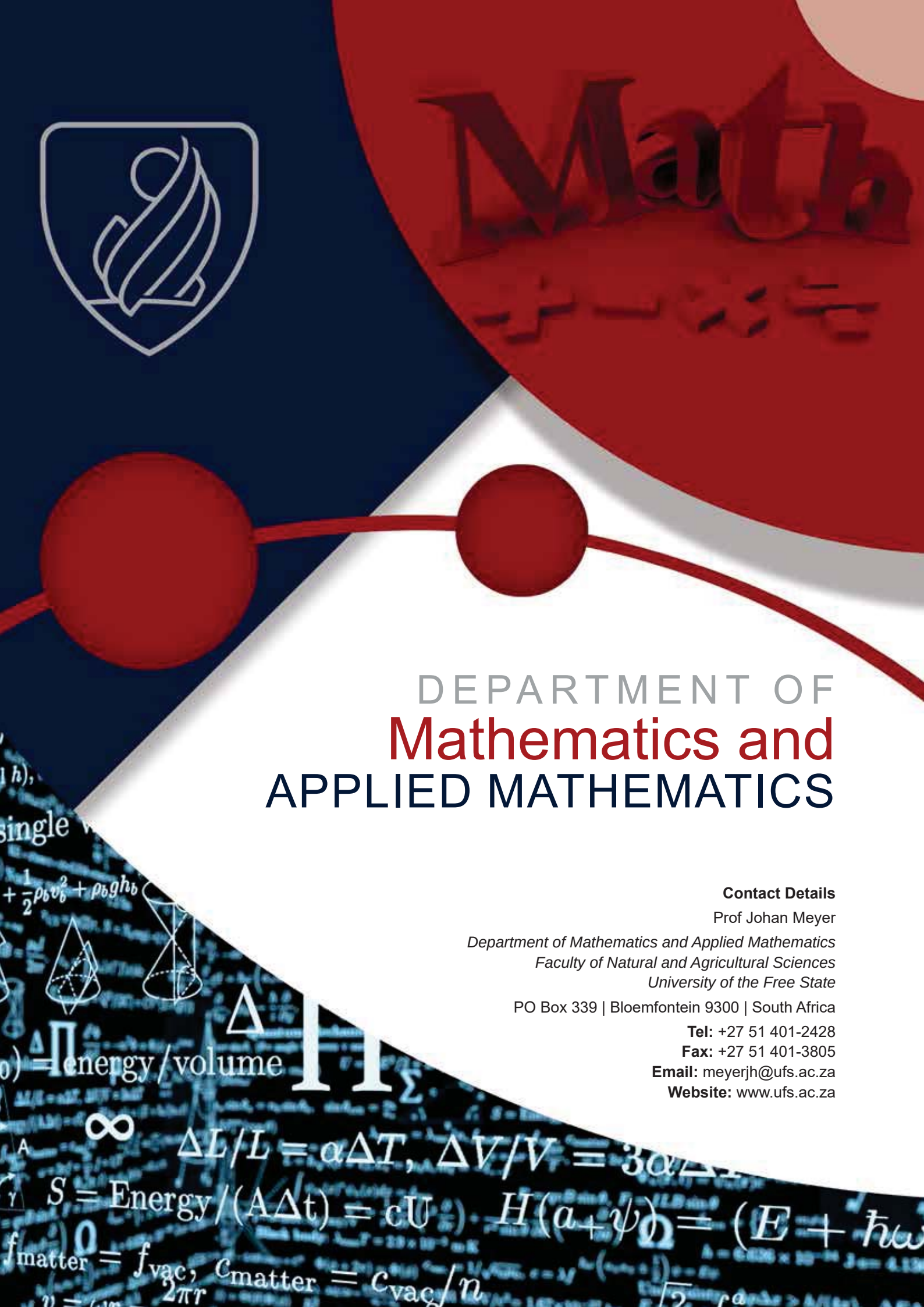
Lecturers: Dr M Sjolander, Dr MJ von Maltitz, ME Girmay, Z Ludick, W Oosthuizen, L da Silva (Units), and AM Naude, J Venter, and S van der Merwe.

Junior Lecturers: A Ngeuleu Kotchap (Units) and AS Ruswa (Units).

Researchers: Prof PCN Groenewald, Prof AJ van der Merwe, Prof DJ de Waal, and Dr VG Micali.

Secretary: ME Mathee.

Messenger: W Baranye.



DEPARTMENT OF

Mathematics and APPLIED MATHEMATICS

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2017 Overview

We offer a variety of modules – some with emphasis on the more abstract side of mathematics, and others more on the applicable side of mathematics. Students who finish their studies in our department typically obtain the degrees BSc, BCom, and sometimes even BA. We also offer service modules to many students who study in other scientific directions, such as biology, agriculture, engineering, and the building sciences.

Research activities have picked up considerably over the past few years, especially in the areas of graph theory, algebra, numerical analysis, and modelling.

The department is also concerned with what is happening at school level. Some of the staff members are closely involved (nationally and internationally) with the training of learners who are interested in Mathematics Olympiads.

ACHIEVEMENTS

Prof JH Meyer continued his research by collaborating with a colleague in Tainan, Taiwan. A paper on bijective matrix maps has been submitted for publication. He also paid a visit to a colleague in Texas, USA, where they started to investigate a new problem regarding congruence preserving self-maps of p-groups, a project that should be finalised in 2018. He presented a talk on the embedding of Grassmann algebras into matrix algebras at the 9th Pan African Congress of Mathematicians in Rabat, Morocco, 3-7 July 2017. A PhD student of Prof Meyer, B-E de Klerk, completed his thesis on the structure of automorphisms of certain abelian groups, and received his degree in June 2017.

Prof Meyer continued his involvement (as in the past 20 odd years) with the training and setting of papers with respect to Mathematics Olympiads, in particular the South African Mathematics Olympiad. He also reviewed several papers for *Zentralblatt Math* (published by Springer), as well as for *Math Reviews*.

Prof T Vetrik visited the following collaborators:

- Prof Edy Tri Baskoro, Bandung Institute of Technology, Bandung, Indonesia.
- Prof Monther Alfuraidan, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia.
- Dr Marcel Abas, Slovak University of Technology, Trnava, Slovakia.
- Dr Samuel Fufa, Addis Ababa University, Addis Ababa, Ethiopia.

He was invited to present lectures at research seminars with the following universities:

- Addis Ababa University, Addis Ababa, Ethiopia (October 2017)
- Bandung Institute of Technology, Bandung, Indonesia (August 2017)
- King Fahd University of Petroleum and Minerals, Dhahran, Saudi-Arabia (April 2017)

Prof Vetrik was also the supervisor of postdoctoral researcher, Selvaraj Balachandran. In addition, Prof Vetrik reviewed papers for the following journals in 2017: *AKCE International Journal of Graphs and Combinatorics*; *Australasian Journal of Combinatorics*; *Discussiones Mathematicae Graph Theory*; *Journal of Graph Theory*; *Journal of Interconnection Networks*; *Opuscula Mathematica*; and *Quaestiones Mathematicae*.

Dr E Ngounda served on the L'oreal panel of the NRF evaluation panel meetings.

Dr S Dorfling was invited to present a talk on generalised edge-colourings of graphs with forbidden subgraphs and additive hereditary graph properties at the Vrije Universiteit Brussel, Belgium, in July 2017. A PhD student of Dr Dorfling, ECM Maritz, completed her degree and graduated in June 2017.

RESEARCH

Community Service

Prof JH Meyer, C Venter, JB Smit, and Dr B-E de Klerk continued to be involved with Olympiad training of school learners from all over the country. Dr S Dorfling was the main organiser of the annual open day (in September 2017) at the UFS for the prize-winners of the Mathematics- and Science-in-Action programme organised by the SA Academy for Science and Arts.

National and International Collaboration

Members of the department engaged in international collaboration with researchers from Slovakia, Saudi-Arabia, Ethiopia, Indonesia, Taiwan, and the USA;

Dr S Dorfling with the prize-winners of the Mathematics- and Science-in-Action programme organised by the SA Academy for Science and Arts. (September 2017)

and national collaboration with researchers from Johannesburg and Stellenbosch.

Postgraduate Students

The following students were enrolled for PhD degrees in our department: JB Smit, ECM Maritz, D Mengesha, IC Oguoma, B-E de Klerk, M Fasondini, BR Gnitchonga, and L Bolton.

STAFF MATTERS

Marco Fasondini, who completed his PhD degree in Applied Mathematics, left the department at the end of November 2017 in order to start a two-year period as post-doctoral fellow at the University of Kent in England.

RESEARCH OUTPUTS

Research Articles

Abas, M and Vetrik, T. 2017. Large Cayley digraphs and bipartite Cayley digraphs of odd diameter. *Discrete Mathematics* 340: 1162-1171.

Mafuta, P, Mukwembi, S, Munyira, S, and Vetrik, T. 2017. Hamiltonicity, minimum degree and leaf number. *Acta Mathematica Hungarica* 152: 217-226.

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Booth, GL, Meyer, JH, and Mogae, K. 2017. Topological rings, homogeneous functions, and primeness. *Communications in Algebra* 45: 322-331.

Maxson, CJ and Meyer, JH. 2017. Unique maximal rings of functions, *Communications in Algebra* 45: 384–391.

Ali, P, Mazorodze, JP, Mukwembi, S, and Vetrik, T. 2017. On size, order, diameter and edge-connectivity of graphs. *Acta Mathematica Hungarica* 152: 11-24.

Conference Contributions

Vetrik, T. 2017. *The metric dimension and the partition dimension of circulant graphs.* 8th International Conference on Research and Education in Mathematics, Bandung, Indonesia, 11-13 August.

Meyer, JH. 2017. *Embedding Grassmann algebras into matrix algebras*, 9th Pan African Congress of Mathematicians, Rabat, Morocco, 3-7 July.

Ngounda, E. 2017. *The value of cost data for estimation: Evaluation of a construction tender price index*. 60th Annual Congress of the SAMS: North-West University, 20-22 November.

STAFF

Professor: Prof JH Meyer (chair).

Associate Professors: Prof TM Acho and Prof T Vetrik.

Senior Lecturers: Dr S Dorfling and J van Niekerk.

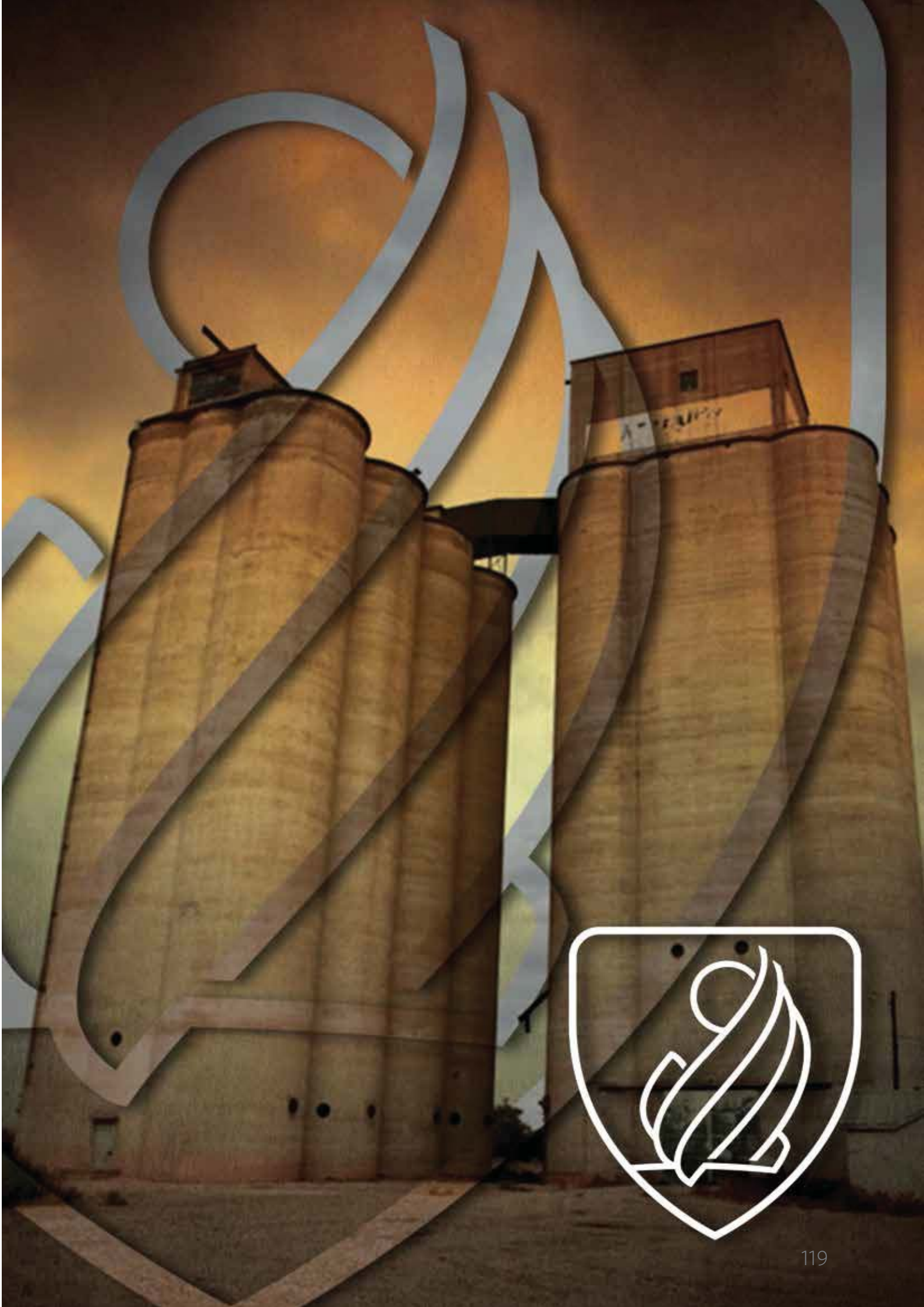
Lecturers: Dr E Ngounda, Dr A Kriel, Dr B-E de Klerk, A Kleynhans, C Venter, M Fasondini, P Mbambo (Qwaqwa), Dr N Loufouma Makala (Qwaqwa), and Dr S Nkonkobe (Qwaqwa).

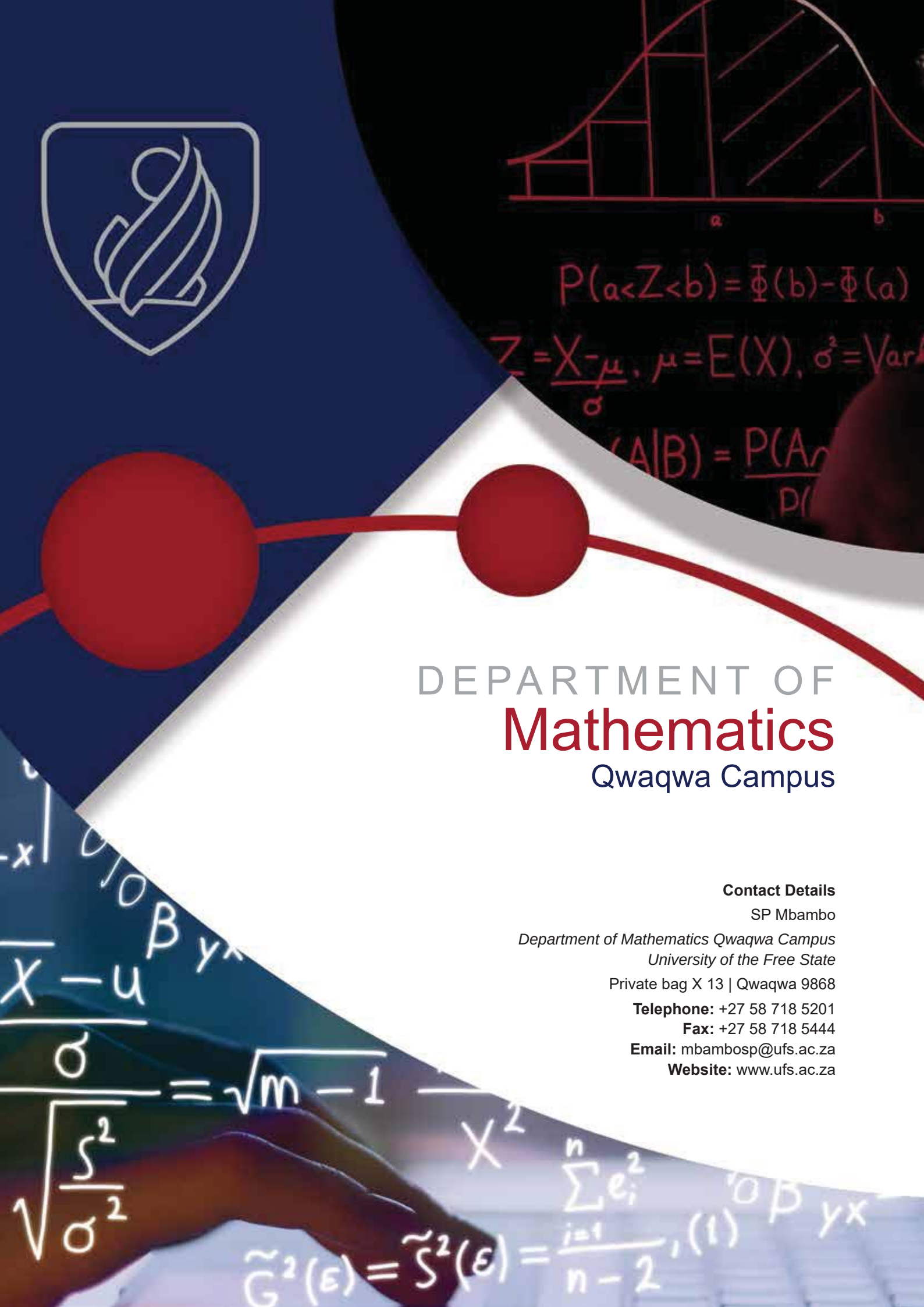
Junior Lecturers: AE Swart, MJF Botha, and C Faber (Qwaqwa).

Temporary Lecturers: ECM Maritz, H Oosthuizen, JB Smit, and RS Jansen.

Administrative officer: SM Venter.

Postdoc Fellow: Dr S Balachandran.





DEPARTMENT OF
Mathematics
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2017 Overview

The department had a quiet, but fairly good year. We welcomed Dr Nkonkobe as new lecturer on 1 January 2017.

RESEARCH

Community Service

We took part in the Science Open Day, as well as the Science week.

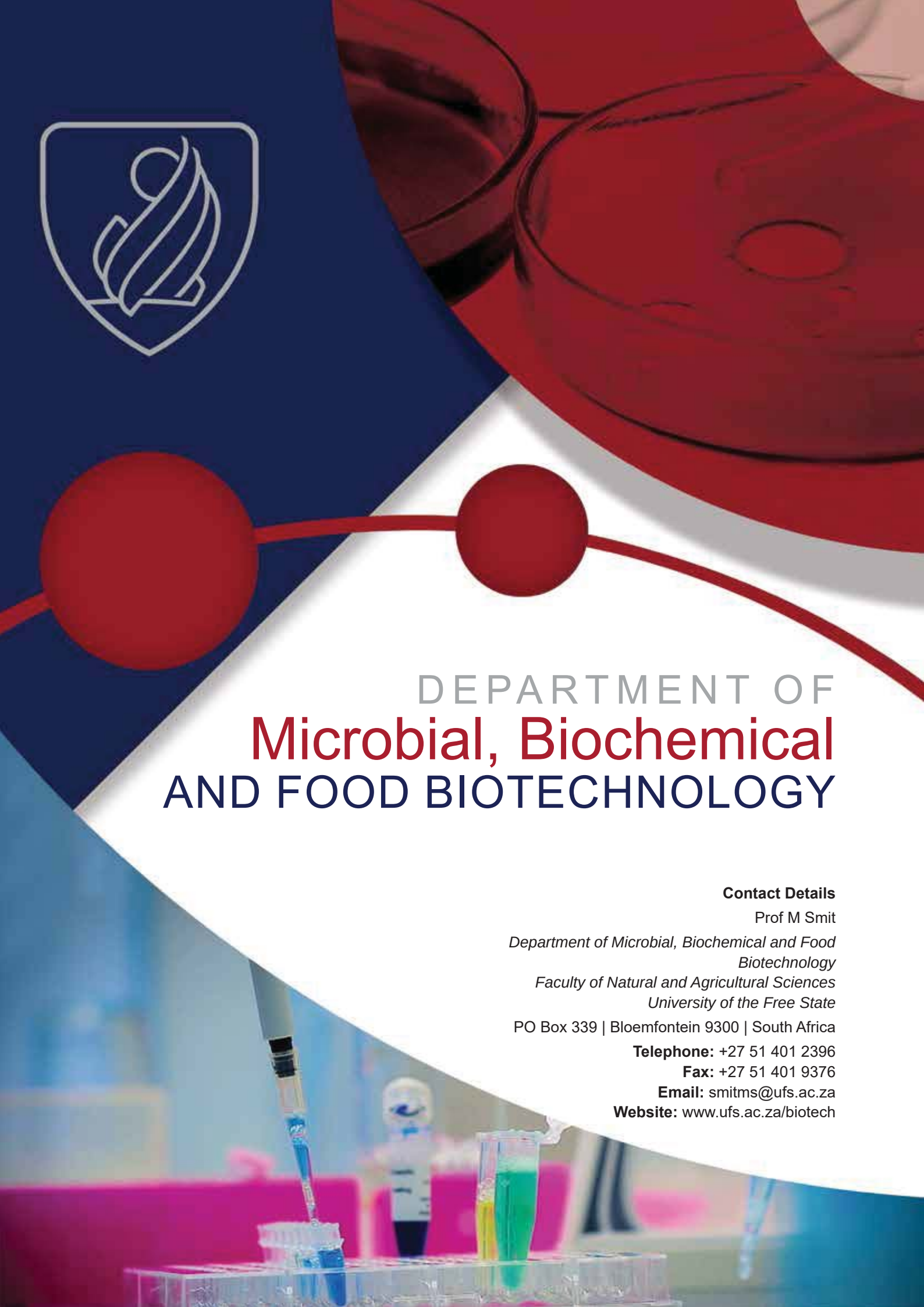
STAFF MATTERS

Dr Nkonkobe was appointed as a new lecturer in January 2017.

STAFF

Lecturers: SP Mbambo, Dr Loufouma Makala, Dr Nkonkobe.

Junior Lecturer: HC Faber.



DEPARTMENT OF

Microbial, Biochemical AND FOOD BIOTECHNOLOGY

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2017 Overview

The Department of Microbial, Biochemical and Food Biotechnology performed well in all deliverables set out for the year, including teaching, research, and creating commercial opportunities to contribute to the third-stream income of the UFS. We are responsible for undergraduate teaching and postgraduate training in three subjects, namely Biochemistry, Microbiology, and Food Science. In 2017, a total of 22 students completed Honours degrees in the three subject areas, while six students received MSc degrees, and six PhD degrees. Research conducted in the department finds application in three main areas, namely (i) production of safe and novel food products, (ii) biocatalytic production of chemicals or bioremediation of chemical pollution, and (iii) improvement of human and animal health. During 2017, our staff and students contributed to 46 articles in mainly international journals, and 17 oral and 42 poster presentations at 16 international and two national conferences. Two of our staff members, Dr Dirk Opperman and Dr Trudi O'Neill, were team members of successful grant applications for funding from the UK and Germany respectively.

ACHIEVEMENTS

Staff Achievements

Dr Maryna de Witt was elected as Agroprocessing representative of the International Cactus Pear Committee and Network at the IXth International Cactus Pear and Cochineal Congress held in Chile in March 2017.

Dr Trudi O'Neill has been the interim chair of the African Research Network for Neglected Tropical Diseases (ARNTD) since November 2016, representing ARNTD in this capacity at the 2nd Global Partners Meeting on Neglected Tropical Diseases (NTDs) and NTD Summit held in Geneva, Switzerland from 19 to 22 April 2017. Discussions held at the Partners Meeting led to awards for ARNTD by the Department for International Development in the United Kingdom (DFID) and the United States Agency for International Development (USAID). She subsequently participated in the Management Board and Planning meeting of ARNTD held in Nairobi, Kenya, from 28 to 30 August 2017.

Dr Koos Myburgh represented South Africa in two standing committees (the Standing Committee on Residues and Chemical Contaminants and the Standing Committee on Dairy Science and Technology) at the 2017 IDF World Dairy Summit which took place in Belfast, Ireland, in October 2017.

In August 2017, the Deutsche Forschungsgemeinschaft (DFG) awarded a three-year grant to a consortium of researchers based in Germany, South Africa, and Mozambique. Dr Trudi O'Neill, as co-principle investigator, is one of the recipients of the grant, titled 'Antigens and Reassortant Strains for Rotaviruses Circulating in Africa (AfRota)'. The other members include Prof Reimar Johne, based at the Federal Institute for Risk Assessment (BfR) (Berlin, Germany), Prof Albie van Dijk (North-West University, Potchefstroom, South Africa), and Dr Nilsa de Deus, based at the National Institute of Health (Maputo, Mozambique). The total amount awarded is € 840 000 and can be renewed, depending on satisfactory progress. The objective of the grant is to employ the recently developed reverse genetics system for rotavirus to develop rationally designed rotavirus vaccine candidates, tailored for application in Africa.

Dr Dirk Opperman is part of the South African research team who, together with researchers from the rest of Africa and the Diamond Light Source UK, were awarded £3,7 million by the Science and Technology Facilities Council (STFC) of the UK at the end of 2017 to develop synchrotron research in Africa – the only continent that has no synchrotron. The project is called START, which stands for 'Synchrotron Techniques for African Research and Technology'. The STFC awarded the funding from the Global Challenges Research Fund (GCRF). START funding will allow African and UK investigators to work together to develop and characterise new materials of relevance for solar energy conversion and catalysis, as well as to characterise proteins of relevance to better understand diseases and develop drugs. Both are considered grand global challenges. With funding until 2021, START will expand African research capabilities and international research collaborations, with possible commercial applications.

Three covers in three years for Dr Dirk Opperman of the Biocatalysis Group

Dr Frans O'Neill and his industry partner, AniPharm Pty Ltd, were successful with a DTI THRIP application on the recombinant production of reproductive animal hormones. The total value of the grant will be more than R2 million.

Kovsie Brewing, an initiative by our 2012 postgraduate students, is currently run by Dr Errol Cason, Dr Jan-G Vermeulen, Christopher Rothman, and Eduan Hellmuth. They managed to secure the SAB World of Learning Educational Brewery for the UFS. After the takeover of SABMiller, AB InBev decided to donate the 500-litre educational brewery that used to be located at the SAB Cyril Ramaphosa World of Learning, to a tertiary education institution. They invited the 16 institutions who participate in the annual SAB Intervarsity brewing competition to submit proposals and motivate why the brewery should be donated to their respective campuses. Kovsie Brewing, with help from Gerard Verhoef and Dr Karen Booysen from DRD, submitted the winning proposal.

The brewers of Kovsie Brewing with the 500-litre SAB World of Learning Educational Brewery, worth an estimated R7 million, which they secured for the UFS. Seen here are from the left: Dr Errol Cason (postdoc), Eduan Hellmuth (MSc student), Dr Jan-G Vermeulen (postdoc), and Christopher Rothman (PhD student)

Student Achievements

Dr Alba du Toit (postdoc) was awarded the prize for best presentation at the IXth International Cactus Pear and Cochineal Congress held in Chile in March 2017.

Cheri Jacobs (PhD student) won one of the three poster prizes awarded at the 20th International Conference on Cytochrome P450: Biochemistry, Biophysics and Biotechnology. Her poster was titled: 'Specificity and selectivity of different CYP153 alkane hydroxylases'.

Saheed Sabiu (PhD student) received the prize as first runner-up in the Science category of the annual National three-minute thesis competition, after being the overall winner from 11 UFS students who took part in the regional competition. The theme of his three-minute thesis was, 'From Waste to Health: Corn silk in the management of kidney disorders'.

Rita Myburg (MSc student) received a merit certificate for the best Dairy Student over a specific academic career from the SA Society of Dairy Technology at their 50th Annual Symposium held in Pretoria in May 2017.

Activities

We hosted our annual Third-year Information Day on 18 May 2017 to promote postgraduate studies. Invited third-year students were informed about postgraduate study options and the main areas of research in the department.

On 14 June 2017, we held our annual Research Day during which the postdoctoral fellows presented their results, and researchers working in the area of safe and novel food products gave overviews of their research. The 2017 Research Day was sponsored by Separations.

The Kovsie Brewing team and the Mushroom Growers,

led by Prof Bennie Viljoen, took part in the Vrystaat Arts Festival in July, as well as the Botanical Garden Food and Art Market in October.

Prof Koos Albertyn and Dr Frans O'Neill accompanied 40 final-year Microbiology students and 10 Microbiology honours students on the annual tour to AB InBev (formerly known as SABMiller) on 2 and 3 October 2017. The visit included a lecture presented by Prof Bettie Lodolo, the Central Laboratory Manager for the Africa Zone of AB InBev and affiliated professor in the department. This was followed by an extensive tour of the Chamdor Brewery in Krugersdorp, as well as a visit to the World of Beer in Johannesburg.

Final-year and honours student annual tour to AB InBev

Prof Carlien Pohl-Albertyn, lecturer for the second-year Microbiology course, and Dr Janine Allen-Spies from the Department of Fine Arts, organised an art exhibition for which second-year Microbiology students contributed artworks that demonstrated any concept dealt with in the module Microbial Evolution and Diversity, while art students contributed works which captured their understanding of biology and science. The exhibition was held in the Department of Microbial, Biochemical and Food Biotechnology from 12 to 24 October 2017.

Collaborative undergraduate teaching and learning between the Departments of Microbial, Biochemical and Food Biotechnology, and Fine Arts culminated in the first BioArt exhibition held in the Department of Microbial, Biochemical and Food Biotechnology. Almost 60 artworks in total were received, from visual art to music, electronic presentations, and written work such as poems and stories. Seen here, are from the left: Prof Heidi Hudson (Dean: Faculty of the Humanities), Dr Janine Allen-Spies (lecturer, Fine Arts), Prof Carlien Pohl-Albertyn (lecturer, Microbiology), Prof Martie Smit (Departmental Head, Biotechnology), Elzmarie Oosthuizen (Teaching and Learning Manager, Natural and Agricultural Sciences), Prof Corli Witthuhn (Vice-Rector: Research). The project was the brainchild of Prof Pohl-Albertyn and Dr Allen-Spies

Laurinda Steyn and Christelle van Rooyen presented a basic computer-skills training course for our service and cleaning staff.

RESEARCH

Safe and Novel Food Products and Processes

Prof Celia Hugo and her research group continued research on psychrotolerant bacteria with emphasis on the genus *Chryseobacterium*. Taxonomic studies on three novel species were initiated, while the significance of *Chryseobacterium* in poultry feather degradation was also investigated in collaboration with Dr Charlotte Boucher.

Prof Arno Hugo and his research group started a new project, funded by the Red Meat Industry, on the reduction of salt levels in traditional South African processed meat products such as boerewors, dried sausage, and biltong. The South African Government is busy implementing new regulations to reduce the sodium levels of food. The purpose of this research is to investigate the effect of sodium reduction on the microbiological quality, chemical stability, and sensory properties of these products.

In the sensory and product development laboratory, Dr Carina Bothma investigated the sensory profiling and nutritional values of novel food plants such as *Agave americana* and lucerne.

The research of Dr Maryna de Wit focuses on the functional uses of cactus pears (*Opuntia ficus-indica* and *Opuntia robusta*) in food applications. These include the natural colourants (betalains) from the fruit, the use of the cladodes as vegetables, as well as the mucilage and seed oils.

Prof Garry Osthoff's research on milk from 25 African non-dairy animals provided proof that milk composition is genetically determined. His research found that alpha caseins are absent in the milk of the African elephant, so that the micelles are only stabilised by beta and kappa caseins, as well as calcium phosphate nanoclusters. Further studies are underway to explain the structure-function aspects of casein micelles.

Dr Koos Myburgh and his students worked on the activation of Plasminogen to Plasmin, which plays a detrimental role during flocculation/gelation in milk. In addition, they developed a strategy using commercial

Prof Garry Osthoff worked with Dr Francois Deacon from the Department of Animal and Grassland Sciences on a project to collar 20 giraffes. As part of the project Prof Osthoff, seen here milking a giraffe, obtained milk samples from eight giraffes

protease to accelerate yogurt manufacturing with more than 20%, without any negative impact on texture and flavour. Dr Myburgh was tasked by IDF SA to represent South Africa at the WDS 2017 dairy congress held in Belfast in Ireland.

Prof Viljoen received funding from the TIA Seed Fund for two projects on the medicinal and animal feed potential of edible mushrooms.

Biocatalysis and Bioremediation

The TIA-funded SAENSE Platform, led by Prof Van Heerden, continued to apply the knowledge gained from their work in the deep subsurface to develop remediation strategies for the treatment of water pollution in various industries. Three pilot plants showcased the technology on-site with industrial partners. Their research also addresses microbial carbon transformations in subsurface environments. In addition, research was also conducted on the feasibility of biogas production by bacteria from various substrates and wastes.

The aim of the Biocatalysis Group of Prof Martie Smit and Dr Dirk Opperman is to develop novel biocatalytic systems for the introduction of oxygen into molecules and the further conversion of these hydroxylated products. The group focuses on the oxyfunctionalisation of various natural and petrochemical hydrocarbons, including monoterpenes, alkanes, and alkenes by cytochrome P450 monooxygenases, and the synthesis of esters and lactones from the corresponding ketones.

The Fermentation Biotechnology Research Group, comprising Prof Stephanus Kilian and Laurinda Steyn, continued optimisation of the conversion of sucrose into potential prebiotic oligosaccharides. The oligosaccharide mixture produced was partially characterised and found to have commercial potential for use in the formulation of prebiotics.

Improvement of human and animal health

Dr Trudi O'Neill's Molecular Virology Group continued to investigate rotavirus strain diversity, the development of alternative rotavirus vaccines, as well as rotavirus and lipid interactions as possible therapeutic targets.

The work of the Clinical Biochemistry Group led by Dr Frans O'Neill, involving human cellular detoxification and sterol metabolism, as well as the heterologous expression of reproductive hormones, continues.

The Pathogenic Yeast Research Group, currently comprising Prof Koos Albertyn, Prof Carlien Pohl, and Dr Olihile Sebolai, focuses on the metabolism and molecular mechanisms of bioactive lipids of pathogenic yeasts, *Cryptococcus neoformans* and *Candida albicans*. They found that 3-hydroxy fatty acids protect *Cryptococcus* against phagocytosis and that certain compounds that may inhibit the production of these fatty acids may be repurposed as anti-*Cryptococcus* drugs. They are also interested in the metabolism of fatty acids to immunomodulatory metabolites in biofilms consisting of *C. albicans* and the bacterium *Pseudomonas aeruginosa* and found that these multispecies biofilms produce more than double the concentration of these immunomodulatory compounds.

The Veterinary Biotechnology Research Group of Prof Rob Bragg and Dr Charlotte Boucher continued their work on the development of sub-unit vaccines against *E. coli* as well as expression of endolysin genes as potential alternatives for antibiotics.

National and International Collaboration

The Veterinary Biotechnology Group has several international collaborations:

- The collaboration with Dr Xiaoling Chen, Beijing Academy of Agriculture and Forestry Sciences (BAAFS), China, is ongoing. The research group of Dr Chen has sequenced the whole genome of *Avibacterium paragallinarum* isolate 221, belonging to serogroup A. The data have been made available for further exploitation and comparison to the sequence data of serovar C2, a genome previously sequenced within their research group.
- In a long-standing collaboration with Dr Patrick Blackall from the University of Queensland, Brisbane, Australia, who is widely regarded as the world expert on infectious coryza in chickens, the long-term storage of the very fastidious bacterium *Avibacterium paragallinarum* – the causative agent of infectious coryza – is being investigated.

- They also have collaborative projects with Dr Asgar of Saife VetMed in India on various potential commercial products, as well as with Dr Gavakar of Ventri Biologicals, the largest poultry-vaccine manufacturer in India, on the development of effective vaccines against infectious coryza and also possible sub-unit vaccine development.
- Prof Rob Bragg was invited to present two Biosecurity workshops for a major poultry producer in Indonesia.
- Dr Charlotte Boucher visited the AgroParis Tech campus of the French National Institute for Agricultural Research (INRA), situated in Grignon, France, to work for one month under the mentorship of leading researcher in Yeast Biotechnology, Dr Catherine Madzak. They worked on evaluating transposomic strategies to study the fitness value of *Yarrowia lipolytica* genes under various conditions.

Prof Arno Hugo collaborated with the Agricultural Research Council, North-West University, the University of Fort Hare, and the University of Swaziland on research regarding the effect of dietary intervention on the lipid component of meat from monogastric and ruminant animals. Prof Hugo also completed a collaboration between the University of the Free State, the University of Kwazulu-Natal, and the Haramaya University in Ethiopia on the oil quality of groundnut seed.

Dr Opperman has two ongoing collaborative projects with groups in Germany: Dr Selin Kara from the Institute of Technical Biocatalysis at the Technical University Hamburg-Harburg (TUHH), and Dr Sabrina Höbenreich at the Philipps University of Marburg. These three groups bring together expertise in the field of Biocatalysis, including protein structure determination, directed evolution, and process development, and are currently focusing on flavin-dependent enzymes for practical biocatalysis. Jennifer Engel, Dr Selin Kara's PhD student, visited the UFS during July 2017 to work with Dr Opperman on creating mutant biocatalysts for improved operational stability and activity. Her visit was sponsored by the German Academic Exchange Service (DAAD). Dr Felix Ferroni, a previous postdoctoral fellow of the Biocatalysis group, now a researcher at the National Scientific and Technical Research Council (CONICET) in Argentina, returned for an eight-week research visit during March-April 2017 to determine the X-ray crystal structures of new copper containing nitrite reductases, ultimately for nitrite-biosensor development.

Dr Trudi O'Neill has active collaborations with several national and international groups.

- During 2017, she continued the collaboration with Dr Nilsa de Deus at the National Institute of Health, Maputo, Mozambique, on rotavirus diversity in Mozambique. As part of this collaboration, PhD student Eva Dora da Cruz João, co-supervised by Dr O'Neill, visited the group in May as well as August to October 2017. She is employed as a scientist at the National Institute of Health, Maputo, in Mozambique, and enrolled for her PhD at the New University of Lisbon, Portugal. Dr O'Neill also collaborates with Dr Martin Nyaga from the UFS Next Generation Sequencing laboratory on this topic.
- The collaboration with Prof Christiaan Potgieter, Deltamune, Pretoria, also continued. This collaboration, supported by funding from the Poliomyelitis Research Foundation of South Africa, aims to develop a Newcastle disease virus (NDV) replicon-based rotavirus vaccine for a veterinary application. To this end, Dr O'Neill hosted an MSc student from the Technical University of Munich, Germany, Jasmin Aschenbrenner, who successfully completed her MSc mini thesis in May 2017.
- Efforts to establish a reverse genetics system for rotavirus was continued with Prof Albie van Dijk (North-West University (NWU)) and Prof Potgieter. This collaboration was extended to include Prof Reimar Johne from the Federal Institute for Risk Assessment in Berlin, Germany.
- As part of the Argentina / South Africa Research Cooperation Programme, Dr O'Neill visited Dr Martin Blasco and his team from the Centre for Biotechnology in the Department of Industrial Biotechnology at the Argentinean National Institute of Industrial Technology in Buenos Aires from 2 to 6 October 2017. During her visit to Buenos Aires, Dr O'Neill also met with researchers from the National Institute of Agricultural Technology. Dr Blasco paid a return visit to South Africa from 13 to 22 November, meeting with various staff members in the department to discuss future possibilities for collaboration.

The SAENSE Platform continued with several national and international collaborations:

- The SAENSE Platform (represented by Prof Esta van Heerden, Dr Julio Castillo, and Alba Gomez), together with the DST, hosted the other members of the Network on the Industrial Handling of Raw Materials for European Industries (ERA-MIN) project, who are: Prof Carlos Ayora (CSIC-Barcelona), Prof Jose Miguel Nieto (University of

Huelva), Prof Manuel Olias (University of Huelva), Petra Shneider (Magdeburg-Stendal University of Applied Sciences) and Dr Stephane Pellet-Rostaing (Institute for the Separation Chemistry in Marcoule). The meeting was held in Phalaborwa from 1 to 5 May 2017. The purpose of this meeting was to visit the Phalaborwa complex and interact with the Palabora Mining Company and Foskor. In addition, the meeting allowed members to prepare the first draft for the second ERA-MIN call and showcase their achievements in a conference where results were presented to the DST and the scientific community, coming from different South African universities.

- In May 2017, Prof Esta van Heerden and Dr Mariana Erasmus travelled to the USA to strengthen existing and establish new collaborations to enhance their bioremediation portfolio and projects. Interaction took place with Prof Mary DeFlaun and her Geosyntec Consultants Team from the USA on metal-reducing reactors, as well as Dr Mark Reinsel from Apex Engineering in Montana, where new technologies and new research questions were discussed.
- The SAENSE Platform hosted Prof Jose Carlo Berenguer from the Centre for Molecular Biology 'Severo Ochoa; (CBMSO) in Madrid from 21 to 25 August 2017. His visit was arranged by the SAENSE Platform in conjunction with an exchange programme between South African and Spanish institutions.
- Prof TC Onstott from Princeton University visited us at the end of September 2017 with regard to an ongoing collaborative project between the SAENSE Platform of the UFS, the North-West University, the German Research Centre for Geoscience (Germany), and Princeton University, that is funded by the International Continental Scientific Drilling Programme, the National Science Foundation, and the National Research Foundation. The multidisciplinary research project is titled KASMS: 'Kinetically Activated Subsurface Microbial Sampler'. The German scientific experiment within this project is called: ProHydroGen. The purpose of the project is to investigate the processes of hydrogen genesis during seismic cycles in active fault zones. The overall idea of this interdisciplinary study is to better understand the correlation between seismicity and gas release and to geochemically characterise the extreme environment of life in the deep subsurface.

Dr Frans O'Neill collaborated with Prof Albie van Dijk (NWU) on the role of GLYAT in cellular detoxification; with Prof David Marais (University of Cape Town (UCT)) on phytosterols in selected South African fauna; and with Dr Dee Blackhurst (UCT) on reactive oxygen species in rotavirus-infected cells. He is also collaborating with AniPharm Pty Ltd on the production of equine chorionic gonadotropin.

Dr Gabré Kemp collaborated with Dr Tim Downing from the Department of Biochemistry and Microbiology, Nelson Mandela Metropolitan University (NMMU), on the toxicity and metabolism of environmental bacterial compounds. The collaboration focuses on mass spectrometric analysis of protein amino-acid compositions, amino acid extracts, and amino acid isotopologue distribution in cell extracts.

Prof Garry Osthoff also collaborated on mass spectrometry analyses of milk proteins with Dr Stoychev (Council for Scientific and Industrial Research (CSIR), Pretoria).

Postgraduate Students

Ruan Fourie (PhD student) and Dr Errol Cason (postdoc) attended the Bioinformatics Conference: 'From Algorithms to Applications', in St. Petersburg, Russia.

Prof Robert Bragg and Dr Charlotte Boucher, with students Marisa Coetzee, Liani Meyburgh, Elebert Mwanza, and Liese Kilian, attended the International Union of Microbiological Societies (IUMS) Conference, held 17-21 July 2017 in Singapore, Malaysia. The group showcased eight posters and Dr Charlotte Boucher delivered an oral presentation based on the research of her PhD student, Ji-Yun Lee.

Carmien Tolmie (PhD student) was sponsored by the Organisation for the Prohibition of Chemical Weapons (OPCW) to attend the School for Integrative Structural Biology that was held from 2 to 11 June 2017 in Erice, Sicily. This school commemorated the 50th anniversary of crystallography meetings started by the Nobel laureate, Dorothy Hodgkin, a pioneer in protein crystallography.

Dr Amy Strydom (postdoc) and Olufemi Folorunso (PhD student) attended the 11th African Rotavirus Symposium that was held from 28 to 30 May 2017 in Lilongwe, Malawi. They received fully sponsored travel grants from the Bill and Melinda Gates Foundation to attend the symposium. Both presented posters at the meeting.

STAFF MATTERS

Millie Cohen, who was departmental secretary for 27 years, retired at the end of January 2017 and was replaced by Mpho Tshotetsi.

Dr Arina Hitzeroth was appointed as Officer: Professional Services in the Food Science section in June 2017.

Dr Julio Castillo Hernandez and Dr Angel Valverde-Portal were appointed as senior researchers in the SAENSE Platform in July 2017.

Alda Fourie, who was Strategic and Operational Manager for the SAENSE Platform and the department since the beginning of 2016, resigned in November 2017 for a new position with the OFM division of the Central Media Group. Dr Mariana Erasmus was appointed as new manager of the SAENSE Platform.

Mariaan Kearney, financial officer of the SAENSE Platform, also resigned in November 2017 for a new position in the Department of Finance at the UFS.

It was a great loss to us when Prof Esta van Heerden resigned in December 2017. She has grown with the department from student to lecturer and was Professor in Biochemistry since 2010. She has also been the driving force behind the SAENSE Platform.

Prof Stephanus Killian, who has also grown with the department from student to lecturer over 40 years and has been Professor in Microbiology since 2003, retired at the end of 2017.

Dr Dirk Opperman and Dr Trudi O'Neill were promoted to Associate Professors in Biochemistry, and Dr Carina Bothma to Senior Lecturer in Food Science.

RESEARCH OUTPUTS

Research Articles

Agunbiade, MO, Van Heerden, E, Pohl, CH, and Ashafa, AOT. 2017. Flocculating performance of a bioflocculant produced by *Arthrobacter humicola* in sewage waste water treatment. *BMC Biotechnology* 17:51.

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Alayande, KA, Sabiu, S, and Ashafa, AOT. 2017. Medicinal properties of *Abrus precatorius* L. Leaf extract: antimicrobial, cytotoxicity and carbohydrate metabolising enzymes' inhibitory potential. *Transactions of the Royal Society of South Africa* 72:242-250. 72:33-38.

Armstrong-James, D, Bicanic, T, Brown, GD, Hoving, JC, Meintjes, G, Nielsen, K, and the EMBO-AIDS Related Mycoses Working Group: Akilimali, AN, Alupo, P, Andrianopoulos, A, Barr, D, Bauman, S, Botha, A, Boulware, D, Bradley, S, Brand, S, Burgers, W, Chari, R, Chiller, T, Cohen, O, Dambuza, I, Day, J, Denning, D, Edwards, J, Fisher, M, Fraser, J, Garelnabi, M, Gomez, BL, Govender, N, Hanise, P, Harrison, J, Harrison, T, Heath, C, Hope, W, Huppler-Hullsiek, K, Jarvis, J, Jenkins, M, Kamuyango, A, Kannambath, S, Katende, A, Kauffman, C, Klausner, J, Kolls, J, Kwizera, R, Lalloo, D, Le, T, Lerm, B, Letang, E, Levitz, S, Limper, A, Longley, N, Loyse, A, Madu, L, Maphanga, TG, Marakalala, M, Mashao-Mphaphuli, B, May, R, Mbwanji, G, Meya, D, Mhlanga, M, Molloy, S, Mthembu, N, Mukaremera, L, Nacher, M, Ndiitwani, D, Netea, M, Ogundeji, A, Okurut, S, Oladele, R, Omondi, F, Orchard, A, Osherov, N, Otieno, PA, Prerez-Casas, C, Perfect, J, Rhein, J, Romani, L, Rukasha, I, Samie, A, Schutz, C, Schwartz, I, Scriven, J, Sebolai, OM, Seleteng-Kose, L, Shikwambane-Ntlemo, G, Smulian, G, Sobel, J, Sriruttan, C, Stone, N, Trollope, K, Tugume, L, Valentine, M, Vreulink, JM, Wake, R, Wasseman, S, Wilkinson, R, Williams, D, Williamson, P, Wood, K, and Youngchim, S. 2017. AIDS-related mycoses: Current progress in the field and future priorities. *Trends in Microbiology* 25, 428-430.

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Cason, ED, Williams, PJ, Ojo, E, Castillo, J, DeFLaun, MF, and Van Heerden, E. 2017. Hexavalent chromium bioreduction and chemical precipitation of sulphate as a treatment of site-specific fly ash leachates. *World Journal of Microbiology and Biotechnology* 33:88.

Cluff, M, Bothma, C, Hugo, CJ, and Hugo, A. 2017. Intermediate added salt as sodium reduction strategy: Effects on chemical, microbial, textural and sensory quality of polony. *Meat Science* 133:143-150.

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cultivars (*Opuntia ficus-indica* and *Opuntia robusta*). *Journal of Food Processing and Preservation* 41:e12898.

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Falowo, AB, Muchenje, V, Hugo, A, Aiyegoro, OA. and Fayemi, PO. 2017. Antioxidant activities of *Moringa oleifera* L. and *Bidens pilosa* L. leaf extracts and their effects on oxidative stability of ground raw beef during refrigeration storage. *CYTA - Journal of Food* 15:249-256.

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Fourie, R, Ells, R, Kemp, G, Sebolai, OM, Albertyn, J, and Pohl, CH. 2017. *Pseudomonas aeruginosa* produces aspirin insensitive eicosanoids and contributes to the eicosanoid profile of polymicrobial biofilms with *Candida albicans*. *Prostaglandins, Leukotrienes and Essential Fatty Acids* 117:36-46.

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Kumar, S, Purcell, W, Conradie, J, Bragg, RR, and Langner, EHG. 2017. Synthesis, characterization, computational and antimicrobial activities of a novel iridium thiourea complex. *New Journal of Chemistry* 41:10919-10928.

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Conference Contributions

Bailey, B, Tonjock, RK, Cason, E, and Gryzenhout, M. 2017. *Root endophyte communities from sodic and non-sodic soils in a catena ecosystem of the Kruger National Park, South Africa* (poster). 21st Congress of the Association for the Taxonomic Study of the Flora of Tropical Africa. Nairobi, Kenya. 15-19 May.

Boucher, CE, and Jawallapersand, P. 2017. *Immunomics: In silico mapping of immune signalling pathways in chickens related to Avibacterium paragallinarum C-3 serovar infection* (poster). International Union of Microbiological Societies Congress. Singapore, Singapore. 17-21 July.

Boucher, CE, Jawallapersand, P. 2017. *Immunomics*: *In silico mapping of immune signalling pathways in chickens related to Avibacterium paragallinarum C-3 serovar infection* (poster). 20th World Veterinary Poultry

Association Conference. Edinburgh, Scotland. 4-8 September.

Bragg, RR. 2017. *The use of various "Omics" in the control of Infectious coryza* (paper). 20th World Veterinary Poultry Association Conference. Edinburgh, Scotland. 4-8 September.

Calitz, A, and Myburgh, J. 2017. *The acceleration of yogurt fermentation by means of peptides derived from proteolytic pre-treatment of milk*. 50th SADT annual meeting and Symposium. Kivits Kroon, Pretoria. 8-11 May.

Cason, ED, Mlandu, CM, and Van Heerden, E. 2017. *Metagenomic exploration of horizontal gene transfer events and phage infections in a South African deep subsurface bacterial population* (paper). Bioinformatics: From Algorithms to Applications Conference. St. Petersburg, Russia. 1-3 August.

Cluff, M, Kobane, I, Bothma, C, Hugo, C, and Hugo, A. 2017. *Intermediate added salt levels as a sodium reduction strategy: Effects on chemical, microbial, textural and sensory quality of polony* (poster). 22nd Biennial International Congress of the South African Association of Food Science and Technology. Cape Town, South Africa. 3-6 September.

Coetsee, E, Boucher, CE, and Bragg, RR. 2017. *Investigating the potential role of prophages present in Avibacterium paragallinarum isolates* (poster). 20th World Veterinary Poultry Association Conference. Edinburgh, Scotland. 4-8 September.

Coetzee, M, Theron, CW, and Boucher, CE. 2017. *Searching for potential immunomodulators within the secreted proteins and virulence factors of Avibacterium paragallinarum* (poster). International Union of Microbiological Societies Congress. Singapore, Singapore. 17-21 July.

Coetzee, M, Theron, CW, and Boucher, CE. 2017. *Searching for potential immunomodulators within the secreted proteins and virulence factors of Avibacterium paragallinarum* (poster). 20th World Veterinary Poultry Association Conference. Edinburgh, Scotland. 4-8 September.

De Wit, M, Coetzer, GM, Fouché, HJ, and Venter, SL. 2017. *Climatic influences on fruit quality and sensory traits of cactus pear (O. ficus-indica): a five-year evaluation* (poster). 9th International Congress on Cactus Pear and Cochineal, and the General Meeting of the FAO-ICARDA International Cooperation Network on Cactus Pear and cochineal (CACTUSNET). Coquimbo, Chile. 23-30 March.

De Wit, M, Du Toit, A, Fouché, HJ, Hugo, A, and Venter, SL. 2017. *Screening of cladodes from 42 South African spineless cactus pear cultivars for morphology, mucilage yield and mucilage viscosity* (paper). 9th International Congress on Cactus Pear and Cochineal, and the General Meeting of the FAO-ICARDA International Cooperation Network on Cactus Pear and cochineal (CACTUSNET). Coquimbo, Chile. 23-30 March.

De Wit, M, Du Toit, A, Fouché, HJ, Venter, SL, and Hugo, A. 2017. *Relationship between cladode morphology and mucilage traits from different cactus pear cultivars for human food applications* (poster). 22nd Biennial International Congress of the South African Association of Food Science and Technology. Cape Town, South Africa. 3-6 September.

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De Witt, FH, Muchenje, V, Fair, MD, and Hugo, A. 2017. *The effect of dietary ω-type fatty acids on broiler production performance and fatty acid profile of breasts and thigh meat* (poster). 50th Congress of the South African Society of Animal Science. Port Elizabeth, South Africa. 18-21 September.

Dube, S, and Myburgh, J. 2017. T*he susceptibility of milk proteins towards Bacillus protease after gas pre-treatment*. 50th SADT annual meeting and Symposium. Kivits Kroon, Pretoria. 8-11 May.

Du Plessis, L, Van Wyngaard, B, and Hugo, A. 2017. *The effect of dietary omega-3 supplementation of pigs on the technological quality, oxidative stability and sensory properties of pork back bacon* (poster). 22nd Biennial International Congress of the South African Association of Food Science and Technology. Cape Town, South Africa. 3-6 September.

Du Toit, A, De Wit, M, Fouché, HJ, Hugo, A, and Venter, SL. 2017. *Rheological characterization of cactus pear mucilage for application in nutraceutical food products* (paper). 9th International Congress on Cactus Pear and Cochineal, and the General Meeting of the FAO-ICARDA International Cooperation Network on Cactus Pear and cochineal (CACTUSNET). Coquimbo, Chile. 23-30 March.

Du Toit, A, De Wit, M, Fouché, HJ, Hugo, A, and Venter, SL. 2017. *Determination of the functional properties of freeze-dried cactus pear mucilage powder from cladodes of four South African cultivars* (paper). 9th International Congress on Cactus Pear and Cochineal, and the General Meeting of the FAO-ICARDA International Cooperation Network on Cactus Pear and cochineal (CACTUSNET). Coquimbo, Chile. 23-30 March

Du Toit, A, De Wit, M, Taljaard, M, Bothma, C, and Hugo, A. 2017. *The application of cactus pear mucilage in health-promoting mayonnaise products*. Poster delivered at 22nd Biennial International Congress of the South African Association of Food Science and Technology. Cape Town, South Africa. 3-6 September.

Engel, J, Huang, L, Romero, E, Opperman, DJ, Rudroff, F, Mihovilovic, MD, Hollmann, F, Fraaije, M, and Kara, S. 2017. *Enzymatic redox-neutral convergent cascade for lactonizations* (paper). 19th International Symposium on Flavins and Flavoproteins. Groningen, The Netherlands. 2-6 July.

Engel, J, Mthethwa, KS, Opperman, DJ, and Kara, S. 2017. *Newly designed and discovered monooxygenases for synthesis of ECL with enhanced stability and reduced inhibition* (poster). 19th International Symposium on Flavins and Flavoproteins. Groningen, The Netherlands. 2-6 July.

Folorunso, OS, Albertyn, J, and O'Neill, HG. 2017. *Expression of VP2 and VP6 in yeast to enable double-layered particle (DLP) production as a non-live rotavirus vaccine candidate* (poster). 11th African Rotavirus Symposium. Lilongwe, Malawi. 28-30 May.

Fourie, R, Cason, ED, Ells, R, Sebolai, OM, Albertyn, J, and Pohl, CH. 2017. *Drilling beyond the tip of the iceberg: A deeper look at the polymicrobialinteraction between Candida albicans and Pseudomonas aeruginosa using RNAseq* (poster). Bioinformatics: From Algorithms to Applications Conference. St. Petersburg, Russia. 1-3 August.

Gomez-Arias, A, Castillo, J, Welman-Purchase, M, Maleke, MM, and Van Heerden, E. 2017. *Novel strategy to concentrate rare earth elements by neutralization of acid drainage from phosphogypsum stacks using carbonatites* (paper). 2nd Conference on European Rare Earth Resources. Santorini, Greece. 28-31 May

Gryzenhout, M, Bailey, B, Kloppers, A, Cason, ED, and Tonjock, RK. 2017. *Root endophyte communities differ between sodic and non-sodic soils in a catena ecosystem of the Kruger National Park, South Africa* (paper). 7th International Barcode of Life Conference, Kruger National Park, South Africa. 20-24 November.

Hatting, A, and Myburgh, J. 2017. *Computer-assisted identification of proteolytic peptide profiles using MILQC software.* 50th SADT annual meeting and Symposium. Kivits Kroon, Pretoria. 8-11 May.

Hellmuth, E, Bragg, RR, and Boucher, CE. 2017. *Evaluation of the ERIC-PCR as a probable method to differentiate Avibacterium paragallinarum serovars* (poster). 20th World Veterinary Poultry Association Conference. Edinburgh, Scotland. 4-8 September.

Hiscock, L, Bothma, C, Hugo, A, Van Biljon, A, and Jansen van Rensburg, W. 2017. *Consumers' acceptability of amaranth leaves as alternative vegetable source* (poster). 22nd Biennial International Congress of the South African Association of Food Science and Technology. Cape Town, South Africa. 3-6 September.

Jacobs, CL, Smit, MS, and Opperman, DJ. 2017. *Specificity and selectivity of different CYP153 alkane hydroxylases* (poster). 13th International Symposium on Biocatalysis and Biotransformations. Dusseldorf, Germany. 9-13 July.

Kilian, L, Bragg, RR, and Boucher, CE. 2017. *Evaluating a novel disinfecting treatment to combat QAC tolerance in the nosocomial pathogen Staphylococcus epidermidis utilizing a bacteriophage encoded enzyme* (poster). International Union of Microbiological Societies Congress. Singapore, Singapore. 17-21 July.

Kobeni, S, Osthoff, G, Hugo, A, and Madende, M. 2017. *Milk of other species: Impala milk* (poster). 50th Annual General Meeting and Symposium of the South African Society of Dairy Technology. Pretoria, South Africa. 8-11 May.

Kühn, Z, Bothma, C, Strydom, PE, Hugo, CJ, and Hugo, A. 2017. *The effect of brine injection level on the physical properties and sensory acceptability of pork loins* (poster). 63rd International Congress of Meat Science and Technology. Cork, Ireland. 13-18 August.

Kühn, Z, Roodt, E, Strydom, P, Hugo, C, Bothma, C, and Hugo, A. 2017. *Effect of brine injection on the chemical, microbial, physical and sensory quality of fresh pork* (paper). 22nd Biennial International Congress of the South African Association of Food Science and Technology. Cape Town, South Africa. 3-6 September.

Lau, CMY, Becraft, E, Cason, ED, Borgonie, G, Kieft, TL, Li, L, Van Heerden, E, Jarett, J, Wokye, T, Stepanauskas, R, and Onstott, TC. 2017. *The uncultivated phylum TA06* (poster). 3rd Deep Carbon Observatory International Meeting. Edinburgh, Scotland. 23-25 March.

Lee J-Y, Bragg, RR, Theron, CW and Boucher, CE. 2017. *The use of heterologously expressed bacteriophage Lambda endolysins together with permeabilising agents as potential bacterial treatment* (paper). International Union of Microbiological Societies Congress. Singapore, Singapore. 17-21 July.

Maleke, MM, Castillo, J, Cason, E, Gomez-Arias, A, Moloantoa, K, and Van Heerden, E. 2017. *New reductive interactions of rey by Thermus scotoductus SA-01 and Clostridium sp* (paper). 2nd Conference on European Rare Earth Resources. Santorini, Greece. 28-31 May.

Maraba, KP, Yusuf, AO, Mlambo, V, Marume, U, Hugo, A. 2017. *Extra dietary vitamin E and selenium as a mitigation strategy against social growth performance and meat quality stress in Dohne Merino lambs* (poster). 50th Congress of the South African Society of Animal Science. Port Elizabeth, South Africa. 18-21 September.

Maseme, M, Opperman, DJ, Van Marwijk, J, and Smit, MS. 2017. *Cytochrome P450 mediated conversions with recombinant bacteria and yeast* (poster). 13th International Symposium on Biocatalysis and Biotransformations, Dusseldorf, Germany. 9-13 July.

Meyburgh, CM, Bragg, RR, and Boucher, CE. 2017. *Virulence factors of Lactococcus garvieae isolated from South African rainbow trout (Oncorynchus mykiss)* (poster). International Union of Microbiological Societies Congress. Singapore, Singapore. 17-21 July.

Myburgh, J, and Dube, S. 2017. *The Susceptibility of Milk Proteins towards Bacillus Protease after Gas Pre-treatment.* World Dairy Summit in Belfast. Ireland (UK). 29 October - 3 November.

Myburgh, R, van Wyngaard, B, and Hugo, A. 2017. *The effect of dietary Echium oil supplementation of pigs on the technological quality, oxidative stability and sensory properties of Salami* (poster). 22nd Biennial International Congress of the South African Association of Food Science and Technology. Cape Town, South Africa. 3-6 September.

Mqeku, M, Cason, ED, Tonjock, RK, and Gryzenhout, M. 2017. *The fungal phytobiome of Searsia lancea (karee) trees with Karee Malformation Disease in South Africa* (paper). 7th International Barcode of Life Conference. Kruger National Park, South Africa. 20-24 November.

Mwanza, EP, Van der Westhuizen, WA, Hugo, CJ, Charimba, G, and Boucher, CE. 2017. *Identification and purification of keratinolytic enzymes of Chryseobacterium carnipullorum* (poster). International Union of Microbiological Societies Congress. Singapore, Singapore. 17-21 July.

Oberholster, L, Aschenbrenner, J, Potgieter, AC, and O'Neill, HG. 2017. *Engineering Newcastle Disease Virus as vaccine delivery system for rotavirus VP7 and NSP4* (poster). 7th Federation of Infectious Diseases Societies of Southern Africa Congress. Cape Town, South Africa. 9-11 November.

Osthoff, G, and Hugo, A. 2017. *A phylogenetic comparison of the milk of African mammals* (poster). 50th Annual General Meeting and Symposium of the South African Society of Dairy Technology. Pretoria, South Africa. 8-11 May.

Osthoff, G, Madende, M, Kemp, G, and Stoychev, S. 2017. *Casein and casein micelle structure* (paper). 50th Annual General Meeting and Symposium of the South African Society of Dairy Technology. Pretoria, South Africa. 8-11 May.

Purtschert, R, Onstott, TC, Jiang, W, Lu, ZT, Müllerm, W, Zappala, J, Yokochi, R, Van Heerden, E, Cason, ED, Lau, CMY, Kieft, TL, and Brennwald, MS. 2017. *Underground production of 81Kr detected in subsurface fluids* (poster). Goldschmidt Conference, Paris, France. 13-18 August.

Rakaki, M, Albertyn, J, and O'Neill, HG. 2017. *Expression of rotavirus VP6 open reading frame in various yeasts as a more affordable rotavirus vaccine candidate* (poster). 7th Federation of Infectious Diseases Societies of Southern Africa Congress. Cape Town, South Africa. 9-11 November.

Smit, MS, Opperman, DJ, Van Marwijk, J, Maseme, M, and Pennec, A. 2017. *Regiospecific P450 catalysed in-chain hydroxylation for lactone synthesis* (paper). 13th International Symposium on Biocatalysis and Biotransformations, Dusseldorf, Germany. 9-13 July.

Strydom, PE, Kühn, Z, Hugo, CJ, and Hugo, A. 2017. *The effects of brine injection level and post mortem aging on sensory and physical characteristics of beef loin* (poster). 63rd International Congress of Meat Science and Technology, Cork, Ireland. 13-18 August.

Strydom, A, Motanyane, L, Nyaga, MM, João, ED, De Deus, N, and O'Neill, HG. 2017. *Whole genome constellations of Rotavirus A detected in southern Mozambique prior to the introduction of vaccination* (poster). 11th African Rotavirus Symposium. Lilongwe, Malawi. 28-30 May.

Tolmie, C, Ferroni, FM, Smit, MS, and Opperman, DJ. 2017. *Structure and function of Baeyer-Villiger monooxygenases from Aspergillus flavus* (poster). 50th

Erice Course on Integrative Structural Biology. Erice, Italy. 2-11 June.

Tonjock, RK, Cason, E, and Gryzenhout, M. 2017. *Seed mycobiomes of six sorghum varieties using Next Generation Sequencing* (poster). 21st Congress of the Association for the Taxonomic Study of the Flora of Tropical Africa, Nairobi, Kenya. 15-19 May.

Tonjock RK, Cason, ED, and Gryzenhout, M. 2017. *Comparisons of the mycobiome of five underutilized crop species in an intercropping system using Next Generation Sequencing* (paper). 7th International Barcode of Life Conference. Kruger National Park, South Africa. 20-24 November.

Van der Westhuizen, WA, Theron, CW, Boucher, CE, and Bragg, RR. 2017. *Immunogenicity evaluation of full-length and truncated transmembrane virulence protein Iss from avian pathogenic Escherichia coli (APEC)* (poster). International Union of Microbiological Societies Congress. Singapore, Singapore. 17-21 July.

Van der Westhuizen, WA, Theron, CW, Boucher, CE, and Bragg, RR. 2017. *Immunogenicity evaluation of full-length and truncated transmembrane virulence protein Iss from avian pathogenic Escherichia coli (APEC)* (paper). 20th World Veterinary Poultry Association Congress. Edinburgh, Scotland. 4-8 September.

Van Niekerk, J, Bragg, RR, and Boucher, CE. 2017. *Development of serological and molecular techniques for diagnosis of Beak and Feather disease virus* (poster). 20th World Veterinary Poultry Association Congress. Edinburgh, Scotland. 4-8 September.

Van Wyngaard, L, Strydom, P, Pohl-Albertyn, C, Van Heerden, I, Kanengoni, A, and Hugo, A. 2017. *Effect of dietary Echium oil supplementation on pork quality* (poster). 22nd Biennial International Congress of the South African Association of Food Science and Technology. Cape Town, South Africa. 3-6 September.

Venter, SL, Fouché, HJ, De Wit, M, Mavengahama, S, Coetzer, GM, Swart, WJ, and Amonsou, E. 2017. *The effect of fostering partnerships on broadening the food base: the role of cactus pear, an underutilised crop with unlimited potential, the South African perspective* (paper). 9th International Congress on Cactus Pear and Cochineal, and the General Meeting of the FAO-ICARDA International Cooperation Network on Cactus Pear and cochineal (CACTUSNET). Coquimbo, Chile. 23-30 March.

Xazela, NM, Hugo, A, and Muchenje, V. 2017. *Physico-chemical characteristics of meat purchased from different purchase points* (poster). 50th Congress of the South African Society of Animal Science. Port Elizabeth, South Africa. 18-21 September.

STAFF

Professors: Profs M Smit (Academic Head of Department), J Albertyn, R Bragg, S Kilian, E van Heerden, B Viljoen, G Osthoff, and C Pohl-Albertyn.

Associate Professors: Profs A Hugo and C Hugo.

Affiliate Professor: Prof M de Flaun.

Affiliate Associate Professor: Prof B Lodolo.

Senior Lecturers: Drs F O'Neill, T O'Neill, D Opperman, M de Wit, K Myburgh, and O Sebolai.

Lecturers: Drs C Bothma and C Boucher.

Junior Lecturers: L Steyn.

Senior Researchers: Dr G Kemp.

Research Associates: Prof D Litthauer, Prof JC du Preez, and Dr R Ells.

Secretaries: OK Tshotetsi and I Auld.

Senior Officers: Professional Services: S Marais and N-M Agenbag.

Officers: Professional Services: Y Makaum, C van Rooyen, D van den Berg, A van Wyk, and E Roodt.

Officer: A van der Westhuizen.

Senior Officer: C Badenhorst.

Senior Assistant Officers: E van den Heever and M Kearney.

Storeman: M Mogopodi.

Technical Help: L Mazwi, A Mokwaqa, T Mkololo, S Senokoane, S Isaac, P Mereko, J Mvula, and VJ Lamle.

DEPARTMENT OF

Physics

(Bloemfontein and Qwaqwa Campuses)

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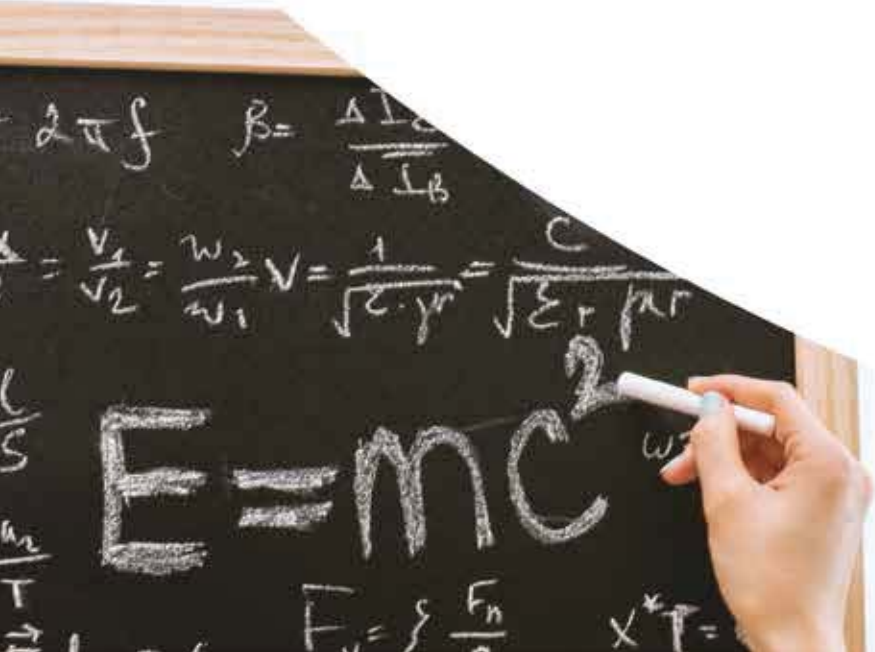


2017 Overview

The Department of Physics is internationally recognised as one of the leading Physics departments in astrophysics, phosphor, and solid-state research. We host a very well-equipped nano-surface characterisation laboratory (with state-of-the-art research infrastructure), an observatory (Boyden) with a 1,5 m telescope, and the Naval Hill Planetarium. Our international collaborators include the USA, Europe, India, and China. The UFS awarded an honorary doctorate to Prof Paul Holloway from the University of Florida, USA – a very influential international collaborator for over 35 years.

Our main research areas are astrophysics, phosphor materials, and solid-state physics (diffusion, segregation, thin films, and theatrical calculations), with challenging and well-balanced undergraduate and graduate programmes that qualifies high-quality and sought-after students. Most of our staff members are also involved with the Boyden Science Centre and Naval Hill Planetarium which actively engage with local, provincial, and national communities.

Prof Paul Holloway after receiving his honorary doctorate, with Profs Swart and Terblans, and Drs Puseletso Mokoena, Jacques Maritz, and Xin Lang Yan

ACHIEVEMENTS

Staff Achievements

SJ Motloung successfully completed his PhD degree under the supervision of Prof OM Ntwaeaborwa and Dr KG Tshabalala.

Prof Swart received the Radio Rosestad Rose award for research and student training.

Student Achievements

Our postgraduate students once again performed superbly at the Annual Conference of the South African Institute of Physics and the International Photonics conference where they won several prizes. The winners were:

Bloemfontein Campus:

S Mishra - the best PhD publication in Solid State Physics (Supervisors: Prof HC Swart and A Tiwari) at SAIP 2017.

TP Mokoena - the best PhD poster in Semiconductor Physics (Supervisors: Prof OM Ntwaeaborwa and Prof HC Swart) at SAIP 2017.

EHH Hasalbeldaim - the best MSc publication in Solid State Physics (Supervisor: Prof OM Ntwaeaborwa and Prof HC Swart) at SAIP 2017.

E Lee - the best student/postdoctoral oral prize (Supervisors: Prof JJ Terblans and Prof HC Swart) at the International Photonics Conference at Amanzi.

A Kumar - the runner-up student/postdoctoral oral prize (Supervisors: Prof JJ Terblans and Prof HC Swart) at the International Photonics Conference at Amanzi.

T Pathak - the best postdoctoral poster prize (Supervisors: Prof RE Kroon and Prof HC Swart) at the International Photonics Conference at Amanzi.

Z Tshabalala - the second runner-up student poster prize (Supervisors: Prof D Motaung and Prof HC Swart) at the International Photonics Conference at Amanzi.

NJ Shivaramu - the best poster prize (Supervisors Prof E Coetsee-Hugo and Prof HC Swart) at the 2nd International Conference on Condensed Matter and Applied Physics, Bikaner, India.

Activities

This was another very successful year for our Advanced

Sakkie van der Westhuizen, Helene Szegedi, Dina Oosthuizen, and Lucas Erasmus all won prizes from the South African Academy for Science and Art

Our staff with students who won prizes at the Photonics Conference

and Luminescent Materials research group, producing more than 90 ISI-accredited journal papers in 2017, including papers in Nano Energy (IF 13.127), ACS Photonics (IF 6.88), Small (IF 9.598) and Biosensors, and Bioelectronics (IF 8.173).

The bilateral research collaboration programmes with Belgium, Sweden, and Romania were strengthened by exchange visits from the groups. A successful Joint South Africa-Sweden Research Collaboration Workshop on improving performance of wide-bandgap materials was held on 25 and 26 September at Gyllene Uttern, Sweden. Visits from Prof Dirk Poelman and Reinert Verstraete from Ghent University, as well as Prof Valentin Craciun from the University of Bucharest as part of these collaboration programmes, added value to our research group. The group was further strengthened with around ten postdoctoral fellows helping to build capacity in the research laboratory.

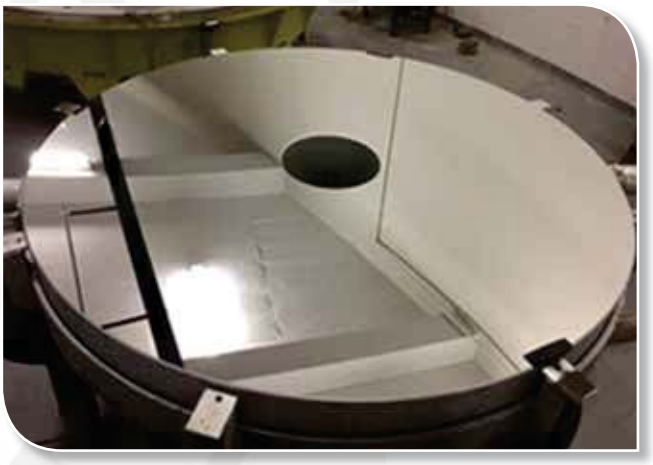
At the end of December, we bought a new Newport solar simulator and held a two-day Nano Facility Launch Tour in the Department of Physics from 19 to 20 Sept 2017, in collaboration with the South African Agency for Science and Technology Advancement (SAASTA).

The 7th bi-annual South African Conference on Photonic Materials was held at Amanzi Game Reserve outside Brandfort from 27 to 31 March to discuss the development of novel high-tech materials with applications such as solar cells, light-emitting diodes, display screens, luminescent paints, chemical and gas sensors, medical diagnostics, bioelectronics, photo catalysts, forensics, and quantum systems involving light. We organised this conference in partnership with the University of Pretoria and the Nelson Mandela University. Over 100 scientists from more than a dozen countries attended; it was a great opportunity to have renowned speakers from India, Germany, France, Luxembourg, India, Brazil, and Belgium share their expertise and build partnerships. In addition, delegates from many African countries including Kenya, Zimbabwe, Nigeria, and Sudan were represented, some of which are pursuing postgraduate studies in South Africa.

The UFS Astrophysics Research Group experienced a very productive 2017, with members delivering presentations at several national and international conferences and contributing to high-profile international collaborations. The group contributed to 35 refereed papers and conference publications during 2017. Most notable was the contribution of the UFS Astrophysics Group to the multi-messenger observations of a colliding neutron star binary system, finally confirming the emission of gravitational waves together with multi-frequency electromagnetic emission up to gamma-ray energies. This event led to a plethora of papers in high-profile journals such as *Science* and *Nature* and was instrumental in awarding the 2017 Nobel Prize in Physics to pioneers working in the field of gravitational wave physics.

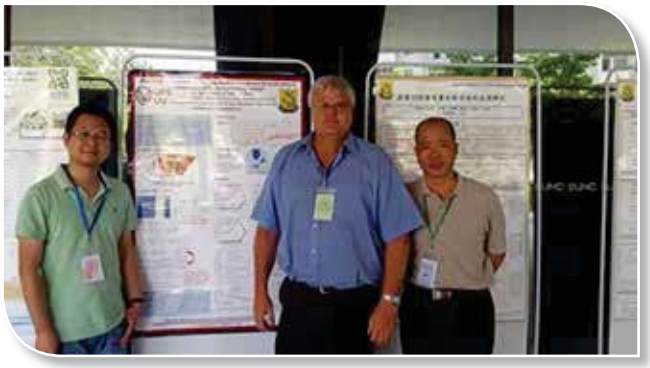
Boyden Observatory:

The Boyden Observatory is situated ± 25 km northeast of Bloemfontein and is managed by the Department of Physics. The observatory hosts several research class telescopes, of which the 1,5 m reflector is the largest. The UFS-Boyden 1,5 m reflector with the Watcher robotic telescope, managed by the University College of Dublin (UCD), is often used in optical



New coating of aluminium on the UFS-Boyden 1,5 m telescope

Profs HC Swart, JJ Terblans, and two MSc students, E Lee and L Erasmus, attended the 9th International Conference on Advanced Materials, ROCAM 2017, in Bucharest, Romania, from 11 to 14 July 2017. Prof Swart gave an invited talk and the others presented their work at the conference. They visited the labs of Prof V Craciun in the Laser Department at the National Institute for Lasers, Plasma and Radiation Physics in Magurele, Bucharest, where they prepared thin films with pulsed laser deposition



Profs Swart and Wang (chairperson of conference) with Xin-Liang Yan, PhD student in the Department of Physics, at the 2017 National Conference on Surface Science and Technology, 10-13 August 2017, Shantou University, Shantou, China. Prof Swart gave a plenary talk, while Xin-Liang presented a poster. Prof Wang was a postdoc in the Department of Physics during 1996/7

follow-up observations of high-energy sources. The mirror of the UFS-Boyden 1,5 m telescope was re-aluminised at the SAAO, Sutherland. The new coating of aluminium resulted in a dramatic increase in the optical reflectivity and performance of the telescope. The UFS Astrophysics Research Group is currently in the final stages of negotiation with the Appalachian State University to install a sophisticated spectrograph on the UFS-Boyden 1,5 m telescope. This will be a very significant addition to the observational capabilities of the UFS-Boyden Observatory.

RESEARCH

Community Service

The Two Observatories Project

The Two Observatories Project is supported by a number of loyal funders. During 2017, contributions were received from:

Dr LF Koao, Prof Oscar L Malta (Chairman of ICL 2017), Mantwa Lephoto (PhD student). and Dr KG Tshabalala

- The American Museum of Natural History (AMNH) in kind
- European Southern Observatory (ESO) in kind
- The Charl van der Merwe Foundation
- The Free State Department of Economic Development, Tourism, Environmental Affairs and Small Business (DESTEA) in kind
- The Hermann Ohlthaver Trust
- The International Performing Arts Trust
- The Office of Astronomy for Development (OAD)
- The Mangaung Metropolitan Municipality (MMM) in kind
- Many volunteers who contributed their time and expertise

The Two Observatories Project at the University of the Free State (UFS) are:

1. The Boyden Observatory (approximately 25 km from Bloemfontein) and
2. The old Lamont-Hussey Observatory on Naval Hill in the centre of Bloemfontein, which has been converted into the Naval Hill Planetarium.

There is a great synergy between the two facilities, with the planetarium often the first point of contact for learners and the general public, whereas Boyden Observatory is often used for intensive and focused workshops. Furthermore, Boyden hosts an astronomy museum and offers 'real sky' and 'telescope' experiences, which lend depth to what people experience at the planetarium. Together, the observatories foster education, science communication, and the development of eco and astro-tourism in central South Africa.

Collaboration with IZIKO Planetarium

The Iziko Planetarium in Cape Town was upgraded to South Africa's second digital planetarium (after the

MSc graduates, Mr IP van der Westhuizen (left) and M Nyamai (right) with their supervisors, Dr Van Soelen and Prof Meintjes

Naval Hill Planetarium), officially opening its doors for the public on 26 May 2017. Since we are both using Sky-Skan projection systems, we exchanged technical expertise between the two planetariums – tapping into the considerable benefits from working together by sharing planetarium content and maintenance visits. The UFS Rector and Vice-Chancellor, Prof Francis Petersen, convened a special planetarium meeting with representatives from Iziko, universities in the Western Cape involved with the Iziko planetarium (University of Cape Town, University of the Western Cape), and the UFS. The meeting, which took place on 15 September 2017, resolved to leverage opportunities for funding and research that will benefit both planetariums.

The Centre for Earth and Space

The hall for environmental education at the Centre for Earth and Space, adjacent to the planetarium, is the second major component of the centre and was completed in January 2017. During 2017, we set operation protocols in place, including event timetables, and making the venue suitable for conferences and other events.

Two officials from the Department of Environment that falls under provincial government, are permanently stationed in offices at the hall. They organise and coordinate school visits as well as other environment-related activities such as community projects on Arbour Day.

School education activities

Science communication and education are at the core of the project. Ongoing public programmes and activities take place throughout the year, and several public lectures were presented. The lectures are very well attended by the receptive and knowledgeable Bloemfontein public. Volunteers from the Friends of Boyden and the Naval Hill Planetarium assist with logistics of the high-impact public events, which are offered on a voluntary basis with no admission charge.

The UFS CLNS3702 Community Service Module made an important contribution to two township schools: Dr Blok and Petunia. The module teaches students the basics of Community Service Learning, including cultural competence and pedagogy. The participating schools received assistance with Science classes from Grades 10 to 12. Five classes of 60 learners each visited the Boyden Science Centre where three UFS students taught them in groups. In 2017, 11 UFS students successfully completed the module.

A special Adventure Camp for 68 high achievers in Maths and Science from 18 different schools was held at Boyden Observatory on 7 June 2017. The programme included Chemistry and Astronomy lectures by Prof Peter Dunby from the University of Cape Town, and Prof Jan Smit from the North-West University. The learners also observed through the Boyden telescopes.

Many schools visited the Boyden Observatory during 2017. Because presentations address curriculum content, teachers are eager to expose learners to the lessons and experiences offered at the planetarium and the Boyden Observatory. The real sky at Boyden reinforces the digital representations which children experience in the planetarium. Children who visit Bloemfontein from the rural areas typically include the National Museum and the Zoo in their itinerary. Almost all school trips are to some degree subsidised by the projects to maximize access and encourage visitors. Children often follow up school visits by attending planetarium shows with their families.

Museum (Heritage) Project

The Boyden Museum now boasts three lovingly curated exhibits. The fourth exhibit, 'Glass Universe', is under construction. The display will consist of valuable glass plates recording the observations made at Boyden Observatory and will open in 2018.

An important development was the Heritage Day presentation at the planetarium on 24 September, communicating information on the astronomical observations and the star lore of the Basotho people.

Postgraduate Students

The following students obtained PhD and MSc degrees:

An honorary doctorate was awarded to Prof Paul Holloway.

Bloemfontein Campus:

PhD:

Dr Jacque Maritz
Dr Puseletso Mokoena
Dr Cornelia van der Walt
Dr Xin Liang Yan

MSc

E Hasabeldaim

M Mokoena
M Nyamai
I van der Westhuizen

Qwaqwa Campus:

PhD

Dr SZ Werta
Dr ET Seid
Dr M Musembi
Dr MA Lephoto
Dr J Ungula
Dr M Hussen
Dr AG Habte
Dr HT Haile
Dr P Korir
Dr D Hile
Dr TD Malevu
Dr SJ Motloung

MSc

S Kiprotish

RESEARCH OUTPUTS

Research Articles

Abbass, AE, Swart, HC, and Kroon, RE. 2017. Non-plasmonic enhancement of the near band edge luminescence from ZnO using Ag nanoparticles. *Journal of Luminescence* 182: 263-267.

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Ogugua, SN, Swart, HC, and Ntwaeaborwa, OM. 2017. *Tunable emission and surface characterization of powders and pulsed laser deposited mixed rare-earths oxyorthosilicate phosphors* (paper). Collaborative Conference on Materials Research (CCMR) 2017, Jeju Island, Korea. 26-30 June.

Pandey, A, Kumar, V, Mohammed, AA, Kroon, RE, Coetsee, E, and Swart, HC. 2017. *Photons and electron beam pumped luminescence characteristics of holmium activated $CaMoO_4$ phosphor* (poster). 7th South African Conference on Photonic Materials, Amanzi Game Reserve, South Africa. 27-31 March.

Pathak, TK, Swart, HC, and Kroon, RE. 2017. *Structural and plasmonic properties of noble metal doped ZnO nanomaterials.* Paper delivered at the 7th South African Conference on Photonic Materials, Amanzi Game Reserve, South Africa. 27-31 March 2017.

Pathak, TK, Kumar, A, Swart, HC, and Kroon, RE. 2017. *Effect of annealing temperature on structural and luminescence properties of Eu doped $NaYF_4$ phosphor* (poster). 7th South African Conference on Photonic Materials, Amanzi Game Reserve, South Africa. 27-31 March.

Purohit, LP, Pathak, TK, Kumar, V, Swart, HC, and Rajput, JK. 2017. *Tailoring and optimization of optical properties of CdO thin films for optoelectronic applications* (poster). 7th South African Conference on Photonic Materials, Amanzi Game Reserve, South Africa. 27-31 March.

Rajoelimanana, A, Meintjes, PJ, Charles, P, and Buckley, DAH. 2017. *Multi-wavelength observations of the unusual soft x-ray transient ASASSN-16oh* (paper). High Energy Astrophysics in Southern Africa 2017 (HEASA2017), Johannesburg, South Africa. 4-6 October.

Rajoelimanana, A. 2017. *Multi-wavelength properties of two supersoft X-ray sources CAL83 and RXJ0513.9-6951* (paper). The X-ray Universe 2017, Rome, Italy. 6-9 June.

Rajoelimanana, A. 2017. *Long-term properties of the eccentric Be X-ray binary A0538-66*. Paper delivered at Be stars in X-ray binaries 2017, Heraklion, Crete. 11-13 Sept 2017.

Ramteke, DD, and Swart, HC. 2017. *Structure and photoluminescence properties of $Ba_{(1-x)}2Si_4O_{10}$:xSm^{3+}* (paper). 7th South African Conference on Photonic Materials, Amanzi Game Reserve, South Africa. 27-31 March.

Schutte, HM, Boettcher, M, Van Soelen, B, Britto, RJ, Marais, JP, and Buckley, D. 2017. *Modelling the spectral energy distribution and polarisation of active galactic nuclei.* Paper delivered at High Energy Astrophysics in Southern Africa 2017 (HEASA2017), Johannesburg, South Africa. 4-6 October 2017.

Schutte, HM, Boettcher, M, Van Soelen, B, Britto, RJ, Marais, JP, and Buckley, D. 2017. *Modelling the spectral energy distribution and polarisation of active galactic nuclei* (paper). Texas Symposium, Cape Town, South Africa. 3-8 December.

Seed Ahmed, HAA, Swart, HC, and Kroon, RE. 2017. *Investigating the capability of ToF-SIMS to determine the oxidation state of Ce ions* (poster). 7th South African Conference on Photonic Materials, Amanzi Game Reserve, South Africa. 27-31 March.

Sharma, AK, Pathak, TK, Dhoble, SJ, Terblans, JJ, and Swart, HC. 2017. *Co-operative energy transfer in Yb^{3+} -Tb^{3+} co-doped $SrGd_4O_7$ upconverting phosphor* (paper). 7th South African Conference on Photonic Materials, Amanzi Game Reserve, South Africa. 27-31 March.

Shingange, K, Mhlongo, G, and Swart, HC. 2017. *Microwave-assisted synthesis of Au nanoparticles incorporated ZnO roselike hierarchical structures and their gas sensing properties* (paper). 7th South African Conference on Photonic Materials, Amanzi Game Reserve, South Africa. 27-31 March.

Shivaramu, NJ, Coetsee, E, and Swart, HC. 2017. *TL and OSL characterization of Eu^{3+} doped Y_2O_3: application in dosimetry* (poster). 62nd DAE Solid State Physics Symposium, Mumbai, India. 26-30 December.

Shivaramu, NJ, Coetsee, E, and Swart, HC. 2017. *TL and OSL Characterization of Eu^{3+} Doped Y_2O_3: Application in Dosimetry* (poster). 2nd International Conference on Condensed Matter and Applied Physics, Bikaner, India. 24-25 November.

Shivaramu, NJ, Lakshminarasappa, BN, Nagabhushana, KR, Coetsee, E, and Swart, HC. 2017. *Correlation between thermoluminescence glow curve and emission spectra of Gamma ray irradiated $LaAlO_3$* (poster). 62nd DAE Solid State Physics Symposium, Mumbai, India. 26-30 December.

Sushch, I, and Van Soelen, B. 2017. *Gamma-gamma absorption in the gamma-ray binary system PSR B1259-63/LS 2883* (poster). 35th International Cosmic Ray Conference (ICRC2017), Busan, Korea. 12-20 July.

Swart, HC. 2017. *Phosphor materials for Solid State Lighting and Solar cell applications* (paper). 2017 National Conference on Surface Science and Technology, Shantou, China. 10-13 August.

Swart, HC. 2017. *Uses of Phosphors in our daily life* (paper). Student Workshop, Shantou University, Shantou, China. 14-18 August.

Swart, HC. 2017. *Rare earths doped and undoped zinc oxide nanophosphor powder: A future material for solid state lighting and solar cell applications* (paper). University of São Paulo, São Paulo, Brazil. 4 September.

Swart, HC. 2017. *University of the Free State, Department of Physics: A pictorial of growth and expansion* (paper). Nanotechnology Facility Tour at UFS, Bloemfontein, South Africa. 20 September.

Swart, HC, Kroon, RE, Terblans, JJ, Pandey, A, Kumar, A, and Holsa, J. 2017. *Up-conversion luminescence of lanthanide activated phosphors* (paper). 232nd Electrochemical Society (ECS) Meeting, Washington, USA. 1-6 October.

Swart, HC, Ntwaeaborwa, OM, Kroon, RE, Terblans, JJ, Coetsee, E, and Kumar, V. 2017. *Rare earths doped zinc oxide nanophosphor powder: A future material for solid state lighting and solar cell applications* (paper). Collaborative Conference on Materials Research (CCMR) Jeju Island, Korea. 26-30 June.

Swart, HC, Ntwaeaborwa, OM, Kroon, RE, Terblans, JJ, Harris, RA, Duvenhage, MM, and Coetsee, E. 2017. *Use of surface sensitive techniques for characterization of phosphor materials for Solid State Lighting* (paper). 18th International Conference on Luminescence, João Pessoa, Brazil. 27 August-1 September.

Swart, HC, Kroon, RE, Terblans, JJ, Pandey, A, Kumar, A, and Craciun, V. 2017. *Photon and electron beam pumped up- and down conversion luminescence of RE activated phosphors* (paper). 9th International Conference on Advanced Materials (ROCAM 2017), Bucharest, Romania. 11-14 July.

Swart, HC, Ntwaeaborwa, OM, Kroon, RE, Terblans, JJ, Harris, RA, Duvenhage, M, and Coetsee, E. 2017. *Use of surface sensitive techniques for characterization of phosphor materials for solid state lighting* (paper). Joint South Africa-Sweden Research Collaboration Workshop on Improving performance of wide-bandgap materials, Gyllene Uttern, Sweden. 25-26 September.

Szegedi, H, Odendaal, A, and Meintjes, PJ. 2017. *Transient emission of selected CRTS Cataclysmic variables* (paper). The Golden Age of Cataclysmic Variables and Related Objects IV, Palermo, Italy. 11-16 September.

Szegedi, H, Odendaal, A, and Meintjes, PJ. 2017. *Multi-wavelength follow-up studies of eruptive cataclysmic variables in the MeerKAT and CTA era* (paper). High Energy Astrophysics in Southern Africa 2017 (HEASA2017), Johannesburg, South Africa. 4-6 October.

Szegedi, H. 2017. *Dramatiese verhelderings van drie dwergnovas* (paper). Studentesimposium in die Natuurwetenskappe, Pretoria, South Africa. 2-3 November.

Terblans, JJ, Madito, MJ, Craciun, V, and Swart, HC. 2017. *The segregation of In in a polycrystalline Cu(In) alloy* (poster). 9th International Conference on Advanced Materials, ROCAM 2017, Bucharest, Romania, 11-14 July.

Terblans, JJ, Van der Walt, C, Craciun, V, and Swart, HC. 2017. *Diffusion and segregation of Ag in Cu(Ag) bulk- and nanocrystals* (paper). 9th International

Conference on Advanced Materials (ROCAM 2017), Bucharest, Romania. 11-14 July.

Thebe, MJ, Koao, LF, and Maboya, CS. 2017. *The efficacy of computer-based laboratory experiments* (poster). Poster presented at the 62nd Annual Conference of the South African Institute of Physics, Stellenbosch, South Africa. 3-7 July.

Tshabalala, Z, Motaung, D, and Swart, HC. 2017. *Structural transformation and enhanced gas sensing characteristics of TiO_2 nanostructures induced by annealing* (poster). 7th South African Conference on Photonic Materials, Amanzi Game Reserve, South Africa. 27-31 March.

Ungula, J, Dejene, FB, and Swart, HC. 2017. *Effect of pH on the structural, optical and morphological properties of Gadoped ZnO nanoparticles prepared by reflux method* (poster). 7th South African Conference on Photonic Materials, Amanzi Game Reserve, South Africa. 27-31 March.

Ungula, J, Swart, HC, and Dejene, FB. 2017. *Effects of growth time on structural and optical properties of ZnO nanorods on Ga-doped ZnO seed layer for dye-sensitized solar cells photoanode* (poster). 62nd Annual Conference of the South African Institute of Physics, Stellenbosch, South Africa. 3-7 July.

Van der Merwe, L, Moyo, D, Kruger, R, Doucet, F, Swart, HC, Coetsee-Hugo, E, Prinsloo, L, Woodard, C, Hlangothi, S, and Reynolds-Clausen, K. 2017. *Ash Filler in Rubber, Fossil Fuel Foundation* (paper). Workshop on Coal Ash, Johannesburg, South Africa. 28 September.

Van der Westhuizen, IP. 2017. *'n Studie van sinchrotronstraling in aktiewe galaktiese kerne deur middel van vloeidinamika simulasies* (paper). Studentesimposium in die Natuurwetenskappe, Pretoria, South Africa. 2-3 November.

Van der Westhuizen, IP, Van Soelen, B, and Meintjes, PJ. 2017. *Hydrodynamic instabilities as a source of variability in AGN jets* (paper). High Energy Astrophysics in Southern Africa 2017 (HEASA2017), Johannesburg, South Africa. 4-6 October.

Van der Westhuizen, IP, Van Soelen, B, and Meintjes, PJ. 2017. *An investigation of synchrotron emission in relativistic AGN jets using 3D grid based hydrodynamic simulations* (poster). Texas Symposium, Cape Town, South Africa. 3-8 December.

Van Soelen, B. 2017. *Gamma-ray binaries: binary systems that dominate the gamma-ray sky* (paper). High Energy Astrophysics in Southern Africa 2017 (HEASA2017), Johannesburg, South Africa. 4-6 October.

Van Soelen, B, Komin, N, Väisänen, P, and Kniazev, A. 2017. *Southern African Large Telescope observations and updated orbital parameters of LMC P3* (poster). Texas Symposium, Cape Town, South Africa. 3-8 December.

Verma, S, Verma, K, Kumar, D, Som, S, Sharma, V, Kumar, V, and Swart, HC. 2017. *Recent advances in rare earth doped alkali-alkaline earth borates for solid state lighting applications: a mini review* (poster). 7th South African Conference on Photonic Materials, Amanzi Game Reserve, South Africa. 27-31 March.

Yagoub, MYA, Swart, HC, Kroon, RE, and Coetsee, E. 2017. *Low temperature photoluminescence study of Ce^{3+} and Eu^{2+} ions doped SrF_2 nanocrystal* (paper). 7th South African Conference on Photonic Materials, Amanzi Game Reserve, South Africa. 27-31 March.

Yousif, AA, Duvenhage, MM, Terblans, JJ, Ntwaeaborwa, OM, and Swart, HC. 2017. *Role of target and Ga particulates on the surface and optical properties of $Y_3(Al,Ga)_5O_{12}$:Tb thin films prepared by PLD* (poster). 7th South African Conference on Photonic Materials, Amanzi Game Reserve, South Africa. 27-31 March.

STAFF

Senior Professor: Prof HC Swart, Prof PJ Meintjes.

Professors: Prof BF Dejene, Prof WD Roos, Prof JJ Terblans.

Associated Professor: Prof E Coetzee-Hugo, Prof MHJ Hoffman, Prof RE Kroon.

Senior Lecturers: Dr RA Harris, Dr LF Koao, Dr B van Soelen.

Lecturers: Dr S Cronje, Dr A Odendaal, Dr KG Tshabalala, RO Ocaya, Dr SJ Motloung, DP van Jaarsveldt.

Junior Lecturers: H Szegedi.

Researcher: Dr M Duvenhage.

Affiliate Associate Professors: Prof KT Hillie, Prof G Mhlongo, Prof DE Motaung.

Research Associates: Prof JPK Hölsä, Dr V Kumar, Dr J Prakash.

Senior Officers, Professional Services: Dr HJ van Heerden.

Officer: K Cronje.

Assistant Officers: MK Lebeko, Y Loots, D Mangope.

DEPARTMENT OF

Zoology and Entomology

(Bloemfontein and Qwaqwa Campuses)

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2017 Overview

Our department focuses on a variety of research aspects in the two main subject fields: animal behaviour and etho-ecology, ornithology, nematology, aquatic ecology (including parasitology), wildlife and conservation research, herpetology, tick resistance, arachnology, pest-control and management, forensic entomology, environmental entomology and dipterology, insect-plant associations, applied agricultural entomology, as well as research on soil ecology and on insects found in new crops. All of these topics are incorporated in the undergraduate courses and also serve as baseline for postgraduate projects. We have long-standing collaborations with numerous government departments, as well as good relationships with various partners in the industry.

ACHIEVEMENTS

Staff Achievements

Prof Aliza le Roux won first prize for research in Teaching and Learning at the annual Teaching and Learning Awards ceremony in Qwaqwa.

Dr M Ndlovu was appointed as panel member for several National Research Foundation (NRF) grant applications.

Student Achievements

Two students received Zoological Society of Southern Africa student awards for the best students in Zoology: Kaylee Nancarrow for the best third-year Zoology student, and Klinette Sutherland for the best Zoology honours student. Liezl Whitehead received the award as best honours student from the Entomological Society of Southern Africa.

Several of our students won prizes at the 12th Colloquium of the African Arachnological Society (AFRAS) held at Goudini Spa and Resort in January 2017. The best student poster award was won by Gary Edwards, with Liezl Whitehead the runner-up. Ruan Booysen won the prize for the best non-spider arachnid photograph in the photographic competition.

Activities

Arachnology

During January 2017, Dr Charles Haddad co-hosted the 12th Colloquium of the African Arachnological Society (AFRAS) together with the Arachnology group of the Biosystematics Division, ARC – Plant Protection Research in Pretoria. This was the largest AFRAS colloquium help to date, with 40 delegates and a further five accompanying persons attending.

Following the colloquium, Dr Haddad hosted PhD candidate Pavel Just from Charles University in Prague, Czech Republic, for three months to conduct research on the karyology and genetic diversity of geogarypid pseudoscorpions. This formed part of collaborative research between Dr Haddad and Drs Jiri Kral and Franticek Stahlavsky of Charles University on the karyology of various arachnid orders. As part of this visit, fieldwork was undertaken in various parts of South Africa to generate material for his PhD study, with regular participation of Jan-Andries Neethling from the National Museum in Bloemfontein. At the end of March, Drs Haddad, Stahlavsky, Pavel Just, UFS honours student Ruan Booysen, and several additional local and international researchers from the USA (Dr Vera Opatova) and Germany (Prof Jutta Schneider and Dr Jasmin Ruch) undertook a two-week field trip to northern KwaZulu-Natal. Besides molecular work on arachnids, material was also collected for research on termitophagous and myrmecophagous spiders, and golden orb-web spiders.

Aquatic ecology

During the autumn recess, our third-year Zoology students went on an Ecology excursion to the China-South Africa Agricultural Technology Demonstration Centre (ATDC) at Gariep Dam. During that week, students were exposed to different ways of fish collection with the assistance of Dr Leon Barkhuizen. Pieter Swanepoel and Katlego Mogorosi, former students from our department currently employed by the Free State Department of Agriculture and Rural Development, participated and presented lectures. They also presented practical activities to the students inside the fishery facilities.

We were very fortunate that Nellie Ndumo, Dries Visser, David Malan, Gert Isaks, and Msayi Simlindile from the Department of Water and Sanitation (National Water Resource Infrastructure), agreed to accompany us during visits into the dam wall, to the hydropower station, and to the inlet tunnel at Oviston. They also presented lectures and information sessions to the students.

The trip included zooplankton collections and measurements of different water-quality parameters of

the river and fishery dams. A laboratory and working area were set up at the fisheries facility where data analyses were conducted. At the end of the week all the topics were presented in the form of posters and PowerPoint presentations.

Third-year Zoology students setting fyke nets in the Gariep Dam under the watchful eye of their instructor, Dr Leon Barkhuizen from the Free State Department of Agriculture and Rural Development, as part of their practical work during the Ecology excursion

Third-year Zoology students finalising their poster presentations in the laboratory at the China-South Africa Agricultural Technology Demonstration Centre at the Gariep Dam, as part of their practical work during the Ecology excursion

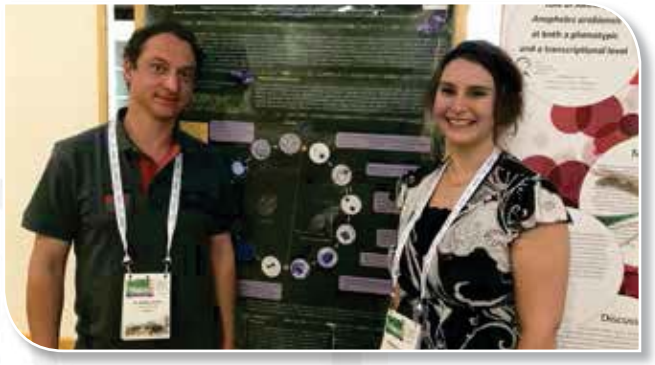
Third-year Zoology students during the Ecology excursion. The students were taken through the Gariep Dam wall and on a visit to the hydropower facility at the dam

In October, the Honours class (Entomology and Zoology) spent a week at the De Hoop Nature Reserve where they were exposed to different activities in the intertidal area and the reserve. Students also took part in academic discussion sessions, confronting them with current scientific challenges.

Zoology and Entomology Honours students on the rocky shores of the De Hoop Nature Reserve during the annual Honours excursion that forms part of the Honours Biodiversity module

Nematology

Two field trips to the Willem Pretorius and Soetdoring Nature Reserves were undertaken in May and October 2017 for MSc students' research projects.



Dr Johann and Michelle van As, lecturers from the Qwaqwa Campus during the 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA) at the Kruger National Park, South Africa

Dr Johann and Michelle van As, lecturers from the Qwaqwa Campus during the 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA) at the Kruger National Park, South Africa.

RESEARCH

Applied Agricultural Entomology – De Villiers Fourie

De Villiers Fourie continues collaborative work with the Stink Bug Research Group and Nelspruit ARC. The group is involved in the management of the sucking bug complex on subtropical fruit and nuts in South Africa, including avocado, macadamia nuts, mangoes, and litchis.

A comprehensive study is being done on possible pyrethroid resistance developing in the two-spotted stink bug on macadamia in the Nelspruit region. The aim of this study is to examine, in collaboration with the Stink Bug Working Group, whether multi-generational genetic resistance is developing towards

synthetic pyrethroids, and aid in the development and establishment of a sustainable resistance-management programme to assist growers in the future. The study is ongoing.

Funding was obtained for the continuation of a collaborative study applying both entomology and plant pathology disciplines. The study investigates the vector potential of various avocado pests and furthermore investigates the pathogen potential of various fungi pathogens. The study commenced end of 2015 and is being conducted in the Nelspruit region of South Africa.

Aquatic ecology - Prof Linda Basson and Prof Liesl van As

Our group was busy with a major research project in the Okavango Delta for two decades, resulting in 13 MSc and five PhD students completing their studies to date, as well as numerous published articles and conference contributions. Currently, we are following up on selected topics. During the 2017 surveys we focused on collections in the Constructed Treatment Wetland and collected a number of fish-parasite species for molecular analysis.

Etho-ecology - Hennie Butler

The etho-ecology study group focuses on various aspects of animal behaviour in their natural environment. Many of these studies are focused on problem-solving with regard to whether animals are influenced by man or cause damage to humankind. We also initiated research on the biodiversity of the Grassveld Biome and launched a project focusing on the effect of dehorning on the behaviour of rhinoceros.

Environmental Entomology and Dipterology - Dr Vaughn Swart

This research group currently has three PhD, two MSc, and two Honours students. Research includes insects as indicators of aquatic ecosystems, inter- and intra-species variation within *Aedes* spp (mosquitos), the efficacy of plant extracts as repellents of *Lucilla* spp., management of fruit flies on table grapes in the Orange River Valley, and soil macrofauna as indicators. Ongoing research has also been done on the taxonomy and phylogeny of wormlion (Diptera: Vermileonidae).

Herpetology - Prof Neil Heideman and Lindi Heyns

Current projects related to postgraduate work:

- Reproduction, diet, and sexual dimorphism in an agama and lacertid species (Hons project).
- Phylogeography, population genetics, and morphology of the tent tortoise complex in South Africa (MSc project).
- Habitat utilisation and related ecological aspects of a berg adder species on the Mpumalanga escarpment (MSc project).

Nematology - Dr Candice Jansen van Rensburg

Currently, research in this group is focused on plant-parasitic and free-living freshwater nematodes occurring in nature reserves in the Free State. Free-living aquatic nematodes are studied at the Willem Pretorius and Soetdoring Nature Reserves in the Free State. Nematodes are also identified from soil samples collected in the Okavango Delta for publication purposes. The study group hopes to increase the current knowledge on freshwater nematodes, especially from wetland ecosystems and nature reserves.

Tick Research Unit - EMSP van Dalen

Research include evaluation of results from tick collections sent in from various areas in South Africa and tested for the presence of tick resistance against the commercially available acaricides in order to monitor the spread of tick resistance over time.

The invasion of the Asiatic blue tick *(Rhipicephalus microplus*) on a commercial farm near Grahamstown in the Eastern Cape was investigated, as well as the presence of the pathogen *Babesia bovis*, transmitted by this tick species to cause Asiatic redwater in cattle.

The development of a testing system to determine the efficacy and possible development of blue-tick resistance against Macrocyclic lactones, an injectable remedy for tick control, was investigated.

Community Service

Etho-ecology – Hennie Butler

Hennie Butler accompanied and presented talks to the Eco 4 X 4 Club of Bloemfontein in the western Free State on two occasions.

Tick Research Unit – Ellie van Dalen

This unit tests blue-tick collections from commercial and communal areas to determine the tick acaricide-resistance profiles for a specific farm or area and to make recommendations for resistance management.

Articles were published in the January to March editions of *Veeplaas* and *Stock Farmer* to educate producers on tick biology, ecology, and resistance management.

Wildlife and Conservation Research – Dr Mdu Ndlovu

Dr Ndlovu served in several NRF-funding (e.g. CPRR, CSUR, FBIP, SARCHI and Thuthuka) adjudication panels, and was invited to be part of the team that reviewed the SANParks Kruger National Park Management Plan for the period 2018-2028. He was also nominated by South Africa and Zimbabwe to serve as their representative expert for the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), Africa regional assessment scoping expert in 2017 for 2018.

National and International Collaboration

Applied Agricultural Entomology – De Villiers Fourie

National

- Dr Schalk Schoeman (Nelspruit Agricultural Research Council).
- M Schoeman (Nelspruit Agricultural Research Council).
- Dr Elsje Kleynhans (South African Subtropical Growers' Association (**Subtrop**).

Aquatic Ecology – Prof Linda Basson and Prof Liesl van As

International

- Dr Gustavo Valladao – a veterinarian from Mexico (*Laboratório de Patologia de Organismos Aquáticos* (LAPOA) Rodovia Paulo Donato Castellane s/n CEP 14884-000 Jaboticabal (SP)).
- Dr Barbara Novak – researcher at the Institute for Marine and Antarctic Studies, University of Tasmania, Newnham, Tasmania, Australia.
- Prof Kurt Buchmann – a professor and researcher in the Department of Parasitology and Aquatic Pathobiology, Stigbøjlen, University of Copenhagen, Denmark.
- Dr František Moravec, Institute of Parasitology, Biology Centre of the Academy of Sciences of the Czech Republic.

Wildlife and Conservation Research - Dr Mdu Ndlovu

National

- Dr Tshifhiwa Nangammbi, Tshwane University of Technology (TUT), Pretoria (Haemoparasite surveillance in the Lowveld region of South Africa).
- Dr Danny Govender, South African National Parks (SANParks), Kruger National Park (Haemoparasite surveillance in the Lowveld region of South Africa).
- Prof Felicity Burt, Department of Medical Microbiology and Virology, Health Sciences, University of the Free State.

Arachnology – Dr Charles Haddad

International

- Dr Ansie Dippenaar-Schoeman and Robin Lyle (ARC – Plant Protection Research Institute, Pretoria): South African National Survey of Arachnida.
- Prof Stano Pekár and Dr Lenka Petrakova (Masaryk University, Prague): spider predation biology.
- Dr Jiri Kral, Dr Franticek Stahlavky, and Pavel Just (Charles University, Prague): arachnid karyology.
- Dr Galina Azarkina (Russian Academy of Sciences, Novisibirsk): spider systematics.
- Dr Matjaz Kuntner (Slovenian Academy of Sciences, Ljubljana): spider reproductive biology and evolution.
- Dr Martin Ramirez (Museo Argentino de Ciencias Naturales, Buenos Aires): spider systematics.
- Prof Wanda Wesolowska (University of Wroclaw, Wroclaw): spider systematics.

Etho-ecology – Hennie Butler

National

- Hennie Butler collaborated with Dr Francois Deacon from the Department of Animal, Wildlife and Grassland Sciences on giraffe research.

Environmental Entomology and Dipterology - Dr Vaughn Swart

National

- Drs Alan Kemp and Lynette Koekemoer (National institute for Communicable Diseases).
- Prof Felicity Burt (Department of Medical Microbiology and Virology, Health Sciences, UFS).
- Dr Elmarie van der Watt (Department of Soil, Crop and Climate Sciences, UFS).

International

- Dr Robert Copeland (International Centre of Insect Physiology and Ecology).
- Dr Norman Woodley (United States Department of Agriculture).

Herpetology – Prof N Heideman and L Heyns

National

- Planning is underway with colleagues from three departments on campus (Genetics, Cell Biology and Haematology, Virology [Next Generation Sequencing Unit]) and from the Department of Biodiversity and Conservation Biology at the University of the Western Cape, to study limb regression and loss in the lizard genus *Scelotes* at a genomic level.
- Planning is underway with colleagues from the Department of Biodiversity and Conservation Biology at the University of the Western Cape for a reassessment of the conservation status of a series of semi-legless skinks belonging to the genus *Scelotes* along the Cape West Coast.

International

- An MSc student in Environmental Science is currently jointly supervised by a colleague at the University of Namibia.

Postgraduate Students

Students who obtained their degrees in 2017:

A Barnard (MSc interdisciplinary in Entomology and Genetics)
AE Botha (MSc in Zoology)
Z Mbo (MSc in Entomology)
AP van Rooyen (MSc in Entomology)
RE Wiid (MSc in Zoology)
EE Wiid (MSc in Zoology)
S Mohlakoana (MSc in Zoology)
M Esterhuyse (MSc in Entomology)
C de Beer (PhD in Entomology)
L Whitehead (BScHons Entomology)
N Aucamp (BScHons Entomology)
R Booysen (BScHons Entomology)
C Duma (BScHons Zoology)
M Masitha (BScHons Zoology)
M Mdhlalose (BScHons Zoology)
S Momberg (BScHons Zoology)
K Sutherland (BScHons Zoology)

Arachnology – Dr Charles Haddad

Sicelo Sebata (PhD candidate), Hannelene Badenhorst (PhD candidate), Zingisile Mbo (PhD candidate), and Ruan Booysen (BScHons) (all ongoing).

Etho-ecology – Hennie Butler

Two students received their master's degrees in Zoology.

Roelof Wiid; Population dynamics and management of invasive rock hyraxes, *Procavia capensis* (Pallas, 1766) in the central Free State, South Africa.

Elsabè Wiid; Aspects of geophagy amongst dairy cattle in a feedlot system.

Tick Research Unit – Ellie van Dalen

Master's:

Esterhuysen, M. Dissertation: Arthropod resistance presented by Zebu (*Bos indicus*), Brahman breed cattle and their crosses with *Bos Taurus* cattle in the Free State, South Africa. Supervisor: EMSP van Dalen. Co-supervisor: Dr S Brink (completed).

Lesenyeho, SK. Dissertation: Resistance of the African blue tick (*Rhipicephalus* (*Boophilus*) *decoloratus*) to Macrocyclic lactones in the Eastern Cape, South Africa (near completion).

Marais, A. Dissertation: The distribution of *Babesia bigemina* and *Babesia bovis* transmitted by *Rhipicephalus* spp. on a farm in the Eastern Cape. Supervisor: EMSP van Dalen (near completion).

Motolo, TC. Dissertation: The cascading trophic accumulation of Aldicarb in a carrion ecosystem: the forensic implications. Supervision: Dr SL Brink, Co-Supervisor: EMSP van Dalen (near completion).

Pottinger, M. Dissertation: The distribution of *Rhipicephalus (Boophilus) microplus* and *Rhipicephalus (Boophilus) decoloratus* on a farm in the Eastern Cape Province, South Africa. Supervisor: EMSP van Dalen (near completion).

Honours:

Duma, C. Hons year project: Comparison of tick control remedies containing pyrethroids on the survival of Blue tick larvae (*Rhipicephalus decoloratus*) using Shaw Larval Immersion Test. Supervisor: EMSP van Dalen (completed).

Herpetology – N Heideman

Master's:

Mohlakoana, TSG. Dissertation: Taxonomy and Aspects of the ecology of the giant legless skink, Acontias plumbeus (Reptillia: Scincidae). (completed)

STAFF MATTERS

Dr Sonja Brink resigned and was appointed in the Department of Genetics. She is still involved with postgraduate students in our department.

NW Mokhethi was appointed as Officer: Professional Services and secretary to Prof Linda Basson in August 2017.

RESEARCH OUTPUTS

Research Articles

Barkhuizen, LM, Weyl, OLF, and Van As, JG. 2017. An assessment of recreational bank angling in the Free State Province, South Africa. *Water SA* 43: 442-449.

Busschau, T, Conradie, W, Jordaan, A, and Daniels, SR. 2017. Unmasking evolutionary diversity among two closely related South African legless skink species (Acontinae: *Acontias*) using molecular data. *Zoology* 121: 72-82.

Ermilov, SG, and Hugo-Coetzee, EA. 2017. New data on oribatid mites of the family Suctobelbidae (Acari: Oribatida) from South Africa, with description of a species of the genus *Suctobelbella. Biologia* 72: 536-541.

Ermilov, SG, Hugo-Coetzee, EA, and Khaustov, AA. 2017. Two new species of the genus *Ausoribula* (Acari, Oribatida, Oribatulidae) associated with termitaries of South Africa. *Acarologia* 57: 643-650.

Ermilov, SG, Hugo-Coetzee, EA, and Khaustov, AA. 2017. Contribution to the knowledge of oribatid mites of the family Lohmanniidae (Acari, Oribatida). *Systematic and Applied Acarology* 22: 666-682.

Haddad, CR, and Mbo, Z. 2017. A new species of the endemic South African spider genus *Austrachelas* (Araneae: Gallieniellidae) and first description of the male of *A. bergi*. *Zootaxa* 4323: 119-124.

Hoving, JC, Cutler, AJ, Leeto, M, Horsnell, WGC,

Dewals, BG, Nieuwenhuizen, NE, and Brombacher, F. 2017. Interleukin 13-mediated colitis in the absence of IL-4Rα signalling. *Gut* http://dx.doi.org/10.1136/gutjnl-2016-313208.

Khaustov, AA, Hugo-Coetzee, EA, and Ermilov, SG. 2017. A new genus and two new species of Pygmephoridae (Acari: Heterostigmata) associated with *Trinervitermes trinervoides* (Isoptera: Termitidae) from South Africa. *Systematics and Applied Acarology* 22: 484-493.

Khaustov, AA, Hugo-Coetzee, EA, and Ermilov, SG. 2017. A new genus of the mite family Scutacaridae (Acvari: Heterostigmata) associated with associated with *Trinervitermes trinervoides* (Isoptera: Termitidae) from South Africa. *Zootaxa* 4258: 462-476.

Lindsay, K, Chase, M, Landen, K, and Nowak, K. 2017. The shared nature of Africa's elephants. *Biological Conservation*, 215: 260-267.

Martin, JG, Pirotta, E, Petelle, MB, and Blumstein, DT. 2017. Genetic basis of between-individual and within-individual variance of docility. *Journal of evolutionary biology*, 30: 796-805.

Ndlovu, M, Cumming GS, and Hockey, PAR. 2017. Body mass and pectoral muscle size changes in African waterfowl during moult. *African Journal of Wildlife Research* 47: 24-31.

Ndlovu, M, Hockey, PAR, and Cumming, GS. 2017. Geographic variation in factors that influence timing of moult and breeding in waterfowl. *Zoology* 121: 100-106.

Nowak, K, Wimberger, K, Hill, RA, Richards, SA, and Le Roux, A. 2017. Samango monkeys (*Cercopithecus albogularis labiatus*) manage risk in a seasonal, heterogeneous landscape in Amathole Mountains, South Africa. *International Journal of Primatology* 38: 194-206.

Renda, S, and Le Roux, A. 2017. Sensory ecology of prey detection in the bat-eared fox (*Otocyon megalotis*). *Behaviour* 154: 227-240.

Řezáč, M, Krejčí, T, Goodacre, S, Haddad, CR, and Řezáčová, V. 2017. Morphological and functional diversity of minor ampullate glands in spiders from the superfamily Amaurobioidea (Entelegynae: RTA clade). *Journal of Arachnology* 45: 198-208.

Smit, J, Pozo, RA, Cusack, JJ, Nowak, K, and Jones, T. 2017. Using camera traps to study the age–sex structure and behaviour of crop-using elephants *Loxodonta africana* in Udzungwa Mountains National Park, Tanzania. *Oryx* 1-9.

Smith, JE, Petelle, MB, Jerome, EL, Cristofari, H, and Blumstein, DT. 2017. Oxytocin experiments shed light on mechanisms shaping prosocial and antisocial behaviors in non-human mammals. *Integrative and Comparative Biology*, 57: 619-630.

Van As, LL, Basson, L, and Van As, JG. 2017. Mobiline Peritrichs (Ciliophora) collected from the gills of African limpets. *Acta Protozoologica* 56: 245-254.

Van As, LL, Smit, NJ, and Van As, JG. 2017. Rediscovery of *Chonopeltis meridionalis* Fryer, 1964 (Crustacea: Branchiura) from *Labeo rosae* Steindachner, in the River Olifants, Mpumalanga, and the taxonomic status of *C. victori* Avenant-Oldewage, 1991 and *C. koki* Van As, 1992. *Systematic Parasitology* 94: 797-807. DOI 10.1007/s11230-017-9737-1.

Welch, R, Périquet, S, Petelle, M, and Le Roux, A. 2017. Hunter or hunted? Perceptions of risk and reward in a small mesopredator. *Journal of Mammalogy* 98: 1531-1537.

Wimberger, K, Nowak, K, and Hill, RA. 2017. Reliance on exotic plants by two groups of threatened samango monkeys, *Cercopithecus albogularis labiatus*, at their southern range limit. *International Journal of Primatology* 38: 151-171.

Chapters in Books

Woodley, NE, and Swart, VR**.** 2017. 36. Vermileonidae (wormlions). In: Kirk-Spriggs, AH and Sinclair, BJ, eds, *Manual of Afrotropical Diptera. Volume 2. Nematocerous Diptera and lower Brachycera*. Suricata 5. Pretoria: SANBI Graphics and Editing, pp 865-875.

Conference Contributions

Adendorff, J, Jankielsohn, A, Louw, SvdM, and Mohase, L. 2017. *Antioxidant enzymes in wheat play a role in Alexin™ mediated resistance in Russian wheat aphid* (paper). Joint XIX Entomological Society of Southern Africa (ESSA) and the 37th Zoological Society of Southern Africa (ZSSA) Congress, July 2017 at Pretoria University, South Africa.

Badenhorst, H, Janion-Scheepers, C, and Louw, SvdM. 2017. *The effect of pollutants and agricultural practices on soil mesofaunal practices* (paper). Joint XIX Entomological Society of Southern Africa (ESSA) and the 37th Zoological Society of South Africa (ZSSA) Congress, July 2017 at Pretoria University, South Africa.

Basson, L, and Swanepoel, PJ. 2017. *Diversity of fish parasites from a survey in the Phongola Floodplain* (paper). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA) held at the Kruger National Park, South Africa.

Booysen, R, and Haddad, CR. 2017. *A comparative study of the efficiency of the SANSA sampling protocol in determining non-acarine diversity during winter and summer in Western KwaZulu-Natal, South Africa* (paper). 12th Colloquium of the African Arachnological

Society, Goudini Spa and Resort, South Africa.

Bopheka, L, Van As, J, and Van As, LL. 2017. *First record of a Trypanosoma species Austroglanis sclateri (Boulenger, 1901) from Sterkfontein Dam, South Africa* (paper). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA) held at the Kruger National Park, South Africa.

Botham, JL, Swart, VR, Bredenhand, E, and Haddad, CR. 2017. *Forest patch status and soil health indices along a topographical gradient within Afromontane grasslands* (paper). Joint XIX Entomological Society of Southern Africa (ESSA) and the 37th Zoological Society of South Africa (ZSSA) Congress, July 2017 at Pretoria University, South Africa.

Brink, S. 2017. *Forensic Entomology: Are we operating at a silo mentality level?* (paper) African Society of Forensic Medicine Congress, 6-10 March.

Coertzen, J, and Fourie, DeV. 2017. *The dissemination of fungal pathogens on avocado trees in South Africa with reference to vector potential of insect pests* (paper). South African Avocado Growers Association research symposium, 2017, Tzaneen, Limpopo, South Africa.

Cook, CA, Netherlands, EC, Smit, NJ, and Van As, J. 2017. *Haemogregarine biodiversity parasitising snakes of KwaZulu-Natal, South Africa* (paper). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA) held at the Kruger National Park, South Africa.

Cook, CA, Netherlands, EC, Smit, NJ, and Van As, J. 2017. *Reptiles of KwaZulu-Natal, South Africa, a blood parasite's paradise* (paper). Herpetological Association of Africa's 13th Herpetological Conference, Bonamanzi, KwaZulu-Natal, South Africa.

De Jager, G, Basson, L, and Van As, JG. 2017. *The great American Trichodinid?* (paper) 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA) held at the Kruger National Park, South Africa.

De Jager, G, Van Marwijk, J, Opperman, DJ, Basson, L, and Van As, JG. 2017. *Trichodina heterodentata Duncan, 1977 (Ciliophora: Peritrichia) species description inferred from 18S rDNA sequenced and the evaluation of a possible species complex* (poster). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA) held at the Kruger National Park, South Africa.

Dippenaar-Schoeman, AS, Haddad, CR, Foord, SH, Lyle, R, and Lotz, LN. 2017. *SANSA - The state of our spiders: how far have we come and where are we going?* (paper) 12th Colloquium of the African Arachnological Society, Goudini Spa and Resort, South Africa.

Dippenaar-Schoeman, AS, Haddad, CR, Pryke, J, Uys, C, and Larsen, N. 2017. *Spider diversity of the Table Mountain National Park* (poster). 12th Colloquium of the African Arachnological Society, Goudini Spa and Resort, South Africa.

Edwards, G, and Haddad, CR. 2017. *Do specialist termitophagous Ammoxenus amphalodes (Ammoxenidae) show a preference for sand mounds of their prey, Hodotermes mossambicus (Hodotermitidae)?* (poster). 12th Colloquium of the African Arachnological Society, Goudini Spa and Resort, South Africa.

Esterhuyze, MM, Van Dalen, EMSP, and Brink, SL. 2017. *A comparative study of ectoparasite tolerance between purebred Brahman (Bos indicus) Linnaeus, Sussex (Bos Taurus) Linnaeus and Brahman x Sussex crossbred cattle in the Free State, South Africa* (paper). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA), Kruger National Park, South Africa.

Fourie, DeV, Schoeman, S, and Louw, SvdM. 2017. *Investigation of possible pyrethroid resistance development in two-spotted stinkbug, Bathycoelia distincta (Hemiptera: Pentatomidae), on macadamia in South Africa* (paper). Entomological Society of Southern Africa (ESSA 2017) National conference in Pretoria, Gauteng, South Africa.

Haddad, CR. 2017. *How important is understanding microhabitat preferences of spiders to exposing true patterns of biodiversity and distribution?* (paper). 12th Colloquium of the African Arachnological Society, Goudini Spa and Resort, South Africa.

Haddad, CR, Ceccarelli, FS, Ramírez, MJ, and Owen, CA. 2017. *The intertidal spider genus Amaurobioides (Araneae: Anyphaenidae) in the Afrotropical Region: revision, biogeography and new data on biology* (paper). 12th Colloquium of the African Arachnological Society, Goudini Spa and Resort, South Africa.

Hayes, PM, Cranenburgh, TS, Cook, RT, Van As, J, Smit, NJ, and Lawton, SP. 2017. *Morphological and molecular insights into the diversity of filarial nematodes infecting lizards in South Africa* (poster). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA), Kruger National Park, South Africa.

Janion-Scheepers, C, and Louw, SvdM. 2017. *A need for soil biota ecological function in southern Africa* (paper). Joint XIX Entomological Society of southern Africa (ESSA) and the 37th Zoological Society of Southern Africa (ZSSA) Congress, Pretoria University,

South Africa. July.

Jansen van Rensburg, C. 2017. *Nematode survey from one of Africa's last unspoiled wildernesses* (paper). 21st Nematode Society of Southern Africa (NSSA) symposium, Ballito, South Africa.

Kay, BJ, Swart, VR, and Van der Watt, E. 2017. *Evaluation and comparison of plant extracts in the management of Lucilia spp* (paper). Joint XIX Entomological Society of Southern Africa (ESSA) and the 37th Zoological Society of Southern Africa (ZSSA) Congress, July 2017 at Pretoria University, South Africa.

Le Roux, A, and Hansen, M. 2017. *Must science #fall for a real connection to be forged with society?* (paper) Symposium organiser at Zoological Society of Southern Africa (ZSSA) conference, Pretoria.

Le Roux, A, Welch, R, and Renda, S. 2017. *The sensory world of a large-eared canid* (paper). International Mammalogical Conference (IMC) in Perth, Australia.

Lesenyeho, SK, and Van Dalen, EMSP. 2017. *Resistance of the African blue tick (Rhipicephalus (Boophilus) decoloratus) to Macrocyclic Lactones in the Eastern Cape, South Africa* (paper). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA), Kruger National Park, South Africa.

Louw, SvdM. 2017. *Managing change in cropping system soils requires strategic thinking* (paper). Joint XIX Entomological Society of Southern Africa (ESSA) and the 37th Zoological Society of Southern Africa (ZSSA) Congress, Pretoria University, South Africa. July.

Marais, A, and Van Dalen, EMSP. 2017. *Identification of tick-borne diseases, Babesia bovis and Babesia bigemina, spread by tick species on a farm in the Eastern Cape* (poster). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA) held at the Kruger National Park, South Africa.

Mitchell, D, Christison, KW, Van As, LL, and Vaughn, D. 2017. *Hexabothriid parasites from Rajidae species of South Africa* (paper). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA), Kruger National Park, South Africa.

Moeti, AT, Brink, SL, and Louw, SvdM. 2017. *Description of the life stages of beetles in the carrion ecosystem of the central Free State* (paper). Joint XIX Entomological Society of Southern Africa (ESSA) and the 37th Zoological Society of Southern Africa (ZSSA) Congress, Pretoria University, South Africa. July.

Mofokeng, TL, Cook, CA, Van As, M, Netherlands, EC, and Van As, J. 2017. *The biology of a Haemococcidium parasitizing Pedioplanis burchelli (Sauria: Lacertidae), eastern Free State, South Africa* (paper). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA), Kruger National Park, South Africa.

Ndou, ZL, Swart, VR, Henschel, JR, and Louw, SvdM. 2017. *Brown locust outbreaks in the Karoo: historic records and a plan to understand the origins of outbreaks* (poster). Joint XIX Entomological Society of Southern Africa (ESSA) and the 37th Zoological Society of Southern Africa (ZSSA) Congress, Pretoria University, South Africa. July.

Nyoka, NW-K, Voua Otomo, P, and Prinsloo, GJ. 2017. *Assessing the effects of biochar on the toxicity of the agrochemical imidacloprid on potworms (Enchytraeus albidus*) (paper). 27th Annual Meeting Society of Environmental Toxicology and Chemistry (Europe), Brussels, Belgium.

Pori, T, Ndlovu, M, Markus, M, and Govender, D. 2017. *Avian Haemoparasite prevalence in Kruger National Park, South Africa* (paper). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA), Kruger National Park, South Africa.

Pori, T, Ndlovu, M, Govender D, Markus, M, and Pierce, M. 2017. *Avian haemoparasite prevalence in Kruger National Park, South Africa* (paper). 15th Annual Savanna Science Network Meeting, Skukuza, South Africa.

Pottinger, M, and Van Dalen, EMSP. 2017. *The invasion of Rhipicephalus (Boophilus)__microplus (Acari: Ixodidae) on a farm in the Eastern Cape province, South Africa* (poster). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA) held at the Kruger National Park, South Africa.

Sebata, S, Haddad, CR, Foord, SH, and Fitzpatrick, M. 2017. *Spiders and holistic management practices at Debshan Ranch, Shangani, Zimbabwe* (paper). 12th Colloquium of the African Arachnological Society, Goudini Spa and Resort, South Africa.

Seetsi, A, Van As, J, Thekisoe, MMO, Leeto, M. 2017. *Haemoparasite infections and relationship with adaptive immune responses in Afromontane lizards of the eastern Free State Province* (poster). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA) held at the Kruger National Park.

Smit, T, Louw, SvdM, and Swart, VR. 2017. *Invasion of Bactrocera dorsalis (Diptera: Tephritidae) into vineyards along the lower Orange River, Northern*

Cape (paper). Joint XIX Entomological Society of Southern Africa (ESSA) and the 37th Zoological Society of Southern Africa (ZSSA) Congress, July 2017 at Pretoria University, South Africa.

Van As, J, Cook, CA, Netherlands, EC, and Smit, NJ. 2017. *Sporogonic biology of Plasmodium intabazwe Van As, Cook, Netherlands and Smit 2016 in scale mites Ixodiderma inverta Lawrence, 1935 infesting crag lizards* (poster). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA) held at the Kruger National Park, South Africa.

Van As, JG, and Van As, LL. 2017. *The disjunct distribution of branchiuran fish parasites* (paper). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA) held at the Kruger National Park, South Africa.

Van As, M, Van As, J, Cook, CA, and Smit, NJ. 2017. *Ticks as possible vectors of a Hepatozoon species (Apicomplexa: Adeleorina: Hepatozoidae) infecting wild African leopards, Panthera pardus pardus (Linnaeus, 1758), in South Africa* (poster). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA) held at the Kruger National Park, South Africa.

Van As, LL., Basson, L, and Van As, JG. 2017. *Ciliophorans collected from a wide variety of hosts from the Okavango system, Botswana* (paper). 3rd International Congress on Parasites of Wildlife (ICPOW), hosted by the Parasitological Society of Southern Africa (PARSA), Kruger National Park, South Africa.

Van der Merwe, SS, Swart, VR, Bredenhand, E, and Haddad, CR. 2017. *Soil biota as bioindicators of erosion levels and fire disturbances in Afromontane grassland areas within the Golden Gate Highlands National Park* (paper). Joint XIX Entomological Society of Southern Africa (ESSA) and the 37th Zoological Society of Southern Africa (ZSSA) Congress, July 2017 at Pretoria University, South Africa.

Van Rooyen, A, Swart, VR, and Moore, S. 2017. *An ecological analysis of stinkbug and lepidopteran borer complexes associated with pecan and citrus orchards* (paper). Joint XIX Entomological Society of Southern Africa (ESSA) and the 37th Zoological Society of Southern Africa (ZSSA) Congress, July 2017 at Pretoria University, South Africa.

Voua Otomo, P, Dioh Lobe, DP, and Filser, J. 2017. *Avoidance behaviour of Enchytraeus albidus (Oligochaeta) after exposure to AgNPs and AgNO3 at fluctuating temperatures* (paper). 27th Annual Meeting Society of Environmental Toxicology and Chemistry (Europe), Brussels, Belgium.

Whitehead, L, Swart, VR, and Gryzenhout, M. 2017. *DNA Barcoding of Aedes (Diptera: Culicidae) in the Free State Province, South Africa* (poster). Joint XIX Entomological Society of Southern Africa (ESSA) and the 37th Zoological Society of Southern Africa (ZSSA) Congress, July 2017 at Pretoria University, South Africa.

Whitehead, L, and Haddad, CR. 2017. *Effect of veld fire and road disturbances on the abundance and species richness of spiders associated with Hyparrhenia hirta grass tussocks* (poster). 12th Colloquium of the African Arachnological Society, Goudini Spa and Resort, South Africa.

STAFF

Distinguished Professors: Prof LJ Fourie.

Professors: Prof L Basson, Prof NJL Heideman, and Prof Schalk vdM Louw.

Associate Professor: Prof LL van As and Prof A le Roux.

Senior Lecturers: Dr CH Haddad, Dr M Ndlovu, and Dr P Voua Otomo.

Lecturers: Dr E Bredenhand, Dr S Brink, Dr C Jansen van Rensburg, Dr PM Leeto, Dr VR Swart, Dr J van As, L Heyns, M van As, EMP van Dalen, and HJB Butler.

Junior Lecturers: De Villiers Fourie.

Postdoctoral Fellows: Dr Antón D Pérez-Rodríguez and Joaquin Verdu-Ricoy.

Research Associates: Prof JG van As, Dr LM Barkhuizen, Dr J Botha-Brink, Dr KW Christison, Dr L Coetzee, Dr Y Marusik, Dr EA Hugo-Coetzee, Dr C Scheepers, and Dr NA Rayner.

Officers, Professional Services: NW Mokhethi, MP Sithole, and JM Mabena.

Senior Assistant Officer: B Maasdorp and SAM Teele.

ACADEMIC CENTRES

Disaster Management Training

and Education Centre for Africa – DiMTEC

Contact Details

Prof Andries J Jordaan

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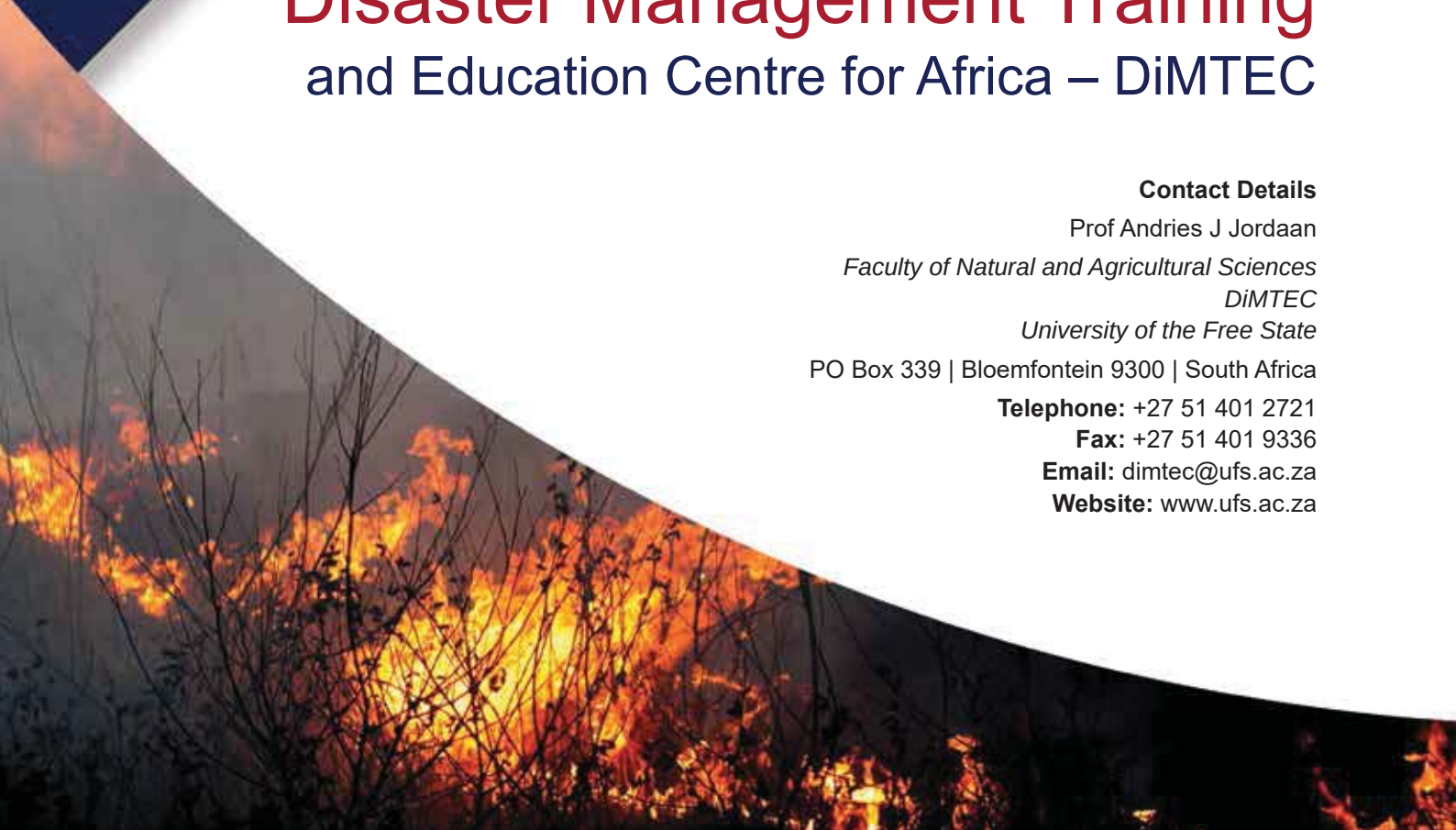


2017 Overview

2017 will be remembered as the year when two of our staff members obtained their PhDs. Drs Belle and Ncube received their PhDs during the June and December graduations respectively. Dr Muluke Fenta also received his PhD during the December ceremony.

We again had a busy international programme, with 13 international scientists visiting and attending our international conference during February. Scientists from Germany, Hungary, Romania, and the Netherlands participated in the DiMTEC international conference and joined our team on a tour to disaster-management centres in Nelson Mandela Bay, George, and Cape Town. Among these visitors was the cosmonaut Dimitriou Prunario, the first Romanian to enter space on the Russian spacecraft Soyuz 40.

DiMTEC is also proud on the successful implementation of the ERASMUS exchange programme with the National University of Public Service in Hungary. Prof Jordaan and Dr Belle each spent two weeks in Budapest as guest lecturers, with Prof Agoston Restas visiting us on a two-week exchange programme. Four of our PhD students, Fummie Muyambo, Albert Maiipisi, Dr Alice Ncube, and Siviwe Shwababa, respectively spent five and three months in Hungary.

2017 was our most productive year to date concerning publications, with 17 papers published by DiMTEC staff and students. Our staff also attended and presented at eight national conferences. The US Forest Service invited Prof Jordaan to a month-long training programme on Incident Command Systems in the USA. The objective of the training was to assist South Africa in the implementation of an incident command system for the whole country.

The DiMTEC academic team was also strengthened with the appointment of Prof Joerg Szarzynski and Prof Fabrice Renaud as Affiliated Associate Professors.

ACHIEVEMENTS

Staff Achievements

Dr Belle and Dr Ncube both received their PhDs during 2017.

Prof Jordaan was invited by the US Forests Service to attend a month-long training programme on Incident Command in the USA.

Prof Jordaan was invited as a disaster management expert on the UNOCHA mission to Namibia.

Student Achievements

2017 Advanced University Diploma

CHOCHE, Mogomotsi Cathrine
HARRIS, Toysten Vernen

KHOZA, Moses
KHUMALO, Nkosinathi Sameul

KHUMALO, Vuyiswa Sinenhlanhla
KODISANG, Makgosi Luisa Jacqueli

KUBHEKA, Bongeka Nokwethemba
LOUW, Izak Jacobus

MABENGU, Mabel Ncumisa
VETSHEZA, Tobani Friend

MAGALE, Mmampe Shirley
MALAMBO, Judith Mainza

MATSIDIDI, Mollin
MEHLOMAKULU, Lusanda

MOFOKENG, Masebele Eyenurse
MOKATI, Josepth Tsoeu Washi

MORKEL, Kelly
MPHAKI, Masoga Gerson

MSWANE, Goodan Lindani
MTHEMBU, Mduduzi Twince

MTHEMBU, Zamukwanda Bukhosibakhe
MUKWASHI, Tsungai

NYATHI, Admire Jealous
SAMSON-AKPAN, Aniebo Benita

VILAKAZI, Akhona Paricia

YALALA, Nonhlanhla Ndhlovu

TSHABALALA, Melita Macia

2017 Master's Degree Graduates

ATSHIPARA, Frans Ndadhnitha
CHISUTA, Kagebel Makoye

FAKUDE, Bongani Christopher
MOSOTHO, Lebogang Linah

MOTLHALE, Tshepo Enoch
MULLER, Garret Josiah

NZUZA, Sizwe Louis
RWILIRIZA, Kellen Namara

SIMUKOKO, Joseph Ivwananji
TAWODZERA, Margaret

CALENI, Jacob Siphiwe
LUBANGA,Samkelisiwe

NANGOLO, Asser Inekela
PULLIAN, Naven Kasenthiren

TSABEDZE, Qinisile Samkelisiwe

2017 PhD Graduates

BELLE, Johannes Amate

NCUBE, Alice

FENTA, Muluken Mekuyie

Activities

International visits

Prof Jordaan:

Led the South African delegation to Berlin for meetings with the Free University of Berlin and the International Red Cross, as well as to Hamburg, where he facilitated a workshop with the focus on South Africa at the 7th International Water Network symposium. He concluded his trip with a visit to Berlin for the EvIDENz workshop with the University of Bonn, the United Nations University, UNCCD, UNFCCC, and other UN organisations.

Led the South African delegation to the National Drought Mitigation Centre in Lincoln, Nebraska, USA, and to the US Forestry Service in Montana, USA, visiting active wildfire fighting and incident command in action.

Invited by the United States Forest Service to the International Disaster Management Seminar. Participated in three-week training in the USA on FEMA National Incident Management System and Incident Command.

Member of South African scientific delegation to 2017 ISDR Global Platform, Cancun, Mexico.

Dr Belle:

Participated in the Erasmus+ International Mobility programme as exchange lecturer at the National University of Public Service, Budapest, Hungary.

Dr Ncube:

Participated in the Erasmus+ International Mobility programme as exchange PhD student at the National University of Public Service, Budapest, Hungary.

RESEARCH

WRC project: Vulnerability, adaptation to, and coping with drought: The case of commercial and subsistence rain-fed farming in the Eastern Cape (KSA 4/Thrust 4/P2 Contract nr 2280).

This project was successfully completed at the end of 2017. The main objective of the research was to propose adaptation and coping strategies for drought risk, based on drought-risk assessment for the rain-fed farming sector in the Eastern Cape. This includes both commercial and communal subsistence farmers and considers risk as a function of hazard, economic/social/environmental vulnerability, adaptation, and coping capacity. Drought classification and drought monitor system for South Africa was one of the major outcomes of this project. Vol 1 and 2 is available on www.wrc.org.za and www.dimtec.ac.za

EvIDENz: Earth observation for drought monitoring.

This project is led by the Centre for Remote Sensing of Land Surfaces (ZFL) at the University of Bonn. Partner institutions are the United Nations University, United Nations Office for Outer Space Affairs (UNOOSA), and the Ukraine Satellite Agency. UFS-DiMTEC is the South African partner. This project is funded by the European Space Agency. The main objective of the research is the development of earth observation methods with open source tools for drought monitoring and implementation at national scale.

WRC project: Development of agricultural water-management scenarios for South Africa.

This project focuses on the development of scenarios for agricultural water management in South Africa. Scenario building, in this case, will involve a variety of indicators such as (i) human, (ii) social (iii) cultural, (iv) economic, (v) institutional, (vi) political, (vii) environmental/ecological, (viii) climate change, (ix) global change, and (ix) technology aspects. GAME theory is applied to develop different scenarios. The project duration is from 2017 to 2021 and will include at least two national water simposia. Prof Andries Jordaan is the project leader and principal researcher. Other researchers include Dr Abiodun Ogundeji, Prof Anthony Turton, Prof Sue Walker, Chantelle Illbury, Aniebo Hagan (master's student), and Sebastian Yong

(PhD student); with Gerdamarie van Coppenhagen as Project Administrator.

Community Service

Training of extension officers and farmers, Eastern Cape: Training workshops were facilitated at Mthata, Sterkspruit, Aliwal North, and Port Elizabeth for more than 200 people. The focus of the training was on drought management.

RESEARCH OUTPUTS

Research Articles

Bahta, YT, Jordaan, AJ, and Muyambo, F. 2017. Communal Farmers' perception of drought in South Africa: Policy implication for drought risk reduction. *International Journal of Disaster Risk Reduction* 1: 1-20.

Bahta, YT, Jordaan, AJ, Mdungela, NM. 2017. Indicators for economic vulnerability to drought in South Africa. *Development in Practice* 27(8)1050-1063.

Belle, JA, Collins, N, and Jordaan, AJ. 2017. Building Resilience in Natural Capital to Reduce Disaster Risks and Adapt to Climate Change: A Case of Wetlands in the Eastern Free State; South Africa. *American Journal of Environmental Science* 13 (5): 358-377.

Belle, JA, Moyo, S, and Ogundeji, AA. 2017. Assessing communal farmers' preparedness to drought in the Umguza District, Zimbabwe. *International Journal of Disaster Risk Reduction* 22: 194-203.

Hlalele, BM. 2017. Cointegration analysis of vulnerability index and standardised precipitation index in Mafeteng district, Lesotho. *Jàmbá: Journal of Disaster Risk Studies* 9(1): a330. https://doi.org/10.4102/jamba.v9i1.330.

Kunguma, O, and Skinner, J. 2017. Mainstreaming Media into Disaster Risk Reduction and Management, South Africa. *Disaster Advances* 10(7): 1-11.

Maipisi, A, Jordaan, AJ, Restas, A. 2017. Locating fault lines of flood disaster vulnerability and susceptibility: Lessons to governments, development agencies and practitioners in developing countries. *Vedelem Tudomany/Defence Science.*

Manombe, S, Ncube, A, Kunguma, O, and Nyawho, M. 2017. Nutritional vulnerability in pregnant women: an assessment of the WFP-VGF programme in Mbire District, Zimbabwe. Authors *Jamba Journal of Disaster Risk Studies* 9(1): 1-8.

Muyambo, F, Jordaan, AJ, and Bahta, Y. 2017. Assessing social vulnerability to drought in South Africa: Policy implications for drought risk reduction. *Jamba* 9(1): 326.

Muyambo, F, Bahta, Y, and Jordaan, AJ. 2017. The role of indigenous knowledge in drought risk reduction: A case of communal farmers in South Africa. *Jamba* 9(1): 1-6.

Muyambo, F, Jordaan, AJ, Carstens, SW, Restas, A, and Ndlasi, N. 2017. The role of disaster management during xenophobic violence in developing countries. *Defence Science Journal* 2(2): 152-164.

Muyambo, F, Jordaan, AJ, and Restas, A. 2017. Unmanned aerial vehicle application in developing countries: A life-saving technology in emergencies. *Vedelem Tudomany/Defence Science Journal* 2(1): 1-5.

Muyambo, F, Jordaan, AJ, and Restas, A. 2017. Possibilities of Using Unmanned Aerial Vehicles (UAV) in Developing Countries. *Vedelem Tudomany: Katasztrofavedenmi online Tudomanyos Folyoirat*. Hungary. 9:1-5.

Ncube, A, and Chimenya, GT. 2017. Hospital emergency preparedness: A study of Onandjokwe Lutheran Hospital, Northern Namibia. *African Safety Promotion* 14(2): 1-17.

Sakulski, D, Jordaan, AJ, Lukic, T, Maric, P, Hrnjak, I, Gavrilov, MB, Mladjan, D, Zorn, M, Komac, B, Milosevic, Z, Markovic, SB, Dordevic, J, Pavic, D, and Stojsavljevic, R. 2017. Forest Fire Analysis and classification based on a Serbian case study. *Acta geographica Slovenica* 57(1): 51-63.

Chapters in Books

Jordaan, AJ. 2017. Building Resilience in Africa through Transformation and a Green Economy: Challenges and Opportunities, in Wanglin Yan, William Galloway, (eds.), *Rethinking Resilience, Adaptation and Transformation in a Time of Change.* Springer. ISBN 978-3-319-50171-0.

Conference Contributions

Belle, JA. 2017. *Building resilience with natural capital to reduce disaster risks and adapt to climate change: a case of wetlands in the eastern Free State; South Africa*. 32nd Annual Conference, Disaster Management Institute of South Africa (DMISA), Coega Vulindlela Accommodation and Conference Centre, Port Elizabeth: 27-28 September.

Jordaan, AJ. 2017. *Taking the Guessing out of Drought Disaster Declaration: Drought Indicators for South Africa.* Joint Conference: 3rd AFAAS Africa-Wide Agricultural Extension Week & 51st Annual Conference of the South African Society for Agricultural Extension; Scaling up Climate Smart Agriculture; Integrating Youth, Women and the Digital Revolution. Durban, South Africa. 30 October-3 November.

Jordaan, AJ, Kew, L, and Blaker, J. 2017. *Promoting entrepreneurship and SMMEs through extension: Case of the Mngcunube mentorship programme amongst small-scale livestock farmers*. Joint Conference: 3rd

AFAAS Africa-Wide Agricultural Extension Week & 51st Annual Conference of the South African Society for Agricultural Extension; Scaling up Climate Smart Agriculture; Integrating Youth, Women and the Digital Revolution. Durban, South Africa. 30 October-3 November.

Jordaan, AJ. 2017. *Modelling Disaster Losses: Doing the Near Impossible*. Africa Conference on Economic Costs of Disasters, Johannesburg, South Africa. 23-25 October.

Jordaan, AJ. 2017. *Taking the Guessing out of Disaster Declaration: Drought Indicators for South Africa.* 32nd Annual Conference, Disaster Management Institute of South Africa (DMISA), Coega Vulindlela Accommodation and Conference Centre, Port Elizabeth: 27-28 September.

Jordaan, AJ. 2017. *Agricultural Water Scenarios in SA 2030*. UFS-DiMTEC International Conference: Toward Climate Resilience and Sustainable Water Use in Africa: Bloemfontein, South Africa. 22-23 February.

Jordaan, AJ. 2017. *Building a Climate Resilient Society in Africa; International Trends in Inter- and Trans Disciplinary Research.* UFS-DiMTEC International Conference: Toward Climate Resilience and Sustainable Water Use in Africa: Bloemfontein, South Africa. 22-23 February.

Ncube, A. 2017. *Analysis of African migrant women coping and adaption in South Africa: the human and Social livelihood capitals approach.* 32nd Annual Conference, Disaster Management Institute of South Africa (DMISA), Coega Vulindlela Accommodation and Conference Centre, Port Elizabeth: 27-28 September.

Research Reports

Jordaan, AJ. (Ed). 2017. *Vulnerability, Adaptation to and Coping with Drought: The Case of Commercial and Subsistence Rain Fed Farming in the Eastern Cape*; Vol I & II, WRC Report Nr TT 716/2/17. ISBN 978-1-4312-0885-2. Pretoria.

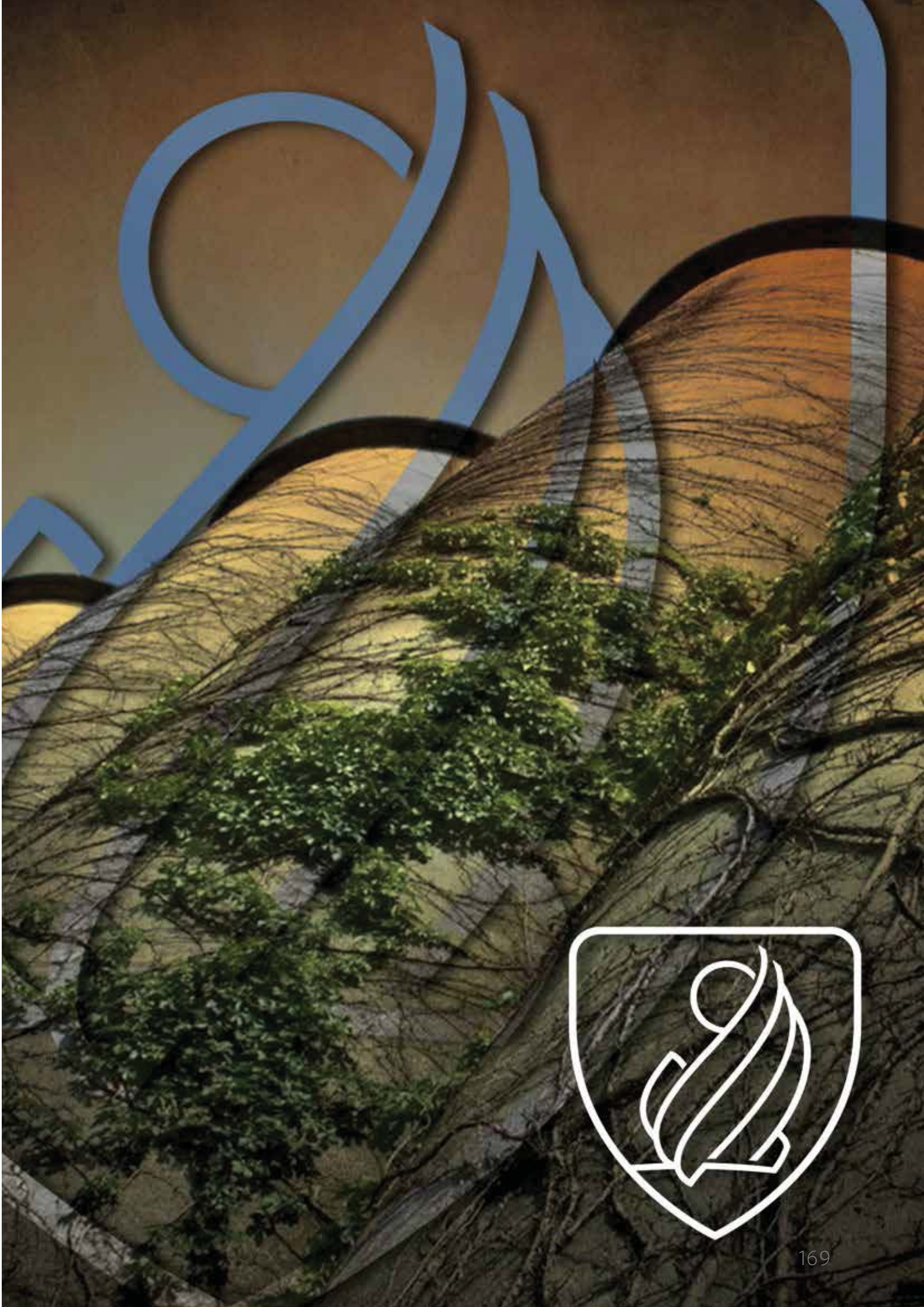
STAFF

Professors: Prof AJ Jordaan, Prof B Grove, and Prof R Bragg.

Lecturers: Dr A Ncube, Dr JA Belle, O Kunguma, Dr E Louw, Dr H Booysen, Dr C Barker, Dr N Matthews, Dr A Ogundeji, Dr D Chikobvu, Dr M Schutte-Smith, L Nogabe, M Joubert, L de Wet, W Ellis, and Dr E du Plessis.

Affiliated Associate Professors: Prof J Szarzynski, and Prof F Renaud.

Senior Assistant Officer: G van Coppenhagen, A van Straten.



ACADEMIC CENTRES

Centre for
Environmental Management – CEM

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2017 Overview

2017 was a very successful year for the Centre for Environmental Management (CEM) – both in terms of research outputs and the delivery of postgraduate students in Environmental Management and Limnology. Our research outputs included six book chapters, 28 articles, and 23 conference contributions, while two PhD students with specialisation in Environmental Management, 33 master's students in Environmental Management, and three BScHons students with specialisation in Limnology received their degrees in 2017. This is in line with the centre's strategy to develop our research profile alongside our postgraduate-degree programmes. We furthermore welcomed Prof Nnenesi Kgabi as an Affiliated Professor, and Dr Carin van Ginkel as a Research Fellow at the centre, but we also had to say goodbye to one of our Research Fellows, Dr Fred Kruger, who unexpectedly died on 20 May 2017. Dr Kruger's sharp wit, honest feedback and advice, and academic rigorousness will be sorely missed.

Dr Fred Kruger, a Research Fellow in the Centre for Environmental Management, unexpectedly passed away on 20 May 2017 at the age of 73. Dr Kruger was the former Director of the South African Forestry Research Institute, and later of the CSIR's Division of Forest Science and Technology

ACHIEVEMENTS

Staff Achievements

Prof Anthony Turton was awarded a Royal Bank of Canada Fellowship by the Water Institute at the University of Waterloo. He also served as an advisory committee member for the *Water, Sewage and Waste* publication.

Prof Anthony Turton and Surina Esterhuyse served as co-editors for the book *Water Legacies of Conventional Mining* published by Routledge, UK and USA.

Surina Esterhuyse served as member of the editorial board for the journal, *Water International*, and participated as a panellist in the monitoring round table at the recent Academy of Science of South Africa (ASSAf) policy conference, titled 'The shale gas industry in South Africa: Toward a science action plan' held from 31 August to 1 September in Port Elizabeth, South Africa.

Dr Shola Ololade participated as a panellist in the Water, Cities and SDG 6 sub-plenary at the Local Climate Solutions for Africa Congress (LoCS4Africa) in March 2017. She also served as an expert on the panel adjudicating Geo and Marine Sciences applications submitted to the NRF for (FISS) Postdoctoral Fellowships, and she is a standing member of the panel reviewing applications for the Knowledge Interchange and Collaboration (KIC) funding instruments.

Surina Esterhuyse (second from left) and Dr Joh Henschel (on the right) during a round-table discussion at the Academy of Science of South Africa (ASSAf) Shale Gas Conference (Photo copyright: Donna vd Watt Photography)

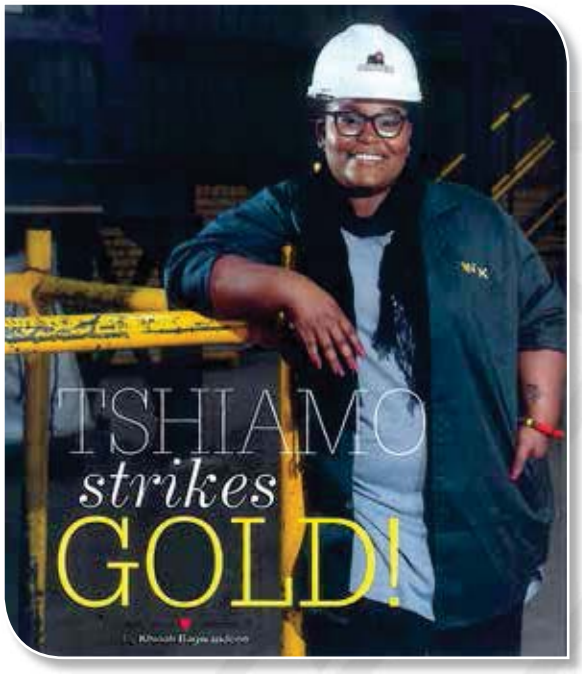
Dr Falko Buschke, with Master of Environmental Management student Ansuné Human, facilitated a workshop at the 14th Annual Kimberley Biodiversity Research Symposium (KBRS) on 'Ecosystem guidelines for the Nama-Karoo biome in South Africa' in October 2017.

Dr Tascha Vos was voted vice-chair of the Modder-Riet Catchment Management Forum during their April 2017 meeting.

Dr Nico Avenant served on the Editorial Board of *Integrative Zoology*, and as Section Editor for *African Zoology* (small mammals). He also served on the Executive Committee of the International Conference on Rodent Biology and Management and has been an advisor to the African Large Predator Research Unit at the University of the Free State since 2002. Dr Avenant was named part of the Zoological Society of Southern Africa local organising committee that will host the 2020 International Congress of Zoology in Cape Town, South Africa.

Student Achievements

Tshiamo Legoale, a student in the Master of Environmental Management programme, was the national winner of FameLab South Africa on 19 April 2017. She went on to represent South Africa at the International FameLab Competition at the Cheltenham Science Festival in the United Kingdom in July 2017, where she won the first prize.



Tshiamo Legoale was named the FameLab International Champion at the Cheltenham Science Festival in the UK on 8 July 2017. This photo of Tshiamo appeared in the September 2017 issue of Fair Lady, pages 26-28

Roderick Jeffery won the Maitland Seaman Prize for Best Magister Student in Environmental Management 2016, as well as the Centre for Environmental Management Prize for the Best Mini-dissertation in Environmental Management in 2016. His research was on the effect of urbanisation on bird-strike hazards at the Air Force Base Ysterplaat, Cape Town, South Africa. He was supervised by Dr Falko Buschke.

Mutukwa Musole from Zambia was awarded the Dr Limpho Letsela Prize for the Best Foreign African Student in Environmental Management for 2016. He was supervised by Dr Shola Ololade and Frank Sokolic. These prizes will be awarded during the faculty's Prize-giving Ceremony in April 2018.

Centre for Environmental Management prize-winners: Mutukwa Musole from Zambia was awarded the Dr Limpho Letsela Prize for the Best Foreign African Student in Environmental Management for 2016. Roderick Jeffery won the Maitland Seaman Prize for Best Magister Student in Environmental Management 2016, as well as the Centre for Environmental Management Prize for the Best Mini-dissertation in Environmental Management in 2016

Activities

Conference attendance

Several core staff members attended international and national conferences:

- Dr Shola Ololade delivered the keynote address at the 1st International Conference organised by the Centre for Research, Innovation and Development in Ekiti, Nigeria in August 2017.
- Carina Coetzer delivered a paper at the 41st Annual Meeting of the Waterbird Society in Reykjavik, Iceland in August 2017.
- Dr Shola Ololade delivered a paper, and was co-author of another, at the 6th World Sustainability Forum held in Cape Town in January 2017. She was also invited to deliver a paper at the Local Climate Solutions for Africa Congress in Ekurhuleni in March 2017.
- Dr Falko Buschke delivered a paper at the 14th National Biodiversity Planning Forum held at Skukuza Camp, Kruger National Park, in June 2017.
- Surina Esterhuyse and Richard Williamson attended the Biennial Groundwater conference in

Stellenbosch in October 2017, where they delivered a paper.

- Sinalo Malindie delivered a paper at the 14th Annual Kimberley Biodiversity Research Symposium in Kimberley, October 2017.

Dr Shola Ololade visited the Life and Earth Sciences Institute at the Pan-African University hosted by the University of Ibadan in Nigeria in August 2017. Dr Ololade has been appointed to supervise a PhD student enrolled at the institute

Carina Coetzer, an NRF Intern at the Centre for Environmental Management, in front of the Hallgrimskirkja Church in Reykjavik, Iceland. Coetzer presented a paper at the 41st Annual Meeting of the Waterbird Society in Reykjavik in August 2017

Surina Esterhuyse and Mr Richard Williamson attended the Biennial Groundwater Conference in Stellenbosch in October 2017

Visitors to the CEM

Dr Falko Buschke hosted Dr Tom Pinceel (KU Leuven, Belgium and CEM research associate) for his research on the effects of climate change on the biodiversity of temporary aquatic ecosystems. This research is funded by the Flemish Fund for Scientific Research.

Prof Nnenesi Kgabi, with four Namibian students, visited the CEM in April 2017. Three of the students enrolled for a PhD in Environmental Management at the University of the Free State in 2017.

Prof Nnenesi Kgabi, appointed as an Affiliated Professor in the Centre for Environmental Management in 2017, visited the centre with four of her Namibian students in April 2017. Prof Kgabi is the Associate Dean of the Faculty of Engineering at the Namibia University of Science and Technology (NUST). Front, from the left: Tabby Resane, Johanna Ithindi, Prof Nnesi Kgabi, Gideon Kalumbu, Marthie Kemp (Student research coordinator, CEM). Back, from the left: Brian Mhango, Martha Uugwanga, Marinda Avenant (Acting Director – CEM, UFS).

Modder-Riet Catchment Management Forum

Dr Vos and Marinda Avenant represented the CEM on the Modder-Riet Catchment Management Forum in 2017. The main objective of this forum, an institutional committee of the Department of Water Affairs and Sanitation, is to promote the responsible management of the Modder and Riet River catchments. Representatives of various stakeholders attend the quarterly meetings of the forum.

Constructing artificial wetlands

The CEM hosted a workshop in May 2017 to explore the feasibility of constructing an artificial wetland at the Free State National Botanical Garden. The workshop was initiated and chaired by Dr Piet-Louis Gründlingh, Deputy Director: Programme Implementation – Wetlands, Department of Environmental Affairs and a Research Associate at the CEM. The proposed project will serve as a pilot study to test the feasibility of artificial water-treatment systems. Marius Venter, a research assistant at the CEM, is assisting on the project.

The centre hosted a workshop in May 2017 to investigate the feasibility of constructing an artificial wetland at the Free State National Botanical Garden. The participants were: Back, from the left: Dr Farai Tererai (Department of Environmental Affairs), PS Rossouw (Terra Soil), Craig Cowden (GroundTruth), Trevor Pike (GroundTruth), Shane Maharaj (GroundTruth), Marius Venter (Centre for Environmental Management, UFS), Dr Althea Grundling (ARC), Dr Piet-Louis Grundling (Department of Environmental Affairs/ CEM, UFS). Front, from the left: Japie Buckle (Department of Environmental Affairs), Mathabiso Letsaba (Department of Environmental Affairs), Franci Gresse (Aurecon), Marinda Avenant (Acting Director – CEM, UFS)

Geographic information systems (GIS) facility at the CEM

Frank Sokolic, a recognised expert and consultant on GIS, continued his close collaboration with the CEM by spending a week every month at the centre. This has been exceptionally fruitful. By having the opportunity to discuss their GIS challenges first-hand, the CEM's students and staff have benefited greatly from the GIS solutions he has provided. He has also presented valuable, environmentally-oriented GIS courses to students and outsiders and provides supervision to master's students.

Short courses

The CEM presented the following short courses in 2017:

- An *Introduction to Geographical Information and Global Positioning Systems* presented by Frank Sokolic on the UFS Bloemfontein Campus from 19 to 23 June 2017.
- An *Introduction to Wetland Delineation* presented by Dr Piet-Louis Gründling and a team of wetland specialists at Roodeplaat Dam from 6 to 10 March 2017.
- A course on *Wetland Rehabilitation* presented by Dr Gründling and a team of wetland specialists for staff members of the South Africa National Parks from 9 to 13 October 2017.

The second-year Master of Environmental Management students went on an excursion to the greater Bloemfontein area to assess the sustainability of urban settlements as part of their semester coursework in July 2017. They were accompanied by Stuart Denoon Stevens, Dr Anton de Wit, Dr Shola Ololade, Prof Maitland Seaman, Dave Reynolds, and Marinda Avenant

RESEARCH

Dr Falko Buschke carried out a research project using butterfly assemblages to identify important habitats for the persistence of biodiversity under climate change. This project focused on the sandstone inselbergs of the Eastern Free State and was funded by the Foundational Biodiversity Information Programme of the South African National Biodiversity Institute.

Dr Falko Buschke, along with Susie Brownlie (private consultant) and Jeff Manuel (SANBI), collaborated on a project to examine the potential of using biodiversity offsetting to expand protected areas across the grassland biome.

Community Service

Aquatic monitoring of Loch Logan: Dr Tascha Vos and our postgraduate students continued the long-term monitoring of the water quality of the urban impoundment, Loch Logan, which is the central focus of Bloemfontein's Waterfront development. The information thus derived has been shared with the Mangaung Local Municipality and the owners of the Waterfront development for use in the management of the lake.

National and International Collaboration

Dr Falko Buschke collaborates with the following people: Dr Tom Pinceel (KU Leuven, Belgium), Dr Bram Vanschoenwinkel (Vrije Universiteit Brussel), Susie Brownlie (private consultant), Emily Botts (private consultant), Sam Sinclair (Imperial College London and the University of Oxford), Jeff Manuel (SANBI).

Postgraduate Students

Drs Alfred Murye and Johannes Belle successfully completed their doctoral studies in Environmental Management in 2017. The degrees were conferred at the June Graduation Ceremony.

Drs Johannes Belle and Alfred Murye were awarded PhD degrees in Environmental Management at the June 2017 graduation ceremony

26 Master of Environmental Management and three BScHons with specialisation in Limnology degrees were also conferred at the June 2017 graduation ceremony.

Seven Master of Environmental Management students graduated in December 2017.

Graduates from the Centre for Environmental Management on graduation day, June 2017

STAFF MATTERS

Prof Nnenesi Kgabi was appointed as an Affiliated Professor in the CEM.

Drs Shola Ololade and Falko Buschke were promoted from Lecturer to Senior Lecturer at the end of 2017.

Richard Williamson and Marius Venter were appointed as research assistants.

Sinalo Malindie was appointed as student assistant.

Carina Coetzer joined the centre in April as a National Research Foundation-funded intern. She left at the end of September after accepting a post at Birdlife Africa.

Theresa Soci resigned as course coordinator at the end of 2017 to accept a new post in Cape Town.

RESEARCH OUTPUTS

Research Articles

Amwele, HR, Motsei, L, Kalumbu, G, Kgabi, N, Njinga, RL, and Tshivhase, VM. 2017. Investigation of possible human exposure to metals concentration in vegetables. *Journal of Toxicology and Environmental Health Sciences* 9(7): 66-72.

Brendonck, L, Pinceel, T, and Ortells, R. 2017. Dormancy and dispersal as mediators of zooplankton population and community dynamics along a hydrological disturbance gradient in inland temporary pools. *Hydrobiologia* 796(1): 201-222.

Buschke, FT. 2017. Biodiversity trajectories and the time needed to achieve no net loss through averted-loss biodiversity offsets. *Ecological Modelling* 352: 54-57.

Clauss, M, Fritz, J, Tschuor, A, Braun, U, Hummel, J, and Codron, D. 2017. Dry matter and digesta particle size gradients along the goat digestive tract on grass and browse diets. *Journal of animal physiology and animal nutrition* 101(1): 61-69.

Codron, J, Botha-Brink, J, Codron, D, Huttenlocker, AK, and Angielczyk, KD. 2017. Predator-prey interactions among Permo-Triassic terrestrial vertebrates as a deterministic factor influencing faunal collapse and turnover. *Journal of Evolutionary Biology* 30(1): 40-54.

De Klerk, JJ, and Avenant, N. 2017. Further evidence in support of the status of small mammals as ecological indicators in areas cleared of alien vegetation in South Africa. *Indago* 33: 49-56.

Dumakude, N, and Graham, M. 2017. Assessing wetland health using a newly developed land cover citizen science tool for use by local people who are not wetland specialists. *Southern African Journal of Environmental Education* 33: 71-83.

Ecker, M, Brink, J, Chazan, M, Kolska Horwitz, L, and Lee-Thorp, JA. 2017. Radiocarbon dates constrain the timing of environmental and cultural shifts in the Holocene strata of Wonderwerk Cave, South Africa. *Radiocarbon* 59(4): 1067-1086.

Esterhuyse, S. 2017. Developing a groundwater vulnerability map for unconventional oil and gas extraction: a case study from South Africa. *Environmental Earth Sciences* 76(17): 1-13 (article 626).

Esterhuyse, S, Sokolic, F, Redelinghuys, N, Avenant, M, Kijko, A, Glazewski, J, Plit, L, Kemp, M, Smit, A, Vos,

AT, and Von Maltitz, MJ. 2017. Vulnerability mapping as a tool to manage the environmental impacts of oil and gas extraction. *Royal Society Open Science* 4: 1-16 (article 171044).

Gabriel, M, Gałka, M, Pretorius, ML, and Zeitz, J. 2017. The development pathways of two peatlands in South Africa over the last 6200 years: Implications for peat formation and palaeoclimatic research. *The Holocene* 27(10): 149-1515.

Gillis-Germitsch, N, Vybiral, PR, Codron, D, Clauss, M, Kotze, A, and Mitchell, EP. 2017. Intrinsic factors, adrenal gland morphology, and disease burden in captive cheetahs (*Acinonyx jubatus*) in South Africa. *Zoo Biology* 36(1): 40-49.

Gowlett, JAJ, Brink, JS, Caris, A, Hoare, S, and Rucina, SM. 2017. Evidence of burning from bushfires in Southern and East Africa and its relevance to hominin evolution. *Current Anthropology* 58(S16): S206-S216.

Grégoir, AF, Philippe, C, Pinceel, T, Reniers, J, Thoré, ESJ, Vanschoenwinkel, B, and Brendonck, L. 2017. Life stage dependent responses to desiccation risk in the annual killifish *Nothobranchius wattersi*. *Journal of Fish Biology* 91(3): 880-895.

Kraaij, T, Young, C, and Bezuidenhout, H. 2017. Growth-form responses to fire in Nama-Karoo escarpment grassland, South Africa. *Fire Ecology* 13(3): 85-94.

Leichliter, J, Sandberg, P, Passey, B, Codron, D, Avenant, N, Paine, O, Codron, J, De Ruiter, D, and Sponheimer, M. 2017. Stable carbon isotope ecology of modern small mammals from the Sterkfontein Valley: Implications for habitat reconstruction. *Palaeogeography, Palaeoclimatology, Palaeoecology* 485: 57-67.

McKenzie, VJ, Song, SJ, Delsuc, F, Prest, TL, Oliverio, AM, Korpita, TM, Alexiev, A, Amato, KR, Metcalf, JL, Kowalewski, M, Avenant, NL, Link, A, Di Fiore, A, Seguin-Orlando, A, Feh, C, Orlando, L, Mendelson, JR, Sanders, J, and Knight, R. 2017. The Effects of Captivity on the Mammalian Gut Microbiome. *Integrative and comparative biology* 57(4): 690-704.

Moradi-Afrapoli, F, Van der Merwe, H, De Mieri, M, Wilhelm, A, Stadler, M, Zietsman, PC, Hering, S, Swart, K, and Hamburger, M. 2017. HPLC-Based Activity Profiling for GABAA Receptor Modulators in Searsia pyroides Using a Larval Zebrafish Locomotor Assay. *Planta Medica* 83(14/15): 1169-1175.

Onjefu, SA, Taole, SH, Kgabi, NA, Grant, C, and Antoine, J. 2017. Assessment of natural radionuclide distribution in shore sediment samples collected from the North Dune beach, Henties Bay, Namibia. *Journal of Radiation Research and Applied Sciences* 10(4): 301-306.

Philippe, C, Grégoir, AF, Janssens, L, Pinceel, T, De Boeck, G, and Brendonck, L. 2017. Acute and chronic sensitivity to copper of a promising ecotoxicological model species, the annual killifish *Nothobranchius furzeri*. *Ecotoxicology and Environmental Safety* 144: 26-35.

Pinceel, T, Hawinkel, W, Wynants, E, Brendonck, L, and Vanschoenwinkel, B. 2017. Habitat uncertainty explains variation in offspring provisioning strategies in a temporary pond crustacean. *Hydrobiologia* 801(1): 141-151.

Pinceel, T, Vanschoenwinkel, B, Hawinkel, W, Tuytens, K, and Brendonck, L. 2017. Aridity promotes bet hedging via delayed hatching: a case study with two temporary pond crustaceans along a latitudinal gradient. *Oecologia* 184(1): 161-170.

Richard, OK, Codron, D, Hagen, KB, Südekum, KH, and Clauss, M. 2017. Little differences in digestive efficiency for protein and fat in mammals of different trophic guilds and digestive strategies: data constraints or fundamental functional similarity? *Journal of Animal Physiology and Animal Nutrition* 101(S1): 127-141.

Sieben, EJJ, Collins, NB, Kotze, DC, Mofutsanyana, SS, and Janks, M. 2017. Temperate grassy wetlands of South Africa: Description, classification and explanatory environmental factors. *South African Journal of Botany* 113: 68-76.

Toerien, DF. 2017. The enduring and spatial nature of the enterprise richness of South African towns. *South African Journal of Science* 113(3/4): 62-69.

Toffolo, MB, Brink, JS, Van Huyssteen, C, and Berna, F. 2017. A microstratigraphic reevaluation of the Florisbad spring site, Free State Province, South Africa: Formation processes and paleoenvironment. *Geoarchaeology-an international journal* 32(4): 456-478.

Van Rensburg, E, Zietsman, PC, Bonnet, SL, and Anke Wilhelm, A. 2017. Alkaloids from the bulbs of *Boophone disticha*. *Natural Product Communications* 12(9): 1431-1433.

Van Staden, J, Bezuidenhout, H, Ferreira, S, and Bredenkamp, GJ. 2017. The effects of elephants and fire on vegetation at Marakele National Park, South Africa. *Pachyderm* 58: 107-122.

Chapters in Books

Esterhuyse, S, Redelinghuys, N, and Kemp, M. 2017. Unconventional oil and gas extraction in South Africa:

water linkages within the population-environment-development nexus and its policy implications. In Brooks, DB, Nickum, JE, Turton, AR, and Esterhuyse, S. (Eds.). *Water Legacies of Conventional Mining*. London: Routledge.

Esterhuyse, S, Kemp, M, and Redelinghuys, N. 2017. Assessing the existing knowledge base and opinions of decision makers on the regulation and monitoring of unconventional gas mining in South Africa. In: Brooks, DB, Nickum, JE, Turton, AR, and Esterhuyse, S. (Eds). *Water Legacies of Conventional Mining*. London: Routledge.

Ololade, O. 2017. Sustainable Development: An Overview. In: Gurjar, BR, Rao, SY, and Govil, JN. (Eds). *Environmental Science and Engineering Volume 1: Sustainable Development*. Studium Press LLC, Houston, USA.

Ololade, O, Esterhuyse, S, and Levine, AD. 2017. The Water-Energy-Food Nexus from a South African Perspective. In: Salam, PA, Shrestha, S, Anal, AK, and Panday, VP. (Eds). *Water-Energy-Food Nexus: Theories and Practices*. AGU/Wiley. Hoboken, USA.

Turton, AR. 2017. Comparative Diagnostics for Transboundary River Basins: Dave Phillips and Public Domain Data. In: McCafrey, SC, Murray, JS, and Woodhouse, M. (Eds). *Promoting Equity, Cooperation and Innovation in the Fields of Transboundary Waters and Natural Resource Management: The Legacy of Dr David JH Phillips*. Boston: Brill Nijhoff.

Turton, AR. 2017. Untying the Gordian Knot: Unintended Consequences of Water Policy for the Gold Mining Industry in South Africa. In Brooks, DB, Nickum, JE, Turton, AR, and Esterhuyse, S. (Eds). *Water Legacies of Conventional Mining*. London: Routledge.

Conference Contributions

Brink, JD, Van Pletzen Vos, L, Thackeray, JF, and Wurz, S. 2017. *An analysis of the large mammal remains of the 1985 – 1987 excavations at Klasies River – evidence for bias in the samples from previous excavations* (poster). Association of Southern African Professional Archaeologists (ASAPA) Conference. Pretoria, South Africa. 5-7 July.

Buschke, F. 2017. *The conservation costs and economic benefits of using biodiversity offsets to meet protected area targets in South African grasslands* (paper). 14th National Biodiversity Planning Forum. Skukuza Camp, Kruger National Park, South Africa. 20-23 June.

Codron, J, Avenant, N, and Codron, D. 2017. *Population demographics of herbivores in Tswalu Kalahari Reserve* (paper). 8th Oppenheimer De Beers Group Research Conference. Ormonde, Johannesburg, South Africa. 17-18 October.

Codron, J, Avenant, N, Wigley-Coetsee, C, and Codron, D. 2017. *Carnivore stable carbon isotope niches reflect predator-prey size relationships in African savannas* (paper). 8th Oppenheimer De Beers Group Research Conference. Ormonde, Johannesburg, South Africa. 17-18 October.

Coetzer, C, and Bouwman, H. 2017. *Using flight initiation distances of waterbirds for bird management at the Barberspan Bird Sanctuary, South Africa* (paper). 41th Annual Meeting of the Waterbird Society. Reykjavik, Iceland. 8-12 August.

Koual, R, Tilak, M-K, Weyer, N, Panaino, W, Fuller, A, Avenant, N, and Delsuc, F. 2017. *A metagenomic approach for assessing the diet of ant-eating mammals* (paper). 8th Oppenheimer De Beers Group Research Conference. Ormonde, Johannesburg, South Africa. 17-18 October.

Malindie, S. 2017. *Stable isotope niche breadths of herbivore populations in the South African grassland biome: effects of density and community composition* (paper). 14th Annual Kimberley Biodiversity Research Symposium (KBRS). Kimberley, South Africa. 25 October.

Olalade, OO. 2017. *Water-energy-food nexus: a dynamic approach to security and sustainable development* (paper). 1st International Conference organised by the Centre for Research, Innovation and Development Ado. Ekiti, Nigeria. 15-18 August 2017.

Ololade, OO. *Water as an enabler of sustainable growth in African cities* (paper). Local Climate Solutions for Africa Congress (LoCS4Africa). Ekurhuleni, South Africa. 22-24 March.

Ololade, OO. *Sustainable resource use through Water-Energy-Food Nexus analysis* (paper). 6th World Sustainability Forum (WSF2017). Cape Town, South Africa. 27-28 January.

Ololade, OO, Tshikalange, B, and Levine, AD. 2017. *Assessing the viability of producing biofuels using agricultural waste in South Africa* (paper). 6th World Sustainability Forum (WSF2017). Cape Town, South Africa. 27-28 January.

Pinceel, T, Buschke, F, Vanschoenwinkel, B, and Brendonck, L. 2017. *Climate change may impact the persistence of temporary pond crustaceans* (paper). Association for the Sciences of Limnology and Oceanography (ASLO) Congress. Honolulu, Hawaii, USA. 27 February–3 March.

Strauss, AJ, De Waal, HO, and Avenant, NL. 2017. *The impact of predation on merino and dorper flocks in the central Free State, South Africa* (paper). Provincial Research Colloquium. Philip Sanders Resort, Bloemfontein, South Africa. 18-20 October.

Toerien, D. 2017. *Of people and enterprises in a Biosphere Reserve* (paper). The SRU's 2nd Research Associates Symposium. NMMU Campus (Saasveld), George, South Africa. 16 May.

Toerien, D. 2017. *Skaliegas en die Karoo/Shale gas and the Karoo* (paper). University of the Third Age (U3A). Stilbaai, South Africa. 26 June.

Thoré, E, Grégoir, A, Philippe, C, Brendonck, L, and Pinceel, T. 2017. *Different strokes for different folks - personality divergence in a short-lived killifish* (paper). Behavior 2017 – the 35th International Ethological Conference (IEC) and the 2017 Summer Meeting of the Association for the Study of Animal Behaviour (ASAB). Estoril, Portugal. 30 July-4 August.

Turton, A. 2017. *A Dual Stream Reticulation Economy as a National Strategic Policy Imperative – Lessons from Mining* (paper). Global Launch of the UN World Water Development Report 2017, World Water Day Summit and Expo. Durban, South Africa. 22-24 March.

Turton, A. 2017. *Big-picture impacts of human activities on water systems* (paper). Burdekin Water Forum. Ayr, Australia. 9-11 October.

Vanschoenwinkel, B, and Pinceel, T. 2017. *Climatic control of diversity in freshwater habitats* (paper). European Conference of Tropical Ecology. Brussels, Belgium. 6-10 February.

Vos, AT, and Van Ginkel, CE. 2017. *Periphyton as a biomonitoring tool in non-perennial, regulated rivers in central South Africa.* Paper delivered at the 54th Annual South African Society of Aquatic Scientists (SASAqS) Conference. Boksburg, South Africa. 25-28 June.

Webster, H, Hoffmann, S, Dube, K, Oberem, E, Avenant, N, Teske, P, Lutermann, H, and Van Vuuren, B. 2017. *A spatial genetic comparison of two endemic Southern African small mammals* (paper). 8th Oppenheimer De Beers Group Research Conference. Ormonde, Johannesburg, South Africa. 17-18 October.

Williamson, R, and Esterhuyse, S. 2017. *Possible wastewater volumes associated with unconventional oil and gas extraction in South Africa and the management thereof* (paper). Biennial Groundwater conference. Stellenbosch, South Africa. 14-18 October.

Research Reports

Avenant, N, and Du Plessis, J. 2017. *Using small mammals to monitor the ecological integrity at Kolomela Mine, Postmasburg: 2011 to 2016*. Report submitted to Kolomela Mine as part of a long-term biodiversity monitoring programme.

Popular Articles

Turton, A. 2017. Operation Vula. *Nongqai*, *Journal of National Security History in Southern Africa* 8(7): 48-61. 2 July.

Turton, A. 2017. Water: Crises and Opportunity. *Green Economy Journal* 26: 12-13. 6 July.

Turton, A. 2017. CT water crisis: heading for ecological suicide? *The Messenger.* 23 October.

Turton, T. 2017. How the Rainbow Nation dried up. *The Resource Magazine*. International Water Association (IWA) publication. 22 May.

Popular Talks

Avenant, NL. 2017. *Klein soogdiertjies: hul posisie en rol in die ekosisteem, en potensiële rol in die bestuur van predasie / Small mammals: their position and role in the ecosystem, and potential role in predation management*. Presented at the Honorary Game Rangers, Free State Region. The Willows, Bloemfontein, South Africa. 3 June.

Avenant, NL. 2017. A tour through the NMB exhibitions, specifically referring to our attempts to cater for persons with disabilities, including a 60 min talk about "*Small mammals, and their position and role in the ecosystem*" in the Childrens' Museum, at the National Museum, Bloemfontein. Bloemfontein, South Africa. 27 September.

Avenant, NL. 2017. *Small mammals ... their role in ecosystems*. The Friends of the Seven Dams Conservancy, Bloemfontein. Bloemfontein, South Africa. 17 October.

Avenant, N, Nokha, R, and Putsane, T. 2017. Visit to the National Museum exhibitions: a talk and touch experience, Aganang Support Group, Free State Society for the Blind, at the National Museum Exhibition Hall, Bloemfontein. Bloemfontein, South Africa. 6 June.

Turton, A. 2017. *After the mining - what's the clean-up plan?* Radio discussion broadcasted on the Rear Vision programme, ABC National Radio, Australia. 23 April, 00:05 pm.

Turton, A. 2017. *How to stop South Africa's billion-rand water loss*. Radio interview broadcasted on Afternoon Drive with Redi Tlhabi, 702, South Africa. 17 May, 17:57.

STAFF

Affiliate Professor: Prof NA Kgabi and Prof A Turton.

Lecturers: Dr FT Buschke, Dr OO Ololade, MF Avenant, SE Esterhuyse, and F Sokolic (units).

Research Associates: Prof Seaman, and Drs NL Avenant, H Bezuidenhout, JS Brink, D Codron, NB Collins, PL Gründlingh, JR Henschel, FJ Kruger (deceased), SA Mitchell, T Pinceel, DF Toerien, C van Ginkel, and PC Zietsman.

Course Coordinator: TQ Soci.

Senior Professional Officer: ME Kemp.

Professional Officer: Dr AT Vos.

Senior Assistant Professional Officer: DM Kolesky.

National Research Foundation Intern: CF Coetzer (1 April to 30 September 2017).

Research Assistant: M Venter and RD Williamson.

Student Assistant: SN Malindie.

Messenger: PS Thibiri.

ACADEMIC CENTRES

Centre for Microscopy

Contact Details

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2017 Overview

The Centre for Microscopy is a faculty-research facility that primarily supports UFS researchers and students to get nanostructural data and information, using advanced scanning and transmission electron microscopes. Several researchers from other local and international institutions also undertake their microscopic research projects at the centre. During 2017, researchers from the Central University of Technology (CUT), in particular, used the facilities. Generally, international researchers work in association with other departments. Our staff supported 59 researchers and students at the centre, covering a variety of areas in microscopic and nanotechnology research. Centre staff handle all microscopic preparations for most of the samples according to the applicants' specific requirements. The latter forms an integral part of the support services at the centre. Indicated below are user figures during the past four years:

2014	2015	2016	2017
76	85	90	59

The variation in each year is due to students who either start or finish new projects or graduate. Total laboratory preparation time of samples for the number of researchers in 2017 involved 448 hours prior to any microscopic analysis. In comparison, 844 hours were spent on sample preparation in 2017, illustrating the correlated variance in the number of users.

ACHIEVEMENTS

Activities

The microscope usage hours by department are indicated in the following table.

Department	Usage hours		
	CLSM	SEM	TEM
Animal, Wildlife and Grassland Sciences	-	63	-
Cardiothoracic Surgery	-	21	20
Centre (data processing, services, training)	2	65	32
Chemistry	-	37	56
Consumer Science	-	52	-
Engineering	-	1	1
Microbial, Biochemical and Food Biotechnology	9	42	26
Physics	-	243	21
Plant Sciences	1	7	-
Plant Sciences (Qwaqwa Campus)	-	2	-
Zoology and Entomology	13	16	-
External researchers/projects:			
CUT	-	6	3
Total Usage	25	555	159

Research and Training Activities

Our staff are not actively involved in academic subjects, but present practical sessions to honours students from the departments of Zoology and Entomology (DRK/ENT614) and Microbial, Biochemical and Food Biotechnology (MKB/BOC614). These presentations demonstrate the preparation of material and the handling of equipment. The Shimadzu scanning electron microscope is used by honours students in Zoology and Entomology. By means of a small project, each student is allowed to examine one sample which was fully prepared by themselves. Microscopy research was also demonstrated to undergraduate students from Engineering Sciences. The mechanical and electronic engineering principles of electron

microscopes and preparation equipment are illustrated to these students, including digital imaging of applicable engineering samples.

The electron microscopes

The annual (2014 to 2017) average usage hours of the scanning electron microscope (SEM) is 709 hours, for the transmission electron microscope (TEM) 179 hours, and for light microscopy 175 hours. Light microscopes are relatively cheaper than electron microscopes, thus most departments can afford to own one. We attract researchers who need light microscope observations but cannot afford a high-resolution microscope like those at the centre. The scanning electron microscope, which delivers impressive dimensional images, is more popular and attract more researchers than transmission electron microscopy. The latter also involves ultra-thin samples that requires specialist handling of a microtome, which can be very time consuming.

The transmission electron microscope has been in use for 23 years, and although still fully functional, the manufacturer no longer makes support service parts. The replacement of the TEM remains an urgent issue. The Shimadzu environmental SEM is no longer supported in South Africa and the microscope was irreparably damaged in 2017. We consider replacing it with a similar type of environmental scanning electron microscope, because the Jeol 7800 SEM cannot accommodate samples requiring low vacuum operation. This will especially benefit researchers in the biological fields with types of samples that cannot easily be examined with certain high-vacuum microscopes (as the analytical Jeol 7800 SEM). Such samples may cause severe damage to a high-vacuum electron microscope.

User support

We accommodated 59 users in 2017, with only two researchers working independently. A full team of support service staff prepare samples according to the specific requirements for analysis by each type of microscope. Due to the cost involved in purchasing chemicals for microscopy by individual researchers, this type of support saves funds and time for researchers. In most cases, routine examinations are also done by the centre staff. All results are delivered to users through an internet *cloud*-based transfer mechanism. This support-service approach has been applied since 2012 and proved to be very successful. It provides researchers with an economically viable route to integrate nanostructure research, rather than rejecting research projects due to time constraints and unnecessary expenses.

RESEARCH OUTPUTS

Research Articles

Balakrishna, A, Swart, HC, Ramaraghavulu, R, Bedyal, AK, Kroon, RE, and Ntwaeaborwa, OM. 2017. Structural evolution induced by substitution of designated molybdate sites (MoO_4^{-2}) with different anionic groups (BO_3^{-3}, PO_4^{-3} and SO_4^{-2}) in CaMoO4:Sm^{3+} phosphors – A study on color tunable luminescent properties. *Journal of Alloys and Compounds* 727: 224-237.

Dutta, S, Som, S, Kunti, AK, Kumar, V, Sharma, SK, Swart, HC, and Visser, HG. 2017. Structural and luminescence responses of $CaMoO_4$ nanophosphors synthesized by hydrothermal route to swift heavy ion irradiation: Elemental and spectral stability. *Acta Materialia* 124: 109-119.

Gumede, T, Luyt, AS, Pérez-Camargo, RA, Tercjak, A, and Müller, AJ. 2017. Morphology, Nucleation, and Isothermal Crystallization Kinetics of Poly(ε-caprolactone) Mixed with a Polycarbonate/MWCNTs Masterbatch. *Journal of Polymers* 10(4): 424.

Hasabeldaim, E, Ntwaeaborwa, OM, Kroon, RE, Craciun, V, Coetsee, E, and Swart, HC. 2017. Surface characterization and cathodoluminescence degradation of ZnO thin films. *Applied Surface Science* 424: 412-420.

Hasabeldaim, E, Ntwaeaborwa, OM, Kroon, RE, Motaung, DE, Coetsee, E, and Swart, HC. 2017. Effect of PLD growth atmosphere on the physical properties of ZnO:Zn thin films. *Optical Materials* 74: 76-85.

Jain, A, Peshwe, DR, Kumar, A, Dhoble, SJ, Yerpude, MM, Nair, GB, and Swart, HC. 2017. Theoretical analysis of electron vibration interactions and study of photo physical properties in Ce^{3+} doped $Ca_2P_2O_7$ nanophosphor capped with SHMP. *Materials Chemistry and Physics* 196: 213-221.

Kumar, V, Ntwaeaborwa, OM, Soga, T, Dutta, V, and Swart, HC. 2017. Rare Earth Doped Zinc Oxide Nanophosphor Powder: A Future Material for Solid State Lighting and Solar Cells. *ACS Photonics* 4(11): 2613-2637.

Kumar, V, Pandey, A, Ntwaeaborwa, OM, Dutta, V, and Swart, HC. 2017. Structural and luminescence properties of Eu^{3+}/Dy^{3+} embedded sodium silicate glass for multicolour emission. *Journal of Alloys and Compounds* 708: 922-931.

Mokoena, TP, Linganiso, EC, Kumar, V, Swart, HC, Cho, S-H, and Ntwaeaborwa, OM. 2017. Up-conversion luminescence in Yb^{3+}-Er^{3+}/Tm^{3+} co-doped Al_2O_3-TiO_2 nano-composites. *Journal of Colloid and Interface Science* 496: 87-99.

Mokoena, TP, Linganiso, EC, Swart, HC, Kumar, V, and Ntwaeaborwa, OM. 2017. Cooperative luminescence from low temperature synthesized α-Al_2O_3:Yb^{3+} phosphor by using solution combustion. *Ceramics International* 43(1): 174-181.

Motloung, SV, Dejene, BF, Kroon, RE, Ntwaeaborwa, OM, Swart, HC, and Motaung, TE. 2017. The influence of Cr^{3+} concentration on the structure and photoluminescence of $MgAl_2O_4$:0.1% Eu^{3+}, x% Cr_{3+} (0≤x≤0.15%) nanophosphor synthesized by sol-gel process. *Optik* 131: 705-712.

Pandey, A, Kumar, V, Som, S, Yousif, A, Kroon, RE, Coetsee, E, and Swart, HC. 2017. Photon and electron beam pumped luminescence of Ho^{3+} activated $CaMoO_4$ phosphor. *Applied Surface Science* 423: 1169-1175.

Parganiha, Y, Kaur, J, Dubey, N, Dubey, V, Shrivastava, R, Dhoble, SJ, and Swart, HC. 2017. Luminescence and structural properties of Gd_2SiO_5:Eu^{3+} phosphors synthesized from the modified solid-state method. *Ceramics International* 43(12): 9084-9091.

Pathak, TK, Rajput, JK, Kumar, V, Purohit, LP, Swart, HC, and Kroon, RE. 2017. Transparent conducting ZnO-CdO mixed oxide thin films grown by the sol-gel method. *Journal of Colloid and Interface Science* 487: 378-387.

Sharma, K, Kumar, V, Swart-Pistor, C, Chaudhary, B, and Swart, HC. 2017. Synthesis, characterization, and anti-microbial activity of superabsorbents based on agar-poly (methacrylic acid-glycine). *Journal of Bioactive and Compatible Polymers* 32(1): 74-91.

Ungula, J, Dejene, BF, and Swart, HC. 2017. Effect of annealing on the structural, morphological and optical properties of Ga-doped ZnO nanoparticles by reflux precipitation method. *Results in Physics* 7: 2022-2027.

Yagoub, MYA, Swart, HC, and Coetsee, E. 2017. Effect of Yb^{3+} ions on structural and NIR emission of SrF_2:Eu^{2+}/Pr^{3+} down-conversion containing Na+ ions. *Materials Research Bulletin* 93: 170-176.

Conference Contributions

Mitchel, DM, Christison, KC, Van As, LL, and Vaughn, D. 2017. *Hexabothrid parasites from* Rajidae *species in South Africa* (poster). 3rd International congress on Parasites of Wildlife, Kruger National Park. 24-27 September.

Mukwada, LT, and Mofokeng, JP. 2017. Structure and properties of PLA/PCL blend nanocomposites with Mg(OH)2 and APTMS-TiO2. Poster presented at the UNESCO/IUPAC Workshop and Conference on Macromolecules and Materials, Stellenbosch. 11-13 April.

Van Wyk, PWJ, and Grobler, H. 2017. Nanostructure to assess trace elements in yeast as supplements in nutrition: an African perspective review. Poster presented at the 16th International Symposium on Trace Elements in Man and Animals (TEMA-16), Saint-Petersburg, Russia. 26-29 June.

STAFF

Professor: Prof PWJ van Wyk.

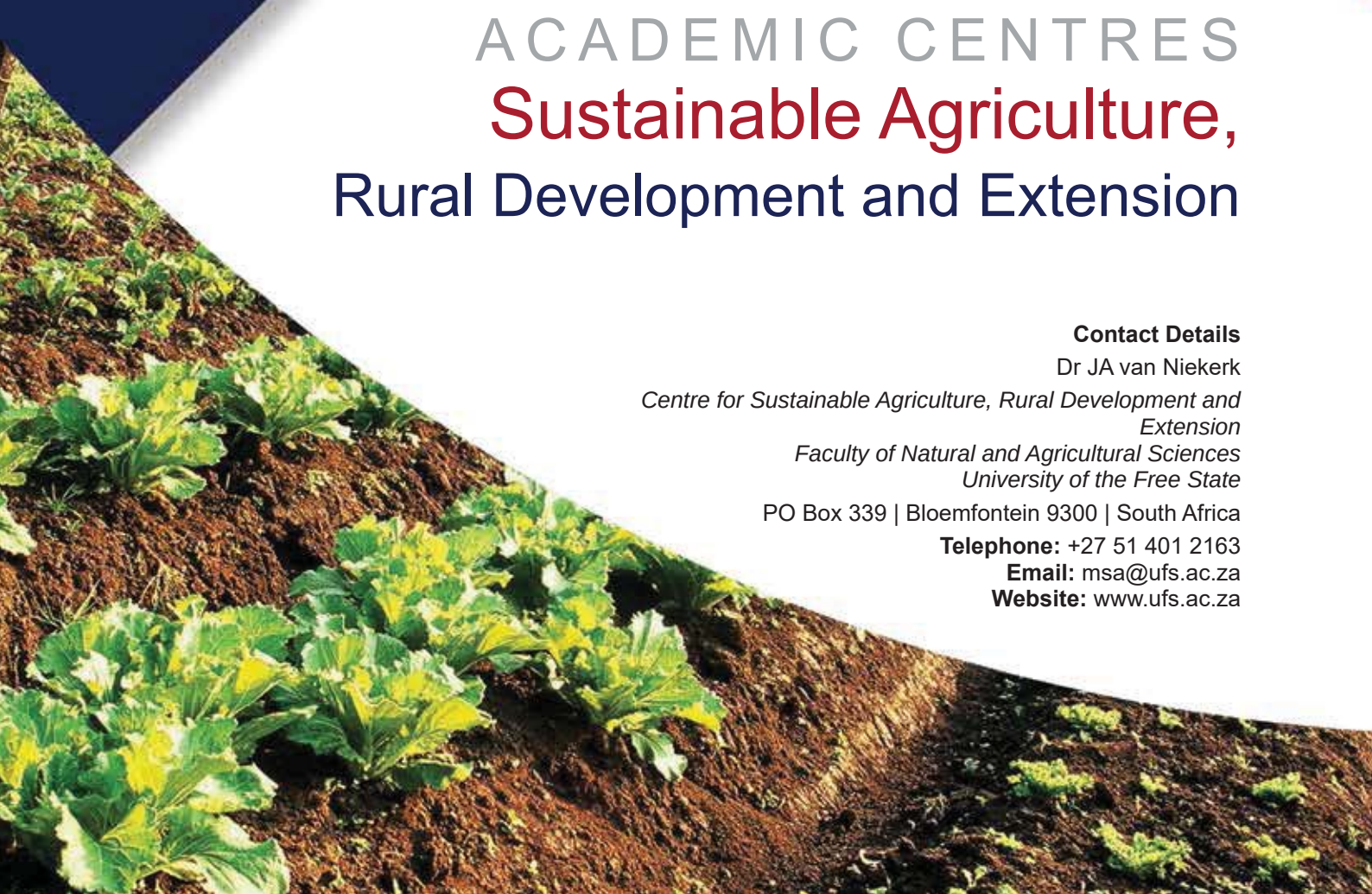
Senior Assistant Officer: H Grobler.

Assistant Officer: SB Shezi.

Contract Appointment: Dr P Mokoena.

ACADEMIC CENTRES

Sustainable Agriculture,
Rural Development and Extension



Contact Details

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2017 Overview

As pioneer in the field of training professionals in the agricultural sector, we realised that sustainable development is increasingly gaining momentum as an imperative, particularly in the context of the post-2015 Government development goals. To address the increasing demand for extension and agricultural capacity and expertise development, we embarked on the development of new academic qualifications during the 2016-2017 academic year. These newly developed PGDip and master's qualifications will be implemented in the 2018 academic year and will address the development of agricultural specialists to support sustainable agricultural practices, which will in return support food security and socio-economic development.

We are proud of our 51 master's students who received their degrees this year. These graduates form part of a legacy of agricultural specialists who have completed our foundation qualification of the past 20 years.

We look forward to welcome new students to a fresh and reviewed curriculum in the 2018 academic year.

ACHIEVEMENTS

Staff Achievements

Dr Johan van Niekerk and Dr JW Swanepoel started a study on good management practices that resulted in successful land-reform initiatives where agricultural extension played a pivotal role. In collaboration with the Food and Agriculture Organization (FAO), Ghent University in Belgium, and SPACE Africa, successful land-reform projects were identified in five provinces in South Africa. These projects were documented as case studies, and feedback was provided in a keynote presentation at the National Extension Week during a joint conference: 3rd AFAAS (African Forum for Agricultural Advisory Services) Africa-wide Agricultural Extension Week and the 51st Annual Conference of the South African Society for Agricultural Extension in October in Durban, KwaZulu-Natal. The national Minister of Agriculture, Minister Zokwana, the acting Director-General of Agriculture, numerous MECs, and 700 delegates from the agricultural sector all over Africa attended this presentation.

Dr JW Swanepoel represented the centre at the International Food and Agribusiness Management Association's (IFAMA) Conference in Miami, Florida, from 17 to 21 June. Currently in its 12th year of existence, the conference brings together participants from around the world to demonstrate their investigative and problem-solving skills in an effort to provide innovative solutions to practical problems. Dr JW Swanepoel did us proud by not only presenting results from his PhD in the academic track of the conference, but by also being part of an advanced case-study team representing South African Universities, which won IFAMA's International Student Case Competition.

Beyond academic excellence, the Centre for Sustainable Agriculture at the University of the Free State endeavours to interface with a wide range of stakeholders to contribute to the ongoing discourse. Hlamalani Ngwenya (lecturer) represented us at the 3rd edition of the International Women's lunch, themed 'A positive connection among women', celebrating the stand that woman in SA took against apartheid laws more than 61 years ago.

Dr JA van Niekerk and Hlamalani Ngwenya attended the 2017 annual GFRAS/ APEN International Conference in Australia during September 2017. The theme for this year's conferences were, 'Rural advisory services and empowered youth for balanced transformation in rural and urban communities' and 'Facilitating balanced change for rural and urban communities'. The development of the New Extensionist Learning Kit received much attention during this conference and has been one of the flagship initiatives of the GFRAS Consortium on Extension Education and Training since 2015. The New Extension concept is in line with the concept of the agricultural innovation systems. The learning kit with 13 modules is suitable for blended approaches to include face-to-face or self-directed learning. The kit has been developed through a consultative process over a four-year period. During the side event, 'The New Extensionist Learning Kit: No longer a dream, but a reality', Dr Van Niekerk delivered a comprehensive overview of the NELK (New Extensionist Learning Kit) mainstreaming and Mrs Ngwenya elaborated on the strengthening relationship, implementation, and evaluation of the NELK.

Hlamalani Ngwenya was appointed deputy chair for the Citrus Industry Trust (CIT). She was also appointed as an ambassador for the Nuffield International Scholarships programme. Ngwenya continues to pursue the PERFECT opportunity and hosts farmer-to-farmer exchange events between local and international farmers (April 2017). PERFECT is used as an acronym for Policies, Education, Research, Farming and Finance, Extension and Advisory Services, Communication and ICTs and Trade. She also attended the Nuffield Farmer Scholarship Contemporary Conference in Brazil (March 2017). In October 2017, she was invited as a presenter and resources person to Brussels, Belgium, for the Bayer Youth Agriculture Summit, an event bringing together more than 150 youths from more than 50 countries to talk about agriculture and sustainable development.

Student Achievements

We celebrate two of our PhD students who successfully completed their PhD studies:

Maanda Caiphus Dagada with his doctoral thesis, 'Socio-Economic Impact of Agricultural and Agro-Processing Co-Operatives on Food Security and Incomes in Limpopo Province, South Africa', has contributed towards new knowledge on the agricultural and agro-processing cooperatives and the role that they play in alleviating poverty in rural areas. He has demonstrated that rural farming systems are dependent on rural institutions such as cooperatives for their livelihood, since they are central to the supply of farming inputs, farming tillage, marketing, product value-adding, and the provision of much needed finances.

Jan Willem Swanepoel with his thesis, 'Analysing Urban Household Food Security in the Cape Town Metropole of South Africa, with reference to the role of Urban Agriculture', contributes to the development of indicators for measuring food security and the quantification of the impact that urban agriculture has concerning food security in this area. With this contribution, he attempts to clarify contrasting assumptions regarding the contribution of urban agriculture towards food security, as well as standardising the ambiguous and inconsistent food-security measurement tools. The results of this research are an enormous contribution to the knowledge base and insight into the field of agriculture, with particular reference to food security and urban agriculture.

RESEARCH

During 2016 and 2017, the FAO, the UFS, and Ghent University embarked on collaborations regarding good management practices in agricultural extension. This led to further research initiatives and partnerships between the UFS and numerous private and academic institutions across Europe, which will be further investigated in 2018.

Community Service

The Chancellor's Medal for outstanding service at local, national, and international level or for service to the UFS community, was awarded to Joyene S Isaacs, as nominated by the Centre for Sustainable Agriculture, Rural Development and Extension.

The Western Cape Department of Agriculture is recognised worldwide for its impeccable record of service delivery, resulting in the Western Cape's agricultural sector thriving in numerous domains. A study we did in collaboration with the FAO, highlighted the department's impeccable execution of tasks and utilisation of resources, incorporating the entire network of farmers, educational structures, industry experts, and private partners. From the results of the study it became evident that the success of the department is mostly due to the excellent leadership and guidance of Joyene Isaacs (Head: Department of Agriculture, WC).

Isaacs' love for agriculture, commitment to her role, and constant desire for innovation not only sets an example for her staff, but also introduces much needed advancements (technological and otherwise) to the department, driving its success. Apart from all the successes she has achieved as HOD, she also boasts numerous publications in international journals, as well as countless presentations at conference proceedings. She is viewed as a true leader in her field and an example of how one person's hard work and commitment can lead an institution to being recognised internationally for its innovative and highly successful implementation of practices. She is not only a great ambassador for the Western Cape, but also for South Africa.

National and International Collaboration

Hlamalani Ngwenya, in collaboration with the Global Forum for Rural Advisory Services (GFRAS) and the Benin National forum, conducted training on farmer organisational development in Benin, West Africa (August 2017).

Dr Johan van Niekerk and Hlamalani Ngwenya attended the Global Forum for Rural Advisory Services Annual meeting in Australia (September 2017).

Hlamalani Ngwenya, in collaboration with RUFORUM (Regional University Forum for Capacity Building in Agriculture), conducted a Principal Investigators Orientation Meeting (PIOM) for the RUFORUM Community Action Research Project, involving universities from Kenya and Uganda.

STAFF MATTERS

To ensure that the language, writing, and research capabilities and skills of students are continuously developed, we contracted Kirsty Green and Anathi Silwana to focus on language and skills development, ensuring the holistic development of our students. Kirsty Green assists students with the data analysis of their research projects. Starting 2018, we endeavour to present Agricultural Extension on B-degree level, for which Anathi Silwana will take the lead in teaching.

RESEARCH OUTPUTS

Research Articles

Ekepu, D, Tirivanhu, P, and Nampala, P. 2017. Assessing farmer involvement in collective action for enhancing the sorghum value chain in Soroti, Uganda. *South African Journal of Agricultural Extension* 45(1): 118-130.

Langa, T, Mutavhatsindi, TF, Baloyi, JJ, and Nkosi, BD. 2017. Effects of a fibrolytic enzyme and bacterial inoculants on the fermentation. Chemical composition and aerobic stability of ensiled potato hash. *South African Journal of Animal Science* 2018. 48(2): 244-252.

Sonandi, A, Zwane, EF, and Van Niekerk, JA. 2017. Feeding Practices, Food Variety, and Dietary Diversity – Indicators of Nutritional Status among Historically Disadvantaged Agri-business Families, South Africa. *Journal of Nutrition and Food Security* 2(4): 308-317.

Swanepoel, JW, Van Niekerk, JA, and D'Hase, L. 2017. The socio-economic profile of Urban farming and non-farming households in the informal settlement area of the Cape Town metropole in South Africa. *South African Journal of Agricultural Extension* 45(1): 131-140.

Zwane, E, and Van Niekerk, JA. 2017. The perceptions and Attitudes of Small-scale Cane Growers' Offspring towards Farming and Implications for Sustainability: A case study of KwaZulu-Natal North Coast, South Africa. *Journal of Human Ecology* 60(1): 1-8.

STAFF

Director: Dr JA van Niekerk.

Lecturers/Researchers (permanent): Dr JW Swanepoel and HJ Ngwenya.

Lecturers/Researchers (part-time): Prof E Zwane, Prof F Neser, Prof CJ van Rooyen, Dr H Smit, Dr BD Nkosi, Dr P Malan, Dr E Kotze, Dr JH Barnard, Dr N Fouché, L Kruger, J van den Berg, K Green, and A Silwana.

Senior Officers: G Green and A Calitz.

Officer: R Coetzee.

ACADEMIC CENTRES

Paradys Experimental Farm

Contact Details
Prof FWC Neser
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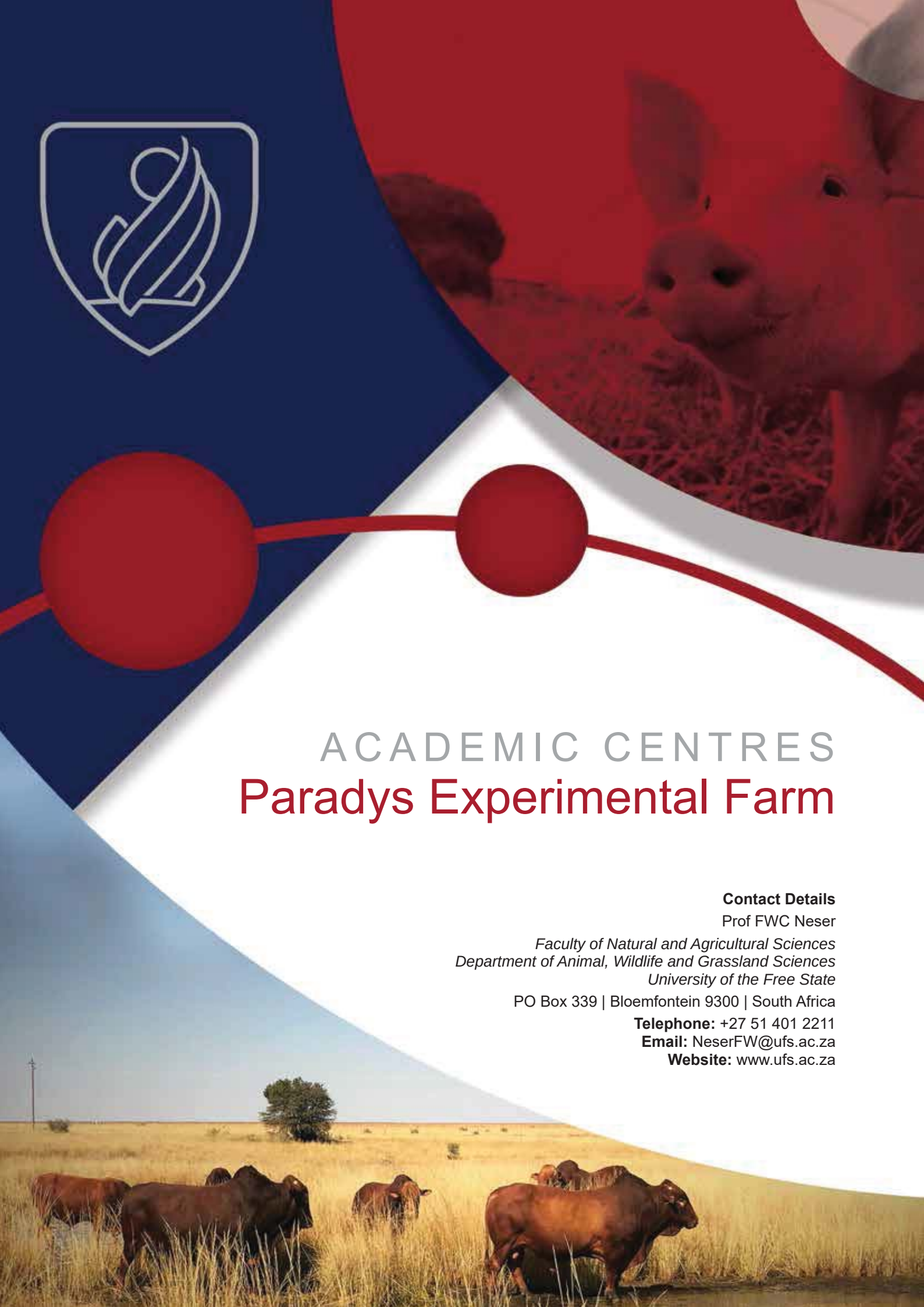


2017 Overview

Because of the ongoing drought gripping our nation, the respective weaning weights of cattle dropped by 5% and sheep by 2%, while the reproductive performance of both enterprises stayed the same. The livestock enterprises had a conception rate of 90% (Afrikaner cattle) and 95% (South African Mutton Merino sheep) respectively. The farm also served as a practical hub for students and the public. During these practical days, the UFS and the respective schools' students were exposed to the practical activities of the agricultural industry surrounding livestock and fodder production. The farm also hosted some social functions for the public and students in the farm's lapa.

ACHIEVEMENTS

Activities

We present farmers' days for students and the public to create awareness and provide information about certain goods, services, and marketing:

- Lucerne (crop for cultivated pastures)
- Pig production
- Stock theft with SAPS (South African Police Service)
- Branding of animals
- Agricultural engineering (irrigation systems)
- Feed catalogue (various feeds and supplying companies)
- Animal health

RESEARCH

We conduct various trials on the farm.

The collection of data on the Afrikaner cattle breed

- Fertility: The age at which the animals reach puberty and the average fertility of the herd.
- Growth: As the production system is based on an ox-production system, the animals are regularly weighed to analyse the quality and quantity of veld-fed beef. The animals are also given various production lick treatments to determine the effect it has on their growth and feed conversion as well as on their gestation period.
- DNA sampling: DNA is collected from all animals born on the farm as part of the Afrikaner Cattle Breeders' Society in order to determine certain genetic markers for growth, milk quality and quantity, weaning weight, maternal and reproductive traits.
- Genetic baseline: The Afrikaner herd on the farm also serves as genetic baseline for the Afrikaner breed, because they are genetically very diverse and well adapted to the environment. Animals sold from Paradys have adapted extremely well to other areas in the country, which is a very rare occurrence.
- Crossbreeding: During the past four years, the Afrikaner maternal line has been crossbred with Simmentaler and Simbra to get an ultimate breed called the Afrisim, which increases the weaning weight and provides an alternative market for selling wearers to feedlots.
- Selective breeding: The main herd has been selectively bred, using excellent bull stock to improve the genetic composition of the herd and especially the birth weight and weaning weight of calves (higher weights), thereby ensuring optimal producing animals.

The collection of data on the sheep herd

- Reproductive performance: The herd is subjected to excelled mating frequency (three births in two years) in order to increase the reproductive rate of the herd. The conception and lambing rates are recorded to ensure that reproductive performance increases.
- Early weaning practices: Lambs are weaned a month sooner than usual and given various feeds to determine the best feed and practice for early weaning.
- Mineral supplementation: The effect of mineral supplementation on the herd has also been tested, as well as the effect it has on reproductive performance. The results show that mineral supplementation is needed for increased reproductive performance.

Feeding trials on cattle and sheep

- Feeding of weaned lambs: For feedlot purposes, different types of feed are tested on lambs to research the effect it has on animal growth and feed

conversion (amount of weight gained / amount of feed ingested).

- Feeding of bulls for slaughter: To research the economic viability of feeding Afrikaner bulls for slaughter and determine the conversion of their feed.
- Lick supplementation: Animals are given various types of production lick to research the effect it has on their growth and condition, and to determine the economic viability of supplementing lick during the winter.

Crop production trials

- Planted pastures (irrigation): Various types of perennial grasses are planted to research the production potential under irrigation and dry-matter production.
- Planted pastures (dryland): Various types of perennial grasses are planted to research the production potential in normal rainfall areas, and as a method of improving the fodder flow on natural veld.
- Dryland production of teff for effective fodder production under various plant population densities.

Community Service

We present the following community training:

- Correct animal handling: Showing and illustrating the correct way to handle animals without causing stress or injury.
- Breeding goals: Determining the type of production system required and advising on the best possible breed and breeding plan to follow and use.
- Animal vaccinations: Teaching the correct way of vaccinating, and the types of vaccination to administer.
- Animal branding and marking: Teaching the correct way of marking and branding animals.
- Stockmanship: Training people to farm better and produce livestock.
- Practical days for schools: Schools visit the farm to familiarise students on the practical aspects of farming and the farming industry.

STAFF

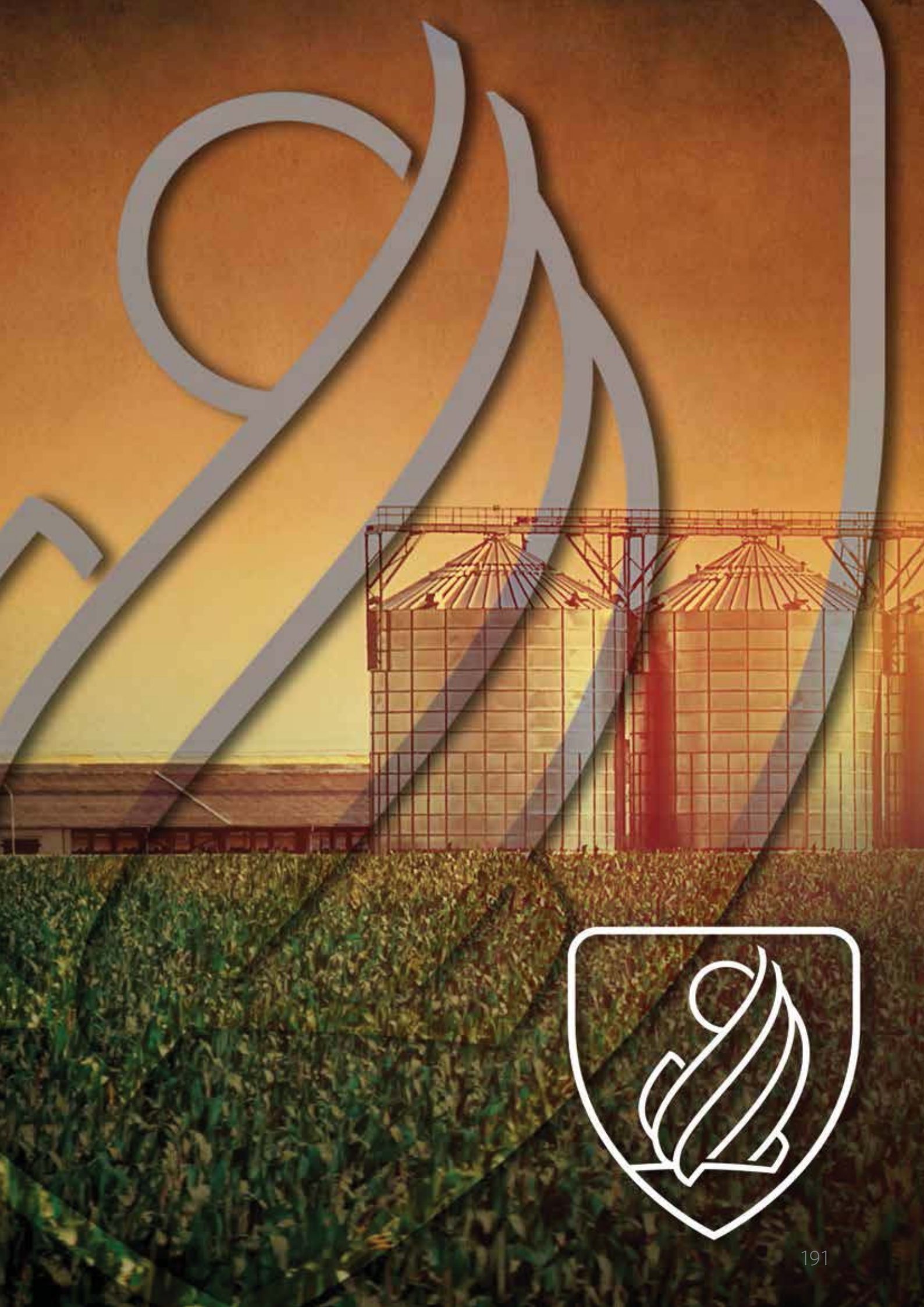
Farm manager: J Barnard.

Assistant Officer: AM Smith.

Research assistant: JF McDonald.

Research assistant: B Madyibi.

Farm workers: MA Khoele, TF Kubheka, MA Kubheka, LE Maqala, PM Morirhela, YS Motswari, KP Ramatekoane, EM Sebonyane, PM Somi.



ACADEMIC CENTRES

Engineering Sciences

Contact Details

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2017 Overview

Student figures for Engineering Sciences increased substantially. We began our first three-year research project on developing a new Green Building Index to determine the cost-benefit analysis for retrofitting existing buildings.

ACHIEVEMENTS

Staff Achievements

Dr Jacques Maritz obtained his PhD in Physics and passed the Certified Energy Manager (CEM) international exam. Louis Lagrange and Jaco Homann passed the Certified Water Efficiency Professional (CWEP) international exam, and Louis also passed the Certified Business Efficiency Professional (CBEP) international exam. Jaco Homann obtained his MSc (Mechanical Engineering) degree.

Activities

We adjusted our curriculum to enable graduates to also articulate into aeronautical and industrial engineering at the University of the Witwatersrand.

RESEARCH

National and International Collaboration

We took part in the establishment of the Innovation Highway memorandum of agreement between the UFS, NWU, CUT, and VUT, and attended and presented at the World Energy Engineering Conference in Atlanta, USA, and the SA Energy Efficiency Confederation Conference (SAEEC).

RESEARCH OUTPUTS

Conference Contributions

Lagrange, LF. 2017. *Conceptualization of the quantity and quality of energy for energy management* (paper). World Energy Engineers Conference (WEEC), Atlanta, United States of America. 27-29 September.

STAFF

Professors: Prof HJ Marx.

Senior Lecturer: LF Lagrange.

Junior Lecturers: RJ Homann and NC Bernstein.

Secretary: C du Toit.

Chief Technician: HJ Lubbe.

Twelve external specialist Engineering lecturers.

ACADEMIC CENTRES

Institute for Groundwater Studies

Contact Details

Eelco Lukas

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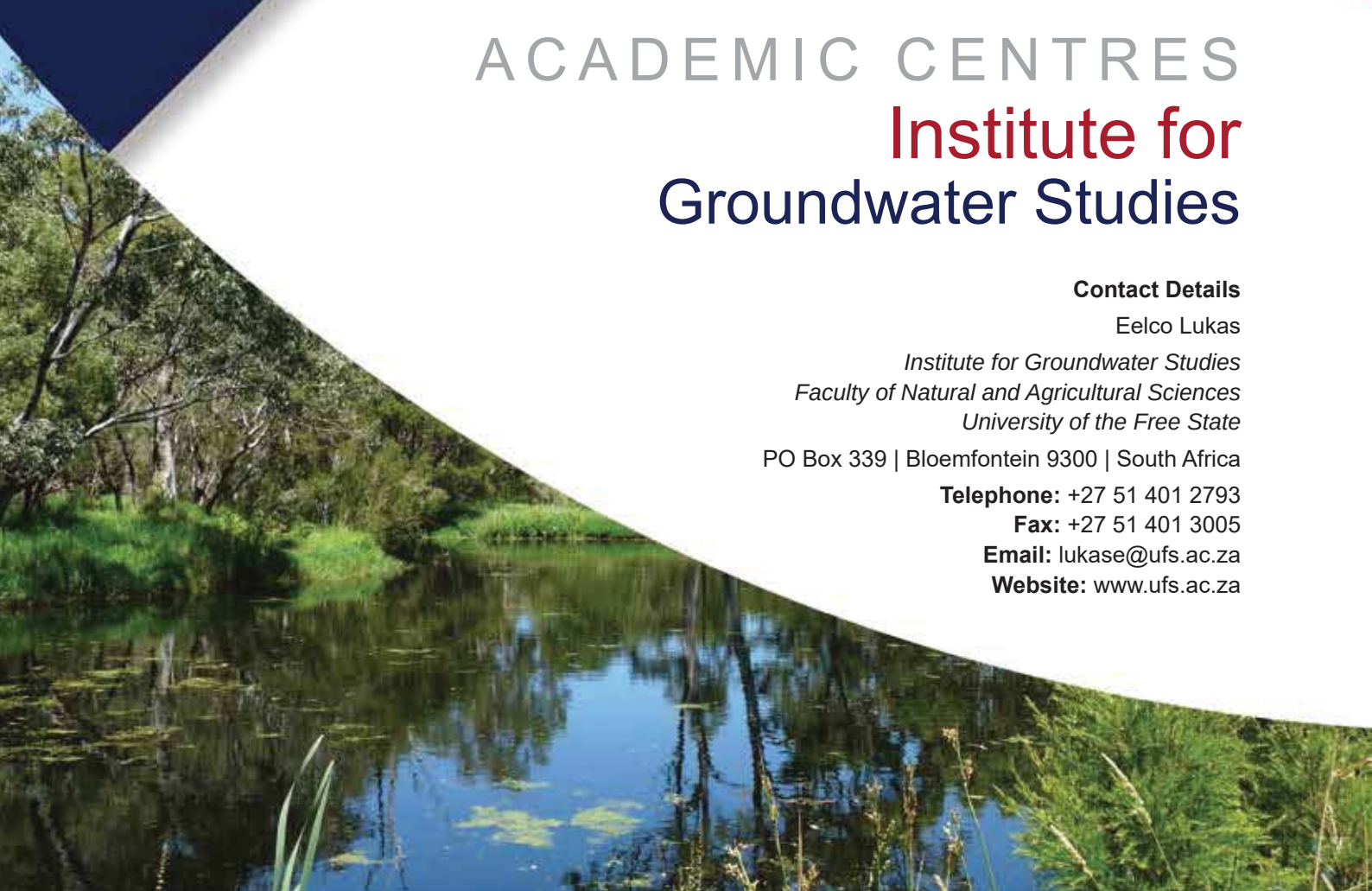

2017 Overview

Since its inception, the Institute for Groundwater Studies (IGS) established itself as the leading groundwater research group in Africa. We have shown a gradual growth in the number of postgraduate students and is proud of the continued quality and excellence in pursuit of the strategic priorities of the University of the Free State. The year 2017 can be regarded as a very successful year for the institute.

One of the highlights of the year was the SADC Groundwater Management Institute (SADC-GMI), sponsored by the World Bank, that became fully operational. The SADC-GMI will strengthen the capacity of institutions to establish sustainable groundwater management. It will promote the management and development of groundwater infrastructures, and advance knowledge about national and transboundary groundwater. With the establishment of the new institute, research will be conducted, knowledge shared, and capacity built.

We gratefully acknowledge the continued contributions and support of all our staff.

ACHIEVEMENTS

Staff Achievements

Prof Abdon Atangana was invited as a plenary speaker to the International Workshop on Mathematical Methods in Engineering. This workshop took place at Çankaya University, Turkey, from 27 to 29 April 2017. He also received the award for invited speakers from the Rector of Çankaya University.

Prof Abdon Atangana – Plenary speaker

Student Achievements

Our staff's and student's commitment and enthusiasm were clearly demonstrated by the graduation figures – 13 MSc and 2 PhD students graduated in 2017. Four master's students passed with distinctions. We are proud of all our students who obtained their degrees.

The following students received IGS bursaries in 2017.

Josepha Zielke (student of Prof Danie Vermeulen)
Martin Tinnefield (student of Prof Pieter le Roux)
Nancy Job (student of Prof Pieter le Roux)
Jescica Spannenberg (student of Prof Abdon Atangana)
Kolade Owolabi (postdoc of Prof Abdon Atangana)
Joyce Ramasala (student of Dr Lore-Mari Deysel)
Matamela Madzonga (student of Dr Lore-Mari Deysel)
Ayanda Hadebe (LAB Intern)
Malefa Moleme (student of Dr Modreck Gomo)
Marnus du Toit (student of Paul Lourens)
Jandre de Beer (student of Paul Lourens)
Jean van Niekerk (student of Eelco Lukas)
Albie Steyn (student of Eelco Lukas)
Nadene Goosen (student of Fanie de Lange)
Nancy Njonguo (student of Amy Allwright)
Anton Lukas (student of Amy Allwright)

The IGS Dux Prize for the best honours student in Geohydrology was awarded to Alina Kadhila from Namibia for an average mark of 77%. The prize was awarded by Amy Allwright, Junior Lecturer in the IGS at the Faculty of Natural and Agricultural Sciences' prize-giving ceremony.

Special Achievements

Researcher, Dr Francois Fourie, was promoted to Senior Lecturer due to his outstanding performance as academic and researcher.

Gaonkile Ntwaeaborwa (Officer: IGS Lab) obtained her MSc in Geohydrology. The title of her dissertation was, 'Acid-Base potential characterization in the Southern Highveld Coalfield of Mpumalanga'. She was appointed as Quality Manager for the IGS Lab. We

value her appointment and wish her all the best with the challenging position.

RESEARCH

We encourage students to present their research results at conferences, and to publish papers in accredited journals. Our research is aimed at various aspects of geohydrology. Staff members and students actively contributed towards generating research outputs, actively provided services to industry and community, and students performed relatively well in their studies. Different projects are funded by different funding institutions and little or no resources are required from the UFS.

All the academic staff are involved in research (e.g. Bloem Water, Water Research Commission (WRC), Sasol, etc.) and consulting projects.

Research Activities

We are proud of our staff's research activities, including:

- Capacity Building for Data Collection and Management in SADC Member States (2017-2018);
- Update of the Groundwater Sampling Manual KSA 1- THRUST 3 Contract no. 2428 (2015-2017) for the Water Research Commission of South Africa;
- Investigation of the Characteristics of Fluid Electrical Conductivity (FEC) borehole profiles in different aquifer systems and different hydrogeochemical conditions (2016-2019);
- Characterising the potential deep aquifer systems in South Africa and investigating options for protecting these aquifers (Water Research Commission Project);
- Investigating the decant rate from an opencast mine by using a water balance approach;
- Developing guidelines to groundwater vulnerability mapping for Sub-Saharan Africa;
- Mapping riparian vegetation and characterising its groundwater dependency at the Modder River Government Water Scheme;
- Connectivity of Geohydrological Processes and the Interaction with the Surface Hydrology of the Letaba River;
- Determination of the possible requirements for remediation of manganese impacted groundwater at an industrial facility in Nelspruit, etc.

Community Service

One of our goals was to increase our involvement in the local community. Several community projects are still ongoing and is supervised by Fanie de Lange, in collaboration with Bloem Water. For example, boreholes were drilled at 13 villages in the Thaba Nchu area.

Thaba Nchu Water

International Collaboration

Prof John Cherry visited the IGS in 2017. Collaboration negotiations are happening between the IGS and G360 Institute for Groundwater Research at the University of Guelph, Ontario. Prof Cherry is probably best known as one half of Freeze & Cherry who authored the authoritative textbook *Groundwater*, first published in 1979. He has had a long and distinguished career in hydrogeology and currently serves as Distinguished Professor Emeritus at the University of Waterloo, Ontario, Canada and conducts research as an Adjunct Professor and member of the G360 Institute for Groundwater Research. He was also the recipient of the 2016 Lee Kuan Yew Water Prize awarded at the Singapore International Water Week in July 2016 in recognition of his achievements and dedication to groundwater research and teaching.

Prof John Cherry

Postgraduate Students

The institute had 20 enrolments for the BSc Honours in Geohydrology, 71 for the MSc, and 18 who registered for the PhD.

We receive an overwhelming number of applications for honours, master's, and doctoral studies each year. Due to the module intensity, limited staff capacity, and space, we only select the best academic students.

All the applications are subject to a strict selection process where the selection committee considers the academic performance of the student, as well as their work experience.

The compulsory annual winter field trip for honours and master's students took place from 3 to 7 July 2017 under the supervision of Fanie de Lange and Paul Lourens. It is important to expose our students to the practical issues of groundwater. They visited Rustfontein Dam, the Barkley East area, and Virginia.

STAFF MATTERS

It was with a sense of disbelief that we bid farewell to a beloved colleague and friend, Dr Johan van der Merwe, who passed away in 2017. He obtained his PhD degree in Geohydrology in 1982 and started working as a researcher and lecturer at the institute in 1997. He also worked for Water Affairs, but soon realised where his roots were. Dr Van der Merwe supervised a few MSc and PhD students and presented the Groundwater Management Honours Module. We will miss his presence, insight, and innovative way of thinking.

Dr Van der Merwe and students

RESEARCH OUTPUTS

The 15th Biennial Groundwater Division Conference with the theme 'Change, Challenge and Opportunity' was held at the Spier Wine Estate in Stellenbosch from 14 to 18 October.

The biennial GWD conferences have been central in sharing knowledge about groundwater in South Africa. Besides groundwater science, it is about networking, exchanging ideas in preparation for the challenges that so often accompany change, and enabling people to see the opportunities in the challenges. Several of our staff members and students presented papers at the conference.

Staff members: Paul Lourens, Dr Francois Fourie, and Amy Allwright.

MSc students: Marnus du Toit, Magiel Lourens, Suleen Vermaas, Nishen Govender, Nwabisa Makiwane, and Tumelo Mokgatle.

PhD students: Nicolette Vermaak, Josepha Zielke-Olivier, and Sage Ngoie.

Prof Danie Vermeulen from the Dean's Office.

Dr T Kanyerere from the University of Western Cape.

The 2017 Annual Conference on IMWA, titled 'Mine Water and Circular Economy' was held in Rauha, Lappeenranta, Finland, from 25 to 30 June 2017. Mining and reliable mine-water management are of crucial importance for the Finnish and worldwide mining industry. Circular economy means "closing the loop" of product lifecycles by improving recycling and re-use. In the case of mine water, this means that mining wastes and mine water are used to extract valuable materials such as metals, fertilisers or absorbents for waste-water purification. Doctoral students Josepha Zielke-Olivier and Emmanuel Sakala, Paul Lourens, Dr Francois Fourie, Dr Modreck Gomo, Prof Danie Vermeulen from the IGS, and Henk Coetzee from the Council for Geoscience presented papers at the conference.

Dr Modreck Gomo was invited by the International Scientific Committee to deliver an oral presentation at the 19th International Conference on Water Resources Management and Technology. The conference was held in Dubai from 27 to 28 November 2017. Dr Gomo delivered a paper titled, 'Assessment of Groundwater Chemistry and Quality Characteristics in Alluvial Aquifer and a Single Plane Fractured-Rock Aquifer in Bloemfontein, South Africa'.

Dr Modreck Gomo attended the 18th WaterNet/WARFSA/GWPSA Symposium on Integrated Water Resources Development and Management: Innovative Technological Advances for Water Security in Eastern and Southern Africa from 25 to 27 October 2017 in Swakopmund, Namibia. The theme of the symposium was 'Innovative Technological Advances of Water Security in Eastern and Southern Africa'. The main objective of the SADC Research Agenda was to promote evidence-based implementation of SADC water programmes and projects through multi- and inter-disciplinary research, and synthesis of existing and new information, which will lead to a realisation of the SADC developmental goals. The title of his paper was, 'Preliminary Site Characterization of a Petroleum Hydrocarbon Groundwater'.

Research Articles

Alkahtani, B, Atangana, A, and Koca, I. 2017. Numerical analysis for the Klein-Gordon equation with mass parameter. *Advances in Difference Equations* 291: 1-13.

Alkahtani, B, Koca, I, and Atangana, A. 2017. New numerical analysis of Riemann-Liouville time-fractional Schrödinger with power, exponential decay, and Mittag-Leffler laws. *Journal of Nonlinear Sciences and Applications* 10: 4231-4243.

Alkahtani, B, and Atangana, A. 2017. Generalized groundwater plume with degradation and rate-limited sorption model with Mittag-Leffler law. *Results in Physics* 7: 4398-4404.

Alkahtani, B, Atangana A, and Koca, I. 2017. Novel analysis of the fractional Zika model using the Adams type predictor-corrector rule for non-singular and non-local fractional operators. *Journal of Nonlinear Science and Applications* 10: 3191-3200.

Alkahtani, B, Atangana A, and Koca, I. 2017. New nonlinear model of population growth. *PLoS One* 12(10): 1-12.

Atangana, A. 2017. Fractal-fractional differentiation and integration: Connecting fractal calculus and fractional calculus to predict complex system. *Chaos Solitons & Fractals* 102: 396-406.

Atangana, A, and Alkahtani, B. 2017. Remarks on a green functions approach to diffusion models with singular kernels in fading memories. *Thermal Science* 21(2): 1-7.

Atangana, A, and Baleanu, D. 2017. Application of Fixed Point Theorem for Stability Analysis of a Nonlinear Schrodinger with Caputo-Liouville Derivative. *Filomat* 31(8): 2243-2248.

Atangana A, and Gomez-Aguilar, J. 2017. A new derivative with normal distribution kernel: Theory, methods and applications. *Physica A: Statistical Mechanics and its Applications* 476: 1-14.

Atangana A, and Gomez-Aguilar, J. 2017. Hyperchaotic behaviour obtained via a nonlocal operator with exponential decay and Mittag-Leffler laws. *Chaos, Solitons and Fractals* 102: 285-294.

Atangana A, and Koca, I. 2017. Model of Thin Viscous Fluid Sheet Flow within the Scope of Fractional Calculus: Fractional Derivative with and No Singular Kernel. *Fundamenta Informaticiae* 151: 145-159.

Gomo, M, Ibrahim, KO, Yusuf, A, and Oke, S. 2017. Vulnerability Assessment of Shallow Aquifer Hand-Dug Wells in Rural Parts of Northcentral Nigeria using AVI and GOD Methods.

The Pacific Journal of Science and Technology 18(1): 325-333.

Gomo, M. 2017. Assessment of Groundwater Chemistry and Quality Characteristics in an Alluvial Aquifer and a Single Plane Fractured-Rock Aquifer in Bloemfontein, South Africa. World Academy of Science, Engineering and Technology. *International Journal of Environmental and Ecological Engineering* 11(11): 933-938.

Gomez-Aguilar, J, and Atangana, A. 2017. New insight in fractional differentiation: power, exponential decay and Mittag-Leffler laws and applications. *European Physical Journal Plus*, 132(13): 1-21.

Gomez-Aguilar J, and Atangana, A. 2017. Fractional Hunter-Saxton equation involving partial operators with bi-order in Riemann-Liouville and Liouville-Caputo sense. *European Physical Journal Plus* 132(100): 1-15.

Gomo, M, and Vermeulen, PD. 2017. A transboundary aquifer of potential concern in Southern Africa. *Water Policy* 19: 1160-1171.

Kameni, S, Atangana, A, and Djida, J. 2017. Modelling the movement of groundwater pollution with variable order derivative. *Journal of Nonlinear Science*, 10: 5422- 5432.

Koca, I, and Atangana, A. 2017. Solutions of cattaneo-hristov model of elastic heat diffusion with Caputo-fabrizio and Atangana-Baleanu fractional derivatives. *Thermal Science* 21(6A): 2299-2305.

Oke, S, and Fourie, FD. 2017. Guidelines to groundwater vulnerability mapping for Sub-Saharan Africa. *Groundwater for Sustainable Development* 5: 168-177.

Oke, SA, and Vermeulen, PD. 2017. Geochemical Modelling and Remediation of Heavy Metals and Trace Elements from Artisanal Mines Discharge. *Soil & Sediment Contamination* 26(1): 84-95.

Owolabi, KM, and Atangana, A. 2017. Numerical simulation of noninteger order system in subdiffusive, diffusive, and superdiffusive scenarios. *Journal of Computational and Nonlinear Dynamics* 12: 031010-1-031010-7.

Owolabi, KM, and Atangana, A. 2017. Mathematical analysis and numerical simulation of two-component system with non-integer-order derivative in high dimensions. *Advances in Difference Equations* 2017: 223-1-223-24.

Owolabi, KM, and Atangana, A. 2017. Analysis of Mathematics and Numerical Pattern Formation in Superdiffusive Fractional Multicomponent System. *Advances in Applied Mathematics and Mechanics* 9(6): 1438-1460.

Owolabi, KM, and Atangana, A. 2017. Analysis and application of new fractional Adams–Bashforth scheme with Caputo–Fabrizio derivative. *Chaos, Solitons and Fractals* 105 2017: 111-119.

Parsons, R, and Vermeulen, PD. 2017. The hidden hydrology of Groenvlei, a lacustrine wetland on the southern Cape coast of South Africa. *Water SA* 43(1): 42-47.

Sharmaa, J, Sharma, K, Purohit, S, and Atangana, A. 2017. Hybrid Watermarking Algorithm using Finite Radon and Fractional Fourier Transform. *Fundamenta Informaticae.* 151 2017: 523-543.

Shakhane, T, Fourie, FD, and Du Preez, PJ. 2017. Mapping riparian vegetation and charactersing

its groundwater dependency at the Modder River government water scheme. *Groundwater for Sustainable Development* 5: 216-228.

Spannenberg, JM, Atangana, A, and Vermeulen, PD. 2017. New non-linear model of groundwater recharge: Inclusion of memory, heterogeneity and visco-elasticity. *Open Geosciences* 9: 436-441.

Toufik, M, and Atangana, A. 2017. New numerical approximation of fractional derivative with non-local and non-singular kernel: Application to chaotic models. *European Physical Journal Plus* 132(444): 1-17.

Wang, S, Du, S, Atangana, A, Lu, Z, and Liu, A. 2017. Application of stationary wavelet entropy in pathological brain detection. *Multimedia Tools and Applications.* 2016: 1-14.

Chapters in Books

Atangana, A, and Koca, I. 2017. On Uncertain-Fractional Modelling. *The Future Way of Modelling Real-World Problems. Advances in Real and Complex Analysis with Applications*. 1st Edition. In Ruzhansky, M, Je Cho, Y, Agarwal, P, and Area, I (eds). Singapore: Birkhäuser. (pp. 121-143). 978-981-10-4336-9.

Book

Atangana, A. 2017. *Fractional Operators with Constant and Variable Order with Application to Geo-Hydrology. 1st Edition*. United Kingdom, London, Academic Press, Elsevier.

Conference Contributions

Allwright, A. 2017. *Numerical groundwater flow modelling of a coal mine to improve the understanding of mine water decant – 1000 piece puzzle* (paper). 15th Biennial Groundwater Division Conference and Exhibition, Stellenbosch, South Africa. 14-18 October.

Coetzee, H, Sakala, E, Fourie, FD, and Gomo, M. 2017. *Hydrogeological investigation of the Witbank, Ermelo and Highveld Coalfields: Implications for the subsurface transport and attenuation of acid mine drainage* (paper). 13th International Mine Water Association Congress - Mine Water and Circular Economy, Lappeenranta, Finland. 25-30 June.

Coetzee, H, Sakala, E, Fourie, FD, and Gomo, M. 2017. *Mapping surface sources of acid mine drainage using remote sensing: case study of the Witbank, Ermelo and Highveld coalfields* (paper). 13th International Mine Water Association Congress - Mine Water and Circular Economy, Lappeenranta, Finland. 25-30 June.

Du Toit, M, and Lourens, PJH. 2017. *Post Mining Aquifer testing at a South African Coal Mine* (paper). 15th Biennial Groundwater Division Conference and Exhibition, Stellenbosch, South Africa. 14-18 October.

Fourie, FD, Allwright, AJ, Makiwane, N, and Govender, N. 2017. *Characterisation and Protection of Deep Aquifers in South Africa: Consolidation of Data Sources* (paper). 15th Biennial Groundwater Division Conference and Exhibition, Stellenbosch, South Africa. 14-18 October.

Fourie, FD, Allwright, AJ, Makiwane, N, and Govender, N. 2017. *Characterisation and Protection of Deep Aquifers in South Africa: Characterisation* (paper). 15th Biennial Groundwater Division Conference and Exhibition, Stellenbosch, South Africa. 14-18 October.

Fourie, FD, and Vermaas, S. 2017. *Using TLERT Surveys and Infiltration Tests to Characterise the Unsaturated Zone and Assess the Groundwater Recharge Potential* (paper). 15th SAGA Biennial Conference and Exhibition, Somerset West, South Africa. 10-13 September.

Gomo, M. 2017. *Preliminary Site Characterization of a Petroleum Hydrocarbon Groundwater* (paper). 18th WaterNet/WARFSA/GWPSA Symposium on Integrated Water Resources Development and Management, Swakopmund, Namibia. 25-27 October.

Gomo, M. 2017. *Assessment of Groundwater Chemistry and Quality Characteristics in Alluvial Aquifer and a Single Plane Fractured-Rock Aquifer in Bloemfontein, South Africa* (paper). 19th International Conference on Water Resources Management and Technology. Dubai. 27-28 November.

Lourens, M, and Fourie, FD. 2017. *Establishing a Groundwater Baseline for Unconventional Gas Projects in South Africa* (paper). 15th Biennial Groundwater Division Conference and Exhibition, Stellenbosch, South Africa. 14-18 October.

Lourens, PJH, and Vermeulen, PD. 2017. *Dewatering impacts of a South African underground coal mine* (paper). 15th Biennial Groundwater Division Conference and Exhibition, Spier Wine Estate, Stellenbosch, South Africa. 14-18 October.

Lourens, PJH, and Vermeulen, PD. 2017. *Dewatering Impacts of a South African Underground Coal Mine* (paper). 13th IMWA Conference, Rauha, Finland. 25-30 June.

Mokgatle, T, and Fourie, FD. 2017. *Groundwater Exploration in the Tsineng Area, Northern Cape, Using Airborne and Ground Geophysical Methods* (paper). 15th Biennial Groundwater Division Conference and Exhibition, Stellenbosch, South Africa. 14-18 October.

Ngoie, S, and Fourie, FD. 2017. *Development of an Artificial Neural Network for the Prediction of Mine Dewatering* (paper). 15th Biennial Groundwater Division Conference and Exhibition, Stellenbosch, South Africa. 14-18 October.

Sakala, E, Fourie, F, Gomo, M, and Coetzee, H. 2017. *Hydrogeological Investigation of the Witbank, Ermelo and Highveld Coalfields: Implications for the*

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Zielke, JSDR, and Vermeulen, PD. 2017. *Applied Geophysics to Investigate Groundwater Pollution Flow Paths Along a Fault System in an Industrial Environment* (paper). 15th Biennial Groundwater Division Conference and Exhibition, Stellenbosch, South Africa. 14-18 October.

STAFF

Acting Director: E Lukas.

Affiliate Associate Professor: Prof KT Witthüser.

Affiliated Researchers: Prof JF Botha and Dr J van der Merwe.

Professor: Prof A Atangana.

Senior Lecturer: Dr F Fourie.

Lecturers: SS de Lange and PJH Lourens.

Researchers/Geohydrologists: Dr M Gomo and E Lukas.

Junior Lecturer: A Allwright.

Chief Officer: Financial Manager: L Rust.

Officer: Professional Services: A Rossouw.

IGS Laboratory:

Deputy Director (IGS Laboratory): Dr L-M Deysel.

Assistant Director (IGS Laboratory): E de Necker.

Assistant Analyst: H Human.

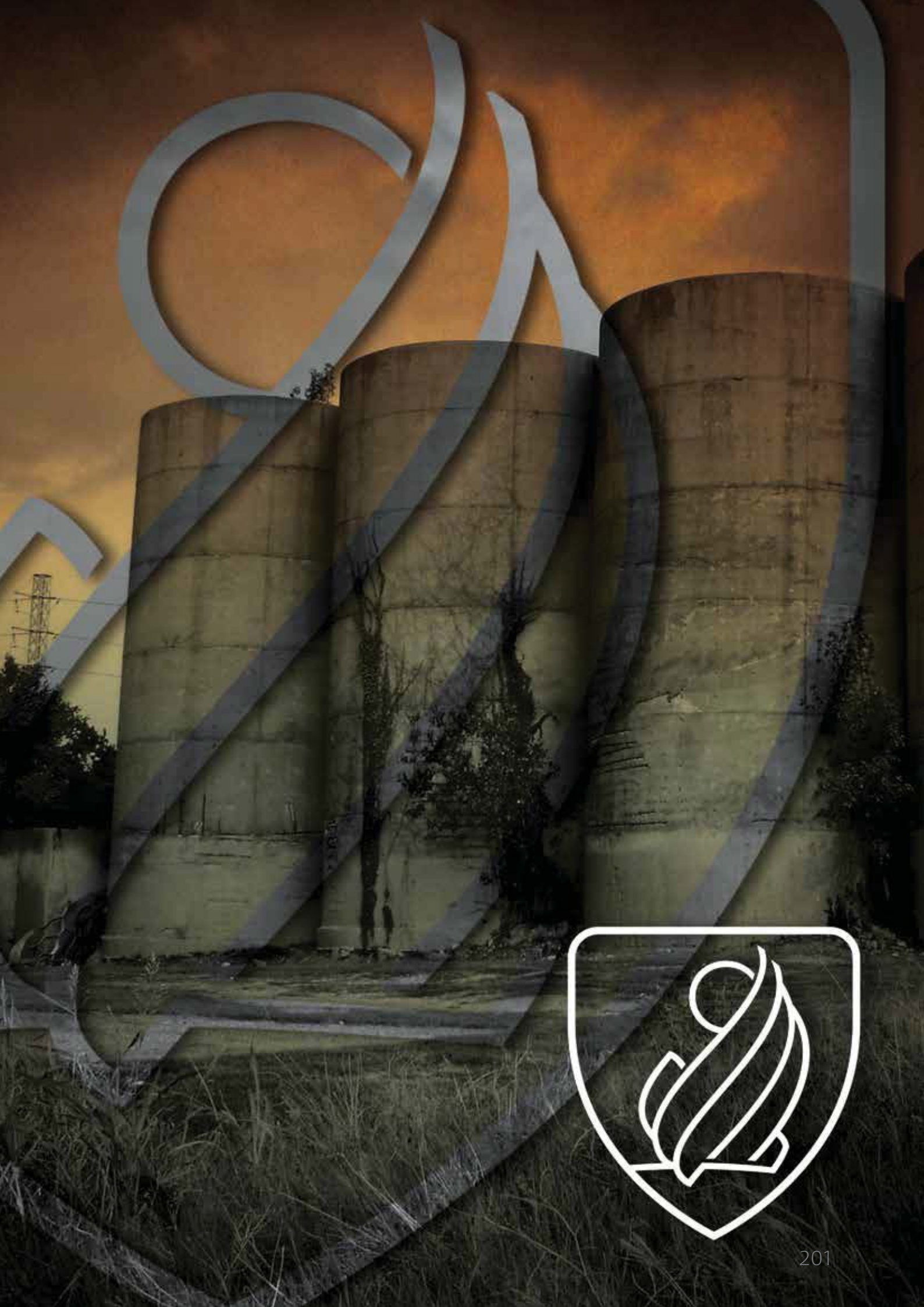
Quality Manager: G Ntwaeaborwa.

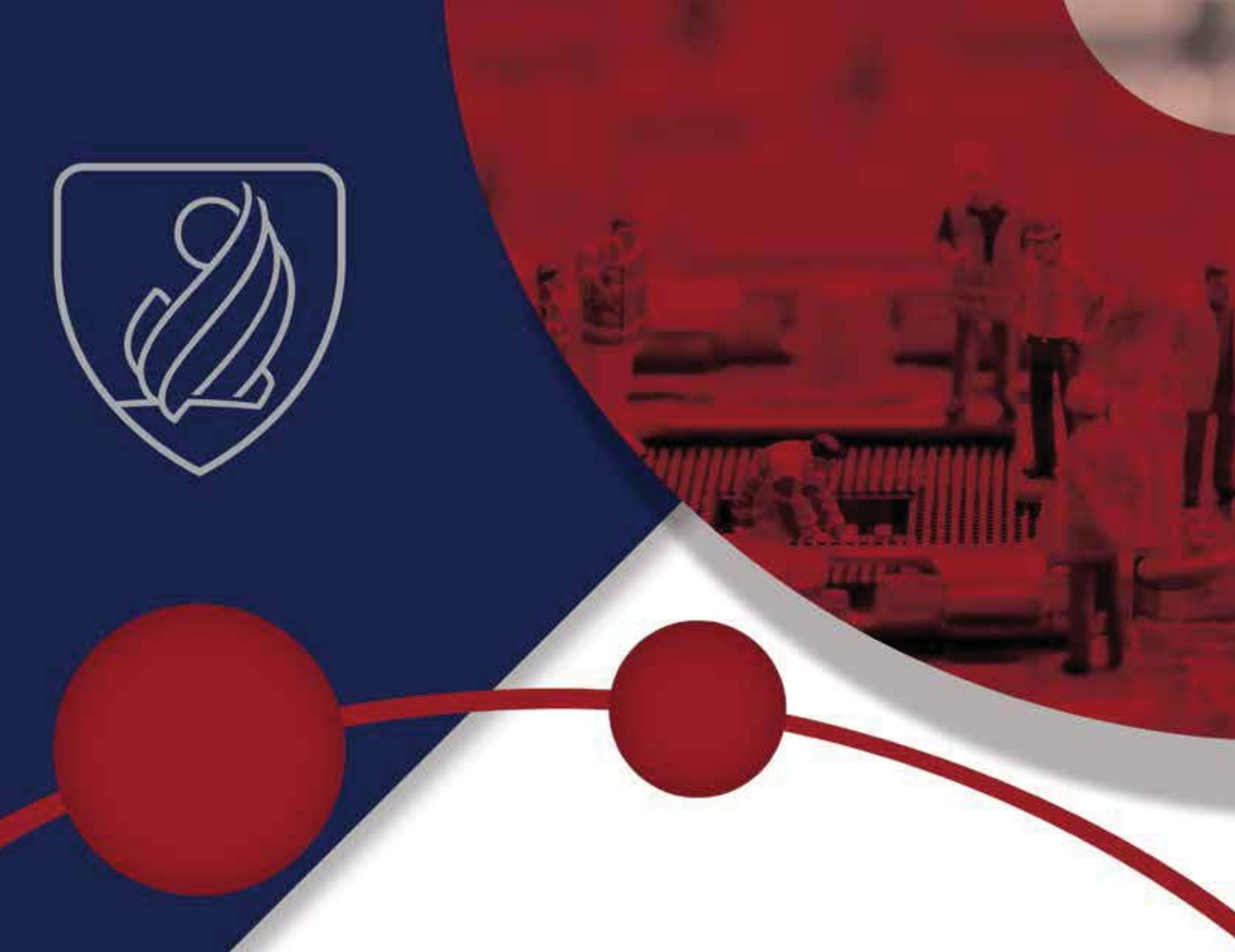
Officers: WC Geyer and T Letebele.

Senior Assistant Officer: NV Ntswabule.

Intern: A Hadebe.

Cleaner: K NciNci.





DIVISIONS

Electronics Division

Contact Details
AB Hugo
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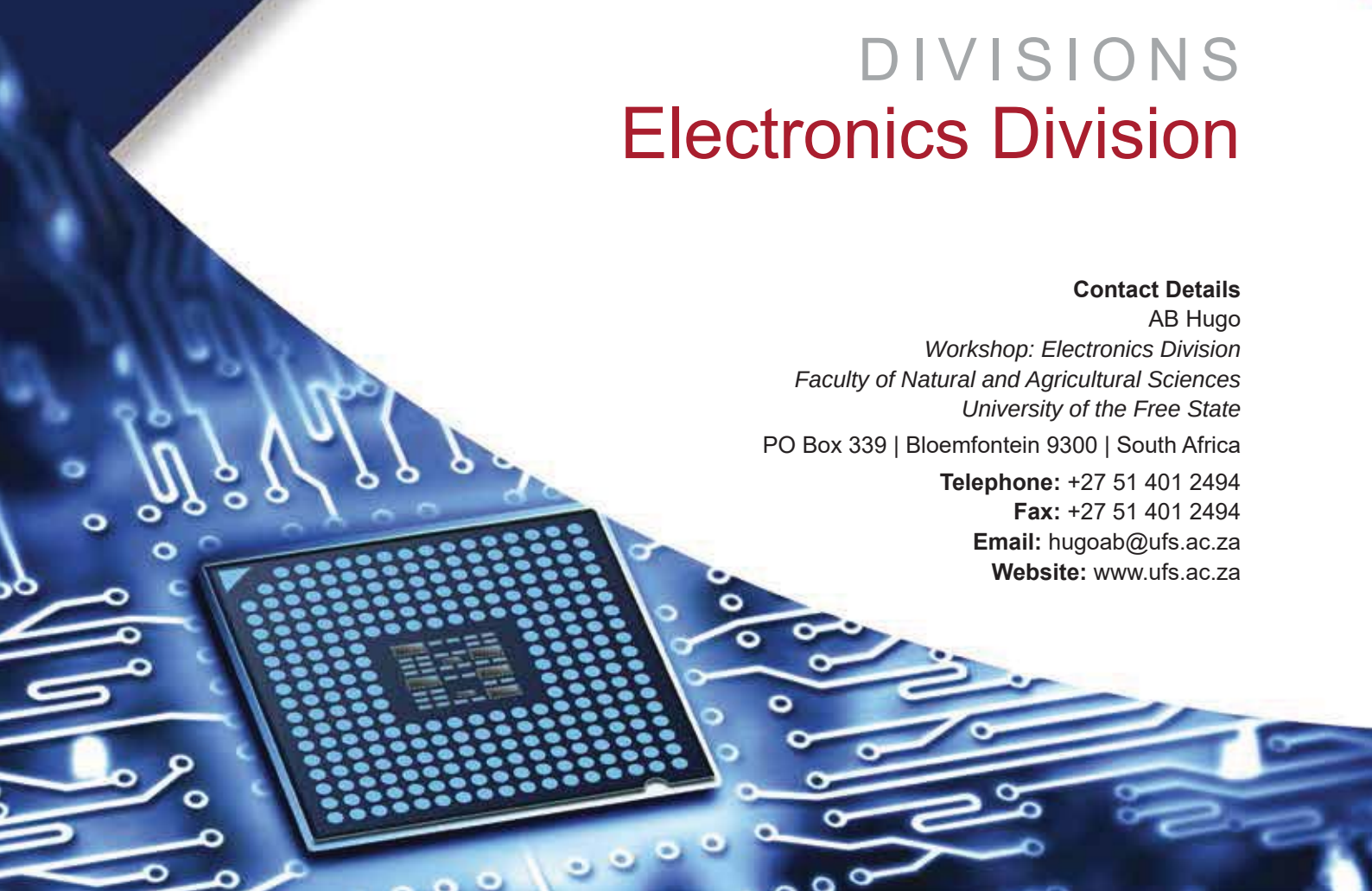

2017 Overview

It was our first full year of operation in the upgraded working environment, which made a big difference regarding work satisfaction and productivity. We are looking forward to improved collaboration between Instrumentation and Electronics, since the two divisions will resort under one divisional head.

The estimated saving for the Faculty of Natural Sciences during the past year was R3,696 million. This amount is calculated by taking the actual number of working hours, minus the internal administration hours, multiplied by R700. We repaired the following expensive apparatus: Versaprobe, XPS, ICP, MS ICP, SAM700, Leco, AA, Potensiostat, and numerous other instruments.

An estimated R3,8 million was saved by repairing the above apparatus, pushing the total savings in the region of R7,496 million.

Work activities

We received a total of 438 work requisitions during the past year, representing 681 apparatus, of which 21 were for development projects. Some were new, and others were extensions of existing systems as well as the upgrading of older systems, as shown in tables 2 and 3.

Of a possible 6 095 working hours, 6 005 were actively used. Percentage-wise, the active usage was calculated at 98,5%. The possible hours were calculated at 7,25 hours per day per person present.

Table 1 lists 31 departments and divisions which made use of the services of the Division of Electronics. This is shown in 1 (Department); 2 (Total time spent); and 3 (Percentage of Total).

TABLE 1

Department	Total Time Spent	Percentage
Chemistry	1 138	18,95%
Physics	1 035	17,24%
Biotechnology	855	14,24%
Internal Administration	725	12,07%
Soil, Crop and Plant Sciences	604	10,06%
Electronics	285	4,75%
Plant Sciences	221	3,68%
Institute for Groundwater Studies	163	2,71%
Outside Work	153	2,55%
Computer Sciences and Informatics	109	1,82%
Geology	103	1,72%
Animal, Wildlife and Grassland Sciences	92	1,53%
Genetics	76	1,26%
Zoology and Entomology	75	1,24%
Pharmacology	61	1,02%
Instrumentation	56	0,93%
Agricultural Economics	47	0,78%
ICT Services	40	0,67%
Geography	28	0,47%
Virology	26	0,43%
Physical Resources	22	0,37%
National Control Laboratory	17	0,28%
Engineering Science	17	0,28%
Urban and Regional Planning	10	0,17%
Haematology and Cell Biology	9	0,15%
Finance	9	0,15%
Architecture	7	0,12%
Centre for Environmental Management	6	0,10%
KovsieFit	6	0,10%
Centre for Microscopy	5	0,08%
Dean's Office	5	0,08%
Total	**6 005**	**100,00%**

TABLE 2	
Completed Projects	
Department	**Apparatus**
Physics	13 x practicum building units
	1 x Fourier synthesiser
	1 x winch control
	1 x power supply
Biotechnology	1 x upgrade camera system
	1 x autoclave
	1 x door alarm
Chemistry	1 x heating/cooling system
	1 x water-slit control
Soil, Crop and Plant Sciences	1 x timer for mist bed
	1 x control for polycarbonate house
Plant Sciences	3 x glasshouse alarm system
	1 x freeze-drier
IGS	4 x maglocks
	1 x cell to gate
Electronics	1 x universal control board

TABLE 3		
Unfinished Projects		
Chemistry	1 x upgrade access control	
	1 x carbon dioxide apparatus	
Physics	16 x practicum apparatus	
Computer Sciences and Informatics	1 x eye-tracking device	
Soil, Crop and Plant Sciences	1 x poison-spray unit	
Time spent on the different faculties:		
Natural and Agricultural Sciences	5 662	94,29%
Other	343	5,71%
A total of 1 589 hours was spent on development, 3 691 hours on maintenance, and 725 hours on administration:		
Maintenance	61,47%	
Development	26,46%	
Administration	12,07%	

STAFF

Head of Division: AB Hugo.

Control technicians: I Basson, HJ Roodt, MH Jackson.

Technical Assistant: Denver de Koker.

DIVISIONS

Instrumentation

Contact Details

P Botes

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2017 Overview

Piet Botes went on early retirement and Adriaan Hugo managed both the Electronic and Instrumentation divisions. There are challenging times ahead, but we are optimistic that the two combined divisions will be able to deliver better service to the university and that there will be closer co-operation between all our customers.

TABLE 1	
Department	**Number of Work Orders**
Outside Work	204
Physics	37
Biotechnology	22
Soil, Crop and Plant Sciences	19
Electronics	18
Plant Sciences	18
Institute for Groundwater Studies	18
Chemistry	17
Animal, Wildlife and Grassland Sciences	11
Zoology and Entomology	8
Pharmacology	7
National Control Laboratory	4
Geology	2
Centre for Microscopy	1
Computer Sciences and Informatics	1
Total	**387**

TABLE 2	
Completed Projects	
Department	**Apparatus**
Physics	20 x foot pieces and stands
	4 x PLD sample holders
	3 x Perspex cabinets
	3 x trolleys
Chemistry	2 x apparatus for thermal analysis
	1 x frame for carbon dioxide apparatus
National Control Laboratory	20 x guinea pig cages
	2 x trolleys
Soil, Crop and Plant Sciences	10 x sample holders
	8 x tripod stands
Biotechnology	1 x autoclave
IGS	2 x bailers
Plant Sciences	1x cabinet for glass tubes

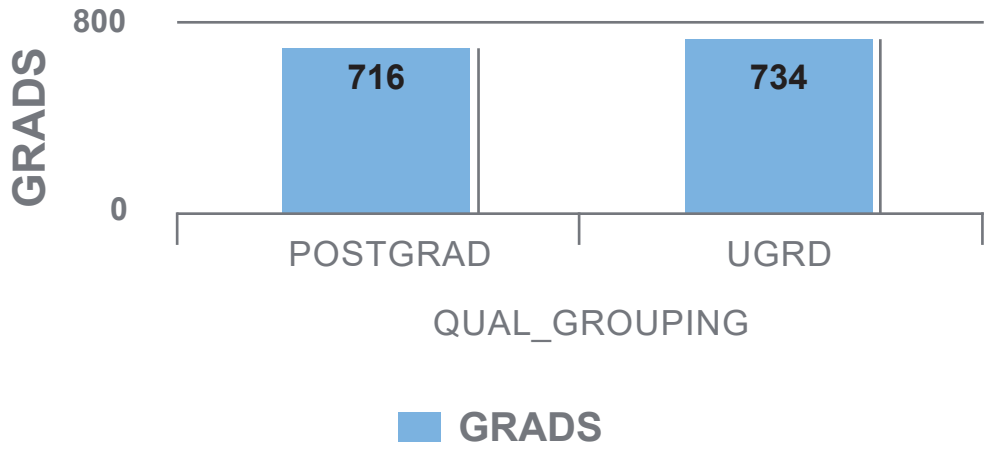
TABLE 3	
Unfinished Projects	
Soil, Crop and Plant Sciences	1 x poison-spray unit

Goals for the new year:

Our first goal is to prioritise the work of the university, and to deliver a friendly service to our clients. We will also focus on improving productivity and time management.

Statistics

Previous Year Graduates by Education Level



QUAL_GROUPING	GRADS
POSTGRAD	716
UGRD	734
TOTAL	**1450**

Graduates by Education Level Report - NAS

YEAR = 2017

Previous Year Registrations by Nationality

NATIONALITY GRP > QUALIFICATION_GRP	ENRL
v INTERNATIONAL	494
v SOUTH AFRICA	6 477
TOTAL	**6 971**

Registrations by Nationality Report - NAS

YEAR = 2017

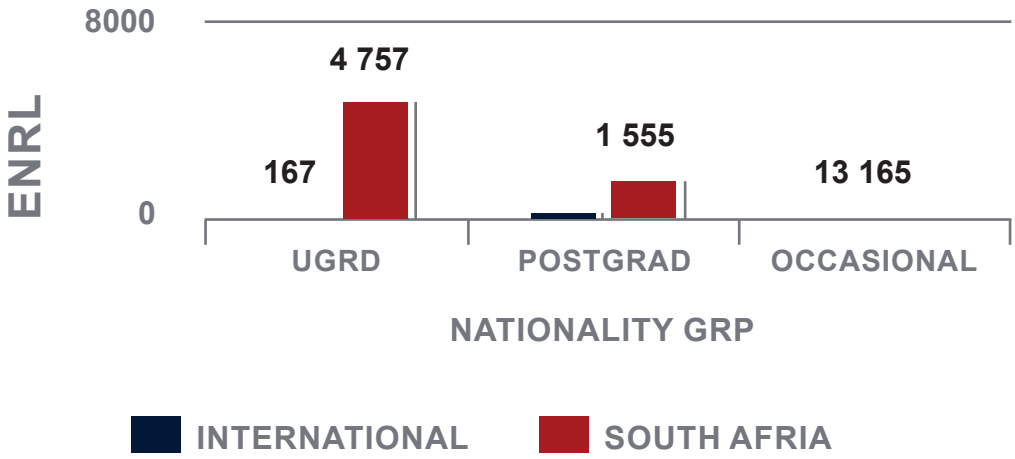
Previous Year Student Figures

QUALIFICATION_GRP > RACE	FEMALE	MALE	Totals
	ENRL	ENRL	ENRL
vUGRD	2 314	2 610	4 924
vPOSTGRAD	881	988	1 869
vOCCASIONAL	108	70	178
TOTAL	3 303	3 668	6 971

Student Figures - NAS

YEAR = 2017

Previous Year Registrations by Education Level

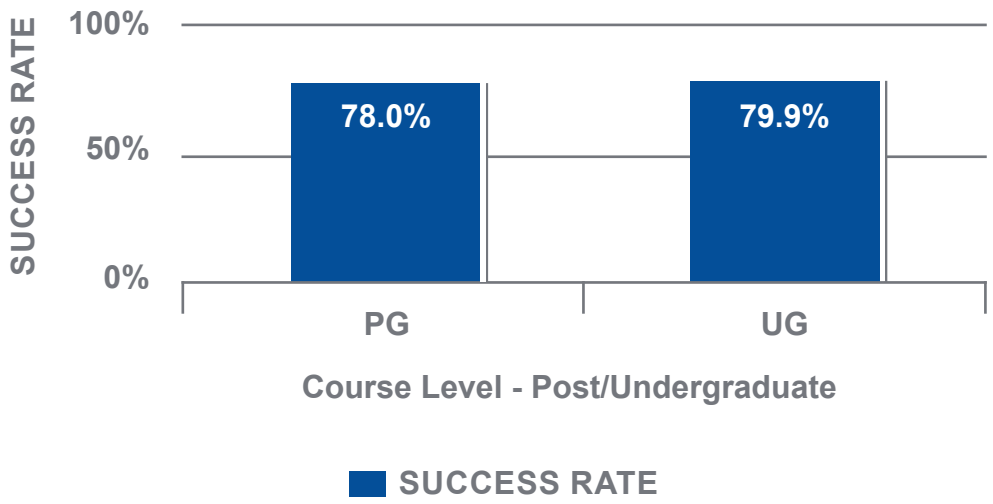


QUALIFICATION_GRP	INTERNATIONAL	SOUTH AFRICA	Totals
	ENRL	ENRL	ENRL
UGRD	167	4 757	4 924
POSTGRAD	314	1 555	1 869
OCCASIONAL	13	165	178
TOTAL	**494**	**6 477**	**6 971**

Registrations by Educational Level Report - NAS

YEAR = 2017

Previous Year Sucess Levels



	SUCCESS RATE
PG	78.0%
UG	79.9%

Success Levels Report - NAS

Success Rate = Passed Module Enrolments/Total Module Enrolments

YEAR = 2017

LIST OF Acronyms

A

ABI – Applied Biosystems

ACS – American Chemical Society

ADF – Amsterdam Density Functional (Theory)

AEASA – Agricultural Economics Association of South Africa

AETFAT – Association for the Taxonomic Study of the Flora of Tropical Africa

AFAAS – African Forum for Agricultural Advisory Services

AFFAS – African Forum for Agricultural Advisory Services

AFRAS – African Arachnological Society

AFMA – Animal Feed Manufacturers Association

AGOA – African Growth and Opportunity Act

AfRota – Antigens and Reassortant Strains for Rotaviruses Circulating in Africa

AgriFoSe – Agriculture for Food Security in Africa

AGU – American Geophysical Union

AI – Artificial Insemination

ALFA – African Livestock Trade Fair

AMI – Advanced Metals Initiative

AMNH – American Museum of Natural History

ANTPAS – Antarctic permafrost, periglacial processes and soils

AP – Admission Point

APGC – Asia-Pacific Grains Conference

ARC – Agricultural Research Council

ARC-GCI – Agricultural Research Council Grain Crops Institute

ARC-SGI – Agricultural Research Council Small Grain Institute

ARC-VOPI – Agricultural Research Council Vegetable and Ornamental Plants Institute

ARNTD – African Research Network for Neglected Tropical Diseases

ARS-USDA – Agricultural Research Service – United States Department of Agriculture

ASAB – Association for the Study of Animal Behaviour

ASAPA – Association of Southern African Professional Archaeologists

ASAQS – Association for South African Quantity Surveyors

ASFM – African Society of Forensic Medicine

ASLO – Association for the Sciences of Limnology and Oceanography

ASOCSA – Association of Schools of Construction of Southern Africa

ASSAf – Academy of Science of South Africa

ATDC – Africa Agricultural Technology Demonstration Centre

ATKV – Afrikaanse Taal- en Kultuurvereniging

AWMS – Australasian Wildlife Management Society

B

BAAFS – Beijing Academy of Agriculture and Forestry Sciences

BCI – Brain-computing Interface

BCIS – Baccalaureus in Computer Information Systems

BRICS – Brazil, Russia, India, China, and South Africa

BfR – Federal Institute for Risk Assessment

C

CACTUSNET - International Cooperation Network on Cactus Pear

CAD – Computer-assisted Drawing

CAS – Chinese Academy of Sciences

CBEP – Certified Business Efficiency Professional

CBMSO – Centre for Molecular Biology 'Severo Ochoa

CCDC – Cambridge Crystallographic Data Centre

CCOA – Chinese Cereals and Oils Association

CEM – Centre for Environmental Management

CEM – Certified Energy Manager

CEO – Chief Executive Officer

CHPC – Centre for High Performance Computing

CIMMYT – International Centre for the Improvement of Wheat and Maize

CIT – Citrus Industry Trust

CLiPS – Computational Linguistics and Psycholinguistics

CLSM – Confocal Laser Scanning Microscopy

CNS – Central Nervous System

CoGTA – Cooperative Governance and Traditional Affairs

CONICET – National Scientific and Technical Research Council

CPD – Continuing professional development

CPRR – Competitive Programme for Rated Researchers

CRUISE – Centre for Regional and Urban Innovation and Statistical Exploration

CSIL – Computing Science Instructional Labs

CSIR – Council for Scientific and Industrial Research

CSUR – Competitive Support for Unrated Researchers

CST-SA – Cereal Science and Technology, South Africa

CTA – Cherenkov Telescope Array

CTL – Centre for Teaching and Learning, UFS

CUT – Central University of Technology

CWEP – Certified Water Efficiency Professional

D

DAAD – German Academic Exchange Service

DEA – Department of Environmental Affairs

DESTEA – Department of Economic, Small Business Development, Tourism and Environmental Affairs

DFG – Deutsche Forschungsgemeinschaft

DFID – Department for International Development

DIFFER – Dutch Institute for Fundamental Energy Research

DiMTEC – Disaster Management Training and Education Centre for Africa

DMISA – Disaster Management Institute of Southern Africa

DNA – Deoxyribonucleic Acid

DoE – Department of Education

DRD – Directorate for Research and Development

DRMSD - Disaster Risk Management for Sustainable Development

DSC – Differential Scanning Calorimetry

DST – Department of Science and Technology

DUT – Durban University of Technology

E

EAAP –European Federation of Animal Science

EASD – European Association for the Study of Diabetes

ECS – Electrochemical Society

EDP – Edamame Development Programme

EEG – Electroencephalography

EGU – European Geosciences Union

EMC – European Metallurgical Conference

ENSO – El Niño–Southern Oscillation

EO – Earth Observation

EPA – Elphick Proome Architects

ERA-MIN – European Research Area – Network on the Industrial Handling of Raw

ESO – European Southern Observatory

ESRC – Economic and Social Research Council

ESRF – European Synchrotron Radiation Facility

ESSA – Entomological Society of Southern Africa

EU – European Union

EuChemS – European Chemical Society

EvIDENz – Earth Observation Based Iformation Products for Drought Risk Reduction on the National Level

F

FAaWC – Forensic Alliance Against Wildlife Crime

FAO – Food and Agricultural Organisation

FABI – Forestry and Agricultural Biotechnology Institute

FBIP – Foundational Biodiversity Information Programme

FEA – Female Entrepreneur Awards

FEC – Fluid Electrical Conductivity

FET – Further Education and Training

FEMA – Federal Emergency Management Agency

FHB – Fusarium Head Blight

FSL – Forensic Science Laboratory

FSPHRA – Free State Provincial Heritage Resources Agency

G

GCP – Good Clinical Practice

GCLP – Good Clinical Laboratory Practice

GCRF – Global Challenges Research Fund

GFAAS – Graphite Furnace Atomic Absorption Spectroscopy

GFRAS – Global Forum for Rural Advisory Services

GIS – Geographical information systems

GLYAT – Glycine-N-acyltransferase

GMI – Groundwater Management Institute

GWD – Ground Water Division

GSPSA – Global Water Partnership Southern Africa

H

HAART - Highly Active Antiretroviral Treatment

HCI – Human-computer Interaction

hCG – Human Chorionic Gonadotropin

HE – Higher Education

HEASA – High Energy Astrophysics in Southern Africa

HGSA – Human Genetics of South Africa

HIV-ART - Human Immunodeficiency Virus Antiretroviral Treatment

HS – Human Settlements

HPC – High-performance Computing

HPLC – High-performance Liquid Chromatography

I

IAHS – International Association of Hydrological Science

IBC – International Botanical Congress

ICARDA – International Center for Agricultural Research in Dry Areas

ICC – International Association for Cereal Sciences and Technology

ICC – International Convention Centre

ICE – International Conference of Endocrinology

ICESD – International Conference on Environmental Science and Development

ICFR – Institute for Commercial Forestry Research

ICPAC – International Conference on Pure and Applied Chemistry Materials

ICPOW – International Congress on Parasites of Wildlife

ICSD – Inorganic Crystal Structure Database

ICT – Information and Communications Technology

ICID – International Commission on Irrigation and Drainage

ICRC – International Cosmic Ray Conference

ICRPMA – International Cereal Rust and Powdery Mildews Conference

IDC – Industrial Development Corporation

IDF – International Dairy Federation

IDP – Integrated Development Planning

IEC – International Ethological Conference

IFAMA – International Food and Agribusiness Management Association

IFHE – International Federation for Home Economics

IGOT – Institute of Geography and Spatial Planning

IGS – Institute for Groundwater Studies

IMC – International Mammalogical Conference

IMWA – International Mine Water Association

INRA – National Institute for Agricultural Research

IPBES – Intergovernmental Platform for Biodiversity and Ecosystem Services

IR – Infrared

ISDR – International Strategy for Disaster Reduction

ISO – International Organisation for Standardisation

ISOCARP – International Society of City and Regional Planners

IT – Information Technology

IUCN – International Union for Conservation of Nature

IUCr – International Union of Crystallography

IUPAC – International Union of Pure and Applied Chemistry

K

KASMS – Kinetically Activated Subsurface Microbial Sampler

KBRS – Kimberley Biodiversity Research Symposium

KIC – Knowledge Interchange and Collaboration

L

LAPOA – Laboratorio de Patologia de Organismos Aquaticos

LC-MS - Liquid chromatography mass spectrometry

M

MARUM – Centre for Marine Environmental Sciences, University of Bremen, Germany

MEM – Master of Environmental Management

MMM – Mangaung Metropolitan Municipality

MOF – Metal Organic Framework

MS – Mass Spectroscopy

MWP – Mzimvubu Water Project

N

NDV – Newcastle disease virus

NDVI – Normalised Difference Vegetation Index

NECSA – Nuclear Energy Corporation of South Africa

NELK – New Extensionist Learning Kit

NCL – National Chemical Laboratory

NGS – Next-generation sequencing

NMMU – Nelson Mandela Metropolitan University

NMR – Nuclear Magnetic Resonance

NRF – National Research Foundation

NRF-FRF – National Research Foundation-FirstRand Foundation

NRM – National Resource Management

NSCF – National Natural Science Collections Facility

NSSA – Nematode Society of Southern Africa

NTD – Neglected Tropical Diseases

NUST – Namibia University of Science and Technology

NWU – North-West University

NZG – National Zoological Gardens

O

OAD – Office of Astronomy for Development

OAPA – Oregon Chapter of the American Planning Association

OES – Optical Emission Spectroscopy

OLED – Organic Light-emission Devices

OPCW – Organisation for the Prohibition of Chemical Weapons

P

PACT – Pan African Conference on Science, Computing and Telecommunication

PARSA – Parasitological Society of Southern Africa

PCR – Polymerase Chain Reaction

PERFECT – Policies, Education, Research, Farming & Finance, Extension & Advisory Services, Communication & ICTs and Trade

PGE – Platinum-group Elements

PI – Principal Investigator

PIOM – Principal Investigators Orientation Meeting

POS – Point of Sale

PSA – Potato South Africa

PSP – Prestige Scholar Programme

R

RAiN – Regional Archives for Integrated Investigations

RCMI – Regional Challenges to Multidisciplinary Innovation

RDP – Reconstruction and Development Programme

RMRD SA – Red Meat Research Development South Africa

RPO – Red Meat Producers Organisation

RUFORUM – Regional University Forum for Capacity Building in Agriculture

RSC – Royal Society of Chemistry

RWA – Russian Wheat Aphid

S

SAAB – South African Association of Botanists

SAAG – South African Association of Geomorphologists

SAAO – South African Astronomical Observatory

SAASTA – South African Agency for Science and Technology Advancement

SACAP/CAA – South African Council for the Architectural Profession, Commonwealth Association of Architects

SACN – South African Cities Network

SACPCMP – South African Council for Project and Construction Management Professions

SACPLAN – South African Council for Planners

SACPVP – South African Council for the Property Valuers Profession

SADC – Southern African Development Community

SADoCoL – South African Doping Control Laboratory

SAEEC – South African Energy Efficiency Conference

SAENSE – Screening Applications and Exploring Novelty in Specialised Environments

SAEON – South African Environmental Observation Network

SAFEX – South African Futures Exchange

SAGA – South African Geophysical Association

SAIA – South African Institute of Architects

SAICSIT – South African Institute of Computer Scientists and Information Technologists

SAIP – South African Institute of Physics

SAJAH – South African Journal of Art History

SALT – Southern African Large Telescope

SAMS – South African Mathematical Society

SANAP – South African National Antarctic Programme

SANBI – South African National Biodiversity Institute

SANParks – South African National Parks

SANSA – South African National Survey of Arachnida

SAPPA – South African Pecan Nut Producers Association

SAPER – South African Planning Education Research

SAPS – South African Police Service

SARChI – South African Research Chairs Initiative

SAS – Statistical Analysis System

SAS – South African Statistical Association

SASAS – South African Society for Animal Sciences

SASAqS – Society of Aquatic Scientists

SASRI – South African Sugarcane Research Institute

SASRN – South African Sclerotina Research Network

SASTA – South African Sugar Technologist's Association

SAWMA – Southern African Wildlife Management Association

SAWSS – Southern African Weed Science Society

SCA – School of Chief Architect

SDF - Spatial Development Frameworks

SEM – Scanning electron microscope

SEMDSA – Society for Endocrinology, Metabolism and Diabetes of South Africa

SIMS – Secondary ion mass spectrometry

SLCi – Sub-Antarctic Landscape-Climate Interactions

SSAJRP – Swiss-South Africa Joint Research Programme

STFC – Science and Technology Facilities Council

SU – Stellenbosch University

Subtrop – South African Subtropical Growers' Association

SVM – Support Vector Machine

SWAMP – Soil Water Management Programme

T

TEM – Transmission electron microscope

TGA – Thermal Gravimetric Analysis

TIA – Technology Innovation Agency

THRIP – Technology and Human Resources for Industry Programme

TUHH – Technical University Hamburg

TUT – Tshwane University of Technology

TWAS – The World Academy of Sciences

U

UAV – Unmanned aerial vehicle

UCD – University College of Dublin

UCT – University of Cape Town

UFH – University of Fort Hare

UFS – University of the Free State

UJ – University of Johannesburg

UK – United Kingdom

UKZN – University of KwaZulu-Natal

UM – University of Minnesota

UN – United Nations

UNCCD – United Nations Convention to Combat Desertification

UNEP – United Nations Environment Programme

UNESCO – United Nations Educational Scientific and Cultural Organisation

UNFCCC – United Nations Framework Convention on Climate Change

UNISA – University of South Africa

UNOCHA – United Nations Office for the Coordination of Humanitarian Affairs

UNOOSA – United Nations Office for Outer Space Affairs

UP – University of Pretoria

UPP – University Preparation Programme

USA – United States of America

USAID – United States Agency for International Development

USDA – United States Department of Agriculture

UV – Ultraviolet

UV-Vis – Ultraviolet-visible

V

VUT – Vaal University of Technology

W

WARFSA – Water Research Fund for Southern Africa

WDS – World Dairy Summit

WEEC – World Energy Engineers Conference

Wits – University of the Witwatersrand

WRE – Water Resource and Environment

WRC – Water Research Commission

WSF – World Sustainability Forum

X

XPS – X-ray photoelectron spectroscopy

XRD – X-ray Diffraction

XRF – X-ray Fluorescence

Y

YAG – Yttrium aluminium garnet

YPP – Young Planning Professional

Z

ZSSA – Zoological Society of Southern Africa